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The Role of Green Innovation Performance in Mediating the Influence of Green Organizational Culture on Green Competitive Advantage

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ABSTRACT

Purpose – A society that cares about environmentally friendly products demands companies have a green competitive advantage through the application of the principles of Reuse, Reduce, and Recycle. The purpose of this research is to examine and analyze the influence of green organizational culture (GOC) on green innovation performance (GIP) and green competitive advantage (GCA).

Design/Methodology/Approach – The study collected data from 314 manufacturing companies that are members of Proper (Environmental Performance Rating Program) on Java Island. Data collection was conducted through online and offline surveys using questionnaires that measured each research variable. Structural equation modelling with SEM PLS software were applied to analyze the data.

Findings – The findings of this paper indicate that green organizational culture has a positive influence on green innovation performance. GOC also positively influences GCA, and GIP fully mediates the relationship between GOC and GCA.

Research Implications – This research contributes to existing literature on GOC, GIP, and GCA, taking into account environmental issues, which have been empirically understudied, especially in manufacturing companies that are members of Proper. Furthermore, this research also explores green innovation performance as a mediator, which has been relatively unexplored in previous studies. However, this research has several limitations, including the dominance of blue-rated Proper participant companies in the sample, as most questionnaires were distributed during the blue certificate awarding moments. Additionally, the sample size per province was uneven, with the majority of participant companies located in the province of West Java.

Keywords: green competitive advantage, green innovation performance, green organizational culture
JEL Classifications: F65, L25, O31, O35

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I. Introduction

Over the past decade, many environmental issues have arisen due to pollution generated by manufacturing companies in production operations, resulting from inadequate waste management systems in the production processes. Data from the Ministry of Environment and Forestry (KLHK) indicates that the manufacturing industry is a significant contributor to hazardous waste. Pollution and hazardous waste are clear evidence of inefficient resource utilization. Societal concern for environmentally friendly products demands that companies have a green competitive advantage (GCA) through the implementation of the principles of Reuse, Reduce, and Recycle. GCA refers to a situation wherein a company possesses distinct positions in terms of environmental protection or green innovation that cannot be replicated by competitors, whether in terms of low costs for environmental protection or green innovation, environmentally friendly product or service offerings, or superior environmental management capabilities. Firmansyah (2019) revealed a lack of recognition for the importance of GCA in Indonesia when applying competitive strategies.

According to Chen and Chang (2013), GCA is a circumstance in which a corporation has diverse positions connected to environmental management or green innovation that competitors cannot copy. As a result, green innovation becomes an alternative option for reaching GCA. Green innovation performance (GIP) refers to benefits derived from green innovation. GIP is separated into two categories in this study: green product innovation performance and green process innovation performance. To achieve GCA, businesses must improve both green product innovation and green process innovation performance in order to offer products with added value and fulfill current consumer needs. This added value will become the competitive advantage held by the company. GIP will be achieved successfully when supported by beliefs, values, and norms related to the environment within an organization.

Environmentally friendly and sustainable activities require a strong corporate culture (Porter et al., 2016). Schein (1990) defined organizational culture as "a set of shared values, opinions, and principles that govern a business". A green organizational culture (GOC) is created by integrating green practices into all aspects of an organization. Green culture has been shown to boost productivity within organizations (Leonidou et al., 2011), create a positive employer brand (Gürlek & Tuna, 2018; Yang et al., 2019), encourage organizational innovation and creativity (Banerjee, 2002), and provide companies with a competitive edge. The promotion of environmentally friendly management techniques within a company can alter the way the organization does business.

Adoption of green practices throughout a corporation results in the change of organizational culture into a GOC, or environmentally friendly organizational culture. According to Chang and Chen (2013), GOC refers to beliefs, values, and norms associated with an organization's environment. In this culture, management is critical in determining work processes and establishing anticipated behavioral norms for each worker within the firm (Chen, 2011). As a result, if a company wants to excel in environmental practices, it must adopt GOC (Fernández et al., 2003; Marshall et al., 2015; Yahya et al., 2015).

As a result, GOC is important to the success of green innovation implementation. This is a vital requirement for green innovation since it creates favorable conditions for green practices and simplifies green innovation activities (Azzone & Noci, 1998). This work adds to the body of knowledge on GOC, GIP, and GCA by investigating environmental concerns that have not to be empirically investigated, particularly within PROPER member industrial companies. Furthermore, this study looked at GIP as a mediator, which has been largely ignored in previous research. This work is significant in exploring the influence of GOC on GCA, with GIP acting as a mediator, based on the descriptions above.

II. Literature Review

1. Resource-Based Theory

Resource-Based Theory was pioneered by Wernerfelt in 1984. According to Teece (1997), the resources a company possesses determine its competitive advantage. Resource-Based Theory is considered a process of developing strategies from the inside out. To implement specific strategies in attaining corporate advantage, the resources a company possesses are the primary levers used to exploit external opportunities and achieve superior company performance. This research utilizes Resources-Based Theory to analyze which indicators can be used to enhance the competitive advantage of the manufacturing industry in relation to environmental concerns. They highlight internal corporate elements as sources of competitive advantage. All available resources are optimized to enhance the performance of the manufacturing industry, making it superior in its field (Banerjee, 2002; Hart & Hart, 1995).

2. Green Organizational Culture

According to Chang (2015), the normal behaviors required of people are formed by the organization's GOC, which includes common views, values, conventions, symbols, and stereotypes of social groups related to environmental management. GOC refers to the system of values, norms, and behaviors within an organization that prioritize sustainability and environmental awareness (Chen, 2011). This culture encourages organizations to adopt environmentally friendly, socially responsible, and economically sustainable practices. Thus, GOC represents a pattern of behavior and thinking that characterizes the shared values and accepted norms within an organization related to environmental management, distinguishing one organization from another. Environmental practices and environmental issues are influenced by organizational culture (Aten et al., 2012), as culture has the ability to foster socio-cultural discourse. Azzone and Noci (1998) defined GOC as a company's assessment of the environment as a variable with values and criteria. It involves the organization's commitment to reducing negative impacts on the environment and implementing sustainable practices in all operational aspects, motivating organizations to commit to long-term sustainability principles, including the use of renewable energy, greenhouse gas emission reductions, and effective waste management.

