Examining the Influence of Environmental Turbulence on Firm Innovation Performance in Emerging Markets: Using an Environment-Strategy-Performance Framework

Abstract

Evidence suggests that turbulent environment exposure is a significant driving force for business innovation. The automotive industry is strongly influenced by environmental dynamics due to continuous technological changes. Car OEMs require an accurate landscape of industrial uncertainties. The purpose of this study is to investigate the role of business environmental turbulence (BET) in innovation performance. Applied to the environment-strategy-performance framework and underpinned by the dynamic capability view (DCV) and contingency theory, our research model concerns both the antecedent and moderation roles of BET in innovation performance. A sample of 306 questionnaire data is collected from the management of Iranian automotive firms, and PLS-SEM is used for the analysis. The results suggest that BET improves innovation performance through enhancing networking capability (NC) and collaborative innovation capability (CIC). Besides, BET positively moderates the relationship between NC and innovation performance. This study contributes to understanding business innovation in a turbulent environment setting. Our findings offer important implications for managers to set strategies, particularly in a dynamic environment.

Keywords. Business environmental turbulence; Market turbulence; Technological turbulence; Networking capability, Collaborative innovation capability; Environment-Strategy-Performance (ESP)

1. Introduction

Business environmental turbulence (BET) refers to constant and substantial changes in the competitive market environment such as consumers' composition or preferences (Hartono and Sheng, 2016) or intra-industrial environments such as competitive intensity among competitors, or broader context such as social, ecological and particularly technological dynamics in recent decades (Yu et al., 2017; Turulja and Bajgoric, 2019). Literature in the environment-strategy-performance (ESP) framework suggests that innovation is one of the critical strategies for firms to respond to the BET challenges (Damanpour and Schneider, 2006; Zaefarian et al., 2017). Firms with higher innovation capabilities can better cope with environmental dynamics and develop adjusted or more effective solutions (Mazzucchelli et al., 2019).

Since not all of the resources needed for innovation are available internally, firms develop collaboration and co-innovation networks (Faems et al., 2005). When firms build collaborative relationships with their partners, they can enhance innovation performance by leveraging collaborative capabilities (Li and Zhou, 2010). Robust relational capabilities enable to leverage of external information exchange, transfer, and recombination of new knowledge and ideas (Eggers et al., 2014), which is more likely to lead to innovation performance, e.g., new products and services (Mokhtarzadeh et al., 2020), increased product complexities (Pittaway et al., 2004) or product novelty (Nieto and Santamaria, 2007). Research has suggested that collaborative innovation is increased in the dynamic competitive industries (Zhao et al., 2018) and general environmental turbulence (Bodlaj and Cater, 2019). However, the question about whether networked relationships will lead to improved innovation performance remains unanswered (Faems et al., 2005). Furthermore, although most studies confirm the significance of the relationship between BET and firm innovation performance (Prajogo and McDermott, 2014), there are some studies whose findings are inconsistent with this (e.g., Aslam, 2020).

Examining the role of BET in managing collaborative innovations is one of the exciting topics for innovation and network managers. They need to analyze the relationship between BET and collaborative capabilities to manage the organization. Based on our limited knowledge, there are two primary streams of literature approaching the role of BET in the ESP framework. One stream believes that BET plays an antecedent role (Huang and Tsai, 2014; Wong, 2014; Lee and Tang, 2017; Yu et al., 2017). The other suggests that BET is a moderator variable moderating the relationship between strategy and performance (Tsai and Yang, 2014; Eggers et al., 2014; Prajogo, 2016). We argue that considering the antecedent and moderator roles of BET separately has led to a partial perspective in the literature. Both BET roles should be considered simultaneously.

From a dynamic capability view (DCV), highly turbulent environments affect the strategy formulation. Moreover, contingency theory emphasizes that firms must adapt their strategies to specific environmental conditions. In practice, strategy is formulated both in response to BET, and sometimes BET moderates the impact of strategy on performance. Therefore, we expect that BET can play both an antecedent of strategic factors and a moderator in that innovation performance depends on the interaction of external environmental conditions and the firm's internal dynamics capabilities (Pittaway et al. 2004; Boso et al., 2013). Our goal is to open a new window in the literature and create new data on the application of both approaches. The dual role reflects strategic choices and the development of strategic capabilities in business organizations.

Together, this research aims to address the following underexplored questions: RQ1) Which strategic path (networking capability or collaborative innovation capability) is more effective in responding to different types of BET (market turbulence or technological turbulence) for innovation performance? RQ2) How can firms achieve better innovation performance when facing BET? RQ3) Does BET have both antecedent and moderating roles? Based on the environment-strategy-performance (ESP) framework, we develop a research model to examine the role of BET (i.e. market turbulence and technological turbulence) in firm strategies (i.e. NC and CIC) and innovation performance. Empirical study has discussed the role of NC and CIC in the relationship between BET and firm innovation performance, most of which have separately explored either NC (Lee, 2010; Wang et al., 2018) or CIC (Wang and Hu, 2017) in promoting firm innovation performance. However, the combined effect of NC and CIC is currently a deficit. The inclusion of the two constructs in our research model enables us to explore our research questions and a better understanding of their synergy effect on firm innovation performance.

As the literature emphasizes, most types of research that study the impact of BET on firm strategies and capabilities have been conducted in the context of leading firms (Boso et al., 2013). As a result, we have little knowledge about how to develop firm innovation capabilities in emerging markets (Popli et al., 2017). We investigate the Iranian automotive industry, as an emerging market, to discover the impact of BET on firm strategy and innovation performance. The automotive industry is one of the essential sectors in the country, accounting for 10% of GDP, 4% of employment, and $1 billion in export (Nguyan and Adomako, 2020). Production of Iran's automotive industry grew significantly between 2000-2013 (UNESCO, 2015) in which companies, such as IKCO, SAIPA, and ParsKhodro, are the leading players. Extensive environmental dynamics in the auto industry have led to a sharp rise in inter-organizational relationships and joint ventures (Neto et al., 2017). Accordingly, Iranian auto industry environmental dynamics such as changes in customer preferences, import tariffs, and industry regulations and standards have led to extensive partnerships between Iranian firms and leading international companies such as Peugeot, Renault, and Kia over the years. Some innovative products, such as Samand, Runna, Dena, and Tiba, have been developed collaboratively.

Based on the abovementioned research gaps, this study states that there is little knowledge of the interactions of BET, NC, CIC, and firm innovation performance. Since most previous research has focused on only one or two of the above variables, their collective effect has been neglected. Based on the environment-strategy-performance theory, this study has developed a conceptual framework to clarify the role of BET in firm strategy and performance. Accordingly, this research contributes to the literature by investigating the relationship between BET and firm innovation performance, considering the role of NC and CIC.

The next section reviews the related literature on BET, NC, and CIC; the theoretical framework is discussed; the research hypotheses are developed. Then data, sampling, and measures are explained. This is followed by a report of the empirical results of the measurement model and structural models' empirical results. Discussion and implications and future research suggestions are provided in the end.

2. Literature Review

2.1 Theoretical framework and research model

The research model (Figure 1) is developed based on integrating two theoretical lenses, DCV, and contingency theory (Mayer and Sparrowe, 2013). The DCV is introduced to extend the resource-based view (Teece et al., 1997; Eisenhardt and Martin, 2000; Dosi et al., 2001). According to the DCV (Teece et al., 1997; Eisenhardt and Martin, 2000; Pavlou and El Sawy, 2011), highly turbulent environments require the development of a set of dynamic capabilities to reconfigure the firm's resources for sustainable competitive advantage (Vera et al., 2011). On the other hand, contingency theory emphasizes that firms need to adapt their strategies and capabilities to dynamic environmental conditions to achieve higher performance. DCV and contingency theory, talk about a single phenomenon, the necessity of adapting firm strategies, and the external environment. While DCV moves from the turbulent environment to strategy, contingency theory moves from strategy to the environment. In a way, DCV, the recent theory, has a proactive view of adapting strategies to the environment; Contingency theory, on the other hand, takes a reactive approach to this phenomenon. We argue that in practice the firm's approach is neither completely proactive nor completely reactive; Rather, a combination of these two approaches is realized. Therefore, it can be asserted that integrating these two theoretical lenses can help to develop new insights in the environmental turbulence literature (Mayer and Sparrowe, 2013).

