

## THE MODERATING EFFECT OF DIRECTORS' NETWORK TOWARDS TECHNOLOGICAL INNOVATION AND FIRMS' PERFORMANCE: A CONCEPTUAL PAPER

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**ABSTRACT** – Scholars have given increased attention to seek for a solution to improve firms' performance. The literature demonstrated that technology innovation is considered the most powerful means of firms' performance for modern companies. Empirical findings showed, however, that the relationship between technological innovation and firms' performance continues to be inconclusive as it has a negative, positive or no impact on firms' performance. In order to address such gap, this paper proposes a theoretical framework to describe the moderating effect of directors' network on technological innovation and firms' performance. It shows that the effectiveness of business innovation can be enhanced through direct or indirect use of each network of directors. The firm still neglects the significant capacity of the board of directors' network in a firm. In short, the crucial discussion found in this paper will lead to improving the information on innovation, networking and organizational studies as well as act as a reference to study in other countries. This study is a promising field. The business will benefit from a large social network of directors. Thus, the company is proposing to fully utilize the function of directors' network to leverage the innovation activities and firm's performance.

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## INTRODUCTION

Firms' performance in an organizational study is one of the crucial topics (Miller, Washburn, & Glick, 2013) and has been commonly used as a dependent variable by many researchers. To stay ahead of the competition, each firm should improve its performance. Those who pursue to innovate and achieve greater performance can hold the winning card. Technological innovation is one of the main determinants of firms' performance (Feeny & Rogers, 2003). The business with high rates of innovation appears to improve its performance more quickly than those without innovation (Roper, Du, & Love, 2008). Since 2000, 52% of companies of fortune 500 have either failed or been bought over or ceased to exist as reported in the Harvard Business Review in 2017 (Tekic & Koroteev, 2019) due to the transformation on innovation, efforts were much delayed. This claim is consistent with Schumpeter's theory of innovation profit, which leads to winners and losers being visible in the market (Yildiz, Bozkurt, Kalkan, & Ayci, 2013).

The need for technological innovation is vital in the Malaysian context in helping Malaysian businesses to stay competitive and gain greater performance. The innovation may enable the firm to improve the Gross Domestic Product (GDP) growth. However, The World Bank (2020) showed that Malaysia's GDP growth rate dropped from 7.53% in 2010 to 4.33% in 2019. The downward trend in the percentage of Malaysia's GDP means Malaysian firms' performance is declining. Rasiah and Yap (2016) argued that the slow pace of Malaysia's GDP since 1997 is primarily due to poor performance in innovation. The more successful businesses are, the more they contribute to GDP growth. GDP is a significant factor in the company's success evaluation (Dimitras, Kyriakou, & Iatridis, 2015). The slow growth can be described as the performance of a company experiencing a sales and earnings decline.

This finding is consistent with firms' performance issues in Malaysia showing that Malaysia lacks business confidence with a score of 85.50 points in January 2020 and Malaysia firms have high bankruptcy rates. Since the year 1998 to 2015, it was recorded that the average number of bankrupt companies per year was 1250 companies in which July 2013 recorded the highest level with 2366 companies. Meanwhile, the lowest record was in February 1999 with 503 companies (Tradingeconomics, 2020). As GDP growth declines, the financial performance of firms may decline too.

Therefore, it is time for Malaysian companies to come up with the best alternative approach to upgrade their company to continue innovating. Innovation can develop ideas, generate value, and improve company performance. The empirical findings on the relationship between technological innovation and business performance are contradictory as they have shown significant, negative, or no impacts of innovations on business performance (Cruz-Cázares, Bayona-Sáez, & García-Marco, 2013). Surprisingly, not all companies fully utilize the advantages of directors' networks especially in terms of corporate innovation. As argued by Jamaludin and Hashim, (2017), little is known about the effect of directors network. Besides, it might help the company to increase its innovation activities while also enhancing its performance. The firm has always been connected (Chen, Wei, & Liu, 2019) with other parts outside the firm. This relation also affects the success and development of businesses.

From a resource-based perspective and a social capital theory perspective, networking and technological innovation are potentially valuable resources for firms and their management (Li, 2019). Director networking not only enables firms to have information access and communities of practice (Andrikopoulos, Georgakopoulos, Merika, & Merikas, 2019) but also makes it possible for organizations to transfer knowledge among themselves. Nonetheless, there is also evidence that networking knowledge may not be applicable to companies resulting in appointed directors being incapable to operate efficiently (Carpenter & Westphal, 2001). Li (2019) claimed that a business has the ability to access significantly distinct information that could enhance technological innovation by creating a relationship with companies in different industries.

