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INTERNATIONAL COMPETITIVENESS OF AGRICULTURE IN SOUTH KOREA: BASED ON ADJUSTED DOUBLE DIAMOND MODEL

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ABSTRACT

Background/Objectives: This study assesses agricultural sector competitiveness in South Korea, New Zealand, the United States, and China, considering global challenges like food security and sustainable development.

Methods/Statistical Analysis: An enhanced double diamond model, based on Porter's model, and the entropy method were utilized to evaluate competitiveness across selected countries.

Findings: Distinct strengths were observed in each country within the adjusted double-diamond model. The US and New Zealand excelled in factor and demand conditions. China outperformed South Korea in demand conditions and related industries.

Improvements/Applications: This research provides insights for policymakers in enhancing sustainability and competitiveness in South Korea's agricultural sector. It also highlights opportunities for stakeholders to improve efficiency and governance through digital transformation.

Keywords: *Agriculture, Competitiveness, Diamond Model, ESG, South Korea*

INTRODUCTION

The recent conflict between Russia and Ukraine has highlighted the impact of international relations on agriculture, leading to food crises and security issues. In addition, a paradigm shift in agriculture is needed, with many countries formulating sustainable strategies for agricultural internationalization [1,2]. Agricultural internationalization refers to the strategic measures taken by agricultural enterprises or countries on a global scale to utilize agricultural resources and competitive advantages, strengthen international trade and cooperation, achieve agricultural industry development, optimize resource allocation, and promote agricultural development [3,4,5,6,7,8].

Prominent researchers in mercantilist theory, such as Thomas Mun (1895) [9], expressed the view that agriculture was the foundation of all industries and an important source of national wealth. According to him, governments should promote agricultural development and ensure national food security through protective trade policies. This perspective had a significant impact on the economic policies of 19th-century Europe. Influenced by mercantilism (15th–18th centuries), many countries implemented various policies and measures, such as raising tariffs, restricting imports, and providing subsidies to protect agriculture. Some scholars argue that agricultural internationalization is significant to agricultural enterprises and countries and has gained worldwide attention.

On the other hand, it also imposes significant pressure on the environment and resources. Schaller (1993) [8] suggested that governments can enhance agricultural production efficiency, reduce resource consumption, and alleviate environmental pollution through strengthening agricultural technological innovation. He also believed that measures, such as improving and establishing scientific agricultural policies, promoting balanced development of agricultural production and consumption, protecting the environment and resources, and enhancing international cooperation, were core means of addressing the challenges of agricultural internationalization and ensuring its sustainable development.

Furthermore, the internationalization strategy of agriculture in the Netherlands is noteworthy [10]. The primary focus of the agricultural internationalization strategy in the Netherlands is to achieve strategic goals through agricultural trade cooperation, using export, foreign direct investment (FDI), and participating in international agricultural technology cooperation. Recently, Dutch agricultural exports have continued to expand, with competitive advantages in products such as high-value-added flowers and fruits. Through international cooperation and exchange, the agricultural products of the Netherlands have been internationalized and supplied a wide variety of international markets [11]. Israel is also creating national wealth through the internationalization of agriculture [12]. As such, agriculture is becoming an important industry in many developed countries.

The rapid spread of the digital economy globally, particularly due to the impact of the COVID-19 pandemic, has led to the rapid digital transformation of agriculture production, distribution, consumption, and trade. For example, digital transformation is an important component of the United States' agricultural internationalization strategy. The United States uses Fourth Industrial Revolution technologies, such as precision agriculture, smart agriculture, prescription agriculture, and autonomous tractors, to precisely allocate resources, determine the optimal harvest time, and improve agricultural production efficiency.

Data sharing has become common in the US livestock industry, with organizations such as CDCB (Council on Dairy Cattle Breeding) and DHIA (Dairy Herd Improvement Association) leading in this field [13]. These new technologies, including automation systems and sensor arrays, have increased the data generated by livestock farms. In addition, the market size of the agricultural sector in New Zealand grew by 15.3% compared to 2020, with an average growth rate of 4.2% over the past five years (2017–2021) [14]. Despite the relatively low contribution of agriculture to the GDP, international competition in agricultural internationalization remains fierce. As the climate crisis worsens, plant-based foods, which are considered environmentally friendly, have rapidly gained popularity in New Zealand [15]. The consumption of plant-based diet foods in New Zealand increased by 19% compared to 2020.

Owing to the food safety and food crisis triggered by the Russia–Ukraine conflict and the spread of COVID-19, there has been an increased demand for agricultural products. For example, New Zealand has consistently promoted seasonal specialties and local food to address the food safety and food crisis [16].

Overall, many countries, such as South Korea, New Zealand, the United States, and China, have different strategies for agricultural internationalization, including strengthening agricultural trade cooperation, promoting the development of agricultural Fourth Industrial Revolution technologies, understanding consumer behavior trends, agricultural ESG management, and digital transformation trends.

Hence, there is an urgent need to study agricultural internationalization strategies. These strategies promote agricultural development and economic growth and enhance farmers' income and standard of living. Furthermore, given the competition and demand in the global agricultural market, agricultural internationalization strategies are imperative. These strategies try to optimize the global distribution of agricultural resources and promote social sustainability and environmental protection. Lastly, agricultural internationalization strategies facilitate agricultural technological innovation and international cooperation, accelerating the modernization of agriculture.

Therefore, as a crucial measure for agricultural development, agricultural internationalization strategies hold significant potential and urgency on a global scale. Therefore, this paper suggests some insights into the development of agricultural competitiveness, including internationalization in South Korea, by a comparison with some major agricultural nations.

THEORETICAL BACKGROUND

INTERNATIONALIZATION OF AGRICULTURE

The basic framework of internationalization in industry includes an analysis of internationalization driving factors and sources of competitive advantage, which can determine different market entries and strategic choices because different market entries and strategic choices have different products and services [17]. In the internationalization strategy, enterprises need to analyze these factors carefully, formulate strategies that meet the requirements of their business and target markets, and adjust according to market changes [18].

Vieira et al. (2021) [19] found some flaws in the internationalization process of Portugal's manufacturing industry in its in-depth development, such as the lack of sustained competitive advantage, relatively low R&D investment, insufficient international strategic innovation, and insufficient institutional support.

Choosing an appropriate internationalization strategy can help improve a company's performance and competitiveness [20,21,22,23]. For example, a study on the internationalization of Taiwan's computer numerical control machinery industry showed that in the early stages of internationalization, the process and competitive advantages helped improve corporate performance. In addition, the industry environment plays a positive regulatory role in the internationalization process and corporate performance. In this situation, it is necessary to establish a 'sustainable internationalization strategy' to enhance agricultural competitiveness.

The early contributions to the internationalization of agriculture originated from the field of economics, particularly from researchers in international trade and development economics. Economists Heckscher and Gerschenkron were among the early researchers who focused on and contributed to the internationalization of agriculture [24,25]. The Heckscher-Ohlin model proposed by Heckscher and Ohlin (2002)[26] explained the reasons for international trade, including agricultural trade, providing a theoretical framework for understanding the role of agriculture in international trade. In addition, Alexander Gerashchenko’s (1904–1978) focus included the role of agriculture in rural economies and development, making a significant contribution to the internationalization of agriculture [27]. The work of these scholars provided a theoretical foundation for subsequent economists and researchers, prompting further in-depth studies on the internationalization of agriculture. Over time, researchers from other disciplines, such as agricultural economists, sociologists, and environmental scientists, have also joined in the study of the internationalization of agriculture [28].