We use the ESP framework to integrate the two theories. This framework suggests that a firm's strategic choice and strategic operations are dependent on the extent of environmental turbulence to achieve and sustain firm performance (Luo, 1999). To survive in a competitive environment, firms must continuously monitor and sense-make the external environment. Firms also need to develop pre-determined strategies to deal with and align with environmental dynamics (Lee, 2010; Turulja and Bajgoric, 2019). Based on the ESP framework, the firm should integrate its strategies with environmental conditions (Duncan, 1972; Miles et al., 1978; Gresov, 1989). Therefore, there is an interactive relationship between environmental conditions and strategies for delivering firm performance.

ESP literature emphasizes that "The firm is viewed as an information processor that has strong cognitive abilities to scan and interpret threats and opportunities arising from external environments, which then lead to strategic decisions" (Lee, 2010). Consequently, ESP literature considers the strategy layer to include capabilities in managing environmental turbulence and ultimately lead the organization to the right strategic decision/posture (Luo, 1999; Lee, 2010). Therefore, the authors argue that in turbulent environments, the ability to establish inter-organizational relationships and collaborative innovation leads to organizational positioning in a collaborative posture and thus enhances the firm's innovation performance. Strategy without capability is forceless and capability without strategy is aimless (Burgelman et al., 2008). Long with this, ESP literature emphasizes that "The firm is viewed as an information processor that has strong cognitive abilities to scan and interpret threats and opportunities arising from external environments, which then lead to strategic decisions (Daft and Weick 1984; Weick 1979)" (Lee, 2010). In line with your notes, the ESP literature considers the strategy layer to include abilities managing environmental turbulence and ultimately lead the organization to the right strategic decision/posture (Luo, 1999; Lee, 2010).

Therefore, the authors argued that in turbulent environments, the ability to establish inter-organizational relationships and collaborative innovation leads to organizational positioning in a collaborative posture; thus, enhancing the firm's innovation performance.

In our research model, BET is specified as the environmental factor and innovation performance as the performance factor. Dynamic capabilities are operationalized as NC and CIC. Based on our proposed model, if BET is enormous and NC is robust, the CIC will enhance, and consequently, the firm's innovation performance will improve. A detailed discussion of the research hypotheses is followed in the next section.

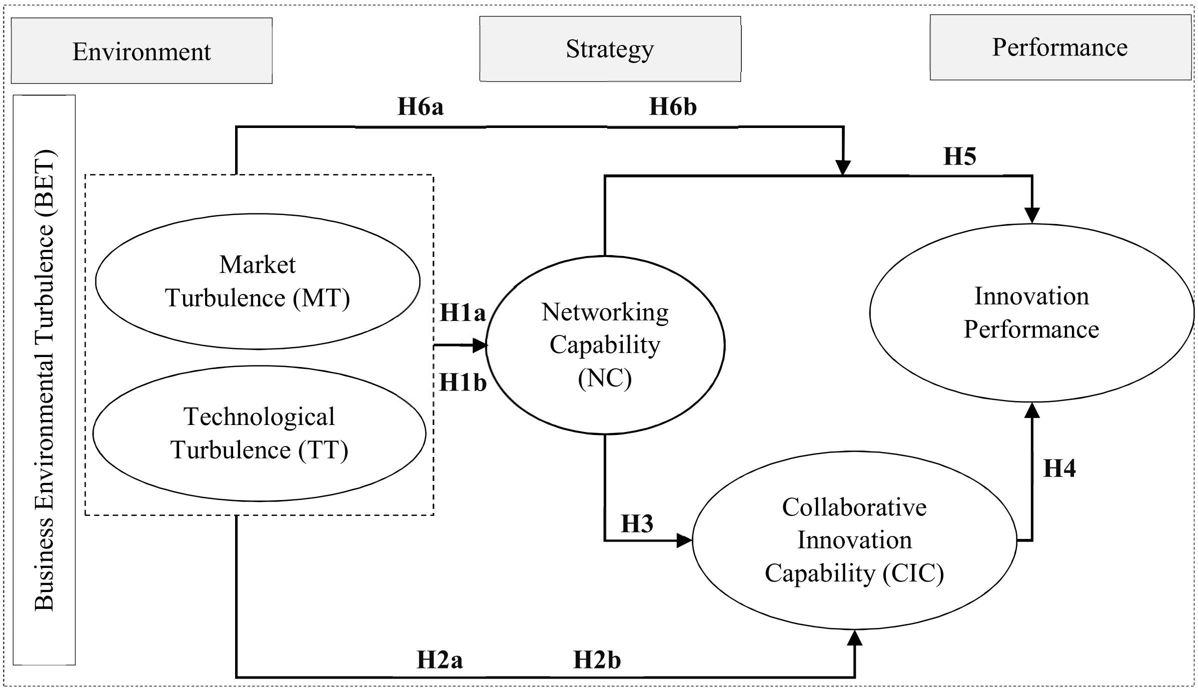


Fig.1. Research model

2.2 Constructs

2.2.1 Business environmental turbulence (BET)

BET has been captured by three main factors: market turbulence (MT), competitive intensity (CI), and technological turbulence (TT) (Jaworski and Kohli, 1993; Bodlaj and Cater, 2019). Market turbulence refers to the rate of changes in customers' composition and their preferences in a market segment. Competitive intensity refers to the rate of the industry-level competitiveness between competitors. Technological turbulence is related to the rate of technological changes as a general environmental condition. In this study, we employ two of the three environmental factors, MT and TT, which are mostly adopted in empirical studies (e.g., Lee, 2010; Hung & Chou, 2013; Tsai & Yang, 2014).

BET can be a driving force for firms to step out of their familiar realm and to become entrepreneurial orientation for new product success (Wong et al., 2014; Hung and Tsai, 2014), or to develop new products (Thornhill, 2006), or to deliver business performance (Lee, 2010; Bodlaj & Cater, 2019). This stream of the literature suggests that BET functions as an antecedent of the organizational strategic choice (Appendix 1). In this sense, organizations adopt a responsive strategy to environmental dynamics (Wong, 2014). Empirical study has shown that the higher the industry dynamism (i.e. the intensity of industry-level R&D), the higher the need for innovation (Thornhill, 2006). Damanpour and Schneider (2006) found evidence in supporting the influence of general environmental factors such as community wealth and unemployment on organizational adoption of innovation. Bodlaj and Cater (2019) found in their study that market turbulence is positively related to the perceived importance of innovation and innovativeness in SMEs. However, there are some contrary results. For instance, the effect of competitive turbulence on business performance is not supported in Lush and Laczniak (1989); the impact of marketing turbulence on firm performance is not supported in Lee (2010).

Different from the above viewpoint, the other stream of the literature believes that BET can be the contingency factor impacting business strategy and the corresponding business performance (Hung & Chou, 2013; Eggers et al., 2014). Therefore, BET plays the moderating role between strategy and performance (Jaworski and Kohli, 1993; Hung and Chou, 2013) (Appendix 1). Prajogo (2016) demonstrates that environmental dynamism and environmental competitiveness positively moderate the effectiveness of the product and process innovation strategies in delivering business performance. Market turbulence and technological turbulence are found to positively moderate the relationship between external technology acquisition strategy and firm performance (Hung and Chou, 2013). However, in other empirical studies, the moderation role of the environmental factors have been found with no evidence to support it (e.g., Tsai & Yang, 2014)

2.2.2 Networking capability (NC)

Various studies have defined NC (Mitrega et al., 2012; Ripolls and Blesa, 2018; Arasti et al., 2022). According to Miterga et al. (2012), NC is "the set of organizational activities and routines implemented at the organizational level of the focal company to initiate, develop, and terminate business relationships for the benefit of the company." Besides, NC is composed of partner selection, coordination, conflict resolution, and resource sharing (Miterga et al., 2012; Ripollés and Blesa, 2017; Mokhtarzadeh et al., 2020; Mokhtarzadeh et al., 2021).