To date, for both academia and practitioners, the link between technical innovation and firms' performance has been a topic of interest. Nevertheless, the moderating impact of directors' network on technological innovation and firms' performance is still limited. This paper explored the relationship between technological innovation, the directors' network, and its effects on firms' performance to resolve the gap in the literature by suggesting that technological innovation has a positive effect on firms' performance and that the directors' network plays a key role in moderating it.

## LITERATURE REVIEW

### Technological Innovation

The most powerful sources of firms' performance in modern organisations are technological innovation. A business that can effectively introduce technological innovation also has a strong market orientation (Lin, Lee, & Hung, 2006) and driven economic growth (Kim, 2019). Nowadays, the word innovation becomes the main agenda in business and its synonym for the company's survival and development, thus, "innovate or die" (Xin, Chen, Zhang, & Sun, 2019; Abbasi, Motavasseli, Zali, Faghih, & Meigounpoory, 2019)

Technological innovation is intended to establish market value (Liao, Liu, & Zhang, 2018) and increase firms' performance (Nwosu, Awurum, & Okoli, 2015; Rahim & Zainuddin, 2019). It is evident in the history of business that successful innovators are more likely to succeed (Chen & Ibhagui, 2019) and those who do not progress appear to not survive in the sector (Azubuike, 2013). In the sense of organizational structures, procedures, goods, and services in the business, technology innovation are often regarded as the critical component of competitiveness (Chege, Wang, & Suntu, 2020). It has been seen as the key contributor to the development master plan to participate in emerging sectors thus increasing current business monopolization (Hagspiel et al., 2020). Hence, it provides the business with a competitive advantage (Yigitcanlar, Sabatini-Marques, Da-Costa, Kamruzzaman, & Ioppolo, 2019).

Innovation also affects how a company is managed. A study by Walsh and Linton (2002) argued that technological innovation is a company-owned specific technique or production method that makes a quick reaction to a change in business climate change. Moreover, innovative technology is believed to enhance the company's efficiency by leveraging dynamic knowledge and competence network especially related to the director's network (Li, 2019). Archibugi and Coco (2005) made a point by saying that technical innovation is the capacity to access, digest, and effectively deliver a new product and use it to dynamically refine, grow, and implement external information. From the abovementioned studies, technology innovation is capable to contribute as one of the critical roles for the purpose of predicting a firms' performance to be more effective and competitive in the market.

Despite the evidence of how technological innovation becoming the center of importance, surprisingly, there are only a few studies concerning the connection involving the directors' network, technological innovation, and the firms' performance. Studying the role of the directors' network has important consequences for practitioners and academicians and can provide additional insights into the determinants of technological innovation. However, this can also deepen awareness of the nature of the directors' network in a broad sense.

Unfortunately, from the standpoint of innovation evaluation, the efficiency of the process of innovation is not being assessed in a homogenous manner, and this lack of consensus inhibits the mechanism of generating competitive gains from an innovative organisation. For innovation measures such as R&D, patents, patent citations, or new product announcements, many studies used the same metric or single indicator, and the others employed two indicators or more to generate one construct. Given the complexity and contradictions in the meanings of the structures, measures, collected samples, databases, industries, and country environments, it seems that the principles and metrics of innovation can hardly be interpreted and analyzed in depth. However, the advantages of using a multi-indicator approach are those indicators may permit researchers to be able to calculate creative success utilizing more complicated and detailed measures. According to OECD/Eurostat (2018), there are two classes of indicators relevant to the measurement of innovation and performance such as resources devoted to R&D and patent statistics.

### Technological innovation in Malaysia

Malaysia is one of the world's developing countries and is listed as a high-medium country with a gross per capita income of US\$10,449 (Julian & Ahmed, 2019). Malaysia has created and implemented various technical strategies and policies to boost technological innovation efficiency. It started in 1986 with the announcement by the government on the first National Science and Technology Policy 1 (NSTIP 1) to outline a framework for achieving the growth of Science, Technology, and innovation development. In 1990, an Industrial Technology Development Action Plan has been developed to address NSTIP 1 vulnerabilities (Bekhet & Latif, 2017).