Various strategies and perspectives have been suggested in the internationalization of agriculture. For example, Cristobal-Frans et al. (2020) examined the use of e-commerce to facilitate the internationalization of agricultural products [29]. Thorlakson et al. (2018) explored the relationship between supply chains and sustainability, emphasizing how agricultural enterprises can ensure environmentally friendly, socially responsible, and economically effective production in international markets [30]. Belletti (2007) examined the impact of the internationalization process of PDO (PHP Data Objects) / PGI (Post Good Issue) agricultural products on small and medium-sized enterprises, as well as how these enterprises can address challenges from different competitors in international markets [31].

Chrysomallidis and Doukas (2023) emphasized how digital transformation can provide production conditions for sustainable agriculture, contributing to the "greening" of the agricultural sector, with the EU's Common Agricultural Policy (CAP) playing a crucial role in promoting agricultural digital transformation [32]. Zeng and Jiang (2023) reported that ESG management has a positive impact on agricultural performance [33]. Kuandykova et al. (2023) evaluated the introduction of organic agriculture and ESG principles in Kazakhstan, promoting the international competitiveness and sustainable development of agricultural products [34].

DIAMOND MODEL VS. DOUBLE DIAMOND MODEL

This study utilized the double diamond model to assess domestic and international competitiveness factors [35]. This model is based on the diamond model developed by Porter (1990) [35], which evaluates mainly domestic competitiveness. The diamond model comprises four endogenous variables (e.g., factor conditions,

demandconditions, related and supporting industries, and firm's strategy, structure, and rivalry (business context)) and two exogenous variables (e.g., government and chance) [Figure 1]. This study used a 'generalized double diamond model' with an internationalization variable [36]. The model was adjusted slightly for the research topic; hence, it can be called an 'adjusted double diamond model.'

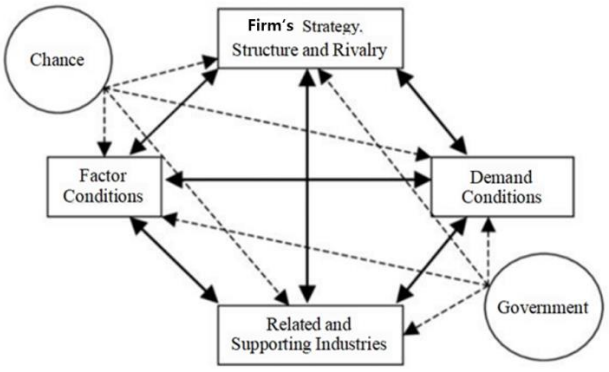


Figure 1. Porter's Diamond Model
Sources: Porter (1990)
Note: Porter's diamond model shows the determinants of competitive advantage in an industry**.**

Factor conditions refer to the basic and advanced factors related to production that are necessary for competition in a specific industry, such as natural resources and skilled labor. Demand conditions represent the characteristics of domestic market demand for products and services, which are based on market size and sophistication. Related and supporting industries refer to the presence of supply or related industries for general competitiveness. In particular, forming clusters that develop positive synergies through related and supporting industries is essential. The strategy, structure, and rivalry of firms (or business context) represent the overall structure and strategy, organization, and operation of a company within a country, with a particular emphasis on assessing competitive relationships in the domestic market. Strategies and structures may vary according to the circumstances, and it is believed that intensified competition may enhance competitiveness.

On the other hand, the government plays the role of an exogenous variable in enhancing national competitiveness, and 'chance' refers to external events that cause significant environmental changes, such as war. Although the diamond model was initially developed for analyzing national competitiveness, it has been widely applied to analyzing industries, companies, and other entities [35, 37].

Many scholars have extensively studied the diamond model developed by Porter (1990) [35], often incorporating additional research variables to enhance the original framework. Table 1 provides an overview of previous studies conducted on each variable of this research model.

Table 1. Definitions of the Variables in the Research Model

Porter (1990)'s Diamond Model	Related variables for research scope	Researchers
Factor Conditions	Mainly human resources, material resources, and technology,land, climate, natural resources or population, skilled labor, the country's stock of knowledge resources (scientific, technical, or market knowledge), transport and communications infrastructure, wage level, financial capital, and quality of work (university enrollment)	Rugman & Collinson (2012).[38] Friedman et al.(1992).[39] Hong et al.(2008).[40]
Demand Conditions	Market quality, Market size, Domestic and foreign markets demand	Bénassy-Quéré et al.(2004)[41] Ali & Guo(2005)[42] Tsiligiris (2018)[43]
Related and Supporting Industries	State of cluster development, Logistics and transportation convenience. Availability of financial services	Coughlin & Arromdee(1991)[44] Wheeler & Mody(1992)[45] Na & Lightfoot(2006)[46]
Strategy, Structure, and Rivalry	Legal system, Business environment, Business strategy, ESG, GII	Woodward(1992)[47] Root & Ahmed(1979)[48] Dumludag et al.(2008)[49]

The diamond model presents a conceptual framework for assessing industrial competitiveness (Porter, 1990) [35]. Based on the diamond model, many researchers have applied it to analyze various industries such as the automobile industry [50], wind power industry [51], ICT industry [52], tourism industry [53], and the film industry [54].

In the agricultural industry, Porter's model has been used to evaluate the agricultural export competitiveness of emerging markets [55]. Related factors such as irrigated land area, competitive labor costs, foreign direct investment (FDI), and export market opportunities play a vital role in enhancing the export competitiveness of the agricultural sector. Constantin et al. (2022) employed Porter's model to investigate the competitiveness of Romanian vegetables, identifying challenges such as fragmented land structure, underperforming irrigation, warehousing, transportation sectors, heavy dependence on imports, and a lack of competitiveness leading to a deepening trade deficit [56]. They suggest that the competitiveness of agriculture can be enhanced by improving the performance and logistics infrastructure of supporting industries and eliminating market access barriers for small farmers.

Balcı and Giray (2020) reported that despite being close to natural resources and inputs, the fruit industry and related sectors in the vicinity of Isparta only constitute a standard agglomeration area and fail to generate a cluster effect due to the absence of a collaborative culture within and between departments [57]. This deficiency diminishes regional competition opportunities in the industry. The study suggests that fostering seamless and consistent communication between sectors, governmental support for sector collaborations, and ensuring that regional actors benefit from these collaborations are crucial for clustering and enhancing regional competitiveness.

Based on the diamond model developed by Porter (1990)[35], Rugman and D'Cruz (1991, 1993)[58,59], Rugman and Verbeke (1995)[60], Cartwright (1993)[61], Hodgetts (1993)[62], Dunning (1993)[63], Van Den Bulcke (1995)[64], Rugman and Verbeke (1995, 1998)[60,65] have further developed the model by adding internationalization aspects . They argued that Porter's diamond model is unsuitable for small open economies, which largely rely on foreign markets and other countries' foreign policies. Moon, Rugman, and Verbeke (1998)[65] suggest that Porter's original diamond model was incomplete owing to its insufficient consideration of multinational activities. Finally, they suggest a generalized double diamond model.

Figure. 2 presents the generalized double diamond model, including the domestic and global (or international) variables of a country. That model is a synthesis of both, reflecting the overall competitiveness of a nation. The disparity between the domestic and international diamonds indicates the extent of domestic and international activities, including export and foreign direct investment. In particular, including multinational activities such as foreign direct investment (FDI) is crucial in analyzing a country's competitiveness [66].