2.2.3 Collaborative innovation capability (CIC)

CIC is defined as the ability of a focal firm to co-work with different network partners in the innovation process (Wang and Hu, 2017; Mokhtarzadeh and Faghei, 2019). CIC is about applying collective knowledge and ideas to innovation activities relating to new products, processes, services, marketing, and systems in conjunction with its inter-firm partnerships (Blomqvist and Levy, 2006). As innovation depends on both the firm's existing technology base and the firm's ability to leverage external knowledge sources (Mazzucchelli et al., 2019), CIC is a focal concept in knowledge creation and collaborative innovation in networks (Blomqvist and Levy, 2006).

Various firms have different capacities to integrate know-how from network collaborations in their innovation process (Ferraris et al., 2019). CIC allows the knowledge and technology created in the network to be fully exploited and prevent re-invention and stagnation of resources (Wang and Hu, 2017). Wang et al. (2017) consider CIC as an integrating dynamic capability, with which companies work together to deal with the rapidly changing environment.

2.3 Hypothesis development

2.3.1 Business environmental turbulence and networking capability

The higher the focal firm's environmental challenges are, the more robust relationships with network partners are needed to eliminate the lack of required resources (Gulati et al., 2000). In a turbulent environment, the focal firm needs to consistently communicate with its business network partners in various locations about their local market information (Inkpen and Tsang, 2005). With this information, the focal firm can adapt its marketing strategy to the environmental changes and maintain and improve its share in different market segments. Therefore, when the market is more turbulent, the focal firm has to strengthen its NCs to identify and address its challenges in local markets (Lee, 2010). As misunderstandings and mismanagement of customer preferences in different market segments lead to a loss of competitive advantage, it is critical to engage in ongoing interactions with network partners in environments with higher market turbulence. Accordingly, this study argues:

Hypothesis 1a (H1a): *Market turbulence (MT) has a positive effect on firm networking capability (NC).*

Unforeseen technological changes can obliterate the technologies embedded in a focal firm's existing products, and consequently, they can lead to the loss of its core competencies (Hansen and Løvås, 2004). Since a business alone does not have all the resources and technical knowledge it needs (Chesbrough, 2006), it has to gain the required knowledge by establishing innovation networks (Hitt et al., 2000). Therefore, the focal firm needs to enhance its NCs in environments with high technological turbulence to obtain relevant and up-to-date technical information, and thus, correctly identify future technologies, new product concepts, and distinctive product features (Hansen et al., 2005). Since misunderstanding and mismanagement of incremental and radical technological changes in the industry will lead to the obsolescence of the firm's technology base, it is vital to establish network relationships in environments with higher technological turbulence. Therefore,

Hypothesis 1b (H1b): *Technological turbulence (TT) has a positive effect on* firm *networking capability (NC).*

2.3.2 Business environmental turbulence and collaborative innovation capability

Competitive pressures in highly turbulent markets force firms to utilize their innovation capabilities (Lee, 2010). Business opportunities are more in dynamic markets due to continuous changes in customer preferences (Wang et al., 2017). This situation puts firms under pressure to dynamically respond to these environmental factors by strengthening their innovation capabilities (Lages et al., 2009; Helfat & Winter, 2011). However, experience has shown that standalone innovation in turbulent markets is impossible, and the firm needs to rely on its business network. Firms have to acquire a certain kind of innovation capability, CIC, in especially highly turbulent new markets. Responding and adapting to environments with high market turbulence requires companies to work collaboratively to create shared knowledge and innovate distinctive features of the new product/service (Wang and Hu, 2020). As a dynamic capability, CIC reduces the risks of BET due to the integration of partners' knowledge and adapts the focal firm to local market conditions (Chi et al., 2018). CIC helps the firm respond to the local market customers' demands based on the local partners' information in a different way from competitors, and even after a short period, it can potentially shape the market needs and lead to the development of the local market (Lee, 2010). Following the above argument, we propose the following hypothesis.

Hypothesis 2a (H2a): *Market turbulence (MT) has a positive effect on* firm *collaborative innovation capability (CIC).*

High technological turbulence involves radical technological changes and the creation of new knowledge (Drucker, 1994). In environments with high technological turbulence, firms most develop capabilities that are difficult to imitate and have the potential to increase firm competitiveness (Wang et al., 2017). The creation of new technology is challenging to individual businesses, and it usually needs businesses to co-create knowledge (Kazadi et al., 2016). As mentioned earlier, the obsolescence rate of products is much higher in environments with high technological turbulence. Therefore, firms are facing shorter product life cycles, and they should increase the pace of development of their new product. In such circumstances, the costs and risks of product development increase dramatically, and firms will inevitably have to develop their product collaboratively. Therefore, technological turbulence makes it necessary for firms to improve their CIC. Even in such environments, firms can change the industry norms, redefine the industry's technological standards by offering breakthroughs, and manage technological turbulence with an aggressive approach (Lee, 2010). Therefore, it can be concluded that:

Hypothesis 2b (H2b): *Technological turbulence (TT) has a positive effect on* firm *collaborative innovation capability (CIC).*

2.3.3 Networking capability and collaborative innovation capability

Wang et al. (2018) define knowledge networks as "knowledge-based structures of inter-organizational relationships that are created to absorb and exchange knowledge." If the focal firm can accurately create and manage its knowledge networks properly, its CIC will improve (Mokhtarzadeh et al., 2020). Therefore, the transfer, translation, and conversion of network members' knowledge depend on the focal firm's ability to develop and manage the network (Carlile, 2004). Knowledge networks help CIC by providing the social capital needed by firms to implement innovation activities (Yli-Renko et al., 2001; Grantt & Pollock, 2011). Research emphasizes that an acceptable level of NC is essential to enhancing firm innovation capability (Pittaway et al. 2004; Feldman, 2004; Swink, 2006). Mishra and Shah (2006) argue that the more diverse partners are participating in the knowledge network by the focal firm, the more it improves its CIC. The higher the firm's NC is, the more it can access partners' technical knowledge and better facilitate the innovative activities of the knowledge network (Wang and Hu, 2017). Since NC provides the context for consensus on innovation projects and for achieving a shared understanding of parties' concerns, it enhances CIC (Mishra and Shah, 2009). In knowledge networks, innovative activities are carried out using collaborative communication and knowledge integration (Guan and Liu, 2016). Sharing knowledge on the network increases partners' willingness to invest in joint projects (Wang and Hu, 2017). The literature emphasizes that the expansion and application of knowledge gained in existing technologies or products require the development of knowledge integration capability, which is critical in high-turbulent environments (Wang et al., 2018). The stronger the focal firm's NC is, the more diverse and newer knowledge it acquires, and the better it adapts to the rapidly changing environment (Briscoe and Rogan, 2016). NC enables the firm to communicate with different partners who are proficient in various knowledge areas and enhance its CIC by acquiring relevant and complementary expertise (Martin-Rios and Erhardt, 2016; Reuer and Devarakonda, 2017). As mentioned earlier, the CIC means integrating and applying network knowledge and applying it to product and process innovations. According to this definition, it can be argued that by assisting the focal firm in identifying the network partners' knowledge resources and acquiring them, the NC provides the fundamental basis for the integration and application of this knowledge. Therefore:

Hypothesis 3 (H3): *Networking capability (NC) has a positive effect on* firm *collaborative innovation capability (CIC).*

