e-ISSN: 2600-7568

Available online at
https://gadingssuitm.com/index.php/gadingss

GADING Journal for the Social Sciences 29(1) 2026, 247 – 264

GADING Journal for the Social Sciences

Enhancing Competitiveness through Synergy: A Qualitat Kota Kinabalu 88770, Sabah, Malaysia ive Study of China's Sporting Goods-Related and Supporting Industries Based on NVivo Software

Minyi Li[1*], Noorziah Mohd Salleh[2], Pg Mohd Auza'e Pg Arshad[3]

[1]*XinYu University. Xinyu Sunshine Road 2666, 338000, Jiang xi, China & Faculty of Business Management, Universiti Teknologi MARA Cawangan Sabah, Kota Kinabalu 88770, Sabah, Malaysia.*
[2]*Faculty of Business Management, Universiti Teknologi MARA Cawangan Sabah, Kota Kinabalu 88770, Sabah, Malaysia.*

ARTICLE INFO

Article history:
Received 15 January 2026
Revised 22 March 2026
Accepted 03 April 2026
Online first
Published 15 April 2026

Keywords:
Related and Supporting Industries (RSI)
Diamond Model
international competitiveness
sporting goods
China

DOI:
https://doi.org/10.24191/gading.v29i1.797

ABSTRACT

How can the Chinese sports goods industry break away from the "production efficiency-oriented" industrial competition model? This study highlights the significant role of mutual synergy efficiency between related and supporting industries (RSI). Using Porter's "Diamond Model" as the theoretical framework, this study examined the composition and interaction mechanism of RSI, one of the six elements of the Diamond Model, to validate the view. To gather insights, semi-structured interviews were conducted with 23 stakeholders from government agencies, enterprises, academic institutions, and the consumer market. NVivo 14 software was utilised for three-level coding, employing grounded theory techniques for analysis. The results revealed five key supporting themes: supply chain integration enhanced the system's ability to resist risks, R&D cooperation promoted the development of cross-domain technologies, digital technology empowered the reconfiguration of the value chain, policy support served as the institutional foundation for industrial development, and a significant drawback was that the logistics system has become the main bottleneck for the international expansion of Chinese sports goods enterprises. The study illustrates the existence of a digital ecosystem that supports this process. Based on the findings, an analytical model centred on RSI has been constructed, which highlights the crucial role of digital infrastructure in the current international market competition and reveals the cooperation mechanisms across industries and fields. It provides a new comprehensive perspective for understanding the industrial upgrading of emerging economies, and offers reference directions for enterprises and policymakers aiming to expand in the global market.

1. INTRODUCTION

In today's world, where global trade is becoming increasingly constant, technology and the global industrial landscape are deeply integrating, leading to profound changes. The collaborative ability between a country's

[1*] Corresponding author. Minyi Li *E-mail address*: 70035030@qq.com

industries and its related and supporting industries (RSI) is becoming crucial for competitiveness in the global market. Although RSI is identified as one of six factors affecting industrial competitiveness, the interaction between enterprises, institutions and related industries is emphasised as vital for promoting innovation and improving efficiency. However, when Porter proposed the Diamond Model (in 1990), the digital economy had not yet emerged. Consequently, the model did not account for the dynamics and complexity of the association between the digital ecosystem and RSI. This comprehensive digital ecosystem environment is particularly important for developing countries that are transitioning from a cost-driven economy to an innovation-driven economy. In the context of platform economy and digital technology empowerment, it is essential to question whether the linear interactions suggested by the traditional model are still fully applicable. This poses a theoretical challenge that needs investigation. Therefore, this study aims to analyse how the collaborative mechanism within China's sports goods industry has evolved in the digital era and how this evolution may reshape the international competition path of the industry. This study focuses on the role and influence of related and supporting industries (RSI) while drawing on the classic framework of Porter's Diamond Model.

China's sporting goods industry is at a critical stage of global strategic transformation. National policies such as "Healthy China" and "sports power" have invested strategic value in the development of the sports industry. However, the industry's international competitiveness primarily depends on production efficiency rather than systematic innovation. When compared to the digital ecosystem built by international brands such as Nike, Adidas, and Puma, China's sporting goods enterprises still fall short in the depth and efficiency of their supporting system integration.

Most current academic research has focused on digital transformation, macroeconomic policies, or consumer trends, with less emphasis on how related and supporting industries (RSI) specifically affected the global position of the sporting goods industry from a structural perspective. In the current context of the digital economy and global supply chain restructuring, it is especially significant to clarify the interaction and synergy mechanism within the support system. This understanding is essential for comprehending the competitive evolution of China's sporting goods industry.

Based on this argument, this paper proposes two core research questions:

i. Which elements related to and supporting the industry are currently playing a key role in enhancing the international competitiveness of China's sporting goods industry?

ii. What kind of relationship and synergistic mechanism exist among these factors, which jointly shape the global competitiveness of the industry?

This study aims to achieve the following objectives:

i. To identify the key relevant and supporting industrial elements of the sporting goods industry;

ii. To analyse the interaction and synergistic mechanism among these elements.

iii. To construct an analysis model oriented to related and supporting industries under the framework of Porter's diamond model and clarify its systematic role in enhancing the international competitiveness of the industry.

This paper employs the grounded theory approach combined with NVivo software to code and analyse interview records from 23 respondents across government, enterprises, academia, and technology service industries. The study identifies five key RSI dimensions, listed as follows:

i. Policy Support: It encompasses government subsidies, industry guidance policies, and local incentive mechanisms that provide an institutional basis for industrial innovation.

ii. R&D and Innovation Support: This aspect focuses on industry-university-research cooperation platforms and joint technology development projects aimed at promoting product upgrades and achieving technological breakthroughs.

https://doi.org/10.24191/gading. v29i1.797

iii. Logistics and Distribution: This dimension involves cross-border logistics efficiency and overseas warehousing capacity, providing infrastructure guarantee for global market responsiveness.

iv. Digital Technology Support: This includes cloud computing, AI-assisted design, short video marketing, blockchain technology and virtual sports events, all of which bring new opportunities for brand building and user connection.

v. Supply Chain Management: This aspect emphasises digital collaboration mechanisms, cost control and supplier integration capabilities to improve system operation efficiency and anti-risk capability.

These elements form a dynamic and interdependent support system, rather than existing independently of one another. The competitive path of enterprises has undergone a fundamental change. More importantly, this shift implies that China's sports goods industry will undergo a significant transformation in terms of concepts, moving from a single-dimensional "cost advantage" to a multi-faceted "system synergy advantage".