Leaders in a green organization play a crucial role in shaping a sustainable culture by setting examples, communicating the importance of sustainability, and encouraging the participation of all members of the organization in green efforts. Additionally, GOC involves the active participation and involvement of employees in adopting sustainable practices. Employees are encouraged to provide ideas, suggestions, and initiatives that contribute to the organization's sustainability efforts. According to Pham et al. (2018), by implementing a GOC, companies should conduct adequate training on environmental issues for employees, giving them opportunities to be effectively trained in environmental issues, thus allowing employees to utilize the environment. Supporting environmentally friendly management practices within an organization can affect the way the organization conducts business (Banerjee, 2002; Chen, 2011; Parr, 2009; C. H. Wang, 2019; Zameer et al., 2019).

3. Green Innovation Performance

GIP refers to an organization's ability to generate and implement sustainable and environmentally friendly innovations. GIP is a company's effort to make its activities more sustainable through the development and implementation of innovative practices involving more environmentally friendly products and processes (Albort-Morant et al., 2016). According to several studies, GIP is measured using the dimensions of Green Product Innovation Performance and Green Process Innovation Performance (Huang & Li, 2018; Wang et al., 2019).

Green Product Innovation Performance is defined by ISO 14031 standards as performance in environmental product innovations such as energy conservation, pollution prevention, waste recycling, non-toxicity, and green product design (Chen et al., 2006). GIP is used to drive environmental management performance to meet environmental protection requirements, which are measured by four factors: (1) effectiveness of environmentally friendly materials, (2) environmentally friendly packaging, (3) product recovery and recycling, and (4) environmentally friendly labeling (Huang & Li, 2018; Wang et al., 2019).

GIP assesses a company's capacity to create environmentally friendly innovations in production processes, which may involve modifications or advancements in production techniques, technologies, or strategies. Environmentally friendly product design, energy-saving efficiency, pollution prevention, waste recycling, and non-toxicity in the manufacturing process are the five criteria used to evaluate the effectiveness of green process innovations.por

4. Green Competitive Advantage

According to Chen (2011), a corporation has a green competitive advantage (GCA) when it has a number of positions in terms of environmental management or green innovation. Barney (1991) and Porter (1981) all identified a firm's competitive advantage as the inability of rivals to copy the competitive strategy that the company is using, and to reap the benefits that the company derives from this strategy. In contrast, GCA is defined as a situation in which a company holds multiple positions in terms of environmental protection or green innovation, wherein competitors are unable to copy the environmental strategy related to low costs in environmental protection or green innovation, the quality of the offered environmentally friendly products or services, and superior environmental management capabilities. According to Chen et al (2016), GCA is an essential factor for organizations to enhance sustainable development achievements. GCA is reflected in actions taken by companies in the form of corporate social responsibility (CSR) to achieve a sustainable competitive advantage.

Competitive advantage depicts how a company chooses and implements generic strategies to attain and maintain a competitive edge. If a company lacks a competitive advantage, to the point it is unable to offer better value to customers compared to competitors, it can result in a loss of market share (Minoja et al., 2010). This is why competitive advantage is required to be the core of every company's strategy. Zameer et al. (2019) believed that items that are challenging to copy produce long-term advantages for the business. Additionally, organizational resources assist businesses in leveraging core strengths (Nagano, 2020), giving a significant competitive edge by offering green products to customers.

The indicators used to measure this dimension, according to (Rahman et al., 2020), include regular environmental performance reports helping reduce environmental costs, reducing environmental costs aiding in reducing production costs, controlling environmental costs improving process efficiency, reducing costs, and improving efficiency enabling competitive pricing of products. The second dimension is Differentiation Advantage. In the context of GCA, Differentiation Advantage indicates that an organization can differentiate its products or services through unique sustainable aspects. Organizations that adopt sustainable practices can create environmentally friendly products, use renewable raw materials, or have more sustainable product life cycles. Market Segmentation Advantage, in the context of GCA, indicates that an organization can identify and meet the specific needs of market segments that prefer environmentally friendly products or services. By understanding the values and preferences of market segments concerned about environmental issues, organizations can develop marketing strategies and product offerings suitable for these market segments. Combining these three dimensions can provide significant competitive advantages and help organizations achieve sustainable economic, environmental, and social

goals. All three strategies offer added benefits that customers can enjoy, and they are proxies used in this research.

5. Hypothesis Development

In addition, according to Zameer et al., (2019), GOC is also a key factor that drives green innovation. According to Hart and Hart, (1995), organizational resources are essential for creating effective environmental strategies. According to Banerjee (2002), one resource that can enhance green performance is GOC. Fergusson and Langford (2006) argued that businesses are more likely to embrace green cultural initiatives if they place high value on environmental protection and are concerned about it (Klassen & Vachon, 2003). As a result, a company's ability to translate proactive environmental plans into green performance is a valuable asset (Schlegelmilch et al., 1996). This indicates that the better the implementation of GOC in a company, the better the company's GIP.

According to previous research, to obtain a competitive advantage, organizations must engage in more green innovation activities, such as green products and processes, to open up new markets and avoid competition (Gürlek & Tuna, 2018). GIP refers to a business's efforts to increase the sustainability of its operations through the creation and adoption of cutting-edge procedures that incorporate more environmentally friendly goods and methods. For competitors to be unable to cope with a company's environmental strategy related to low costs in environmental protection or green innovation, environmentally friendly product or service quality offered, and superior environmental management capabilities, a company must be in a condition known as GCA. To determine how well a firm complies with its environmental protection requirements, the GIP measures the company's efforts in environmental management and sustainable practices (Chen et al., 2006).

Companies must have a GCA through reuse, reduction, and recycling to comply with the public demand for environmentally friendly products (Manongko & Kambey, 2018). According to the resource-based view, valuable, uncommon, and hard-to-replicate resources can aid businesses in achieving long-term competitive advantage. According to Zameer et al. (2019), products that are challenging to duplicate produce sustainable benefits for a company. Organizational resources also enable businesses to capitalize on core capabilities (Nagano, 2020). The major performance metrics of GCA are anticipated to be green innovation and environmental management. Investments in green product innovation and green process innovation benefit firms considerably according to Chen's (2006) research, because these performance areas are positively correlated with a firm's competitive advantage.