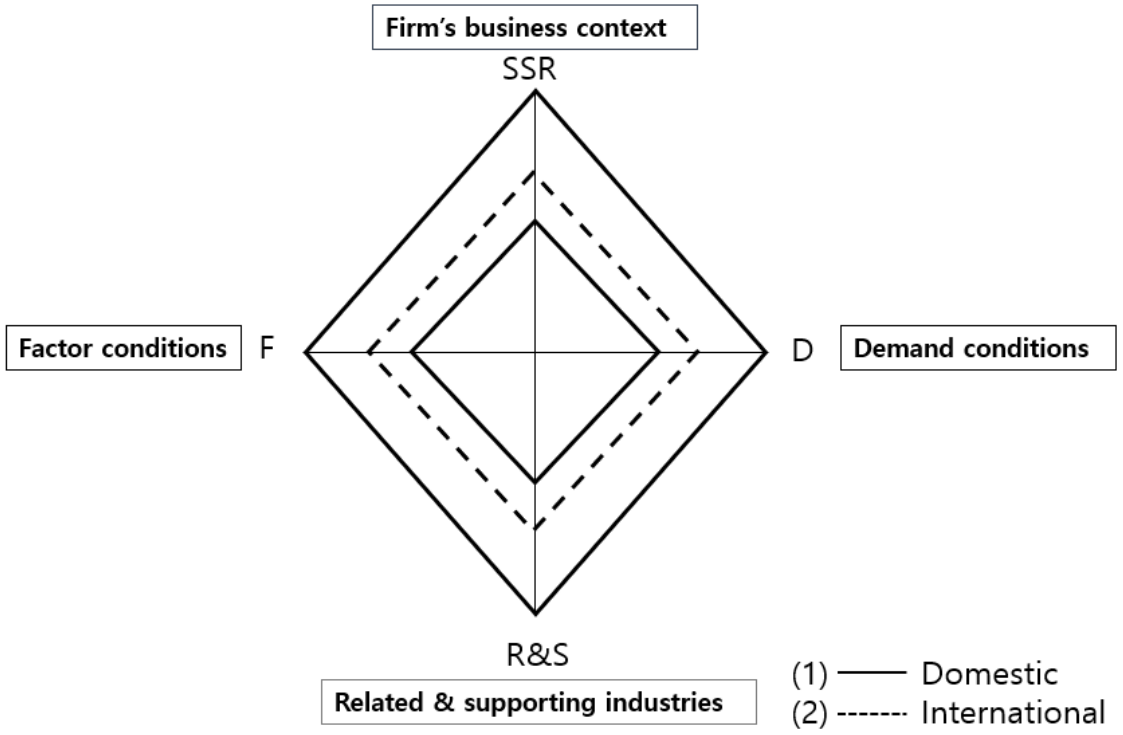


Figure 2. Generalized Double Diamond Model
Source: Moon et al. (1998)

Note: The solid line represents the domestic diamond model, while the dashed line represents the global (or international) diamond model

Subsequently, many scholars have conducted extensive empirical research using the diamond model [67,68,69,70] For example, Jung (2008)[54]compared the advantages of South Korea and the United States using the double diamond model to provide insights into the development direction and competitive advantages of the

South Korea's film industry. Liu and Hsu (2009) [71] used the double diamond model to compare the competitive advantages of Taiwan and South Korea, showing that South Korea's industrial structure and products are similar to Taiwan's, positioning South Korea as a major competitor in the Chinese and global markets. This study used the adjusted double diamond model to analyze the four variables (or components) of the original diamond model, including domestic and international variables.

RESEARCH MODEL AND HYPOTHESES

RESEARCH MODEL

China, the United States, and New Zealand were selected to analyze the international competitiveness of Korean agriculture. China is an Asian country with a large proportion of agriculture close to Korea, and the United States is the number one agricultural export country in the world. New Zealand is an agriculturally developed country with many agricultural exchanges with Korea. Therefore, this study aimed to find meaningful implications by comparing the agricultural competitiveness of the United States, New Zealand, and China, focusing on Korea.

The fundamental goal of this study was to analyze the four components of the adjusted double diamond model, including internationalization variables (or factors). Through this analysis, the competitiveness of agricultural internationalization in South Korea, New Zealand, the United States, and China will be evaluated, and insights will be suggested to improve the growth and enhancement of sustainable competitiveness of agricultural internationalization in South Korea. The comparative analysis of the selected variables is based on the fundamental attributes of the adjusted double diamond model, as shown in Figure 3.

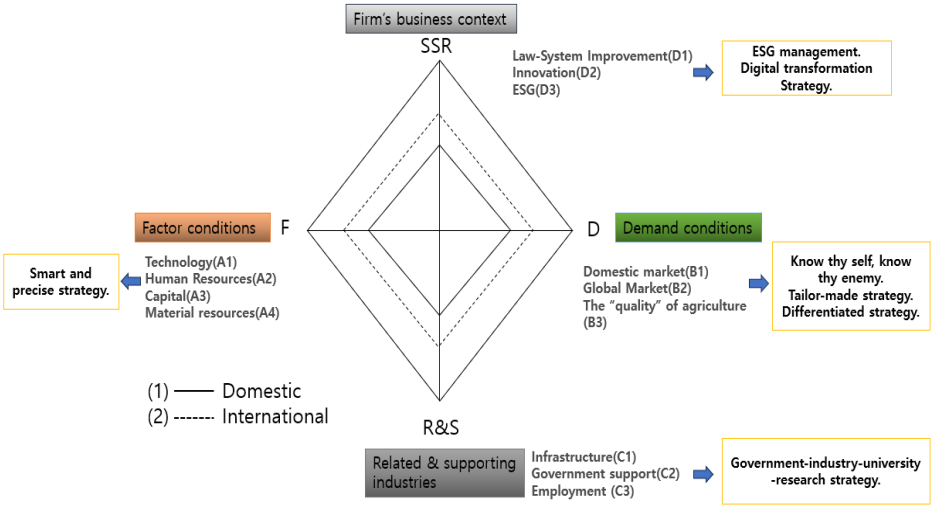


Figure 3. Total variables based on the adjusted double diamond model.

This study formulated the variables based on the adjusted double diamond model. The elements of the factor conditions can be subdivided further into technology (A1), human resources (A2), capital (A3), and material resources (A4). The elements of demand conditions can be subdivided into the domestic market (B1), global market (B2), and the 'quality' of agriculture (B3). The elements of related and supporting industries can be subdivided into infrastructure (C1), government support (C2), and employment (C3). The elements of strategy, structure, and rivalry can be subdivided into law-system improvement (D1), innovation (D2), and ESG (D3).

For successful agriculture, different strategies should be implemented from each dimension of the diamond model. A smart and precise strategy can be adopted regarding factor conditions. In terms of the demand conditions, a strategy of understanding oneself and others, adapting to local conditions, and differentiation can be implemented. The related and supporting industries can use the government–industry–research collaboration strategy to enhance agriculture. Implementing ESG management and digital transformation strategies is critical in terms of firm's strategy, structure, and rivalry (business context). A more detailed explanation of these strategies will be described later after conducting empirical analyses of the agricultural competitiveness of the four countries.