2.3.4 Performance implications of collaborative innovation capability and networking capability

Although some research has shown that collaborative innovation does not always positively affect performance (Jean et al., 2014), the main body of literature believes that the financial returns of collaborative innovation projects are far higher than standalone innovation projects (Wang and Hu, 2017). Therefore, one of the most important reasons for improving firm innovation performance is the development of inter-firm relationships with different business network partners (Faems et al., 2005). However, the firm may have access to its partners' knowledge; nonetheless, it may not improve its innovation performance. It is because the firm cannot absorb and exploit this knowledge (Wang and Hu, 2017). Therefore, in some situations, merely accessing partners' knowledge is not enough. The firm must be able to absorb and apply knowledge through CIC to facilitate the impact of knowledge on innovation performance. CIC facilitates collaboration among network members, leading to the promotion of the focal firm's innovation performance. Collaborative learning enables a firm with a higher level of CIC to have superior innovation performance (Hartono and Sheng, 2016). By leveraging CIC, firms create channels that reduce investment time and volume to gather information, as well as open up new opportunities for firms as they learn (Wang and Hu, 2017). In this way, the focal firm can use partners' new ideas and knowledge to launch new customer-friendly products to the market, improve the operational efficiency of its processes, and increase profitability (Wang et al., 2017). Therefore, collaborative innovation enables the focal firm to integrate the network partners' resources and improve its innovation performance (Mishra and Shah, 2009; Steen, 2017). Hence, we propose the following:

Hypothesis 4 (H4): *Collaborative innovation capability (CIC) has a positive effect on* firm *innovation performance.*

Networking intensity has a positive effect on innovation (Pittaway et al., 2004; Rogers, 2004; Min et al., 2020). It is especially true in the manufacturing industries (Rothwell, 1991; Eggers et al., 2014). Networking leads to better and faster coping with innovation challenges (Uzzi, 1997; Pittaway et al., 2004). Networks play an important role in seeking and identifying opportunities for innovation (Frenken, 2000). In the product design and development process, networking with suppliers and customers allows customers' needs to be met more quickly; therefore, time to market is reduced significantly (Eggers et al., 2014). Many studies have confirmed the relationship between networking and innovation performance (Faems et al., 2005; Gulati et al., 2011; Singh et al., 2016; Mokhtarzadeh et al., 2020). Networked collaborations provide the complementary assets needed to innovate, share knowledge between the focal firm and its partners, and help share R&D risks and costs (Faems et al., 2005). Moreover, firms can manage the emergence of new competitors by collaborating with newcomers or technology providers and providing them with the complementary assets they need (Taylor and Helfat, 2009). Accordingly, the present study argues that by identifying innovation opportunities and providing the necessary technological and complementary assets, NC reduces the time to market and sharing of innovation risks and costs, thus improving the firm's innovation performance. Therefore:

Hypothesis 5 (H5): *Networking capability (NC) has a positive effect on* firm *innovation performance.*

2.3.5 The moderating role of business environmental turbulence

As mentioned earlier, environments with high turbulent markets require the constant introduction of new products. In such an environment, adapting to rapidly changing market conditions requires exploring, identifying, managing, and leveraging new relationships that both help explores and exploit opportunities (Mu, 2012). Customer relationship management helps the firm continuously obtain information about their needs and preferences and apply it to firm innovation projects (Yu et al., 2014). By building relationships with partners, the focal firm acquires the necessary complementary assets for exterritorial commercialization and enhances its innovation performance (Hung and Chou, 2013). The higher the market turbulence is, the more difficult it is to identify and respond to market needs. Therefore, a joint solution provided by the focal firm and its partners is more likely to succeed. When market turbulence is high in an environment, the focal firm's NC will be more robust in developing and managing a more efficient knowledge network. Thus, it will have a more significant impact on the firm's innovation performance. Therefore:

Hypothesis 6a (H6a): *Market turbulence (MT) moderates the relationship between networking capability (NC) and firm innovation performance.*

As environmental turbulence increases, firms need more complementary resources, acquiring and exploiting them relying on networking capability. In environments with high technological turbulence, networking can reduce the time it takes to search and respond to innovation opportunities and consequently improve innovation performance (Eggers et al., 2014). The technological turbulence forces companies to adapt to incremental and radical changes in the environment through trial and error (Mu, 2012). In turbulent technological environments, the focal firm must modify and upgrade technologies that are about to become obsolete with the help of its partners; hence, they can be re-exploited (Hung and Chou, 2013). Firms with more robust NCs can effectively communicate their technological relationships and respond to technological changes faster by acquiring new technologies (Yu et al., 2014). In environments with high technological turbulence, it is possible to gain value from the knowledge gained through networking, because technological dynamics create different customer needs, and the firm can capture value (Eggers et al., 2014). Ju et al. (2013) argue that in high-turbulence environments, NC leads to innovation performance because both the process of risk reduction and risk sharing can be implemented by leveraging the firm's resources outside and using partners' resources inside. Therefore, it can be argued that in environments with high technological turbulence, the networking capability will have a more severe impact on innovation performance. Hence:

Hypothesis 6b (H6b): *Technological turbulence (TT) moderates the relationship between networking capability (NC) and* firm *innovation performance.*

3. Method

3.1 Narrative of the research setting

In the research context, Iran is one of the largest developing countries with significant political and economic impacts on the West Asian region. However, studies show that Iranian companies suffer from barriers such as lack of access to sufficient financial resources, poor networking, corporate dependence on the government in commercialization, low R&D investment in the private sector, and low levels of international cooperation on innovation (UNCTAD, 2016). As such, Iran's emerging market becomes a complex and highly dynamic environment, which is relevant to the focus of this study, namely BET, networking, and innovation.

The automotive industry is the third-most active industry in the country, after its oil and gas industries, accounting for 10% of Iranian gross domestic product (GDP) and 4% of the Iranian workforce. Since the early 2000s, automobile production in Iran has grown exponentially. According to figures from the International Organization of Motor Vehicle Manufacturers (OICA), Iran was the 12th biggest car market on the planet in 2017, with sales in the region of 1.5 million cars. That number of cars represented an 18% growth in sales, which made Iran the fourth fastest-growing nation in the globe, behind Brazil, Portugal, and Russia. Today, Iran is the 18th largest automaker in the world and one of the largest in Asia.

However, studies show that, together with constantly changing customer preferences, recent technological advances cause significant challenges and require product and process innovations (bin Zainuddin, 2017). Due to the coexistence of product and process innovations, innovation performance measurement will provide a more comprehensive estimate than industries that focus solely on the product or process (Utterback and Abernathy, 1978; Voss, 1994). Furthermore, the complex nature of the automotive industry makes it impossible for automakers to develop products and processes on their own, and inevitably move toward the formation of business networks and collaborative innovation (Sturgeon et al., 2008).

3.2. Measures and instrument

In this study, the items of measurement tools are adopted or adapted from existing literature. The authors employed a five-point Likert interval scale for measuring the constructs with options ranging from 1 (strongly disagree) to 5 (strongly agree). The authors avoided using the categorical scale in endogenous constructs. Moreover, a uniform value of 1 as starting weight was utilized for the approximation of the latent variable scores. The authors report factor loadings clearly to guarantee a good outer model evaluation. Hence, the maximum number of interactions and run bootstrapping were not exceeded. Two BET measures (i.e., market turbulence and technological turbulence) and their measurement items were extracted from Bodlaj and Cater (2019). Since the market structure in the Iranian automotive industry is oligopolistic, the third BET measure, i.e., the competitive intensity, is excluded from our study. NC items were designed based on the dimensions of partner selection, coordination, conflict resolution, and resource sharing (Miterga et al., 2012; Ripollés and Blesa, 2017). CIC items were developed based on Wang et al. (2017) and Wang and Hu (2017). Innovation performance items were also designed based on Frishammar and Horte (2005) and Chen et al. (2020). Although innovation performance items are not objective, it is possible to access their relevant subjective data (Ritala et al., 2015).