2. LITERATURE REVIEW

2.1 Theoretical Foundation of Porter's Diamond Model and Industrial Competitiveness

The comparative advantage theory put forward by Ricardo (1817) is typically cited as the theoretical source of national and industry competitiveness. As the economic environment changes and technology advances, this theoretical framework has evolved, increasingly highlighting the dynamic relationship between innovation ability and production efficiency. Porter introduced the "diamond model" in his substantial work, "National Competitive Advantage", which has become a key theoretical basis for analysing industrial competitiveness. Subsequent academic studies have expanded Porter's original diamond model by incorporating various perspectives on competitiveness, emphasising the interactive and evolving relationship between national setting and industrial development (Cho & Moon, 2013). The model argues that the international competitiveness of an industry is driven by four interrelated core elements: factor conditions, demand conditions, related and supporting industries (RSI), and the strategic positioning and industrial structure of firms. These four factors, influenced by government policies and unforeseen events, form a self-reinforcing system known as the "diamond system".

2.2 Impacts of Related and Supporting Industries (RSI) on Competitiveness

Among the four core elements of Porter's diamond model, related and supporting industries (RSI) are often ignored, yet they are key factors affecting industrial competitiveness. Porter (1990) divided RSI into two categories: vertically integrated industries, such as upstream enterprise members that provide key raw materials, components or specialised technologies; and horizontal complementary industries, which provide support in marketing, service improvement, or product synergies. When these related industries are closely connected, either spatially or operationally, and have strong capabilities, they usually drive knowledge expansion, resource sharing, and technological innovation. This, in turn, enhances the international competitiveness of the whole industry. Emerging research emphasises digital transformation as a key factor in promoting these cross-industry linkages, which can augment the innovation efficiency and market adaptability of the sports industry (Wu, 2024).

A large number of studies have shown that a stable and efficient resource sharing and innovation (RSI) system can effectively improve the productivity, innovation ability, and international market performance of enterprises (Lall, 2001; Kim et al., 2023). Building on Porter's theory, Rugman and D'Cruz (1993) proposed the "double drill model", arguing that national competitiveness stems not only from domestic resource support and innovation but can also be enhanced through a global industrial network. In their analysis of Korea's competitive advantages, Moon et al. (1998) pointed out that Korea's breakthroughs in

https://doi.org/10.24191/gading. v29i1.797

many industries were closely linked to the policy and institutional support of government departments, as well as the technical support offered by universities and research institutions to industries.

2.3 Related and Supporting Industries in the Chinese Context

In the context of China's economic development, the structural role of related and supporting industries (RSI) in the sporting goods industrial system is particularly significant. The government is actively promoting national strategies such as "Made in China 2025" and "Digital China" to guide the development of industrial clusters and encourage cross-industry cooperation. These initiatives aim to upgrade the manufacturing industry and expand its international market reach. Numerous studies have highlighted key supporting industries in globally competitive industries, such as electronics, automobiles, and new energy. These supporting industries include a comprehensive manufacturing base, mature digital infrastructure, well-established supply chain systems, rapidly evolving data platforms, and robust digital ecosystems. Moreover, there is a significant involvement of universities and research institutions, along with ongoing and effective policy support.

Among these supporting industries, the performance of China's sporting goods industry is particularly prominent. The growth of this industry is highly dependent on the support of many related industries, such as textile manufacturing, material technology, logistics and distribution, artificial intelligence design, digital marketing, and e-commerce platforms. However, when compared with high-tech industries such as electronic communication, new energy, and intelligent robots, the ecosystem supporting the sporting goods industry is still fragmented. It lacks sufficient digital collaboration and integration, and regional development is unbalanced. While digital transformation has become a crucial factor in enhancing the competitiveness of China's sporting goods industry, the specific mechanisms in which digital service providers and innovation platforms contribute to this process still need an in-depth theoretical explanation. Research in the manufacturing field also shows that digital transformation can enhance companies' market competitiveness by improving operational efficiency, innovation ability, and environmental adaptability (Zhang et al. 2023).

These observations are highly consistent with the coding analysis conducted in this study using NVivo software. Ultimately, this study identified five core dimensions of RSI support: policy support, R&D cooperation, logistics system, digital technology empowerment, and supply chain integration. One notable finding from the survey data is that digital technology was referenced 96 times, significantly more than other characteristics. This is not coincidental; it demonstrates that digital technology is now the primary driver of the current industrial transformation process, rather than merely an auxiliary tool.

2.4 Evolution of RSI from Static Cluster to Dynamic Ecosystem

The emergence of digital ecosystems has radically altered the structure and operations of related and supporting industries (RSI). This represents a significant organisational paradigm shift, in addition to a technology advancement. A new industrial linking model based on platforms and data is emerging due to the integration of blockchain, cloud computing, artificial intelligence, and the Internet of Things. These technologies are increasingly crossing traditional industrial boundaries. In this context, Adner (2017) and Teece et al. (1997) defined this process as a transition from the "traditional cluster model" to the "digital collaborative ecosystem". During this period, businesses, institutions, governments, and technological forces continue to engage in symbiotic development relationships.

The function of RSI has changed significantly in this new landscape. They are becoming more than just reliable raw material suppliers or ancillary service providers; they are progressively becoming important collaborators in the development of new products and core values. This transformation is driven by the expansion of digital infrastructure, which facilitates smooth global market access, user-engaged product co-creation, and real-time data exchange. For instance, in the sporting goods industry, AI-based design systems and digital platforms are creating new user experiences, consumption scenarios, and even demand patterns, enabling personalised product customisation and interactive experiences. The logic of resource

https://doi.org/10.24191/gading. v29i1.797

sharing and industrial support has changed from a fairly static and linear supply connection to a multi-dimensional, dynamic network. This new network focuses on knowledge exchange and technological collaboration, reflecting the increasingly interconnected and interactive reality.