The second NSTIP2 agenda was announced under the 10<sup>th</sup> Malaysia Plan (2011 – 2015) by the government to redesign and set the Science, Technology, and Innovation (STI) Strategic Guideline for Malaysia to achieve the mission to become an innovative economy by 2020. Nevertheless, some of the issues in the past initiatives, including the diffusions of

technology, investment from the private sector to R&D and technological innovation, commercializing of products and services, and monitoring and evaluation issues have not been enforced (Rasiah & Chandran, 2015). Throughout its agenda for 2013 until 2020, many ministries showed participation and many organizations, groups, and initiatives have been created and organized (Bekhet & Latif, 2017).

In the perspective of the world ranking, the latest Global Innovation Index (2019) has reported that Malaysia is currently ranked 35 out of 143 countries in 2019 with a score of 42.68. It dropped from rank 25 in 2009, rank 31 in 2011, and ranked 33 in 2013. The significant decrease in rank is due to other countries has improved their standing far greater than Malaysia (Rasiah & Yap, 2016). Thus, the organization is proposed to increase its technological innovation activities in order to guarantee that Malaysia is competitive on the market and represents its business success.

Malaysia is facing a slow pace in innovation due to various reasons and its impact on firms' performance is reflected in the documents and official reports. Firstly, there is still a lack of cooperation between universities and businesses. The findings from public research institutions do not match the industry requirement (CEDAR, 2018). Product developers are often hesitant to implement new technologies built locally in their products. The lack of expectations between researchers and industry happened in which researchers from university argued that the method used must be of high efficiency but not necessarily improve the bottom line of user experience. This also contradicts the industry that wants a simple and user-friendly solution (Malaysia Productivity Corporation, 2019)

Secondly, R&D, and innovation activities are often constrained by inadequate resources (Julian & Ahmed, 2019). While R&D and innovation activities are also supported by universities, they do not meet the demands of the industry. Thirdly, industry players are more likely to use current technology without upgrades and have lagged in technological growth compared to the newly industrialised economies. It is time to boost Malaysia to manufacture, design, and create new products from the assembly phase (Chandran, Rasiah, & Wad, 2009). Malaysia may emulate the achievement of South Korea and attain goals to be a highly-income country if it can manage technical and innovation activities effectively. Therefore, the involvement of local companies should be intensified to ensure the goal of being an innovation hub is achieved and the firms' performance can be improved.

### Firms' Performance

Taouab and Issor (2019) proposed that the firms' performance is a result obtained by management in providing competitiveness, profitability, and effectiveness to the firm. Since this indicator tests the productivity and effectiveness operation of businesses (Neely, Gregory, & Platts, 2005), the companies' accomplishments are the first to be measured by investors worldwide (Al-Matari, Al-Swidi, & Fadzil, 2014). This was also deemed important as it showed how businesses grow and function over time. The results must be measurable in order to be significant (Al-Matari et al., 2014). Effective management (Selvam, Gayathri, Vasanth, Lingaraja, & Marxiaoli, 2016) of any company is crucial in measuring performance. Process improvement can only be achieved if the result is measured. Improved organizational performance, therefore, requires assessment to identify firms' performance levels (Al-Matari et al., 2014) through the use of organizational resources (Homroy & Slechten, 2019).

The comprehensive summary of previous research provided a myriad of ways for measuring firms' performance and they can be divided into two categories (Al-Matari et al., 2014; Selvam et al., 2016). The classification of predictors for firms' performance as proposed by Selvam et al. (2016) is divided into two aspects, including financial and strategic performance. Financial performance covers three variables, namely revenue and profit performance, productivity performance, and open market valuation performance, while strategic performance includes six other variables, such as employee engagement, customer satisfaction, environmental performance, environmental audit performance, corporate governance performance, and social performance. Profitability measures a company's past ability to generate returns. Market value performance refers to market prices. The financial asset, such as the share of a company, should have a market value. Market value is also commonly used to refer to the market capitalization of a publicly-traded company and is obtained by multiplying the number of its outstanding shares by the current share price.

In the same sense, Al-Matari et al. (2014) argued that firms' performance measurement may be classified into two classifications, which include accounting-based measurement and market-based measurement. Accounting-based measurement is usually known to be an effective measure for the profitability and performance of a business when compared to the benchmark rate of return which equals the risk-adjusted weighted average cost of capital. The market-based assessment is best described by its forward-looking nature and reflects the expectations of the shareholders regarding the future performance of the company, which is based on previous or current performance. Indeed, accounting-based measures can reflect the company's past performance, while market-based indicators help to predict future performance. Table 1 shows the sample indicators for accounting-based assessment and market-based assessment.