DEFINITION OF VARIABLES

Table 2. Definitions of Variables in the Research Model

Model classification		Index	Description	Source
FC	Technology (A1)	Biotechnology (R&D)	Use of biological systems or living organisms to develop products or technologies.	OECD
		Data infrastructure technology	Systems and technology used to manage and process large volumes of data efficiently.	World Bank
		General agricultural AI technology	Artificial intelligence technology applied to various aspects of agriculture, such as crop management and yield prediction.	Market.us
	Human Resources (A2)	Rural population (proportion Of total population)	Percentage of the total population living in rural areas	FAO
		Education level of Labor force	Level of education attained by individuals working in rural areas.	OECD
	Capital (A3)	Rural credit	Financial services and credit facilities provided to rural communities or agricultural businesses	FAO
	Material resources (A4)	Organic farming area	Agricultural land used for organic farming practices, avoiding synthetic pesticides and fertilizers	FAO
DC	Domestic market (B1)	Domestic demand	Total demand for agricultural products within a country's borders	OECD
		Agricultural FDI inflows	Foreign direct investment specifically directed towards the agricultural sector within a country.	FAO
	Global market (B2)	Overseas demand	Demand from foreign markets.	OECD
		Agricultural FDI outflow	Outward foreign direct investment in the agriculture sector (going abroad)	FAO
	The quality of agriculture (B3)	Agricultural added value (one person)	Value increase in agriculture products during the production process.	World Bank
R&S	Infrastructure (C1)	Logistics system（Service quality）	Quality of transportation service	Word Bank
		Logistics infrastructure	Facilities and structures for transportation.	Word Bank
		Water stress	Pressure on water resources	OECD
		Water efficiency	Effective use of water resources.	FAO
	Government support (C2)	Total support estimate TSE	Total estimated support for agriculture.	OECD
		Production protection	Measures to safeguard agricultural output	OECD
		Agriculture as a share of Government expenditure	Percentage of government spending on agriculture	FAO
	Employment (C3)	Agricultural employment (% of total employment)	Percentage of workforce in agriculture.	Word Bank
SSR	Law-System improvement (D1)	Ease of doing business (business freedom)	Level of ease for business operations.	Word Bank
		Market environment (economic freedom indicator)	Indicator of economic freedom.	Heritage
		Labor freedom	Degree of freedom for the workforce	The global economy

	Innovation (D2)	GII (Innovation Index)	Measure of the innovative capacity	WIPO
	E-ESG (D3)	Nitrogen fertilizer use efficiency	How effectively do crops use nitrogen fertilizers	OECD
		Nitrogen input per hectare	Amount of nitrogen-based fertilizers used per unit area of land	OECD
		Land fertilizer (phosphorus)	Application of phosphorus-based fertilizers to the soil	FAO
		Fertilizer consumption (kg per hectare)	Quantity of fertilizers used per hectare of land	OECD
		Carbon monoxide emissions	Release of carbon monoxide gas into the atmosphere	OECD
		Energy consumption	Amount of energy used in agricultural processes	OECD
		Terrestrial and marine protection rate (%, based on total land area)	Percentage of land and marine areas protected for conservation	Word Bank
	S-ESG (D3)	Healthy eating cost and affordability	Affordability of a balanced diet	FAO
		Prevalence of food insecurity	Proportion of people with inadequate access to food	FAO
	G-ESG (D3)	Government pillar AI (E-Government Development Index)	Government Pillar AI refers to the integration and utilization of artificial intelligence (AI) technologies within the governmental sector	UNIDO
		Government Integrity	Government integrity is a term used to describe the ethical behavior and moral standards within a government or public administration.	OECD

Table 2 lists the variables of the research model. The first column represents the original diamond model developed by Porter (1990). Table 2 also describes the detailed variables, explanations, and sources. The data for these indices (or indicators) were sourced from official government websites and international organizations. Primarily, the data are gathered from reputable sources such as the Food and Agriculture Organization (FAO), the Organization for Economic Cooperation and Development (OECD), and the World Bank. Therefore, the reliability of the source data is high.

The first dimension (or factor conditions) of the diamond model is related to the level of production factors and is consistent with the Factor Endowment Theorem of Heckscher-Ohlin. Porter (1990) [35] distinguishes between basic and advanced factors in the diamond model. Basic factors include land, climate, natural resources, or population. In contrast, advanced factors involve more complex and advanced elements, including knowledge resources (scientific, technological, or market knowledge), transportation and communication infrastructure, sophisticated technologies, and skilled labor.

In factor conditions, advanced factors are crucial for competitive advantage. These factors are developed through training, research, and innovation, representing investments by individuals, companies, or governments. The fundamental assumption is that a country must continuously upgrade its factor conditions. The basic factors provide the initial advantage to a country, which can then be strengthened by investing in advanced factors. Conversely, weaknesses in basic factors suggest the need for investment in advanced factors (Porter, 1990) [35]. Therefore, enhancing a country's advanced factors, such as the education system or infrastructure, will improve a country's competitive advantage.

The demand conditions refer to the nature and scale of domestic demand for products and services within an industry. A key characteristic is the intensity and complexity of domestic customer demand. Porter (1990) [35] suggested that companies are most sensitive to the demands of their closest customers. Therefore, domestic market demand plays a crucial role in shaping the attributes of company products. In this study, international variables, such as the global market and the quality of agriculture, were also included.

The domestic market functions as a multifaceted catalyst, enhancing local company performance and offering potential advantages. Its significant size facilitates economies of scale and experience curve benefits and influences a country's attractiveness as a business destination, particularly when logistical constraints restrict the establishment of multiple production sites. Empirical studies indicate a notable trend. After tapping into their expansive domestic markets, efficient enterprises are driven to explore international opportunities. Leveraging the scale advantages from domestic operations, these firms try to expand into global markets, pursuing new avenues for growth [72].

The related and supporting industries are composed of relevant suppliers. In particular, complementary enterprises are considered crucial in establishing competitive advantages within an industry. Furthermore, the concentration of companies, suppliers, and supporting businesses in a specific geographical location is called an industry cluster, which creates a positive synergy effect [73].

This study established the following indicators as key variables of this sector. Infrastructure (C1) encompasses logistics system (service quality), logistics infrastructure, water stress, and water efficiency. Government support (C2) included the total support estimate TSE, production protection, and agriculture as a share of government expenditure. Employment (C3) comprises agricultural employment (% of the total employment).

In strategy, structure, and rivalry (or business environment), the operations, structure, and administration of companies are significantly influenced by the unique national context and competitive landscape in which they operate [35]. The level of competition within a country directly impacts the ability of a firm to compete globally. Local rivals can negate any inherent advantages derived from a nation's resources or domestic market characteristics. Moreover, intense domestic competition compels firms to enhance their efficiency and embrace technological advancements. This competitive environment fosters a natural selection process, where only the most efficient enterprises survive, driving ongoing innovation and improvement [74].

In this dimension, law-system Improvement (D1) includes ease of doing business (business freedom), market environment (economic freedom indicator), and labor freedom. Innovation (D2) comprises innovation index GII. E-ESG includes nitrogen fertilizer use efficiency, nitrogen input per hectare, land fertilizer (phosphorus), fertilizer consumption (kg per hectare), carbon monoxide emissions, energy consumption, and terrestrial and marine protection rate (%, based on total land area). S-ESG encompasses the cost of healthy eating, affordability, and the prevalence of food insecurity. G-ESG includes the government Pillar AI (E-Government Development Index) and government integrity.

Countries face varying levels of competitive pressure and exhibit significant differences in organizational models, management practices, company objectives, and individual achievement goals. These differences lead to the diversity of international strategies adopted by enterprises. According to Porter, success in each industry requires a specific management system. Therefore, if a country's enterprises adhere to a particular management system, their success may be limited to specific industries. As a result, these variations play a crucial role in the diamond model because differing management ideologies can profoundly influence a country's ability to establish a competitive advantage [35].