From the perspective of the global value chain, digital integration has produced two effects (Edition, 2018). On one hand, it enables local supporting industries to become more deeply integrated into the global production network, enabling them to engage in higher value-added market behaviours by accessing abundant resources and professional knowledge. On the other hand, since key platforms and data standard setters often control the distribution of value, this "integration" can exacerbate unequal dependency relationships. While digital transformation provides upgrading opportunities for regional supply chain enterprises, it may also bring new structural risks and lock-in effects. A comprehensive understanding of China's sports goods industry and its support system in the global value chain requires examining the internal power structure and value distribution mechanism of this ecosystem, while also working to enhance collaborative efficiency. Empirical studies have shown that digital finance plays a critical role in this process by facilitating the flow of funds among related industries and alleviating financing restrictions, thereby enhancing innovation drives and resource utilisation efficiency for sports enterprises (Li et al. 2024). Knowledge-based organisations, such as universities, research institutions, and data analysis service providers, have also highlighted their strategic significance within the support system through the digitalisation process. According to Etzkowitz and Leydesdorff (2000), the "triple helix" innovation mechanism is formed by combining academic research, enterprise R&D and policy resources. Mechanisms such as industrial incubation parks and university-enterprise interaction have accelerated the adoption of this model in China. However, certain structural obstacles still impede the collaborative efficiency of the RSI system, such as regional development imbalance, inconsistent standards and lack of data integration.

2.5 Support System and Sporting Goods Industry in the Digital Era

The sporting goods industry has a dual nature: it is both part of the manufacturing sector and deeply embedded in digital culture and consumer lifestyles. Therefore, assessing the international competitiveness of the industry should not be limited to production efficiency; it should also consider the underlying industrial foundation, including innovation capacity, logistics system, and global brand building. Existing literature indicates that digital marketing strategies, optimised logistics processes, and industry-university-research alliances play increasingly important strategic roles in the industry. However, most existing studies tend to discuss these factors independently and lack a comprehensive analysis that considers them as a cohesive supporting ecosystem. Emerging research addresses this shortcoming by clarifying the central role of the digital economy in integrating these supporting industries and building a comprehensive ecosystem, thus enhancing the competitive advantage and long-term development capacity of the sporting goods industry (Wei et al., 2023).

In China, the digital transformation of supporting industries has indeed improved the responsiveness of enterprises to market changes, evidenced by the remarkable progress in the application of e-commerce platforms, intelligent production processes, and data-driven product design. Nevertheless, the analysis of this study based on NVivo interviews indicates persistent significant deficiencies in inter-industry collaboration and supply chain coordination. Compared with leading global brands, China still lags in cross-border logistics capacity and global distribution channel system development, which somewhat restricts the industry's export potential. Additionally, despite significant progress in policy guidance and R&D investment, the lack of a systematic coordination mechanism prevents the overall operational efficiency of the support system. Current policy research also shows that China's sports industry policies are progressively shifting towards digital, intelligent, and coordinated governance. The goal is to strengthen cross-department cooperation and improve the overall efficiency of the system (Pan & Ma, 2025).

Therefore, to thoroughly investigate the internal dynamic of continuous improvement of the competitiveness of China's sporting goods industry, it is essential to understand the characteristics of comprehensive network cooperation represented by its underlying supporting system. Empirical evidence corroborates this view that technological progress and cross-industry cooperation have significantly

https://doi.org/10.24191/gading. v29i1.797

improved the competitive position and value creation potential in the supporting ecosystem (Hu et al., 2025). This study proposes regarding related and supporting industries (RSI) as collaborative platforms embedded in a digital environment. In this context, policy support, R&D and innovation support, logistics and distribution, digital technology support and supply chain management are interrelated, interactive, and continuously evolving, forming a system structure that drives industrial upgrading and global expansion. This paper aims to provide a valuable contribution to existing research from both theoretical and empirical perspectives.

2.6 Analytical Framework of This Study

This paper constructs an analytical framework applicable to China's sporting goods industry, drawing from a systematic review of existing studies and applying the perspective of RSI. Using Porter's diamond model, the framework emphasises the importance of the related and supporting industries (RSI) dimensions, defining it as a multi-level composite ecosystem nested within the digital environment. To explain the interrelationships among the various dimensions of RSI, a conceptual framework was constructed, as shown in Figure 1.

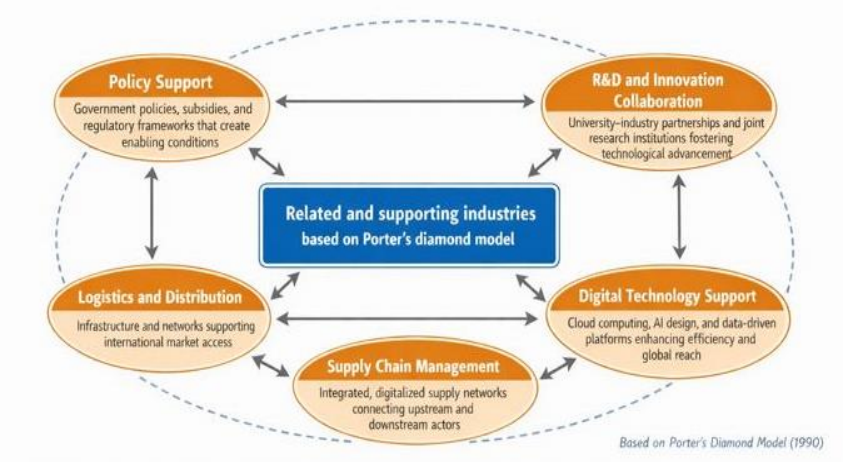
i. Policy Support: This refers to the industrial support policies, financial subsidies and regulatory systems at the central and local levels, providing institutional guarantee and development incentives.

ii. R&D Cooperation: This dimension focuses on technical cooperation among universities, research institutions and enterprises, including the construction of joint laboratories and innovation platforms to promote key technology innovation.

iii. Logistics System: This involves cross-border transportation, overseas warehouse distribution and other infrastructure to ensure the export circulation of sporting goods and global market coverage.

iv. Digital Technology Empowerment: This integrates cloud computing platform, artificial intelligence design tools, data analysis system, etc., to inject technical driving force for business operation and international expansion.

v. Supply Chain Integration: This aspect focuses on upstream and downstream coordination, cost control and real-time data linkage, and builds an efficient and flexible digital supply chain system.



Source: Porter Diamond Model(1990)

Fig. 1. Framework for analysis of related and supporting industries

The five dimensions mentioned are interconnected and form a dynamically coupled system. Through their multidimensional synergies, these dimensions help companies to continuously optimise their innovation capabilities, operational efficiency, and market responsiveness. This synergy ultimately builds a sustained competitive advantage for the sporting goods industry in the international market.

3. RESEARCH METHODOLOGY

3.1 Research Philosophy and Path Selection

This study adopts an interpretivist theoretical approach, focusing on understanding the subjective experiences and sense-making of actors in specific social situations. This perspective is especially suitable for exploring complex and dynamically changing social phenomena, such as the interrelations and collaboration mechanisms between related and supporting industries in China's sporting goods industry. Therefore, rather than testing any hypothesis, this paper attempts to reveal the underlying logic behind the operation of relevant and supporting industrial systems through the true narratives and experiences of stakeholders.