**Table 1:** Indicators of measurement sample under accounting and market-based category

<b>Accounting-Based Measurement</b>	
<b>Indicator</b>	<b>The author</b>
Return on Equity (ROE)	(Pislaru, Herghiligi, & Robu, 2019; Wu & Gu, 2018; Ravšelj & Aristovnik, 2020)
Return on Sales (ROS)	(Han, Dong, & Dresner, 2012; Wu, Chen, Chen, & Chien, 2019; Bharadwaj, 2000)
Return on Investment (ROI)	(Pislaru et al., 2019; Liao et al., 2018; Alshehhi, Nobanee, & Khare, 2018; Lee, Kwon, & Pati, 2019a; Wang, 2019)
Return on invested capital (ROIC)	(Ramli et al., 2019 ; Alam, Uddin, Yazdifar, Shafique, & Lartey, 2020; Koellinger, 2008; Lin, Yip, Ho, & Sambasivan, 2020)
Profit Margin (PM)	(Ghapar, Brooks, & Smyth, 2014; Al Manaseer, Al-Hindawi, Al-Dahiyat, & Sartawi, 2012)
Earnings per Share (EPS)	(Jakpar, Tinggi, & Hui, 2019; Cazavan-Jeny & Jeanjean, 2006; Alarussi & Alhaderi, 2018)
<b>Market-Based Measurement</b>	
<b>Indicator</b>	<b>Authors</b>
Tobin Q	(Zuo, Fisher, & Yang, 2019; Wesselman, 2017; Chen & Ibhagui, 2019; Kim, 2019; Lee et al., 2019a)

**Source:** Developed from various studies including Al-Matari et al., (2014)

The research on firms' performance suffers from problems such as the selection of measurement indicators. In this respect, there is incomplete literature and on-going debate on the issue of the firms' performance. Most prior research assessed firms' performance using one single indicator (Miller et al., 2013). Since there were several dimensions, Selvam et al. (2016) suggested that new researchers should use more than one dimension to ensure that the findings are clearly conceptualized and that their sizes, measurement, and performance are discussed effectively.

#### Directors network in technological innovation

Prior studies showed that the director's network is closely linked to technical innovation (Chen et al., 2019; Li, 2019). The effectiveness of corporate innovation activities can be increased by directly or indirectly leveraging each director's network. However, Jamaludin and Hashim (2017) contended that the company still neglects the significant role of the director's network in the firm. A similar idea was proposed by Hamid (2011) which stated that the need to nominate and retain a member of the board was less concerned with the influence of the networks of the director. Therefore, if the issue remains and no corrective measures have been taken by the firm, it means that this valuable resource was left unused. This is a loss for the company.

Director's network can be interpreted as the directors' connection or directors' interlock, established based on direct ties created by at least one common board during service. The directors, as suggested by Wincent, Anokhin, and Örtqvist, (2010) are linked through meetings and discussions while exchanging knowledge and information across their network (Wang, Jean, & Zhao, 2020). Information exchange is one of the primary functions of the directors' network towards innovation. Allen (1977) argued that the directors are known as "gatekeepers", who had more informal contacts outside different companies which were crucial in sharing new information and linking it with the firm. Helmers, Patnam, and Rau, (2017) stated that the Indian companies have increased their propensity to patent as a response to an increase in their level of directors networking. As a result, the greater the network connectivity of the director, the more technological information is provided and more innovation activities of the company can be leveraged.

This evidence is strengthened by looking at the case of Tube Investment of India Ltd, operating in the based metals industry. After this company appointed Mr. Murugappan using the directors' network resources, the company witnessed an increase in R&D investment for Tube Investment of India Ltd to US\$ 530,000 by the end of 2004, an increase of approximately 35% compared to the year before. Therefore, board interlocks may lead to increased R&D spending by fostering the transfer of new knowledge that will enable the firm to perform better in technological innovation (Helmers et al., 2017).

The second role is the advisor. Carpenter and Westphal (2001) here argued that the directors' network offers better advice and guidance to boost the performance of firms in innovation. The third role is monitoring. Helmers et al. (2017) concluded that a blend of advising and monitoring roles could improve the company's innovation activities by the directors' network. Directors' networks also deliver reputational incentives that increase the willingness of directors to efficiently advise and monitor management actions (Shaw, Cordeiro, & Saravanan, 2016). Additionally, directors' network may increase the board network capital. Wincent et al. (2010) concluded that innovative output is strongly affected by directors' networks. The network capital of the board refers to the whole spectrum of knowledge, skill, experience, and abilities that produce a conclusive output.