Companies can improve product differentiation benefits by incorporating green environmental themes into product design and packaging (Shrivastava, 1995). Earnhart and Mark Leonard (2016) provided evidence that worker knowledge of the manufacturing process can be shared to spur innovation and increase competitive advantage. Knowledge-based resources and procedures can be used by businesses to provide innovative services. According to Noci and Verganti (1999), companies invest considerable administrative and financial resources into environmentally friendly innovation because they understand the strategic importance of initiatives that provide sustainable competitive advantage. This was strengthened by Chen et al. (2006), who indicated that a company's competitive advantage increases with the amount of investments made in green product innovation and green process innovation. Research results by Chen and Hung (2014) supported the positive influence of GIP on GCA. Finally, green product innovation can boost resource productivity and boost company superiority. Research has shown that service process and service product innovation have a favorable and significant impact on external competitive advantage (Chang & Zhang, 2015; Porter, 1985; Porter & Van Der Linde, 1995). Similarly, Chiou et al. (2011) discovered that green products and process innovation have a beneficial impact on competitive advantage. This implies that

the higher a company's GPI, the higher is its GCA.

A GOC must be implemented if an organization wants its environmental policies to be successful (Marshall et al., 2015; Yahya et al., 2015). According to the GOC, a company's assessment of the environment is a variable with values and norms (Azzone et al., 1997). The perspective of the Resource-Based Theory was first introduced by Hart and Hart (1995). These resources need to be expensive, uncommon, immobile, and non-replaceable. Ma (2000) defined competitive advantage as the distinction between organizations along comparable dimensions that enables one company to perform better than its rivals. Companies must be able to produce new resources in response to environmental problems (Menguc and Ozanne, 2005).

In research by C. H. Wang (2019), manufacturing companies in Taiwan showed that GOC significantly influenced innovation. The direct relationship also showed that GOC can enhance competitive advantage. Because GOC can set a company apart from rivals, managers must foster such a culture within their organizations. To preserve a competitive edge, managers can create shared values in environmentally friendly industrial processes to minimize adverse environmental repercussions. This is supported by Gurlek's et al (2017) that GOC has a positive influence on competitive advantage. Therefore, according to Gurlek's et al (2017), GOC is a crucial determinant of competitive advantage. The idea suggests that a superior green value culture can help a company gain a competitive edge by supporting GOC and using green innovation to open up new market opportunities. Therefore, by applying green innovation, firms may efficiently manage natural resources, which in turn generates a sustainable competitive advantage. (Gupta & Kumar, 2013; Wagner, 2006). This demonstrates that a company's GCA improves with improved GOC implementations.

H1: GOC has a positive influence on GIP.
H2: GIP has a positive influence on GCA.
H3: GOC has a positive influence on GCA.

III. Methodology

1. Sample and Procedure

This study used primary data, which were responses to an online survey that was provided as a Google form. Data were gathered through an online survey posted on the WhatsApp Group of the Environmental Agency in each province on the island of Java, along with a questionnaire used to measure each variable. Employees from the relevant department in charge of the Proper Program were in charge of distributing the questionnaire.

An online survey form was created and administered to gather information from Java-based manufacturing firms to respond to the research questions. According to a 6-point Likert scale adapted from Elhossade et al. (2022), respondents were asked to indicate the degree of adoption. The manufacturing sector predominates on Java and has a tendency to consume many natural resources, which could have an adverse effect on the environment. Companies that participated in Proper were chosen for the study because they are more concerned with environmental issues and strongly support environmental conservation programs, both of which are important to the factors being examined. In accordance with Hair's et al. (2017) technique, the minimum sample size was determined by multiplying the total indicators in each dimension of the variable by a factor of 10, and the calculation result showed that 240 respondents would be the minimum number needed. However, 350 respondents took part in the data collection procedure, representing 314 companies as the study's primary analytical and research design.

The majority of respondents (64.6%) were environmental safety and health managers, followed by environmental division staff (11.1%), upper-level managers and directors (19.4%), technical managers (3.5%), and production managers (1.3%). However, some general employees also responded to the survey at explicit supervisor or director request. Because

of their expertise and familiarity with the study variables, the respondents that participated in the survey showed that more than 50% had a solid understanding of the constructs. According to the analysis of respondent gender, 71.3% were men, and 28.7% were women. 35% of respondents were between the ages of 30 and 40; the second group, those under 30, made up 30.3% of the total. The remaining respondents (29.6 %) were aged 40–50 years, and 5.1%, a very small percentage of the population, was over 50. The fact that 65.9% of respondents had a bachelor's degree (S1), 11.8% had postgraduate degrees, and 22.3% had degrees below the bachelor's level indicates that the respondents were highly qualified for the research. Additionally, more than 50% had been employed by their respective businesses for more than five years, showing that they had knowledge of managing corporate cultures. All respondents also worked for organizations that were given proper ratings in the blue, green, and gold colors, suggesting that these organizations had good environmental management practices, and that the variables under research were supported by the proper ratings of the organizations where respondents worked. The survey respondent profiles are listed in Table 1.

Table 1. Recapitulation of Respondent Characteristics

Respondent Characteristic		Sample (n=314)	Percentage (%)
Age Group	< 30 years	95	30,3
	30 - 40 years	110	35,0
	40 - 50 years	93	29,6
	> 50 years	16	5,1
Gender	< 30 years	95	30,3
	Male	224	71,3
	Female	90	28,7
Educational Background	High School	44	14,0
	Diploma (D3)	26	8,3
	Bachelor's Degree (S1)	207	65,9
	Master's Degree (S2)	24	7,6
	Other	13	4,1
Participation in Proper	< 1 year	37	11,8
	1 - 3 years	67	21,3
	> 3 years	210	66,9
Proper Color	Gold	44	14,0
	Green	26	8,3
	Blue	207	65,9

2. Measurements of Variables

The measurement of GCA uses three dimensions adopted from Rahman et al. (2020), consisting of Cost Leadership Advantage, Differentiation Advantage, and Market Segmentation Advantage. The scale measurement of GOC was adapted from Marshall et al. (2015), which was also used in studies by Gürlek and Tuna (2018) and L. Wang (2019). Additionally, the measurement of GOC was also constructed based on Harris and Crane (2002), and used in the research by Aggarwal and Agarwala (2021). In this study, GOC is represented by two dimensions: Performance Beliefs and Industry Macro-Culture.