3.2 Research Design and Implementation

3.2.1 Data Collection

This study mainly used semi-structured in-depth interviews to collect primary data, conducted from March to July 2025. A total of 23 respondents participated, selected based on their roles as stakeholders in the sporting goods industry and its supporting industries. The respondents comprised six senior managers from large sporting goods companies, five policy-related personnel from government agencies and industry associations, four researchers from universities or research institutions, four representatives from technology service companies, and four professionals and consumers engaged in logistics, marketing or in direct contact with the consumer markets. This diverse selection ensured diversity and a broad representation of perspectives and data sources. To provide a clearer overview of the interview sample composition, the respondent profiles are summarised in Table 1, which includes their positions, organisational affiliations, years of experience, and relevance to RSI. The data illustrate the diversity of perspectives and ensure the representativeness of the information collected, forming the empirical foundation of this qualitative study.

Table 1. Respondent Profiles

Code	Position / Role	Organisation / Sector	Years of Experience	Expertise / Relevance to RSI
A1	Deputy Director	Provincial Sports Bureau (Government)	15	Policy support, industry coordination
A2	Senior Policy Analyst	National Sports Development Office	18	Industrial policy design, R&D incentives
A3	Cluster Development Officer	Local Government (Industrial Park)	12	Cross-industry collaboration programs
B1	General Manager	Leading Sporting Goods Manufacturer	20	Supply chain management, export strategy
B2	Production Director	Sports Footwear Factory	14	Manufacturing innovation, digital SCM
B3	International Business Manager	Sports Equipment Company	10	Overseas logistics and marketing
B4	Marketing Director	Sports Apparel Brand	13	Digital marketing, e-commerce integration
B5	R&D Manager	Sports Technology Company	9	AI design, material innovation
B6	Operations Manager	Smart Sports Product Firm	11	Data analytics, digital transformation

https://doi.org/10.24191/gading. v29i1.797

Code	Position / Role	Organisation / Sector	Years of Experience	Expertise / Relevance to RSI
C1	Associate Professor	University of Physical Education	16	Industry–academia collaboration
C2	Research Fellow	Sports Industry Research Institute	12	R&D policy, innovation clusters
C3	Lecturer	University of Sports Business	8	Entrepreneurship and supply chains
C4	Research Assistant	Innovation Laboratory	5	Smart design systems, digital tools
D1	Regional Director	Logistics and Warehousing Company	17	International distribution and transport
D2	Senior Analyst	E-commerce Platform	10	Digital sales and consumer behavior
D3	Director	Sports Industry Association	19	Industry policy coordination
D4	Cluster Consultant	Industrial Consulting Firm	14	Cluster competitiveness, digital integration
E1	CEO	Sports Export Trading Firm	18	Global logistics and export strategy
E2	Supply Chain Supervisor	Sports Accessories Manufacturer	9	Procurement and supplier collaboration
E3	IT Manager	Digital Service Provider	7	Cloud computing, system integration
E4	Marketing Executive	Sports Media & Event Company	6	Social media promotion, virtual events
E5	Startup Founder	Sports Technology Startup	4	Blockchain applications, wearable devices
E6	Product Designer	Independent Freelancer	5	AI-based sports product design

3.2.2 Interview Outline Design

The interview outline for this study is based on the Porter Diamond model, focusing specifically on the performance of "related and supporting industries" within the sporting goods sector. The interview includes the following core questions: What relevant and supporting industrial elements do the respondents think are the most critical for improving the competitiveness of the industry? What are the cooperation mechanisms and actual effects between related industries? What role do digital tools, policy guidance, and innovation systems play? What are the main challenges and potential opportunities for promoting coordinated industrial development? The questions used an open-ended question design that encouraged respondents to elaborate on their own practical experiences.

3.3 Data Analysis Process

This study utilised the basic paradigm of grounded theory (Glaser & Strauss, 2017) to systematically analyse interview data, employing NVivo 14 software for coding, classifying, and sorting out. This approach ensured logical clarity and traceability in the data processing. The analysis unfolded in three stages, creating a deductive pathway from the original statements to a theoretical generalisation.

In the first stage, open coding was employed to extract key terms from the original interview material and initially construct conceptual labels. For example, terms such as "government subsidy", "distribution efficiency", "digital platform collaboration", "supply chain digitalisation", and "AI design" were repeated frequently in the responses of many respondents. As a result, 125 initial coding nodes were identified at this stage. The research team then entered the axial coding stage, where they merged and integrated semantically similar codes. This process allows them to gradually refine the core explanatory categories and finally form five thematic groups, reflecting the RSI structure: policy support, R&D cooperation, logistics system, digital technology empowerment, and supply chain integration. In the final stage, selective coding was implemented, focusing on "digital intermediary ecosystem" as the core concept. The team integrated the dynamic relationships among various themes to form a comprehensive theoretical structure that reflects the interactive logic of RSI in the sporting goods industry.

https://doi.org/10.24191/gading. v29i1.797

3.4 Credibility and Validity of the Study

In assessing the quality of qualitative research, the four criteria of credibility, transferability, reliability, and verifiability proposed by Lincoln and Guba (1985) have been widely recognised and applied. To ensure the academic rigour and standardisation of this study, the following aspects were designed and controlled:

i. Credibility: Multi-source interview data collected from government departments, businesses, academia, and consumers were used in this study to achieve triangulation validation. In addition, some respondents were invited to comment on the preliminary analysis results to verify the accuracy of the researchers' interpretation.

ii. Extensibility: By carefully presenting the research context, sample composition, and interview environment details, readers can assess the potential applicability and significance of these conclusions in other similar industries or regions.

iii. Reliability: The whole research was coded and managed using NVivo tools, with all analysis steps and logical judgments systematically recorded to ensure that the research path can be traced and the process can be reproduced.

iv. Verifiability: Team members continuously wrote analysis memos, actively identified, and recorded subjective tendencies throughout the study. This approach reduces bias interference on the conclusion and ensures that the interpretations are always based on the data itself.

3.5 Statement of Ethics

This research strictly adheres to the principles of academic ethics. Before conducting the interviews, all respondents were clearly informed about the research objectives, data usage methods, and privacy protection measures. This ensures that respondents were fully aware of their rights. At the same time, respondents have the right to withdraw from the study at any time. To ensure the confidentiality of personally identifiable information, all interview materials were anonymised and assigned numbered labels (e.g., "A1", "B2"). The texts did not contain any information that could be traced back to individuals or organisations. Furthermore, recordings and transcripts were stored in encrypted devices and accessible only to members of the research team.