When directors serve on various boards, they build ties with other companies and provide an opportunity to exploit them (Caiazza & Simoni, 2015), which may be converted into certain benefits even if they may cause disadvantages as well. The negative side of the network of directors on organizational innovation can be divided into many areas based on the literature review. Firstly, the directors' network can impede technological innovation activities in firms. A well-connected board could also be a busy board, as directors can sit on multiple boards and take part in many social events. They appear to spend less time offering advice on strategic innovation initiatives (Bhuiyan & Roudaki, 2018) and do not



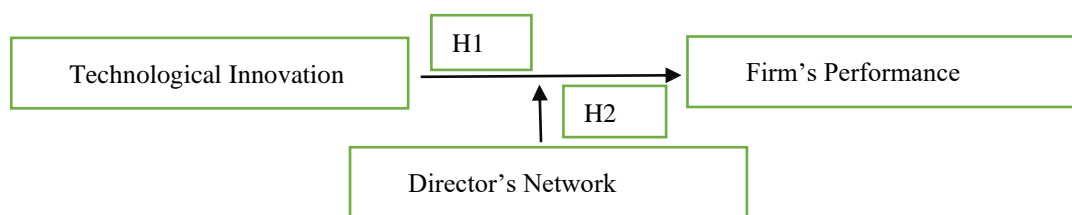
work as effective monitors (Fich & Shivdasani, 2012). However, Roudaki and Bhuiyan (2015) argued that busy directors are good for the company because they have more diverse knowledge and experience.

Secondly, Shaw et al. 2016, and Oh, Labianca, and Chung (2006) argued that multiple directorships may result in overcommitment, correlated with poorer governance. This also may result in companies being inadequately advised which can cause less profitability. Finally, the information channel is an essential tool provided by the directors' network. Nonetheless, Larcker, So, and Wang (2013) concluded that if the information is not accurate or wrong, the data could spread negative practices (Baran, 2017), for example backdating (Bizjak, Lemmon, & Whitby, 2009) and income management (Chiu, Teoh, & Tian, 2013). This situation can eventually damage the credibility of the business and firms' results (Shaw et al., 2016).

Prior to this research, the positions of the directors' network and their significant effect on technological innovation were discovered. Some preliminary findings demonstrated the positive effects as well as some negative effects. The basic influence of the network of directors should be utilized to encourage technological innovation in companies. In this research, Malaysia can support local companies by providing a strong social network for a local climate. The next segment of this paper focuses on the theoretical framework and hypothesis.

## HYPOTHESIS AND THEORETICAL FRAMEWORK

### Theoretical framework



**Figure 1:** Theoretical framework

The theoretical framework was drawn up from the literature review and outlined in Figure 1. The relationships between the dependent (firms' performance) and the independent (technological innovation) variables proposed to be calculated by ROA, ROE, ROIC, Tobin Q was demonstrated. The moderating influence of the director's network on independent and dependent variables was also calculated.

### The link between technological innovation and firms' performance

Numerous studies suggested that the impact of technological innovation on firms' performance is substantial (Xin et al., 2019). Many researchers around the world supported this suggestion. Increasing investment in innovation by firms tends to provide better financial statistics in the manufacturing industry of the Czech Republic (Bockova & Zizlavsky, 2016). Technological capabilities in Malaysia and Vietnam impact significantly on competitive advantages and company performance in the automotive industry (Rahim & Zainuddin, 2019), as well as in the agriculture sector (Ho, Nguyen, Adhikari, Miles, & Bonney, 2018). Lee, Lee, and Garrett (2019) also suggested that the success of low-tech firms in South Korea would have a direct and positive effect on organizational innovation.

Innovation is considered to be one of the main drivers of firms' performance (Azubuike, 2013; Hervas-Oliver, Albors Garrigos, & Gil-Pechuan, 2011). Therefore, innovation has a positive impact on the growth, market, and financial results of the business (Azubuike, 2013). Roper et al. (2008) argued that if the organization has a high level of innovation, its performance may be improved. Since they can manufacture a range of goods and services using technological innovations, the company can have high performance and profits (Camisón & Villar-López, 2014).