According to previous studies, GIP has implications for addressing stakeholder demands to maximize production without hurting the ecosystem. For this reason, it was selected as the mediating variable in this study (Albort-Morant et al., 2016; Chen et al., 2006; Chen & Chang, 2013). GIP functions as a mediating variable between GOC and GCA as a company's response to internal changes (such as cultural shifts, managerial strategies, etc.) and external changes (such as market trends, stakeholder preferences, normative frameworks, and social expectations).

IV. Results and Discussion

1. Measurement Results

Based on the output of descriptive statistical tests, the mean of each variable, GOC, GCA, and GIP was higher than the respective standard deviation values, indicating that the data distribution in each variable of the study is quite diverse or heterogeneous. The calculation results show that the highest average rating given by respondents is for the GOC variable, with a score of 4.68. Table 2 displays the descriptive statistics for each variable examined.

Table 2. Descriptive Statistics

Variable	N	Min.	Max.	Mean	Std. Dev.
GOC	314	1,83	6,00	4,6810	1,04643
GCA	314	1,67	6,00	4,5239	1,05525
CIP	314	1,22	6,00	4,1447	1,13197
Valid N (listwise)	314				

Structural equation modeling with the partial least squares (PLS) approach as an alternative was used to execute a number of quantitative analyses pertinent to the research goals. The correlation between item and construct scores was used to evaluate the convergent validity of the measuring model. Factor loadings and AVE values were used to evaluate convergent validity in addition to factor loadings. Discriminant validity was assessed using cross-loading values.

The AVE values for all latent variables were determined to be > 0.5, as based on the Convergent Validity test, indicating that the respective constructs accounted for more than 50% of the variance of the indicators. The Confirmatory Factor Analysis (CFA) model for the variables GOC, GCA, and GIP thus has strong convergent validity. Each indicator for each variable

demonstrated greater correlations with the measured construct than with other latent variables according to the cross-loading test, demonstrating good discriminant validity for all indicators of GOC, GCA, and GIP. Furthermore, the Fornell-Larcker criterion testing showed that all constructs had AVE values higher than the correlations with other constructs, supporting the conclusion that each construct has good discriminant validity.

Cronbach's alpha (CA) and composite reliability (CR) are further tools for assessing the dependability of construction. Each construct has a CR value greater than 0.7 and is further supported by a CA value greater than 0.6 according to the findings of the composite reliability and Cronbach's alpha tests, demonstrating that all constructs are reliable. This demonstrates the uniformity with which all indicators measure their respective constructs. The results of the examination of the outer model for each study variable are presented in Table 3.

2. Hypothesis Tests

The R-square and Q-square were two of the indicators examined throughout inner model testing. The R-squared value of the GCA variable is 0.748, which is considered strong. This suggests that the GOC and GIP variables accounted for 74.8% of the GCA. Other factors that were not examined in this study had an impact on the remaining 25.2%. On the other hand, the R-squared value for the GIP variable was 0.364, which is considered moderate. This suggests that the GOC variable accounted for 36.4% of GIP. Other unresearched factors affected the remaining 63.6%. The value of predictive relevance (Q2) was another metric used for structural model testing in the inner model, in addition to the R-square. The model had predictive importance when the Q-squared value was greater than 0. The model has predictive relevance if the Q2 values for the endogenous variables GCA and GIP are greater than 0. The R-squared and Q-squared values for each endogenous variable obtained using the blinfolding method are listed in Table 4.

GOC had an impact on GIP, as according to Hypothesis 1. Based on the findings of the statistical tests, the path coefficient for the impact of GOC on GIP was 0.603 (sig. <0.05). Hypothesis H1 is accepted because the path coefficient is positively skewed. Therefore, it can be said that GOC significantly influences GIP. The more effective the GOC, the greater is the improvement in the GIP. The second hypothesis is that GIP affects GCA. The path coefficient for the impact of GIP on the GCA was 0.596 (sig. <0.05). Therefore, it can be said that GIP significantly influences GCA in a good way. GIP improves GCA more when it is better. GOC had an impact on GCA, as according to Hypothesis 3. The path coefficient for the impact of GOC on GCA was 0.363 (sig. <0.05). Therefore, we can conclude that GOC significantly and favorably influences GCA. The better GOC, the greater the improvement in GCA. Based on the statistical test results presented above, it was found that the indirect effect (path coefficient) of GOC on GCA through GIP was 0.360 (sig. <0.05). Therefore, it can be concluded that GIP mediates the influence of GOC on GCA. Considering the indirect effect (0.723), the total effect of GOC on GCA was higher than the direct effect (0.363), indicating that GIP positively contributes to the relationship between GOC and GCA.

3. Discussion

GOC had a positive influence on GIP. This demonstrates the significant managerial implications that GOC, which prioritizes environmental preservation, directs managers to understand and increases the awareness of the effectiveness of energy conservation, pollution prevention, product recovery, and waste recycling, thereby enhancing the company's GIP. Simultaneously, it acknowledges the responsibility to preserve the environment and establishes a clear policy statement that urges environmental consciousness in every operational area, making green culture a priority for the company (Gürlek & Tuna, 2018; Marshall et al., 2015; C. H. Wang, 2019).