ANALYSIS AND COMPARISON BY THE ADJUSTED DOUBLE DIAMOND MODEL

FACTOR CONDITIONS

The factor conditions of the diamond model represent the essential elements of competition within a specific industry, such as human resources, material resources, knowledge resources, capital resources, and production infrastructure. In particular, the generation, upgrading, and specialization of production factors are more important than mere possession [35].

This study employed the adjusted double diamond model for analysis, categorizing the factor conditions into technology, human resources, capital, and material resources. This study analyzed the factor conditions by differentiating variables across South Korea, New Zealand, the United States, and China. In addition, the entropy weight method (EWM) was used to calculate the weight of indicators for each country and the final scores for each factor condition.

The entropy method in comprehensive evaluation is a multi-index comprehensive evaluation method that calculates the entropy of different indicators [75]. The main purpose of this method was to determine the weights and contributions of each indicator in the overall evaluation to evaluate the overall performance of the object more comprehensively and objectively.

The entropy method has the following characteristics: Its objectivity is based on information theory, which can objectively reflect the differences and contributions between indicators, avoiding the influence of subjective factors on the evaluation results. The weights in the overall evaluation can be determined through weight determination and calculations of the entropy of each indicator. Indicators with higher entropy have smaller weights, reflecting their relative importance in overall performance. In addition, the entropy method for multi-index comprehensive evaluation is suitable for multi-index, multi-level comprehensive evaluation problems. It can comprehensively consider the contributions of different indicators to overall performance and form comprehensive evaluation results. Standardization of the entropy method refers to the need to standardize indicator data to ensure comparability and avoid evaluation bias caused by different units.

When assessing the competitiveness of different regions or countries, entropy technology is vital for conducting a thorough evaluation. In this context, entropy technology serves several essential functions. First, it facilitates a multi-index comprehensive evaluation by considering various indicators from the Porter Diamond Model, such as the agricultural basic technology level, innovation level, ESG, and policy support within factor conditions. The use of entropy technology allows for a comprehensive assessment of multiple indicators, aiding in the equitable allocation of weights to each indicator and providing a comprehensive and unbiased evaluation of each country's competitiveness. Second, entropy technology enables the scientific allocation of weights by calculating information entropy, ensuring that the weight of each indicator is determined objectively. This is particularly crucial for the agricultural industry, where specific indicators, such as technological innovation, may have a more significant impact on overall competitiveness, a factor that entropy technology can accurately reflect

Third, entropy techniques facilitate differential analysis by highlighting variations between countries. By comparing the entropy values, researchers can discern the differences in the performance of agricultural industries across different countries, enhancing the understanding of the sources and constraints of competitiveness. Fourth, entropy technology necessitates data standardization to ensure the comparability of various indicators. This standardization helps eliminate evaluation biases stemming from differences in measurement units between regions, leading to more precise comparisons. Lastly, the results of comprehensive evaluations conducted through entropy technology can offer valuable decision-making support. Regional governments, enterprises, or research institutions can adjust their strategies based on these assessment results, focusing on developing areas with higher competitiveness to enhance the overall competitiveness of national agriculture. Consequently, entropy technology emerges as a potent tool for comparative studies of national agricultural competitiveness, enabling a comprehensive and scientifically grounded assessment of regional competitiveness and furnishing decision-makers with a solid foundation for strategic decision-making.

Table 3. Detailed indicators reflecting the EWM parameters in factor conditions

Model classification		Index	Figures by country			
			NZ	KR	US	CN
FC	Technology (A1)	Biotechnology (R&D)	0.0351742	0.0529317	0.0712841	0.0000712
		Data infrastructure technology	0.0350193	0.0298996	0.0221024	0.0000350
		General agricultural AI technology	0.0198819	0.0393234	0.0334292	0.0000393
		AVE	0.0300251	0.0407182	0.0422719	0.0000485
	Human Resources (A2)	Rural population (proportion of total population)	0.0001219	0.0284929	0.0199809	0.1219810
		Education level of the rural labor force	0.1069427	0.0336869	0.0171107	0.0001068
		AVE	0.0535323	0.0310899	0.0185458	0.0610439
	Capital (A3)	Rural credit	0.0041174	0.0708964	0.1003932	0.0125516
	Material resources (A4)	Organic farming area	0.1075106	0.0001074	0.0278956	0.0213639
AVE			0.1951854	0.1428120	0.1891066	0.0950079

* FC= Factor Conditions, NZ= New Zealand, KR= South Korea, US= America, CN=China
* AVE=Average

This study investigated four agriculture-related variables across four countries: Technology—biotechnology, data infrastructure technology, and general agricultural AI technology; Human resources— rural population and educational levels of the rural labor force; Capital funds—rural credit; Material resources—organic farming area. The findings indicate that the United States and South Korea have comprehensive technological advantages in agriculture, while China and New Zealand excel in the total score of human resources. The United States and South Korea have notable advantages in agricultural rural credit, and New Zealand stands out for its natural resource advantages in organic farming areas. After evaluating the overall factor conditions, the United States and New Zealand emerged as leaders in agricultural factors.

Moon (1998) [76] reported that overcoming resource scarcity is deemed more crucial than the resources themselves, despite the common belief that countries abundant in natural resources are wealthy. Japan's lightweight strategy exemplifies this. Australia and New Zealand benefit from not only natural resources and but also advanced resource development, processing, and transportation technologies. In contrast, despite its absolute wealth in natural resources, the United States faces challenges because of its high consumption levels necessitating substantial oil imports, which also influences its Middle East policy.

Stringent entry procedures in Australia and New Zealand, particularly concerning agricultural product inspections, underscore the importance of technological and institutional advances alongside natural resources for national progress. Data analysis in this study shows that while China has abundant labor resources, its

performance in agricultural capital investment and technology lags. In contrast, New Zealand has increased its investments in agricultural education and natural resources, while the United States has prioritized agricultural education and technology investments. Consequently, with substantial investments in agricultural technology, the United States and New Zealand are poised to be more competitive than China and South Korea.

DEMAND CONDITIONS

The demand conditions represent the specific characteristics of product and service demand within a particular industry. These demand conditions determine the pace and nature of domestic enterprise improvement

and innovation, encompassing three crucial attributes: the composition of domestic demand (or the characteristics of buyer demand), the scale and pattern of domestic demand in growth, and the mechanisms of domestic preferences when shifting to foreign markets. The first attribute influences the latter two.

When determining competitive advantage, the quality of domestic demand is more significant than quantity Porter, [35]. This study qualitatively and quantitatively compares the demand conditions of relevant agricultural variables in four countries, as presented in Table 4.

Table 4. Detailed indicators reflecting the EWM parameters in demand conditions

Model classification		Index	Figures by country			
			NZ	KR	US	CN
DC	Domestic market (B1)	Domestic demand	0.0000975	0.0143575	0.0840117	0.0975877
		Agricultural FDI inflows	0.0136922	0.0001052	0.1053064	0.0827192
		AVE	0.0068948	0.0072313	0.0946591	0.0901534
	Global market (B2)	Overseas demand	0.0296476	0.0001287	0.1287797	0.0412087
		Agricultural FDI outflow	0.0001254	0.0224799	0.1255732	0.0525625
		AVE	0.0148865	0.0113043	0.1271765	0.0468856
	The quality of agriculture (B3)	Agricultural added value (per person)	0.0050780	0.0020500	0.0100000	0.0005600
AVE			0.0268594	0.0205856	0.2318356	0.1355990

* DC= Demand Conditions. Conditions, NZ= New Zealand, KR= South Korea, US= America, CN=China
* AVE=Average

This study examined the variables influencing agricultural demand in four countries, encompassing domestic and international agricultural demand, as well as agricultural quality, including product quality and added value.