Since this study was conducted in Iran, the Persian version of the questionnaire instrument had to be prepared. We used back-to-back and double-blind translation procedures to ensure the transferability of the items and eliminate the interpretive and cross-cultural effects. In this procedure, the measurement tool was first developed in English, then translated into Persian for the data collection. It causes the translator to re-create the new wording if the desirable meaning is not obtained after the translation (Eggers et al., 2014). Finally, the questionnaire is checked in the second round by another translator to resolve any possible defects. After the translation, the content validity was investigated, and the survey was modified based on the feedback received from experts. A pre-test was then performed to assess the reliability of the questionnaire, and Cronbach's alpha was 0.923 (Cronbach, 1951). Subsequently, larger companies were contacted by telephone, and efforts were made to obtain their consent to participate in the study and identify key informants. Then, the cover letter and questionnaire were sent in the form of a link to critical informants' email or social network line. Follow-ups were conducted to increase the response rate. During the initial communication, to gather sufficient data, key informants of bigger firms were asked to create a communication channel with the network of firms around them.

3.3. Sampling frame and data collection

The sampling frame of this study was developed based on the database of the Iranian Vehicle Manufacturers Association (IVMA) and the Iranian Auto Parts Manufacturers Association (IAPMA). An examination of this database shows that Iran has 1,228 companies operating in the automotive industry. Of this list, 1213 companies' contact information was available.

A questionnaire was sent to all 1213 respondents by email. After the first email contact, phone calls, emails, and follow-up text messages have been used to encourage and remind them to participate in the survey (Dillman, 2000). As a result, 318 questionnaires were returned. The response rate is around 26%, which is in the range of similar research (e.g., Bodlaj and Cater, 2019). Of these, 12 incomplete questionnaires were removed from the analysis. Therefore, a sample of 306 survey data is valid for the analysis. In the structural equation approach, the sample size should be at least ten times the number of structural paths of the model (Hair et al., 2017). Besides, according to Cochran's formula (Cochran, 1963), the required sample size is 293. Therefore, the sample of this study meets both of the above standards. In this study, the average age of firms is 31.6, and the standard deviation is 32.2 years. The oldest firm has 58 years of history, and the latest firm has nine years. The increasing trend of privatization in Iran indicates a severe decline in the government's share in automotive companies. However, the vast majority (81%) of the sample firms are still State-owned. Sample company profiles and demographic information of participants are depicted in Table 1.

Our survey respondents are senior managers, new product development managers, project managers, R&D managers, and strategic planning experts. The majority (98%) are male, indicating that the Iranian auto industry is male-dominated in career. (Please add a bit more description of the respondent profile here)

Table 1. Sample profile

Indicator	Category	Frequency	Percentage (%)
Panel A: Firm Characteristics			
Ownership	Private	61	19
	State-owned	245	81
Size	Large Firm	139	45
	SME	167	55
Age	Recent (Less than 20 years)	52	16
	Experienced (More than 20 years)	254	84
Panel B: Respondent Characteristics			
Gender	Male	301	98
	Female	5	2
Age	Less than 35	38	12
	35 to 45	96	31
	More than 45	172	57
Education	Graduate	193	63
	Post-graduate	113	37
Work Experience	Less than 10	53	17
	10 to 15	41	13
	15 to 20	36	11
	More than 20	176	59
Job Position	Senior managers	28	10
	New product development managers	51	16
	Project managers	65	21
	R&D managers	116	38
	Strategic planning experts	46	15

3.4. Bias test

Since this study adopted a key informant approach (Kumar et al., 1993), a set of criteria was considered for the respondent's qualifications, including job position, job title, work experience, duration of cooperation with the company, level of education, and level of familiarity with the central research topics (Kortmann et al., 2014). More than 90% of respondents had more than five years of work experience, and they held high-ranking job positions. The results of t-tests show that there is no statistically significant difference between respondents and non-respondents and early and late respondents (Sheikh and Mattingly, 1981). Therefore, this study is not affected by nonresponse bias. Common method bias is also one of the survey-related biases that occur due to data collection at a certain point of time, the use of the same communication channel, and the inquiry of a specific set of respondents (Podsakoff et al., 2003). Some strategies used to deal with this bias include breaking the questionnaire into different sections to make the respondent unaware of the relationships between constructs, simplifying and removing ambiguity from the items, creating confidence in respondents on the lack of correct and incorrect answers, and ensuring the confidentiality of their participation (Wang et al., 2018).

4. Results and Analysis

In this study, the structural equation modeling (SEM) method with a partial least squares (PLS) approach was used to test the measurement model and hypotheses. PLS-SEM analyses are performed in two steps. The first step is to validate the measurement model, and then the structural model analysis is followed (Chin, 2010; Hair et al., 2017). Measurement model analysis requires an assessment of construct validity and reliability. The structural model analysis is performed to evaluate the extent to which the conceptual model fits empirical data. The results of these analyses will be described below.

4.1. Measurement model analysis

Tables 2 and 3 report descriptive statistics of the constructs of the measurement model, including the means, standard deviations, and correlations.

Table 2. Descriptive statistics

Constructs	Mean	SD	VIF
1. Innovation performance	3.13	0.52	2.82
2. Collaborative innovation capability	3.22	0.59	1.79
3. Networking capability	2.96	0.58	2.07
4. Market turbulence	3.47	0.7	-
5. Technological turbulence	3.39	0.61	-

Table 3. Correlation matrix

Constructs	1	2	3	4	5
1. Innovation performance	*				
2. Collaborative innovation capability	0.55	*			
3. Networking capability	0.7	0.66	*		
4. Market turbulence	0.56	0.42	0.62	*	
5. Technological turbulence	0.64	0.44	0.67	0.73	*

All correlations are significant at the 5% error level (two-tailed

The measurement model defines the relationship between measurement items and their latent variable. Table 4 shows the test results of the measurement model analysis and construct reliability and validity. The authors report factor loadings clearly to guarantee a good outer model evaluation. The factor loadings of the items are above 0.7, and the AVE values for all variables are above 0.5, indicating the internal convergent validity of the constructs. Cronbach's alpha and the composite reliability (CR) index for all variables are above 0.8, suggesting satisfactory reliability of all constructs and the measurements (Hair et al., 2010; Kock, 2012).

Table 4. Evaluation of measurement model

Constructs	Items	Factor Loadings
Market turbulence (AVE=0.68) ($\alpha_c = 0.948$) (CR=0.959)	Customer demands are changing rapidly.	**0.868**
	Customer buying behavior is changing rapidly.	**0.811**
	Customers are continually looking for new products.	**0.809**
Technological turbulence (AVE=0.62) ($\alpha_c = 0.946$) (CR=0.951)	In our industry, technology is changing rapidly.	**0.710**
	Technological changes provide great opportunities for our industry.	**0.740**
	In our industry, many new product ideas can be realized through unexpected technological advances.	**0.900**
Networking capability (AVE=0.58) ($\alpha_c = 0.931$) (CR=0.945)	We prepare a formal list of preferred features of the partner and identify which partners are attractive.	**0.757**
	We evaluate the resources and capabilities of potential partners formally.	**0.745**
	We discuss who is doing what in an inter-firm context collaboratively.	**0.851**
	We check that promises by all parties are fulfilled.	**0.793**
	We wait a considerable time in case of conflicts to allow the situation to calm down.	**0.701**
	We try to establish a compromise that is acceptable for all sides when a conflict arises.	**0.701**
	We facilitate mutual access to technical systems and equipment with our partners.	**0.730**
Collaborative innovation capability (AVE=0.64) ($\alpha_c = 0.957$) (CR=0.960)	Our company can develop new collaborative skills.	**0.763**
	Our company can design new collaborative business processes.	**0.833**
	Our company can maintain and use new knowledge and technology in its business network.	**0.799**
Innovation performance (AVE=0.51) ($\alpha_c = 0.920$) (CR=0.949)	There is a strong emphasis on the launch of new products.	**0.703**
	There exists a very strong emphasis on R&D, technological leadership, and innovations.	**0.711**
	We can develop new technology to improve product quality.	**0.713**
	Changes in products have usually been dramatic.	**0.797**
	We make a considerable profit from our new products.	**0.765**
	We can develop new technology to improve operational efficiency.	**0.812**
	We can develop new production and manufacturing methods and procedures to improve productivity.	**0.787**
	We purchase new instruments or equipment to improve productivity.	**0.711**
	We make a considerable profit from our new processes.	**0.706**

Tables 5 show the results of discriminant validity. All the HTMT (Heterotrait-Monotrait) ratios, ranging from 0.63 to 0.81, are below the criterion value, 0.85 (Henseler et al., 2015). Therefore, the discriminant validity of all constructs is satisfied.