Table 3. Outer Model Evaluation

Construct Variable	Validity Test		Reliability Test		Cross Loading and Fornell Lacker Criterion						
	Loading Factor	AVE	CA	CR	GOC1	GOC2	GCA1	GCA2	GCA3	GIP1	GIP2
GOC1			0,931	0,956	0,937						
GOC1.1	0,949	0,878			0,949	0,826					
GOC1.2	0,950				0,950	0,849					
GOC1.3	0,912				0,912	0,795					
GOC2			0,939	0,961	0,878	0,944					
GOC2.1	0,941	0,891			0,831	0,941					
GOC2.2	0,967				0,858	0,967					
GOC2.3	0,923				0,798	0,923					
GCA1			0,932	0,951			0,911				
GCA1.1	0,909	0,830					0,909	0,811	0,777		
GCA1.2	0,889						0,889	0,735	0,687		
GCA1.3	0,939						0,939	0,821	0,762		
GCA1.4	0,907						0,907	0,772	0,756		
GCA2			0,964	0,974			0,862	0,951			
GCA2.1	0,936	0,904					0,849	0,936	0,858		
GCA2.2	0,942						0,814	0,942	0,842		
GCA2.3	0,958						0,804	0,958	0,794		
GCA2.4	0,967						0,811	0,967	0,832		
GCA3			0,935	0,954			0,819	0,875	0,915		
GCA3.1	0,932	0,837					0,799	0,840	0,932		
GCA3.2	0,936						0,774	0,844	0,936		
GCA3.3	0,867						0,647	0,731	0,867		
GCA3.4	0,925						0,769	0,783	0,925		
GIP1			0,880	0,918						0,859	
GIP1.1	0,868	0,737								0,868	0,755
GIP1.2	0,890									0,890	0,699
GIP1.3	0,792									0,792	0,707
GIP1.4	0,881									0,881	0,671
GIP2			0,914	0,936						0,825	0,864
GIP2.1	0,913	0,746								0,781	0,913
GIP2.2	0,901									0,774	0,901
GIP2.3	0,818									0,598	0,818
GIP2.4	0,801									0,730	0,801
GIP2.5	0,880									0,667	0,880

Table 4. Results of Hypotheses Tests

Hypothesis	Path	T-Statistic	Sig.
Direct Effect			
H1 GOC → GIP	0,603	6,886	0,000
H2 GIP → GCA	0,596	5,730	0,000
H3 GOC → GCA	0,363	3,217	0,001
Indirect Effect			
GOC → GIP → GCA	0,360	5,730	0,000
Total Effect			
GOC → GIP	0,603	6,886	0,000
GIP → GCA	0,596	5,730	0,000
GOC → GCA	0,723	8,351	0,000
R Square GCA: 0,748; R Square GIP: 0,364; Q2 GCA: 0,564; Q2 GIP: 0,241			

Similar to Gurlek's et al. (2017), GOC is a critical determinant of green innovation. In situations where environmental regulations become stricter and environmental awareness increases, managers must take environmental care measures and build an organizational culture focused on sustainability. This is aimed at creating new market opportunities for the company by motivating and directing employee energy towards environmentally friendly innovations that enhance the company's innovation performance.

GIP had a positive influence on GCA. GIP, which represents innovation performance in creating environmentally friendly products, services, or processes, has a positive influence on GCA, a competitive advantage based on environmentally friendly practices and products. The findings of Chen's research (2006) indicate that the performance of green product innovation and green process innovation correlates positively with a company's competitive advantage. This means that investments in green product and process innovations are highly beneficial for businesses, with more investment in green product and process innovations creating a stronger company competitive advantage.This provides an advantage for the company in terms of differentiation from competitors; by producing more environmentally friendly and innovative products or services, the company can distinguish itself in the market. GIP helps create unique and appealing products for environmentally conscious consumers. With GIP, the company can attract loyal customers because the offered products align better with customer environmental values. Moreover, it facilitates access to new markets because companies with GCA tend to be more capable of entering new markets related to environmentally friendly products or services. This provides opportunities to embrace a wider market share and enhance the scale of operations.

Innovation in sustainability and environmental aspects can enhance the company's reputation as an entity that cares about environmental issues. A good reputation in this regard can increase customer trust and build long-term relationships with stakeholders, such as business partners and the government. Companies that innovate in environmental aspects are likely to be more compliant with environmental regulations,

reducing the company's risk of fines or sanctions that may arise due to non-compliance. This competitive advantage can become a valuable asset for achieving long-term growth and success in an era of sustainable business.

GOC has a positive influence on GCA. From a practical perspective, managers must build an organizational culture that supports environmental values, which can enhance reputation and competitiveness and set the company apart from competitors. Managers can develop shared values that focus on environmentally friendly production processes by providing high-quality, environmentally friendly products, which can enhance customer loyalty and enable market entry opportunities to achieve GCA. This is in line with Gurlek's et al. (2017), that GOC has a positive influence on competitive advantage. Therefore, according to Gurlek's et al. (2017), GOC is a crucial determinant for competitive advantage.

Therefore, through GOC, managers can reduce negative environmental impacts and contribute to environmental preservation efforts. Although environmental protection challenges may not always be easy to confront, managers are expected to fully understand the company's environmental strategies when facing environmental issues. By doing so, the company can make appropriate decisions and support a sustainable competitive advantage. By adopting GOC, managers and companies can demonstrate commitment to environmental issues, which in turn enhances the company's reputation in the eyes of customers, business partners, and the community. Additionally, products resulting from environmentally friendly production processes attract environmentally conscious customers, thereby increasing customer loyalty and increasing market share. Thus, practicing GOC can be a valuable resource in achieving a long-term competitive advantage. GOC enables companies to efficiently manage natural resources by fostering green innovation, which in turn leads to sustainable competitive advantage (Gupta & Kumar, 2013; Wagner, 2006). Overall, by implementing GOC, managers can play a vital role in creating a positive impact on the environment while strengthening the company's market position and achieving a sustainable competitive advantage.

GIP mediates the influence of GOC on GCA. GOC refers to a strong organizational culture that supports environmental values and sustainability, wherein the company has a high commitment to environmentally friendly business practices. A strong GOC encourages employees to think creatively and innovatively to develop environmentally friendly solutions. By applying environmental values to organizational culture, employees will be motivated to seek new methods for production, resource utilization, or the development of more sustainable products. This contributes to an improvement in the company's GIP. GOC also influences employee perspectives and attitudes toward environmental issues. When a company has a culture that supports the environment, employees are more likely to adopt environmentally friendly practices in daily tasks. This creates a work environment that supports GIP as employees feel motivated to contribute to sustainable practices. When a company has a culture that cares about the environment, its business strategies will be more focused on creating sustainable competitive advantages driven by green innovation. The innovations generated support GCA, helping the company differentiate itself from competitors in an environmentally oriented market. With GIP supported by GOC, the company can achieve sustainable competitive advantages. Innovative and environmentally friendly products and services will attract environmentally conscious consumers, create loyal customers, and open opportunities to enter new markets in sectors that emphasize sustainability. The results of this study support Gurlek's et al. (2017), that green innovation acts as a full mediator of the influence of green organizational culture on competitive advantage.