Domestic demand is evaluated using indices, such as the agricultural domestic demand and agricultural FDI inflows, while the global market is assessed through indices, such as overseas demand and agricultural FDI outflows. The quality of agriculture is scrutinized through the added value of agricultural products.

The findings from the survey suggest that China has a significant advantage in the domestic market because of the current potential agricultural product market to meet domestic demand. Gale, H. F.(2013) [77] suggested that China's agricultural strategy is geared toward expanding domestic demand to bolster its trade surplus and competitiveness. In global markets, the United States demonstrated competitive strengths on the global platform, followed closely by China. This was attributed to initiatives such as the Foreign Market Development (FMD) program, which the United States has implemented to enhance the global presence of U.S. agricultural products through collaboration between the Foreign Agricultural Service (FAS) and U.S. agricultural producers and processors.

In contrast, New Zealand excels in terms of value-added agriculture, as highlighted by Small et al. (2016).[78] Considering these factors, the competitive positioning of the United States and China in terms of demand is evident, with New Zealand emphasizing the significance of value-added agriculture. In particular, New Zealand has a distinct advantage in unilateral value-added agriculture, indicating a shift in consumer preferences towards quality and safety over quantity.

This trend reflects the success of Japanese and Korean electronics firms on the global stage, where the consumer demand for high-quality products drives continuous innovation and technological progress. Therefore, it is imperative to consider the market size and prioritize market quality to stimulate market demand.

RELATED AND SUPPORTING INDUSTRIES

The related and supporting industries refer to the existence and competitiveness of industries that provide goods or services for a specific industry at an international level. Although the presence of these industries is crucial, it is even more important to determine how to effectively utilize these factors [35].

When there are internationally competitive domestic suppliers, it not only enables the rapid and efficient acquisition of cost-effective input factors, but also promotes rapid innovation and improvement through proximity. The competitiveness of an industry is generally evaluated based on the development status of intermediate goods supply and other related industries. This study investigated the indices for related and supporting industries, as shown in Table 5.

Table 5. Detailed indicators reflecting the EWM parameters in related and supporting industries

Model classification		Index	Figures by country			
			NZ	KR	US	CN
R & S	Infrastructure (C1)	Logistics system（Service quality）	0.0001720	0.0215408	0.0430386	0.0215408
		Logistics infrastructure	0.0000869	0.0870084	0.0474986	0.0079889
		Water stress	0.0347742	0.0000347	0.0257213	0.0197071
		Water efficiency	0.0254739	0.0198440	0.0348572	0.0000348
		AVE	0.0151268	0.0321070	0.0357789	0.0123179
	Government support (C2)	Total support estimate TSE	0.0000625	0.0484668	0.0099632	0.0625359
		Production protection	0.0020157	0.1624501	0.0001623	0.0444797
		Agriculture as a share of government expenditure	0.0352481	0.0123903	0.0778006	0.0000777
		AVE	0.0131088	0.0744358	0.0293087	0.0356984
	Employment (C3)	Agricultural employment (% of total employment)	0.0234154	0.0195623	0.0001100	0.1100641
AVE			0.0516510	0.1261050	0.0671976	0.1580804

* R&S= Related and Supporting Industries. NZ= New Zealand, KR= South Korea, US= America, CN=China
* AVE=Average

Based on the data provided, South Korea and the United States exhibit strengths in logistics systems and efficient agricultural water resource utilization. South Korea benefits from its advanced infrastructure and technology, facilitating the smooth flow of goods through well-developed transportation networks and innovative logistics management practices. The United States capitalizes on its abundant water resources for agriculture, implementing modern irrigation techniques and stringent water management policies to ensure sustainable utilization and minimize wastage.

The New Zealand government has a high proportion of government spending in the agricultural sector. New Zealand also excels in water efficiency and conservation because of innovative agricultural practices and robust water management policies. In China, agriculture accounts for a large proportion of total employment, so there is strong protection for the agricultural sector and agricultural products. Although this may be highly competitive in related and supported sectors, it has several limitations in overall agricultural competitiveness.

In sum up, fostering international competitiveness in agriculture requires comprehensive efforts beyond the scope of individual enterprises. In addition to the development of supporting industries, it is imperative to establish requisite facilities and industrial clusters. Moreover, effective policy support from government entities is essential. These multifaceted measures collectively reinforce the value chain of the agricultural sector, augmenting its competitiveness and sustainability in the global arena. Such integrated strategies are essential for ensuring the resilience and adaptability of the industry amid evolving economic landscapes and environmental challenges.

FIRM'S STRATEGY, STRUCTURE & RIVALRY (OR BUSINESS CONTEXT)

The 'firm's strategy, structure, and rivalry' refers to the conditions and characteristics of a country, indicating how enterprises are created, organized, and managed [35]. In specific industries, different countries organize their enterprises with varying objectives, strategies, and methods, and the competitive advantage in a specific industry result from the appropriate combination of these conditions and competitive advantages [35].

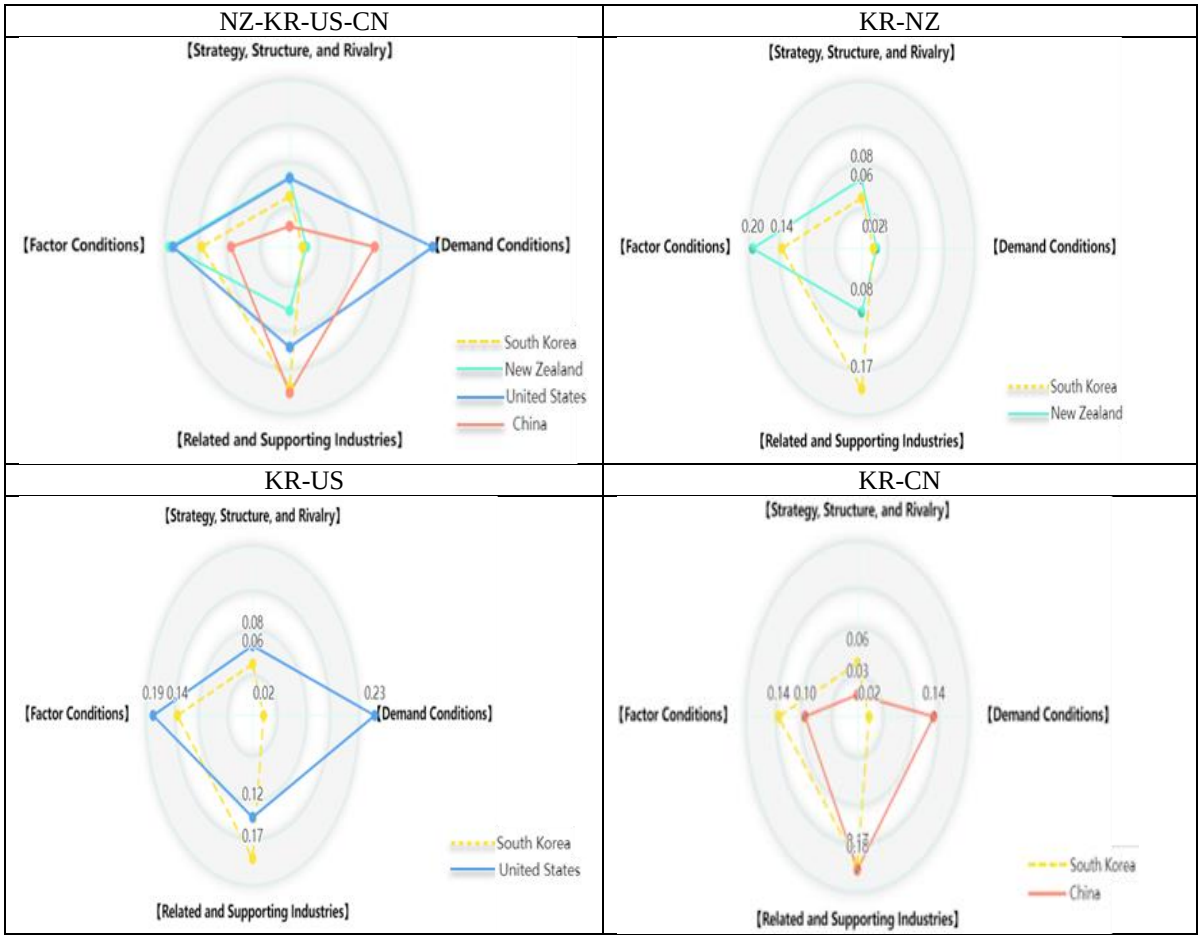
This study examined the domestic perspectives on law-system improvements, innovation, and agricultural ESG strategies, as shown in Table 6. The effective utilization of these variables is essential [35]. With globally competitive suppliers in the international market, it becomes possible to acquire the most cost-effective input factors efficiently and rapidly and achieve rapid innovation and improvement due to proximity.