Table 5. Discriminant validity based on Heterotrait-Monotrait ratio

Constructs	1	2	3	4	5
1 Market turbulence	*				
2 Technological turbulence	0.72	*			
3 Networking capability	0.68	0.63	*		
4 Collaborative innovation capability	0.70	0.81	0.72	*	
5 Innovation performance	0.65	0.61	0.69	0.76	*

4.2. Structural model analysis

The structural model evaluates the intensity of relationships between variables. It examines the extent to which the conceptual model fits empirical data based on a set of criteria. Answering the third research question, which is about the dual roles of BET, we developed and tested two models separately. The first model considers BET as an antecedent, and the second one includes both antecedent and moderating roles of BET. Comparing the results of these two models confirms the dual role of BET. The relationship between the variables studied in each hypothesis is tested based on a causal structure using the partial least squares method. In this method, bootstrapping or Jackknife crosscutting methods are used to test the significance of the hypotheses. In this study, the former approach has been used. The authors did not exceed the maximum number of interactions and run bootstrapping according to the suggested conditions.

4.2.1 Model 1 (BET as the antecedent)

The results of testing model 1, shown in Fig 2, confirm the antecedent role of BET. In the next section, we are going to test the BET dual roles (model 2) and compare them with model 1.

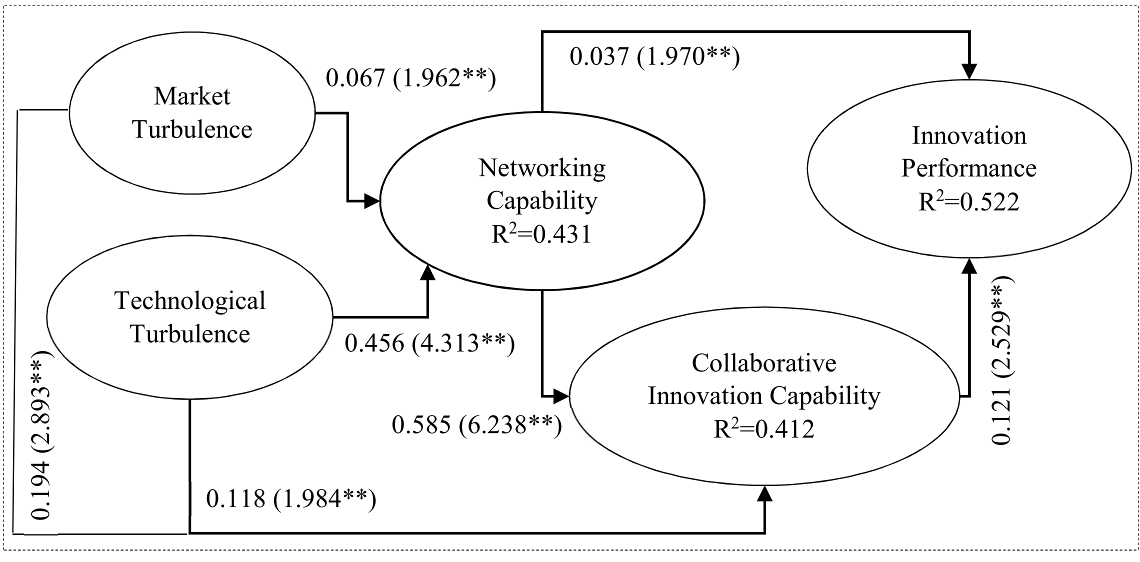


Fig. 2. Results of model 1 test

4.2.2 Model 2 (BET as antecedent and moderator)

The results of testing model 2 are indicated in Fig. 3. The comparison of statistic loadings in the two models presented in Table 6, suggests that the additional moderating role of BET improves the path coefficients of the model. Moreover, the R square of innovation performance in model 2 (R^2=0.646) is also much improved in comparison with that in model 1 (R^2=0.522), suggesting innovation performance is better explained in model 2.

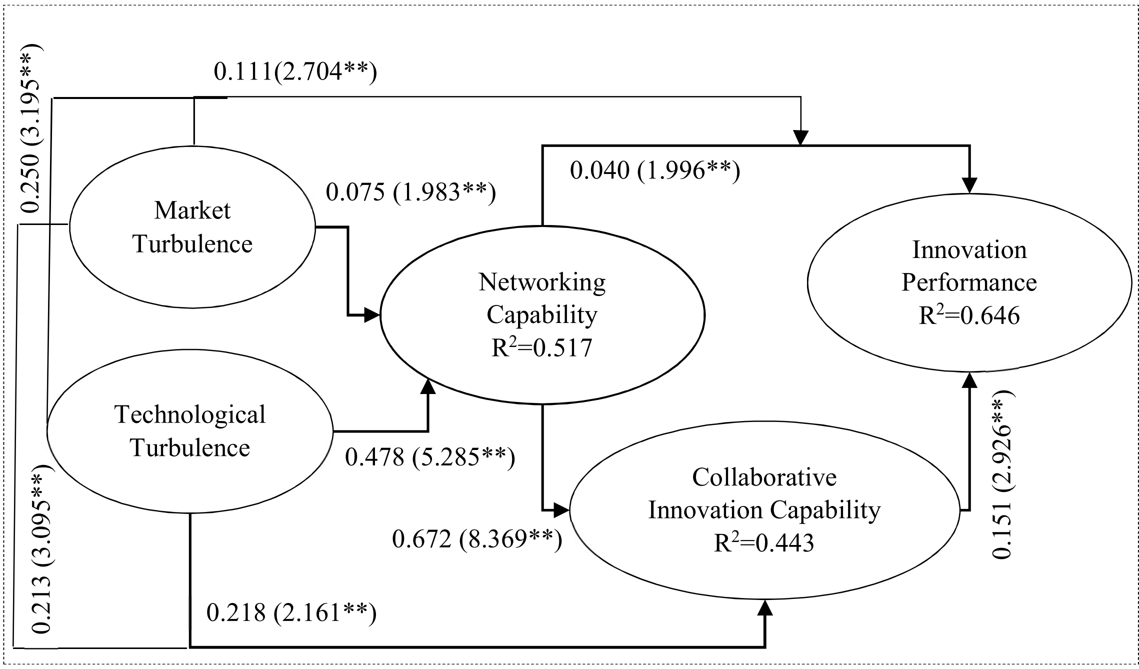


Fig. 3. Results of model 2 test

Table 6. Comparing path coefficients of model 1 and model 2

Hypotheses	Model 1	Model 2
H1a (MT to NC)	0.067 (1.962)	0.075 (1.983)
H1b (TT to NC)	0.456 (4.313)	0.478 (5.285)
H2a (MT to CIC)	0.194 (2.893)	0.213 (3.095)
H2b (TT to CIC)	0.118 (1.984)	0.218 (2.161)
H3 (NC to CIC)	0.585 (6.238)	0.672 (8.369)
H4 (CIC to IP)	0.121 (2.529)	0.151(2.926)
H5 (NC to IP)	0.037 (1.970)	0.040 (1.996)
H6a (Moderating Role of MT)	-	0.111 (2.704)
H6b (Moderating Role of TT)	-	0.250 (3.195)

T values are in brackets

All research hypotheses have been statistically supported (Table 6). Based on the results, market turbulence and technological turbulence with 0.075 and 0.478, respectively affect NC. Furthermore, market turbulence and technological turbulence with 0.213 and 0.218, respectively, have a positive effect on CIC. Therefore, it can be concluded that firms can improve their CIC by leveraging opportunities caused by BET. Hypothesis 3 is also confirmed with a coefficient of 0.672. The antecedent role of NC is significant compared to CIC. Businesses must first be able to communicate well with each other and then jointly implement innovative activities. Based on the result of hypothesis 4, BET moderates the relationship between NC and innovation performance. It means that the intensity of this relationship is higher in environments with high turbulence. Finally, the effect of CIC and NC, with a correlation of 0.151 and 0.040 on firm innovation performance, is also confirmed. All coefficients are significant at 95%.