Overall, GOC provides a strong foundation for GIP, which in turn becomes an effective mediator to achieve GCA. An organizational culture that cares about the environment will create an environment that supports green innovation

and sustainable business practices, leading the company toward success in a market that increasingly focuses on environmental issues and sustainability.

V. Conclusion

This study concludes that GOC has a positive influence on GIP. This shows that participating companies in Proper have effectively implemented a GOC, wherein the implementation of such a culture motivates employees and strengthens the organization's commitment to sustainable environmental practices, thus enhancing GIP. GIP has a positive influence on GCA. When a company consistently generates innovations focused on sustainability and resource efficiency, it can create environmentally friendly products that provide a competitive advantage in differentiating itself from competitors. This highlights the role of GIP as a key factor for participating companies to create unique and appealing products for environmentally conscious consumers and achieve GCA.

GOC has a positive influence on GCA. This is because a strong and positive environmental organizational culture motivates employees to be more environmentally conscious and actively participate in green practices within the company. Employees that engage in green practices can enhance the innovation and green performance of a company, thus providing a GCA. GIP mediates the relationship between GOC and GCA. Therefore, the best influence is indirect, in which GIP positively contributes to the relationship between GOC and GCA.

The findings also suggest the need for companies to change the perceptions of managers and employees regarding profit and growth as the dominant goals rather than green agendas. It is essential to build better awareness and understanding of the importance of environmental conservation and the impact of business activities. Managers should be prepared and trained on the long-term benefits of sustainability and the significance of integrating green practices into a company's daily operations. Additionally, companies need to adopt an approach that involves the entire organization in environmental preservation efforts. This can begin by communicating and promoting green values to all employees, ensuring that environmental programs and initiatives are integrated into company strategies and policies. Support from top management and the recognition of environmental efforts can further strengthen GOC. Furthermore, the uneven distribution of sample companies across provinces, with the dominance of companies from West Java, poses another limitation to the study.

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Factors Affecting the Digital Readiness and Adoption of Digital Marketing of Vegetable Farmers in CALABARZON, Philippines*

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ABSTRACT

Purpose – The paper analyzed the factors affecting the digital readiness and adoption of digital marketing by vegetable farmers in CALABARZON, Philippines. It assessed knowledge on different digital marketing technologies, evaluated access to and use of digital devices and marketing platform, and determined the cost of digital marketing adoption.

Design/Methodology/Approach – A total of 773 vegetable farmers were selected using disproportionate stratified random sampling, and then personally interviewed. Adapting the methodologies of Horrigan (2016) and Roberts and Hernandez (2019), farmers were categorized based on digital readiness. Correlation and Probit analyses were performed to determine the factors affecting digital readiness and adoption of digital marketing.

Findings – Results revealed the following: unprepared (0.33%), traditional (14.49%), reluctant (25.00%), cautious clickers (53.33%), and digitally ready (6.85%). Only 14 percent were digital platform users; the most common gadget used was mobile phone, and while home Wi-Fi and cellular data were the most popular connections, they were still unstable. Adoption of digital marketing lessened vegetable marketing cost. Those single with a higher level of education, household income, and larger household had higher digital readiness level. Digital marketing adoption was positively affected by level of education and digital readiness, but the cost of adoption had negative effect.

Research Implications – The results suggest the implementation of location- and readiness level-specific training and digital literacy programs; improvement of Internet infrastructure in major producing areas; and the provision of institutional support to prevent scam and fraudulent transactions to enhance the digital readiness and adoption of digital marketing by farmers.

Keywords: internet infrastructure, digital marketing adoption, digital readiness

JEL Classifications: O15, Q13

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I. Introduction

Agriculture is undergoing a new technology revolution supported by policymakers around the world. The fourth industrial revolution, or Agri 4.0, has already begun with the growth of digital technologies occurring within agricultural systems. Much of the attention has been focused on technological innovations such as the Internet of Things (IoT), cloud computing, robotics, and artificial intelligence (AI) with have the potential to change the agriculture industry beyond recognition. Agri 4.0 is an information-driven farming approach that essentially uses digital technology to increase farm output while drastically reducing input expenses using precision agriculture. The growing popularity of smart phones and remote sensing services are already giving smallholder farmers the advantages of Agri 4.0, one of which is better access to information, inputs, and markets. A study done by the Food and Agriculture Organization of the United Nations (FAO) in 2022 revealed that digital technologies and online networks play a crucial role in assisting young farmer entrepreneurs in East Africa initiate, sustain, and expand agribusinesses (FAO, 2022). However, poor connectivity due to weak infrastructure, unreliable or unstable network coverage in rural areas, digital illiteracy, and costly data bundles, among others, were identified as significant barriers to digital inclusion in the region. The study also showed that while a majority of the respondents were young farmers, the utilization of information and communication technology (ICT) in agribusiness posed a challenge for many, not just because of unreliable connectivity but also due to the unaffordability of Internet and a lack of advanced digital skills.

In the Philippines, the COVID-19 pandemic exposed the limitations of the traditional marketing system when the lockdown scenario caused the problems of information asymmetry to stand out. Those with access to information on prevailing prices and volume requirements, among others, tended to have an advantage when it came to pricing decisions and setting buying and selling terms. Asymmetry in market information such as product requirements, price, and quality resulted in high transaction cost, weak bargaining position, and a low margin of the benefits to upstream stakeholders (Aquino et al., 2015). This is more crucial for agricultural products because marketing is complex and costly as they are bulky, highly perishable, and seasonal, resulting in highly volatile prices. This renders digital marketing technologies very useful due to enabled access to real-time (or near real-time) and supposed to be accurate information; something ideal and desired for any information technology. However, in the case of the many small-holder farmers, the knowledge gap on existing digital marketing technologies, use, and availability of gadgets and Internet connectivity are stark hindrances. Small-holder farmers are in the countryside, where the tendency of little to no Internet connection is very high, suggesting the heightened possibility of not being able to reap the benefits of Agri 4.0.