A company that effectively brings technological innovations to the marketplace is also extremely market-oriented (Lin et al., 2020). In comparison to non-tech innovation, technical innovation has a greater impact on business efficiency and growth (Ryu & Lee, 2015). Wang (2019) showed that technological innovation and corporate success have produced mixed results. The author found that radical innovation is good for business success but it has a negative impact on mainstream innovation strategies.

With regard to the empirical data mentioned above in the literature, an important relationship was established between the performance of a company and technological innovation. Therefore, this study proposed the hypothesis as follows:

*Hypothesis 1:* Technological innovation is positively related to firms' performance.

### Moderating effects of the director's network on technology innovation and firms' performance

Prior research has largely assumed that network of directors could lead to innovation and technology activities to improve company performance. Studies in emerging economies such as India (Helmets et al., 2017) have shown that the Indian firms' network of directors boosts innovation in R&D and patenting performance. Researchers from Spain (Hernández-Lara & Gonzales-Bustos, 2019), China (Han, Bose, Hu, Qi, & Tian, 2015), Thailand (Peng, Au, & Wang, 2001), Malaysia (Rohaida, Hasnah, Kamarun Nisham, & Noriah, 2013) and Hong Kong (Au, Peng, Mike, & Wang, 2000) also claimed that firms with high-level network directors benefited from better organizational effectiveness. Singh and

Gaur's (2009) pooling data for the top 500 Indian and Chinese companies showed that group members were weaker than non-affiliated companies and the negative relationship in Indian firms was greater than in China's. Therefore, there is a valuable link between the directors' networks (Shaw et al., 2016), which can boost firms' performance.

Investing in research and development by championing the communication of new knowledge by directors (Han et al., 2015) has allowed a company to carry out new studies. This can lead to a long-term increase in shareholder assets. Gomes-Casseres, Hagedoorn, and Jaffe (2006) showed that the flow of knowledge among allied firms is higher than those between companies without alliances in terms of patenting performance.

Past researchers demonstrated that the directors' networks can help companies access information that is vital to technological activities (Wu & Dong, 2020), be a major corporate innovation mechanism (Jiang, Yang, Zhao, & Li, 2020), and help to achieve company performance (Larcker et al., 2013). Wu and Dong (2020) argued that the connectivity of directors of the company in China has a significant positive effect on corporate innovation. For Italian manufacturing firms, Medda, Piga, and Siegel (2006) reported seeing improved efficiency and firms' output through partnering with other companies in the field of research and development.

From the previous discussion, it can be concluded that the directors' network has an impact on technological innovation and firm performance. Thus, this paper proposed the hypothesize that follows:

*Hypothesis 2:* The relationship between firms' performance and technological innovation is moderated in a way that technological innovation is considered to have a positive effect on results when the directors' network exhibit high.

## METHODOLOGY

The methodology for this study was a library search and the analysis of prior known documentation in the field of directors' network, technological innovation as well as firms' performance was held too. Online and offline material from article journals, books, and agency reports were included in the library search. Online databases such as Scopus, Google Scholar, Science Direct, and the Science web were used as references and some were chosen from the conference journal. For the systematic search, the final search query was given by the word directors network, director interlock, firms' performance, technology, technological innovation, and innovation. It was acknowledged that other keywords can be relevant or interesting, but this study believed that the above keywords are sufficient to cover the key criterion. The limitations in this study could also be due to restricted resources from the database, as the search results were excluded on health studies, science, and education field that connected to the impact of the directors' network on technological innovation and firm performance. Moreover, the references used were not restricted only to innovation and firms' performance in Malaysia but also taking into consideration global transformation.

## CONCLUSION

In short, this conceptual paper proposed a theoretical framework to describe the moderating effect of directors' network on technological innovation and firms' performance. The combination of these three variables will make it possible for researchers to further explore the area of network innovation. The directors' network has been seen as one mechanism that a company can use to access resources. Prior research largely inferred that the network of directors may lead to improve technological innovation activities and enhance the firms' performance but empirical evidence is required to prove this link.

Nevertheless, since this paper is conceptual, no data were collected to allow generalization to other nations. Furthermore, the structure of this analysis was based on previous literature. Generalization is therefore not appropriate. The same study was promoted in other countries, and various angles to technological innovation may apply. The main recommendation in this paper is that technological innovation has a positive impact on firms' performance and the directors' network plays a crucial role in moderating this effect.

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