3.6 Study Limitations

Similar to other qualitative studies, this paper has some limitations. Although the sample selection process strives to encompass a wide range of perspectives and levels through purposiveness sampling, it still may not fully capture the complexity and different voices of China's sporting goods industry. In addition, the data collected reflects the context of digital transformation and rapid development, meaning that the relevant institutional and technological environment may change dynamically over time, which could affect the applicability of interview content. Nevertheless, this study provides empirical insights that reveal the interaction and synergy mechanisms within relevant and supporting industries, and it serves as a foundation for future cross-regional and cross-industry comparative or quantitative verification studies.

4. FINDINGS

4.1 Overview of NVivo Coding Results

Data from 23 semi-structured interviews were systematically coded using the NVivo 12 tool for this study. The analysis process followed the basic framework of grounded theory, which includes three stages: open coding, axial coding, and selective coding. The research objective was to identify the key themes of related and supporting industries (RSI) in Porter's Diamond model and analyse how these themes contribute to the international competitiveness of China's sporting goods industry. The coding results identified five key supporting themes: policy support, R&D cooperation, logistics systems, digital technology empowerment, and supply chain integration. The enabling dimension of digital technology appeared the most frequently

(96 times), far exceeding other categories. This was followed by policy support, R&D cooperation and supply chain integration (9 times each), and logistics systems (1 time). Together, these five elements constitute the core RSI structure that drives the global competitiveness of China's sporting goods industry.

4.2 Policy Support

Respondents generally agreed that policy support is an important prerequisite for improving industrial competitiveness. Through special subsidies, tax incentives, and financial support, both central and local governments actively encourage sports goods enterprises to develop high added value.

A government representative stressed that policy support has significantly boosted technological upgrades by enabling SMEs to access financing and participate in various project opportunities:

> *"The government's sports industry development plan has made it easier for SMEs to access finance and participate in innovative projects. Without this support, many manufacturers will not be able to make technology upgrades".* (A1)

Several interviewees mentioned that operational and targeted policy support not only provides resources, but also fosters cooperation among enterprises, technical institutions and universities. In provinces such as Zhejiang, Fujian, and Jiangsu, local governments have facilitated the formation of industrial clusters and established innovation ecosystems and export-oriented systems, all based on local multi-party cooperation.

4.3 R&D Cooperation

The third theme focuses on industry-university-research collaboration, which is crucial in promoting product R&D, material innovation, and smart manufacturing. Interviewees pointed out that partnering with universities or research institutions provides access to laboratory resources and technical personnel support, and bridges the gap between theoretical innovation and commercialisation.

A university researcher described the industry-university-research cooperation model:

> *"We have set up joint laboratories with some local sportswear brands. Our role is to test new materials and provide design data, while these companies focus on scaling up production and commercialising". (H1)*

Many enterprise executives believe that in-depth and continuous industry-university research cooperation can substantially improve product quality and technical capabilities, which enhances the visibility and competitiveness of domestic brands in the international market. These conclusions are consistent with the triple helix theory proposed by Etzkowitz and Leydesdorff (2000), which emphasises that close interactions among government, universities and industry are fundamental for establishing a knowledge-based competitive advantage.

4.4 Digital Technology Empowerment

Among the five core themes, digital technology empowerment is the most frequently mentioned and has the broadest impact. Many interviewees highlighted that AI, digital platforms, and data analytics tools have triggered systemic changes in production processes, marketing, and user engagement.

One business manager illustrated this point by referencing e-commerce practices:

> *"We used to rely mainly on traditional distributors, but now digital platforms enable us to sell directly to overseas customers. At a live-streamed event, more than 30 per cent of the audience came from Europe and Southeast Asia".* (B4)

Digital systems play a vital connecting role in the industry, seamlessly connecting manufacturing, supply and marketing channels to form a collaborative and efficient operational mechanism.

https://doi.org/10.24191/gading. v29i1.797

4.5 Supply Chain Integration

Respondents generally agreed that establishing a flexible and highly integrated supply chain system is crucial for controlling costs, improving delivery efficiency, and enhancing resilience to risks. Digital platforms and a robust supplier network facilitate real-time collaboration during the production process, significantly shorten delivery cycles, and help manage uncertainties in the global market.

A department director of one company noted:

> *"By connecting our suppliers and distributors through the data sharing platform, we have shortened the production cycle and improved the reliability of overseas order delivery"*. (B1)

This finding shows that the flexibility and competitiveness of digital global value chains are crucial in shaping the dynamics of the modern industrial system. Furthermore, deep supply chain integration has become essential for maintaining stable operations and has emerged as a key strategic resource to support the internationalisation process of enterprises.

4.6 Logistics System

Despite being mentioned infrequently in the coded data, logistics and distribution systems are vital in the export effect. Several interviewees pointed out that high transportation costs and the lack of overseas storage facilities are important bottlenecks restricting Chinese sports goods enterprises from expanding into the international market.

One export manager mentioned:

> *"Shipping costs have risen sharply in recent years, and delays often affect our relationships with international retailers. We are currently exploring cooperation with foreign logistics companies to build overseas storage facilities".* (B2)

Some leading companies have begun developing overseas warehousing and distribution networks to improve cross-border logistics efficiency and enhance the end-customer experience. However, compared to the rapid development of manufacturing and digitalisation processes, the construction of logistics and distribution infrastructure is still lagging, which has become the primary shortcoming restricting the international competitiveness of China's sporting goods industry, highlighting an urgent need for system optimisation and strategic investment.

4.7 Summary of the Research Results

To sum up, the qualitative analysis conducted using NVivo indicates that the development of China's sporting goods industry significantly benefits from a well-coordinated and strongly supported industrial system. The system plays a multi-dimensional supporting role in the continuous improvement of the global competitiveness of enterprises. Key components such as policy support, R&D cooperation, logistics systems, digital technology empowerment, and supply chain integration combine to create a dynamically evolving support ecosystem. This system is crucial for promoting the transformation of the industrial structure towards higher value-added products and provides essential support for enterprises looking to expand into the international market. These empirical findings lay a solid theoretical and data-driven foundation for further discussion.