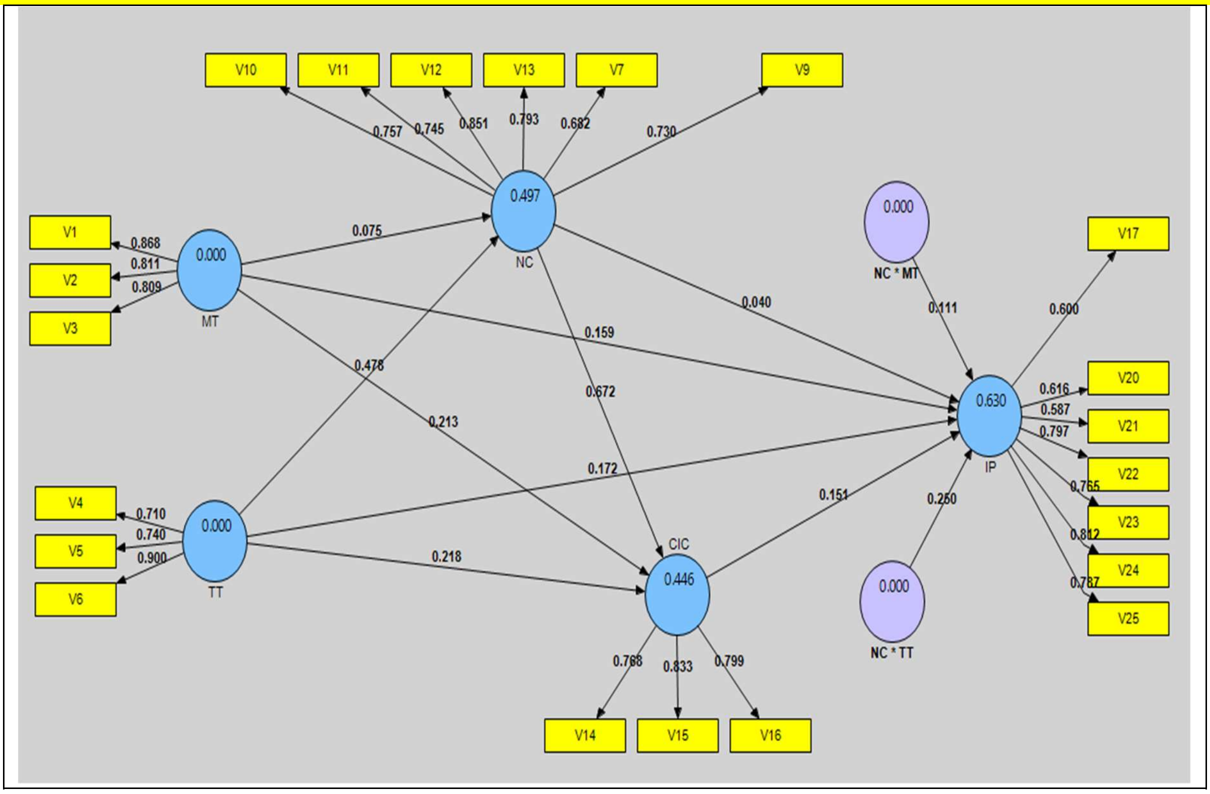
4.2.3 Model Quality

0.19, 0.33 and 0.67 are introduced as a weak, medium, and strong values for R^2 (Chin, 1998), 0.15, 0.2 and 0.35 as weak, medium and strong predictive power for Q^2 (Henseler et al., 2013) and 0.1, 0.25, and 0.36 as weak, medium, and strong values for GOF (Wetzels et al., 2009). The blindfolding technique is used to calculate Q^2 in SmartPLS software. In this study, the blindfolding values of all acceptable constructs were obtained based on cross-validated redundancy and cross-validated communality indices. The satisfactory level of statistics related to structural indicators confirms the high quality of the conceptual model (Table 7). Therefore, this model explains the hypotheses well.

Table 7. Quality of the structural model

Endogenous Constructs	Communality	Redundancy	R^2	GOF
NC	0.558	0.275	0.517	
CIC	0.638	0.277	0.443	0.544
IP	0.536	0.316	0.646	

The inner and outer models with the PLS-SEM software are presented as follows (Figure 4).



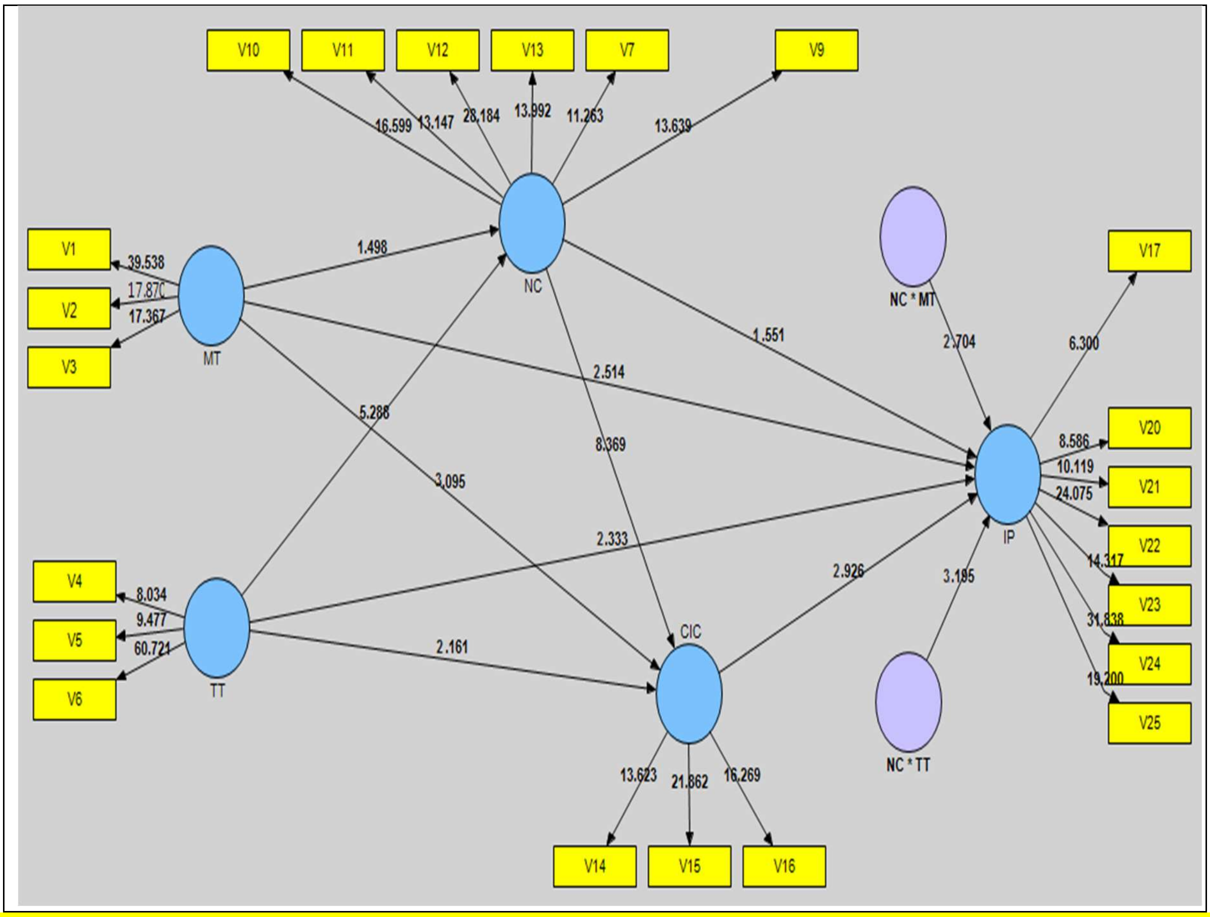


Figure 4. The PLS-SEM results

5. Discussion and Conclusions

This study seeks to simultaneously examine the antecedent and moderating roles of BET in promoting a firm's innovation performance by adopting a networked innovation strategy. Our research provides new insights for automotive industry managers. The central question of the research is, "how does BET affect firm innovation performance through NC and CIC?" Based on the relevant literature and the environment-strategy-performance framework, the authors proposed a conceptual model that includes six main hypotheses and five constructs consisting of market turbulence, technological turbulence, NC, CIC, and innovation performance. Although previous research has examined these factors separately, their combined effect has been neglected. Following, the authors have examined the theoretical contributions, practical implications, and some suggestions for future research.