Marketing systems need to be dynamic, competitive, and involve continuous change and improvement. This makes digital tacks, specifically digital marketing, more relevant. Digital marketing is an encompassing concept that refers to activities, institutions, and processes facilitated by digital technologies for creating, communicating, and delivering value to customers and other stakeholders (Kannan & Li, 2016). With good use of ICT, products can be promoted through one or more forms of electronic media. Likewise, the free exchange of information through data analytics and management can minimize information asymmetry. However, much like other industries, digital marketing in agriculture needs to focus on first understanding the current client base to be able to promote it more effectively. Digital marketing in the Philippines is also challenged by slow Internet connectivity, far too low, in fact, when compared with that of neighboring countries (Attaché Docs, 2023). This is crucial since, with digital marketing, slow or intermittent connectivity could translate to slow or no e-business at all. Since agricultural products are highly perishable, this could translate to

postharvest losses, and for some, non-marketing of harvested crops. It is also important to understand how to connect to these new and exciting platforms. Ryan and Jones (2009) pointed out that digital marketing was not about technology alone, but was also about understanding people, how they use the technology, and how they can leverage it to engage with others more effectively. These, therefore, steer the general questions of how ready vegetable farmers are for digital marketing and their needs for this growing trend in the marketing of agricultural commodities. This study assessed the level of digital readiness of vegetable farmers in CALABARZON, the region being a large supplier of *pinakbet* vegetables in the country despite the increasing dominance of manufacturing and service industries. *Pinakbet* or *Pakbet* is a local Filipino dish originating from Central and Northern Luzon. It is composed of a variety of vegetables such as eggplant, tomato, string beans, lady finger, squash, bitter gourd, and finger chili flavored with shrimp paste or *bagoong* (fish sauce). The study also evaluated the determinants of such readiness for future actions toward Agri 4.0.

II. Review of Related Literature

Attaché Docs (2023) reported that in 2022, the Philippines was ranked 56th among 63 countries studied by the International Institute for Management Development (IMD) for World Digital Competitiveness Ranking. Ranking was based on future readiness, knowledge, and technology. Knowledge concerns intangible infrastructure that enables the discovery and understanding of new technologies, and the Philippines was ranked 62nd under this element. It rose to 49th (from 54th) in terms of technology but slipped lower to 58th in the future readiness category. The same report mentioned that, despite the rank improvement, the country is still lagging behind other Southeast Asian economies like Indonesia, Thailand, Malaysia, and Singapore and within Asia-Pacific region, it is ahead only of Mongolia.

The study by Yap et al. (2023) determined the association between technology readiness and behavioral intention to adopt the e-AgriFinance App (a mobile agricultural finance app), as well as gender, age, and level of education. Data collected from 334 farmers (oil palm, rubber, cocoa, and pepper) in Sarawak were subjected to correlation analysis and independent t-tests. It was reported that technology readiness and behavioral intention were positively related, but the inhibitor dimension of technology readiness was negatively related to behavioral intention.

In East Africa, Pafumi and Arimbi (2022) assessed the digital readiness of youth entrepreneurs. The study found that around 95 percent of the youth respondents could connect to the Internet at least once a day, but they found the actual use of ICT for agribusiness challenging due to unreliable connectivity, unaffordability, and lack of advanced digital skills. Even then, they were able to increase outreach and exposure to other stakeholders, enabling the obtaining of information about the market and best farming and business practices. Still, they were wary of possible risks from scams and fraud; thus, they were adamant about spending more money and time on digital platforms. Those using digital platforms accessed them only for price comparison and forecasting instead of actual selling. They also found these platforms expensive in terms of subscription fees and registration, and they were more difficult to use compared with Facebook and WhatsApp. In addition, focus group discussions pinpointed that youth in the rural areas were challenged by poor connectivity, limited smartphone ownership, and digital illiteracy.

McCampbell et al . (2023) performed an ex-ante study in Rwanda to verify a user readiness framework that incorporated the capabilities, opportunities, and motivations of target users. Capability was defined as an individual's psychological and physical capacities (knowledge, skills, and stamina) to use digital technology or extension service. Opportunities were those that are beyond the control (accessibility, affordability, and social acceptance) of the possible user of the digital technology. Motivation referred to

workings of the mind that gave the urge to use digital technology were not limited to intentional decision-making, and could also include conscious or unconscious habits, emotional decisions, and goals and analytically-made decisions. For this study, a survey was conducted among 690 banana farmers, wherein they were required to respond to operational questions pertaining to each of the three elements, and collect data on household characteristics, general farming activities, banana production, agronomic practices, and disease management, agricultural extension, communication, and use of ICT (including phones). A mixed methods approach was used in the analysis. They found that in terms of capacity, respondents had limited access and use of phone-based extension services, especially those requiring a smartphone. There was also a mismatch between expected user readiness and actual user readiness, current capabilities, and opportunities. The authors claimed that these findings could be regarded as a basis for designing suitable digital extension projects and interventions that prioritize capability building. In particular, capability building should embed digital technologies into existing practices, such that there will be a blend of digital and analogue technologies, or what they termed 'high-tech' and 'low-tech'.

Another measurement of e-readiness level of the farmers was done in New Delhi covering 435 farmers composed of 270 users and 165 non-users of ICT-based extension service by Anandra Pradesh. The authors constructed an e-readiness index using e-awareness, e-skill, e-ownership, e-accessibility, e-frequency of use, and e-willingness as indicators. It was found that for the majority of the farmers, both users and non-users of ICT-based extension services had low levels of e-readiness. Logistic regression analysis proved that gender, family size, mass media exposure, innovativeness, risk-orientation, and self-confidence determined e-readiness to use mobile advisories/extension services (Vankudothu & Padaria, 2018).

In essence, these limited reviews point to the fact that the vegetable farmers in the Philippines are almost in the same boat with counterparts in these countries; that is, they are not yet digitally ready, and Internet connectivity has been a constant impediment, along with capability to perform digital transactions.