5. DISCUSSION

This section analyses and interprets the results of the study using Porter's diamond model, focusing on how the related and supporting industries can enhance the international competitiveness of China's sporting goods industry. The discussion combines qualitative evidence and theoretical perspectives from interviews to present analytical insights and practical implications. The results show that policy support, R&D cooperation, logistics system, digital technology empowerment, and supply chain integration collectively

constitute an interactive and synergistic ecosystem that shapes the status and influence of China's sporting goods enterprises in the international market.

5.1 Interpretation of Research Results Based on Porter's Diamond Model

5.1.1 Policy Support

Government policy is often regarded as a critical factor in shaping the competitive environment of an industry. This aligns with the theory of "government as a catalyst" proposed by Porter (1990), which suggests that it is the government's responsibility to create an institutional ecosystem conducive to the development and cooperation of enterprises.

One official from a local government department remarked:

> *"Local governments have introduced innovation vouchers and research and development funding schemes to encourage sportswear manufacturers to develop their own brands and technologies instead of relying on contract manufacturing".* (A2)

This observation supports the findings of Deng and Luo (2025), who argued that introducing targeted policy and actively managing risk management are essential for maintaining the momentum of digital transformation in the sports industry. Such measures guarantee continuous technological innovation and strengthen the overall system environment. The increasing collaboration among enterprises, scientific research institutions, and suppliers, and the gradual formation of regional industrial clusters, highlight the advantages of localised cooperation emphasised in Porter's diamond model. This approach effectively promotes resource sharing and improves efficiency.

5.1.2 R&D Cooperation

This study shows that cooperation among universities, research institutions, and enterprises can significantly promote the implementation of technology R&D and product differentiation strategies. The industry-university-research interaction is a typical embodiment of the dynamic co-creation relationships among government, academia, and industry in the triple helix model (Etzkowitz & Leydesdorff, 2000).

A senior manager of a well-known sports equipment manufacturer noted:

> "*We have established long-term partnerships with two universities in recent years. They provide technology to help us develop new materials, optimise product performance and collect experimental data, while we provide real market data and test feedback. This collaboration significantly shortens the innovation cycle and significantly reduces R&D costs"*. (B4).

However, it is important to note that, although cooperation continues to deepen and initial results are being achieved, there remains a significant imbalance in how innovation resources are allocated between large enterprises and small and medium-sized enterprises (SMEs). Several respondents suggested that this structural imbalance may have become a major barrier to overall systemic innovation efficiency.

5.1.3 Empowerment through Digital Technologies

An increasing number of empirical studies have demonstrated that digital-driven productivity can significantly increase the revenue potential and international market influence of sports enterprises. This underscores the strategic value of digital transformation in enhancing industrial competitiveness (Feng et al. 2025). Digital tools can optimise production processes, marketing efforts, and customer interactions, while also improving the ability to interact with users around the world in real time.

A department director of a company at a sporting goods company stated:

> *"Digital platforms and social media now allow us to build communities of brands. Overseas customers can directly interact with us through live streaming or short videos".* (B1)

https://doi.org/10.24191/gading. v29i1.797

This empirical finding echoes the theory proposed by Kim and Lee (2023), which suggests that the level of digitalisation is gradually becoming the basis for countries and industries to build new competitive advantages.

5.1.4 Supply Chain Integration

By strengthening supply chain integration and collaboration, enterprises can significantly improve their responsiveness and anti-risk ability to deal with market uncertainty. Numerous studies have confirmed that digital transformation helps to improve this capability, mainly by promoting supply chain integration, which is essential for strengthening digital application and improving anti-risk capability (Yu, Xu, & Wen, 2025).

A supply chain manager asserted:

> *"In the past, we often encountered delays in communicating with suppliers. Now, with the help of a digital supply chain platform, our production plans and shipments can be synchronised in real time"*. (E2)

This situation exemplifies the concept of "dynamic capability" proposed by Teece et al. (1997). It suggests that enterprises can detect changes in market trends and flexibly allocate resources to maintain a sustained competitive advantage despite drastic environmental changes. Research on Chinese manufacturing enterprises (Jing and Fan, 2024) support this viewpoint, concluding that the use of digital technologies can significantly enhance supply chain performance. This improvement may be attributed to two interrelated mechanisms: the development and enhancement of the organisation's "dynamic capabilities", and the promotion of internal cross-organisational "integration processes". These findings provide empirical support for the relationship between digital technologies and supply chain integration within a broader manufacturing context.

5.1.5 Logistics System

However, the logistics system remains the main bottleneck for China's sports goods enterprises seeking to expand into the global market. Although there have been significant advancements in the application of digital technology, these improvements have yet to fully address the longstanding challenges that hinder China's sportswear enterprises from entering the international market. Issues such as high shipping costs, complex customs clearance procedures, and limited overseas warehousing capacity still restrict the enterprises' ability to conduct export business. Existing research indicates that the application of blockchain technology could offer a transformative solution by enhancing supply chain transparency, tracking accuracy, and process efficiency, which may help alleviate customs clearance delays and logistics congestion (Bipasha, 2023).

This contradiction is directly revealed by the statement of one company department head:

> "*It sometimes takes more than a month for our products to reach European customers. If the overseas warehouse is built, the efficiency and reliability will be greatly improved. On the one hand, this confirms the authenticity and urgency of logistics bottlenecks. On the other hand, it also implies that technical solutions (such as blockchain) and infrastructure investment (such as overseas warehouses) must be promoted in coordination to systematically break through logistics constraints"*. (B1)

Improving logistics infrastructure requires the joint efforts of the government, enterprises, and international cooperation. This cooperation is essential for strengthening the global position of China's sporting goods industry. This study highlights that implementing advanced logistics approaches, including AI-based predictive maintenance, digital twin simulation, IoT infrastructure, and blockchain-enabled transportation systems, can significantly enhance the robustness and functionality of supply chains, ultimately enhancing their competitiveness on a global scale (Verma et al., 2025).

https://doi.org/10.24191/gading. v29i1.797

5.2 Strategic Implications and Suggestions

Based on the empirical results of this study and the theoretical framework provided by Porter's diamond model, this paper presents the following strategic suggestions to further enhance the global competitiveness of China's sporting goods industry.

i. Strengthening policy coordination and long-term cooperation: Governments at all levels should strengthen overall planning across industrial, technology and digital policies. Establishing a comprehensive cross-sectoral long-term cooperation mechanism is essential for improving the consistency and pertinence of policy implementation.

ii. Building a digital innovation ecosystem: Enterprises, universities, and research institutions are encouraged to jointly build digital innovation platforms. This collaboration should promote the widespread application of advanced technologies, such as AI design, data analysis and virtual testing, to form a collaborative innovation ecosystem. Wei et al. (2023) emphasise that the digital economy serves as a critical foundation for the sustained competitiveness of the sports industry. It facilitates cross-sectoral and cross-field cooperation, accelerates the dissemination of innovative results, and encourages environmental and social inclusion.