Generally, industry competitiveness is assessed based on the development of intermediate supply and related businesses. This study conducted a detailed investigation of related and supporting industries, as shown in Table 6.

Table 6. Detailed indicators reflecting the EWM parameters in strategy, structure, and rivalry

Model classification		Index	Figures by country			
			NZ	KR	US	CN
SSR	Law-system improvement (D1)	Ease of doing business (business freedom)	0.022805	0.022751	0.012138	0.000023
		Market environment (economic freedom indicator)	0.021644	0.012725	0.021554	0.000022
		Labor freedom	0.050092	0.001292	0.063904	0.000064
		AVE	0.031514	0.012256	0.032532	0.000036
	Innovation (D2)	GII (Innovation Index)	0.012811	0.019279	0.025963	0.000026
	E-ESG	Nitrogen fertilizer use efficiency	0.039578	0.000051	0.050693	0.004856
		Nitrogen input per hectare	0.016580	0.029886	0.000030	0.014309
		Land fertilizer (phosphorus)	0.034776	0.025508	0.000035	0.009868
		Fertilizer consumption (kg per hectare)	0.000019	0.016968	0.019194	0.015609
		Carbon monoxide emissions	0.033896	0.010098	0.000034	0.024972
		Energy consumption	0.020226	0.011877	0.000039	0.039018
		Terrestrial and marine protection rate (%, based on total land area)	0.040916	0.000041	0.016195	0.014756
		AVE	0.026570	0.013490	0.012317	0.017627
	S-ESG	Healthy eating cost and affordability	0.017840	0.016442	0.016966	0.000018
		Prevalence of food insecurity	0.013331	0.020412	0.020695	0.000021
		AVE	0.015586	0.018427	0.018830	0.000019
	G-ESG	Government pillar Ai (E-Government Development Index)	0.000025	0.015672	0.024713	0.015335
		Government Integrity	0.030443	0.014103	0.016836	0.000030
		AVE	0.015234	0.014887	0.020774	0.007683
AVE			0.088904	0.059060	0.084453	0.025365

*SSR= Strategy, Structure, and Rivalry, NZ= New Zealand, KR= South Korea, US= America, CN=China
* AVE=Average



* NZ= New Zealand, KR= South Korea, US= America, CN=China

Figure 4. Comparison of the adjusted double diamond models in the four countries

The adjusted double diamond model analysis across four countries shows notable discrepancies in competitiveness between the United States and other nations. The United States appears to have a higher level of competitiveness, particularly in factor conditions, demand conditions, and business context (or firm's strategy, structure, and rivalry) compared to other countries. South Korea falls behind the United States in various aspects except for related and supporting industries, meaning the country needs serious improvement.

In the context of agricultural internationalization, the discrepancies in competitiveness between the United States and other nations, particularly South Korea, take on a different dimension. The United States' dominance in factor conditions, demand conditions, and business context positions it as a formidable player in the global agricultural market, enabling its agricultural sector to thrive internationally. With advanced technology, abundant resources, and a well-established market, US agricultural products enjoy a competitive edge in terms of quality, innovation, and market penetration. This allows US farmers and agribusinesses to capitalize on global opportunities and expand their reach across borders.

On the other hand, while South Korea exhibits strengths in related and supporting industries within the agricultural sector, such as technology and manufacturing, it faces challenges in fully capitalizing on these advantages in the international arena. Regulatory barriers, limited market access, and the dominance of larger agricultural players hinder South Korea's ability to compete effectively with countries such as the United States on a global scale.

In the realm of agricultural internationalization, the disparities highlighted in the adjusted double diamond model underscore the need for strategic interventions and policy reforms to bolster the global competitiveness of South Korea's agricultural sector. Addressing regulatory constraints, enhancing market access,

and fostering innovation and technology transfer are critical steps toward facilitating the successful internationalization of South Korea's agriculture industry, enabling it to harness its strengths and navigate the complexities of the global market more effectively.

When examining the adjusted double diamond model between South Korea and New Zealand, it becomes evident that New Zealand outperforms South Korea in factor conditions and business context but lags in related and supporting industries. Hence, Korea should benchmark New Zealand's factor conditions and business context.

Based on the comparison, South Korea may face challenges in agricultural competitiveness because of the weaker factor conditions and business context. This could result in difficulties in attracting investments, accessing advanced technologies, and optimizing agricultural operations. Therefore, benchmarking New Zealand's strengths in these areas could help South Korea enhance the international competitiveness of its agricultural sector.

A comparison of South Korea and China showed that China has superior competitiveness in the domestic market. In the case of Korea, which has a small domestic market, it will be necessary to expand a global market to overcome this.

China's competitive advantage in the domestic market stems mainly from its vast population base and growing middle class, providing Chinese businesses significant sales opportunities and room for development. In contrast, South Korea's domestic market is relatively small, limiting the scale and growth potential of enterprises. Therefore, South Korean enterprises must seek opportunities in the international market to achieve growth and enhance competitiveness. Expanding into the global market can help South Korean enterprises reduce their dependence on the domestic market, explore new sales opportunities, and expand their business scope and visibility through collaboration with international partners. Therefore, South Korea should actively promote agricultural internationalization to address the limitations of the domestic market and achieve sustainable growth globally.

South Korea can derive valuable insights and strategic lessons based on a comparative analysis of the adjusted double diamond model across South Korea, the United States, New Zealand, and China. South Korea can benefit from the advanced factor conditions of the United States, including abundant natural resources, advanced technology, and infrastructure. By investing in research and development, education, and innovation, South Korea can enhance its factor conditions to drive agricultural competitiveness. In addition, studying the demand conditions strategies in the United States, such as consumer preferences and market trends, can help South Korea develop effective marketing and branding strategies to stimulate domestic consumption and expand export opportunities. Moreover, emulating the business context of the United States, characterized by a competitive business environment, supportive regulatory framework, and vibrant entrepreneurial ecosystem, can foster innovation and entrepreneurship in South Korea's agricultural sector.