5.1. Theoretical contributions

From several aspects, this study has theoretical contributions to innovation management. Regarding RQ_1, this study proposes two main strategic paths for enhancing the firm innovation performance in the turbulent environments, which are leveraging network relationships for external sourcing (NC >> IP) and innovation-oriented collaborations (NC >> CIC >> IP). To highlight the significant role of CIC in improving innovation performance, we try to draw the attention of innovation scholars to this new construct. Our results show that NC is more actively influenced by technological turbulence than CIC while CIC is more actively influenced by market turbulence. This result suggests that facing the challenge of technological turbulence;

innovation performance could be achieved by developing a more robust networking capability. Moreover, facing the problem of market turbulence, a more substantial CIC may be more effective for delivering innovation performance.

Regarding RQ_2, leveraging NC and CIC leads to an effective response to the instability caused by BET and the firm's adaptation to the environment (Anning-Dorson, 2017). Therefore, consistent with Turulja and Bajgoric (2019), our results suggest that BET is a driving force for innovation capability, which is consequently related to innovation performance. Different from the previous studies, the combined effect of NC and CIC is our original contribution. The results of this study show that a networking strategy is not enough for responding to environmental turbulence. Since in such an environment, the complexity and instability of variables are considerably high, firms require to integrate various assets and abilities for building and improving innovation capability (Wang and Hu, 2017). And more importantly, the integration of technology bases needs to build upon CIC with various other partner firms (Wang et al., 2018).

Regarding RQ_3, different from the previous literature, which considers BET as either the antecedent or moderator, this study found that BET has a dual role. As an antecedent, BET acts as a driving force determining the formulation of business strategies. This finding is consistent with the dynamic capability theory (Teece et al., 1997). Meanwhile, our results suggest that BET moderates the relationship between strategy and performance. This finding is in line with the contingency theory (Hung and Chou, 2013; Eggers et al., 2014). By doing so, our research updates the ESP literature in the Iranian automotive industry context. Moreover, this study contributes to understanding business innovation performance in a turbulent environment setting.

5.2. Practical implications

This research had some practical implications for practitioners. First, based on the findings of this study, co-innovation is one of the most vital strategies for firms in today's dynamic and changing environment. Therefore, managers must pay serious attention to the importance of innovation to neutralize BET (Turulja and Bajgoric, 2019). However, while the senior Iranian managers should consider innovation as a critical factor influencing performance, they should also develop the capabilities they need simultaneously. Besides, inter-firm cooperation in innovation projects cannot be active if there are unfavorable environmental conditions (Ju et al., 2013). Second, the conceptual model provides a clear understanding of how to gain a competitive advantage through innovation. If firms have a clear understanding of environmental conditions, purposefully leverage inter-organizational relationships, and foster innovation through partners' participation, they can achieve innovation-driven competitive advantage. If this is disseminated through newsletters, posting on corporate social networks, and objectively appearing in senior management behaviors among all employees, it will strengthen the open culture and teamwork in the organization (Bodlaj and Cater, 2019). Third, managers must consider the interdependence of NC and CIC in promoting innovation performance. CIC is enhanced if the NC dimensions work correctly. For example, collaborative skills are developed if the partners are appropriately selected. The maintainability of technical knowledge on the network is mainly dependent on socio-human aspects and resolving conflicts between partners. Intertwined NC and CIC dimensions are one of the most important practical implications of this study.

5.3. Limitations and suggestions for future research

Despite theoretical and practical implications, this study, like other innovation management studies, faces limitations that provide the avenue for future research. *First*, this research has methodological limitations. For instance, we conducted the study in a specific period, and the findings are related to that particular time. We consider a longitudinal strategy for future studies for robust results. *Also,* the results of the study are relevant to the Iranian automotive industry, and care should be taken for generalizing the findings to other industries and countries. *Second*, future research could investigate the reversal effect of improving CIC and firm innovation performance on attracting external partners. Bodlaj and Cater (2019) emphasize that as the firm's reputation for innovation expands, it will be able to improve the attraction rate of top talents, customer loyalty, brand value, and well-known partners. Fifth, by adding other variables to the conceptual model of this study, its explanatory power will increase. *Third*, the ESP model assumes that the turbulent environmental conditions drive the firm to improve these strategic capabilities for innovation performance. In this sense, the strategy places responsively rather than proactively. What is the role of the firm's strategic orientation plays in the field of innovation performance? This intriguing question is worth exploring in the future.

Appendix 1. Summary of key literature on the role of environment in ESP framework.

Role of Environment	**Reference**	**Environment indicator**	**Strategy indicator**	**Performance indicator**	**Results (Performance indicator as dependent variable)**
as Moderator	Jaworski & Kohli (1993)	TT MT CT	Market orientation (MO)	Business performance	MO*TT (Y) MO*MT (Y) MO*CT (Y)
	Hung & Chou (2013)	TT MT	Eternal technology acquisition (ETA); Eternal technology exploitation (ETE)	Business performance	ETA*TT (Y) ETE*TT(N) ETA*MT(Y) ETE*MT(Y)
	Tsai & Yang (2014)	TT MT	Firm innovativeness (FI)	Business performance	TT *FI (Y) MT *FI (N)
	Eggers et al. (2014)	TT	Networking (MW); Customer responsiveness (CR)	Radical innovativeness	NW*TT*CR (Y)
	Prajogo (2016)	ED EC	Production innovation strategy (Pd); Process innovation strategy (Pc)	Business performance	ED*Pd(Y) ED*Pc(N) EC*Pd(Y) EC*Pc (Y)
as Antecedent	Lusch & Laczniak (1989)	CI	Nonprice competitive strategy (CS)	Business performance (BP)	CI->CS (Y) CI->BP (N) CS->BP (N)

Role of Environment	Reference	Environment indicator	Strategy indicator	Performance indicator	Results (Performance indicator as dependent variable)
	Tan & Litschert (1994)	EU	Defensive-oriented strategy (DS); Proactive oriented strategy (PS)	Business performance	EU->PS (Y) EU->DS(Y) DS->BP (Y)
	Lee (2010)	MT TT	Market responsiveness (MR); Product innovation (PI); Network strength (NS)	Business performance	MT->MR(Y) MT->PI(N) MT->NS(Y) TT->MR(Y) TT->PI(Y) TT->NS(N) MR->BP(Y) PI->BP(Y) NS->BP(Y) MR*NS->FP(Y) PI*NS->FP(Y)
	Wong (2014)	ET	Risk-taking (RT); Innovativeness (In); Proactiveness (Pr)	New product success (NPS)	ET->NPS(N) ET->RT(Y) ET->In(Y) ET->Pr(Y) RT->NPS(Y) In->NPS(Y) Pr->NPS(Y)
	Yu et al. (2017)	ER SP	Innovation strategy (IS)	Environmental performance (EP); Financial performance (FP)	ER->IS (Y) SP->IS (Y) IS->EP(Y)
	Bodlaj & Cater (2019)	MT; TT; CI	Perceived importance of innovation (PI); Innovativeness (In);	Business performance	MT->PI (Y) MT->In (Y) TT->PI (Y) TT->In (N) CI->PI (N) CI->In (N) PI->In (Y) In->BP (Y))

Technological turbulence (TT); market turbulence (MT); Competitive intensity (CI); Environmental dynamics (ED); Environmental competitiveness (EC); Environmental uncertainty (EU); Environmental regulation(ER); Stakeholder pressures(SP).

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