iii. Promote the construction of a management system: Promoting the development of overseas warehouses, blockchain logistics tracking, and smart supply chain management systems to improve export response speed and international delivery capabilities. It is suggested to enhance cross-border logistics capabilities through public-private partnership models.

iv. Deepening international cooperation and brand globalisation strategy: Enterprises must actively accelerate the brand globalisation process while consolidating the advantages of the manufacturing end. The key is to increase global visibility and market penetration through strategic partnerships with international sports organisations, professional marketing agencies, and sustainability platforms. This strategy is consistent with the eclectic paradigm proposed by Dunning and Lundan (2008), which argues that multinational companies enhance their competitiveness by strategically applying ownership, location, and internalisation (OLI) advantages in the global market. Yu (2025) further emphasised that the comparative analysis between China and the United States shows that although China's sporting goods enterprises have strong manufacturing capabilities and policy support, they still need to further participate in international marketing channels and global brand ecosystems to truly gain international competitiveness.

v. Cultivating innovative talents: Joint talent training mechanisms between universities and enterprises should be strengthened, focusing on systematically cultivating multidisciplinary talents in sports science and technology, digital communication, cross-border supply chain, and other disciplines, and providing human resources support for the continuous innovation of the industry.

5.3 Discussion and Summary

Based on the analysis and discussion, China's sporting goods industry is undergoing a structural transformation from "production efficiency-oriented" to "innovation-driven collaboration" and "digital network competition". The interaction and synergy among industrial policy, technological progress, and multi-party cooperation have collectively built a dynamic collaborative ecosystem. This aligns with Porter's (1990) theoretical framework, which suggests that industrial competitiveness is influenced by multiple factors. Research indicates that adopting Industry 4.0 technologies can significantly improve the sustainability and competitiveness of manufacturing supply chains, including advancing green supply chain initiatives and incorporating circular economy principles (Karmaker et al., 2023). Despite the overall positive trend in China's sporting goods industry, there are still challenges that need to be addressed. These include the need for improvements in the modern logistics system, international brand recognition, and the mechanisms for institutional innovation. Optimising these key weak points is essential for transforming

https://doi.org/10.24191/gading. v29i1.797

China's sporting goods industry from a manufacturing powerhouse into a strategic centre for global innovation and brand building.

6. CONCLUSION

This study utilises Porter's "Diamond Model" as its theoretical foundation and systematically analyses the key role and mechanism of "related and supporting industries" in shaping the international competitiveness of China's sports goods industry. Through semi-structured in-depth interviews with 23 key stakeholders from government departments, enterprises, research institutions, and the front line of consumers, and employing the grounded theory analysis method supported by NVivo, this study identified five core supporting factors: policy support, R&D cooperation, logistics system, digital technology empowerment, and supply chain integration. These factors do not operate independently; instead, they form an interacting and mutually reinforcing ecosystem that jointly drives the industry transformation from a traditional "manufacturing-led" model to a new model of "innovation cooperation and digital-driven".

The analysis reveals that related and supporting industries enhance the technological upgrading and brand-building capabilities of China's sports goods enterprises and promote the overall progress of the entire industry in the global value chain. Based on Porter's model, this study proposes an analytical framework centred on RSI, emphasising the key role of digital infrastructure and cross-industry, cross-domain cooperation in developing current competitive advantages. This framework enriches the theoretical explanation of industrial competitiveness and offers a new perspective on how emerging economies can achieve industrial upgrading through systematic support structures. At a practical level, to accelerate the globalisation process of China's sports goods industry, the study recommends the continuous optimisation of policy coordination mechanisms. This includes a focus on building a digital innovation ecosystem, systematically improving logistics and supply chain infrastructure, and strengthening brand international operations while cultivating multi-skilled talents. These suggestions provide strategic directions for policymakers and industry participants.

This study has some limitations worth noting. First, the sample coverage is limited due to its qualitative nature, making it difficult to fully represent the multi-level and diverse ecological differences within the entire industry. Additionally, data collection occurred during a specific period of rapid digital development. As a result, subsequent policy and technological changes may affect the timeliness of certain research conclusions. Therefore, future research could adopt a mixed-method approach, combining quantitative data with long-term tracking, to further develop and validate the logic and framework of this study. At the same time, extending the analysis to other industry elements, such as corporate strategies and demand conditions, would also provide a more comprehensive view of the competitive landscape of the industry.

The outcomes of this study deepen the theoretical understanding of the "Diamond Model" in the context of the digital era. They offer empirical insights and references for building a sports industry system with global adaptability and innovation-driven characteristics. In summary, China's multi-dimensional collaborative mechanism and comprehensive development of digital resources, systems, and infrastructure have become crucial for boosting its competitiveness on the international stage. By promoting the organic integration of institutional mechanisms with technical support and strengthening internal connections, China is expected to further strengthen its position as a global hub for the production and innovation for sports goods.

ACKNOWLEDGEMENTS/FUNDING

The authors thank the Faculty of Business and Management at Universiti Teknologi MARA for their generous support, all the interviewees and institutional partners who helped complete this study, and all the friends and colleagues who provided assistance.

CONFLICT OF INTEREST STATEMENT

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts, and declare the absence of conflicting interests with the funders.

AUTHORS' CONTRIBUTIONS

Li Minyi conceptualised the research idea, developed the analytical framework, and designed the study. Noorziah Mohd Salleh collected and analysed the qualitative data using NVivo software, interpreted the findings, and drafted the manuscript. Pg Mohd Auza'e Pg Arshad also revised the paper critically for intellectual content and approved the final version for submission.

REFERENCES

Adner, R. (2017). *Ecosystem as structure: An actionable construct for strategy*. Journal of Management, 43(1), 39–58. https://doi.org/10.1177/0149206316678451

Bipasha, Y. A. (2023). Blockchain technology in supply chain management: transparency, security, and efficiency challenges. *International Journal of Science and Research Archive, 10*(01), 1186-1196. https://doi.org/10.30574/ijsra.2023.10.1.0792

Cho, D. S., & Moon, H. C. (2013). *From Adam Smith to Michael Porter: evolution of competitiveness theory (extended edition) (Vol. 7)*. World Scientific.