South Korea can learn from New Zealand's success in sustainable agricultural practices and efficient resource management. South Korea can enhance its agricultural productivity while minimizing environmental impact by adopting environmentally friendly farming techniques, promoting sustainable agriculture, and implementing resource-efficient technologies. Moreover, New Zealand's business context, which emphasizes sustainability, transparency, and ethical practices, can inspire South Korea to strengthen its corporate social responsibility initiatives and governance practices in the agricultural sector.

Despite having a smaller domestic market compared to China, South Korea can learn from China's competitiveness in catering to the needs of a large consumer base and effectively utilizing local resources. By focusing on market segmentation, product differentiation, and customer engagement strategies, South Korea can enhance its competitiveness in both domestic and international markets.

Furthermore, studying the strategies of the United States for market expansion and global trade can help South Korea identify new growth opportunities and develop effective internationalization strategies for its agricultural sector.

CONCLUSION

SUMMARY AND DISCUSSION

This study examined the comprehensive competitiveness of the agricultural industries in South Korea, New Zealand, the United States, and China, including the internationalization level of the agricultural sectors. An adjusted double diamond model was adopted to compare their overall competitiveness. Based on the analysis results, the following suggestions are proposed to enhance the competitive advantage of Korean agriculture.

Compared with other countries, South Korea is competitive in agricultural technology (AI), database technology (A1), and overall agricultural artificial intelligence technology (A2). On the other hand, in an era where technology is constantly being updated, South Korea should continue to increase its investment in agricultural technology because, with the development of the fourth industrial revolution, agricultural competition is no longer limited to labor resources but also involves various digital transformation of agriculture such as smart farms.

In factor conditions, however, New Zealand's rural labor education level is higher than that of South Korea. Therefore, South Korea needs to improve agricultural education and increase the popularization of agricultural knowledge. Regarding natural resources, New Zealand far exceeds South Korea, which shows that South Korea needs to strengthen the development of organic farms and the maintenance of ecological resources.

Second, in the demand conditions, South Korea's domestic demand and exports are lower than other countries. This shows that the consumer market for Korean agricultural products is low, and global markets are not active enough. Therefore, it is necessary to expand global markets by enhancing agricultural competitiveness. The quality of agricultural products is more important than the quantity (or size) of demand. Hence, Korea should increase the added value of Korean agricultural products.

Third, related supporting industries must be improved urgently, focusing on the following aspects. Agriculture in South Korea faces challenges, such as population aging, labor shortages, and climate change. The primary focus is government support, production protection, and agricultural research and development support. On the other hand, South Korea's proportion of investment in agriculture is still lower than that of the United States and New Zealand. South Korea's agricultural employment rate is lower than that of China and New Zealand. Agricultural support policies in South Korea should focus on promoting agricultural production and employment. In other words, South Korea must strengthen human resource development through agricultural education.

Finally, the business context also needs to be improved urgently. South Korea lags behind other countries regarding the ease of doing business indicators such as law-system improvement, market environment, and innovation. In addition, in terms of ESG management, the Korean government should improve the environmental, social, and governance of agriculture. Therefore, South Korea must improve agricultural competitiveness through policies such as improving laws and regulations, market environment, and strengthening innovation strategies.

IMPLICATIONS

The analysis suggests that South Korea enhances agricultural science and technology investment, focusing on information technologies, such as artificial intelligence and databases, to improve agricultural production efficiency and competitiveness. Furthermore, efforts should be made to bolster agricultural education and training to elevate farmers' scientific and cultural proficiency and skills, supporting the advancement of agricultural modernization.

South Korea should also be placed on resource conservation by reinforcing farmland protection and ecological environment management, enhancing the quality and value of agricultural products, and aligning with consumer demands. To expand its market size, South Korea is encouraged to actively engage in global markets to elevate the presence and impact of its agricultural products. In addition, increased investment in research and development, cultivation of distinctive agricultural brands, and enhancement of product value to cater to evolving

consumer preferences are recommended. The agricultural policy should try to enhance the agricultural support system, augment investments in agricultural research and development, refine agricultural production subsidy policies, and foster a conducive policy environment for Korean agricultural progress.

Simultaneously, streamlining administrative processes, fostering fair market competition, and stimulating agricultural innovation are essential for optimizing the business environment. Lastly, in terms of ESG (Environmental, Social, and Governance) management, the Korean government should promote ESG practices, fortify agricultural–environmental protection and social responsibility initiatives, and bolster the sustainability of agricultural development.

The academic implications of this study are as follows. This study used an adjusted double diamond model to analyze the general competitiveness of agriculture, including internationalization, and proposed some new views and insights. The traditional diamond model mainly focuses on the impact of national domestic factors on competitiveness, while the double diamond model incorporates international factors into the analytical framework. This study used the double diamond model to analyze the current situation of Korean agricultural international competitiveness and explore its influencing factors.

The following are the practical implications of this study. Korean agricultural businesses are gaining a deeper insight into the global market competition environment and devising successful competitive tactics. This research can also enhance the competitiveness of Korean farmers and enable them to engage more effectively in international market competition.

Regarding policy implications, the government must increase funding for the advancement of agricultural technology and foster the growth of innovative technologies within the sector. Furthermore, the government must enhance policies to safeguard agricultural resources and establish a sustainable framework for agricultural production. Moreover, the government must provide greater assistance for accessing international markets and to explore new market opportunities. Emphasis should also be placed on supporting the production of premium agricultural goods and enhancing brand recognition. Policy measures should be implemented to bolster the competitiveness of agricultural enterprises and facilitate their expansion into global markets. In addition, initiatives to promote the adoption of ESG practices by agricultural firms should be encouraged, fostering an environment conducive to sustainable agricultural management.

The Korean government proactively invests in technological innovations within the agricultural sector to enhance productivity by incorporating novel technologies. Efficient resource utilization and embracing sustainable agricultural methodologies are essential for organizational success. Furthermore, formulating a comprehensive international market entry strategy and thoroughly comprehending foreign markets are imperative. Emphasis should be placed on the cultivation of superior agricultural goods and the augmentation of brand recognition. Collaboration with global entities is recommended to bolster competitiveness. Agricultural companies are urged to actively participate in competitive readiness efforts and prioritize sustainable practices by adhering to ESG management principles.

In sum up, implications of this research for enhancing South Korea's competitive advantage in agricultural internationalization are as follows. Key recommendations include a focus on technological advances through continued investment in agricultural technologies, such as AI and database management, to compete effectively in the era of smart and information-based agriculture. In addition, improving rural education to equip farmers with the necessary skills to utilize advanced technologies and optimize agricultural practices is crucial.

Protecting organic resources through increased focus on organic farmland protection and ecological resource management can differentiate South Korean products and meet sophisticated consumer demand. Strategies to expand the global market, develop high-value products, invest in supporting industries, strengthen government support, improve the regulatory environment, and implement ESG management are essential for enhancing Korean agricultural competitiveness. By addressing these recommendations, South Korea can significantly enhance its agricultural competitiveness and establish a more sustainable agriculture.

LIMITATIONS

This study had several limitations, which can be used as important issues for future research. first, this research was constrained to a specific set of countries (south korea, new zealand, the united states, and china). a broader inclusion of nations could offer a more comprehensive perspective on agricultural internationalization strategies. second, more in-depth analysis can be performed in future studies using other data or methodologies such as primary data or interviews. furthermore, given the dynamic nature of the agricultural sector, future studies could explore emerging trends and the latest technologies that might impact future agricultural competitiveness.

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