Deng, L., & Luo, Y. (2025). *Research on policy guidance and risk prevention, and control in the digital transformation of the sports industry*. Journal of Infrastructure, Policy and Development. https://doi.org/10.24294/jipd10671

Dunning, J. H., & Lundan, S. M. (2008). *Multinational enterprises and the global economy*. Edward Elgar Publishing.

Etzkowitz, H., & Leydesdorff, L. (2000). *The dynamics of innovation: From national systems and "Mode 2" to a triple helix of university–industry–government relations*. Research Policy, 29(2), 109–123. https://doi.org/10.1016/S0048-7333(99)00055-4

Edition, A. P. S. (2018). *Global Value Chain Analysis*. Global Value Chains and Development: Redefining the Contours of 21st Century Capitalism, 305.

Feng, J., Wen, C., Ren, Y., & Ni, Y. (2025). *The economic impact of digital productivity on sports competitions(Conference Paper)*. Advances in Economics, Management and Political Sciences, 21599. https://doi.org/10.54254/2754-1169/2025.21599

Glaser, B., & Strauss, A. (2017). *Discovery of grounded theory: Strategies for qualitative research*. Routledge.https://doi.org/10.4324/9780203793206

Hu, Y., Lu, L., & Li, Q. (2025). Configuration analysis on servitisation transformation of sporting goods manufacturing enterprises: The case of 33 listed companies of China. *PLOS ONE, 20*(1), e0329826. https://doi.org/10.1371/journal.pone.0329826

Jing, H., & Fan, Y. (2024).Digital transformation, supply chain integration and supply chain performance: Evidence from Chinese manufacturing listed firms. *SAGE Open, 14*(1). https://doi.org/10.1177/21582440241281616

Kim, Y., Atukeren, E., & Lee, Y. W. (2023). Digital Double Diamond (DiDD) Model Analysis of National Competitiveness Under Digital Transformation: An Application to Healthcare and Pharmaceutical Industries in South Korea and Switzerland. *International Journal of Global Business and Competitiveness, 18*(1), 1–18. https://doi.org/10.1007/s42943-023-00080-4

Lall, S. (2001). Competitiveness, technology and skills. *In Competitiveness, technology and skills*. Edward Elgar Publishing. https://doi.org/10.4337/9781781950555

Li, D., Wu, Z., & Wu, Q. (2024). How does digital finance affect sports enterprise innovation? *Sustainability, 16*(14), 5847. https://doi.org/10.3390/su16145847

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Beverly Hills, CA: Sage Publications.

Karmaker, C. L., Al Aziz, R., Ahmed, T., Misbauddin, S. M., & Moktadir, M. A. (2023). *Impact of industry 4.0 technologies on sustainable supply chain performance: The mediating role of green supply chain management practices and circular economy*. Journal of Cleaner Production, 419, 138249. https://doi.org/10.1016/j.jclepro.2023.138249

Moon, H. C., Rugman, A. M., & Verbeke, A. (1998). *A generalised double diamond approach to the global competitiveness of Korea and Singapore*. International Business Review, 7(2), 135–150. https://doi.org/10.1016/S0969-5931(98)00002-X

Pan, Z., & Ma, L. (2025). Research on the evolution and evaluation of Chinese sports industry policies based on intelligent analysis. *PLOS ONE, 20*(1), e0316206. https://doi.org/10.1371/journal.pone.0316206

Porter, M. E. (1990). *The competitive advantage of nations*. New York, NY: Free Press.

Ricardo, D. (1817). *On the principles of political economy and taxation*. London: John Murray.

Rugman, A. M., & D'Cruz, J. R. (1993). *The "double diamond" model of international competitiveness: The Canadian experience*. Management International Review, 33(Special Issue), 17–39.

Teece, D. J., Pisano, G., & Shuen, A. (1997). *Dynamic capabilities and strategic management*. Strategic Management Journal, 18(7), 509–533. https://doi.org/10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z

Verma, P., Kumar, V., Verma, P., Lai, K., & Kaur, P. (2025). Leveraging innovative logistics for strengthening supply chain resilience in the face of disruptions. *Asian Journal of Interdisciplinary Research, 8*(1), 23–39. https://doi.org/10.54392/ajir2523

Wei, X., Zhang, J., Lyulyov, O., & Pimonenko, T. (2023). The role of the digital economy in enhancing the sports industry to attain sustainable development. *Sustainability, 15*(15), 12009. https://doi.org/10.3390/su151512009

Wu, T. (2024). *Navigating the digital transformation of the sports industry in China based on the experience of sports and competition events in developed countries*. SHS Web of Conferences. https://doi.org/10.1051/shsconf/202420801010

Yu, X. (2025). *Comparative analysis and research on the sports industry and competitive sports between China and the United States*. Frontiers in Business, Economics and Management. https://doi.org/10.54097/r4srav83

Yu, Y., Xu, L., & Wen, X. (2025). The impact of digital transformation on supply chain resilience in manufacturing: The mediating role of supply chain integration. *Sustainability*, *17*(9), 3873. https://doi.org/10.3390/su17093873

Zhang, L., Qiu, P., & Cao, P. (2023). *Does digital transformation enhance the core competitiveness?—Quasi-natural experimental evidence from Chinese traditional manufacturing*. PLOS ONE, 18. https://doi.org/10.1371/journal.pone.0289278

About the Authors

Li Minyi is a PhD candidate at the Faculty of Business and Management, Universiti Teknologi MARA. His research focuses on business management and industrial competitiveness. He has published numerous articles on these topics in journals such as *Wireless Communications and Mobile Computing*, *Journal of Commercial Economics*, *Modern Marketing*, and *Journal of Xinyu University*. He can be contacted at 70035030@qq.com

Noorziah Mohd Salleh, PhD is an Associate professor at the Faculty of Business and Management, Universiti Teknologi MARA. Her research focuses on human resource management, strategic management, and blockchain. She has published numerous articles on these topics in journals such as Proceedings, *Journal of ASIAN Behavioural Studies*, *Asian People Journal*, and *International Academic Symposium of Social Science*. She can be contacted at noorziah@uitm.edu.my.

Pg Mohd Auza'e Pg Arshad, PhD is Senior Lecturer at Faculty of Business and Management, UiTM Sabah Branch. His main research activity is in the area of management, Human Resource, Entrepreneurship and Information Technology. He has published widely on these subjects in publications such as the *Advanced Science Letters*, *Journal of Tourism Management Research*, *AIP Conference Proceeding* and *Advanced of Marketing Studies Journal*. He can be reached through mohdauzae@uitm.edu.my.

https://doi.org/10.24191/gading. v29i1.797