III. Conceptual Framework

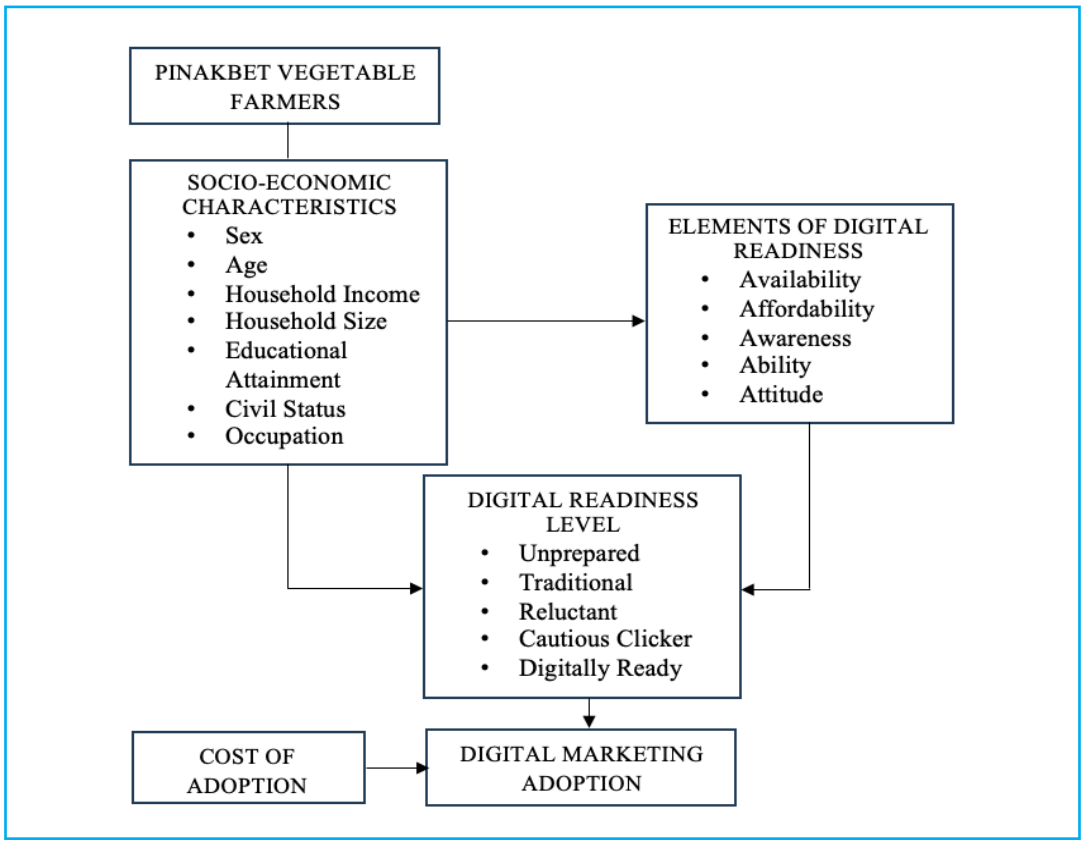
Fig. 1 depicts the conceptual framework from which this study was based. Similar to the study of McCampbell et al. (2023), his study developed its own metrics for measuring digital readiness, but the bases were those by Horrigan (2016) and Roberts and Hernandez (2019). According to Horrigan (2016), digital readiness has five levels: unprepared, traditional, reluctant, cautious clicker, and digitally ready. As modified from Roberts and Hernandez (2019) and Horrigan (2016), for this study, the elements of digital readiness are composed of availability, affordability, awareness, ability, attitude and accessibility. The absence/presence or adequacy of these elements determine the level of digital readiness.

Availability tackles the presence of appropriate gadgets for use online and stable Internet connection in the areas where farmers live or sell produce. It also concerns whether technical support that can be relied on is available. *Affordability,* on the other hand, deals with the cost of mobile devices and attendant peripherals, and whether farmers can afford them. Maintaining an online store is also a concern in this element. A*wareness* has to do with whether the farmer knows that with the possibility of selling more products online, the product can reach a wider audience and area, online marketing can shorten the value chain of agricultural products, and it is faster to transact business online. *Accessibility* is the usability of digital devices and digital marketing platforms among farmers, and ease of entry into and exit from the business of selling online or using the platform. *Ability* is related to the skill required for the effective use of mobile facilities such as the Internet, and how to use the information that can be accessed through online platforms, including

online banking and other financial transactions. Lastly, *attitude* involves the general feeling of the farmers toward the use of online technologies, which includes online transactions being safe, honest, and trustworthy. More importantly, it solicits the willingness of the farmer to switch to digital marketing. These elements spell the difference in the categorization of respondents into the five levels of readiness: unprepared, traditional, reluctant, cautious clicker, and digitally ready.

Those unprepared have a lower degree of technological adoption, do not use the Internet for learning, require assistance in setting up new technology equipment, and are unfamiliar with technology jargon. They are unsure about their computer skills and whether or not they can find reliable information online. In contrast, the traditional have gadgets and are active learners, but they are less likely to use the Internet for the purpose of learning because they have concerns about online information being trustworthy. Those reluctant are characterized by higher levels of digital skills than the unprepared, but they have low levels of awareness of new technology concepts, resulting in their relatively lower usage of the Internet for learning. On the other hand, cautious clickers have high levels of gadget/technology ownership and have confidence in their online skills and abilities to find trustworthy information. However, they are less familiar with online learning terms and less capable than the digitally ready in using online tools for learning and other activities. The digitally ready are keen learners eager to enrich their knowledge. They

Fig. 1. Conceptual Framework



also have gadgets/technology and are sure of their digital skills and abilities to find trustworthy online information (Horrigan, 2016).

Both the level of digital readiness and readiness elements can be affected by socio-economic characteristics which may include sex, age, household income, household size, educational attainment, occupation, and civil status. In turn, digital readiness and the cost of digital marketing adoption can influence the adoption of digital marketing.

IV. Research Methodology

1. Study Areas

The study areas covered were the provinces in the CALABARZON Region, namely Cavite, Laguna, Batangas, Rizal, and Quezon. The region was chosen because it is where majority of *pinakbet* vegetables are grown, and it is also considered as second booming region after Metro Manila. The proximity of the region to Metro Manila and other nearby business hubs offers easy access and convenience for trading of goods.

In Batangas, the municipalities included in the survey were Calatagan, Lian, Nasugbu, and Tuy, where most *pinakbet* vegetable farmers can be found. In Cavite, vegetable farmers are mostly found in Alfonso, Amadeo, Indang, and Mendez. The municipalities covered in Quezon were Lucban, Sariaya, Tayabas, Dolores, and Lucena City. As for Rizal, the municipalities considered were Binangonan, Pililla, and Taytay, while Siniloan, Sta. Maria, Famy, Nagcarlan, and San Pablo City were covered for Laguna (Fig. 2). Identification of these locations was based on the Provincial and Municipal Agriculture reports on volume produced and area planted.

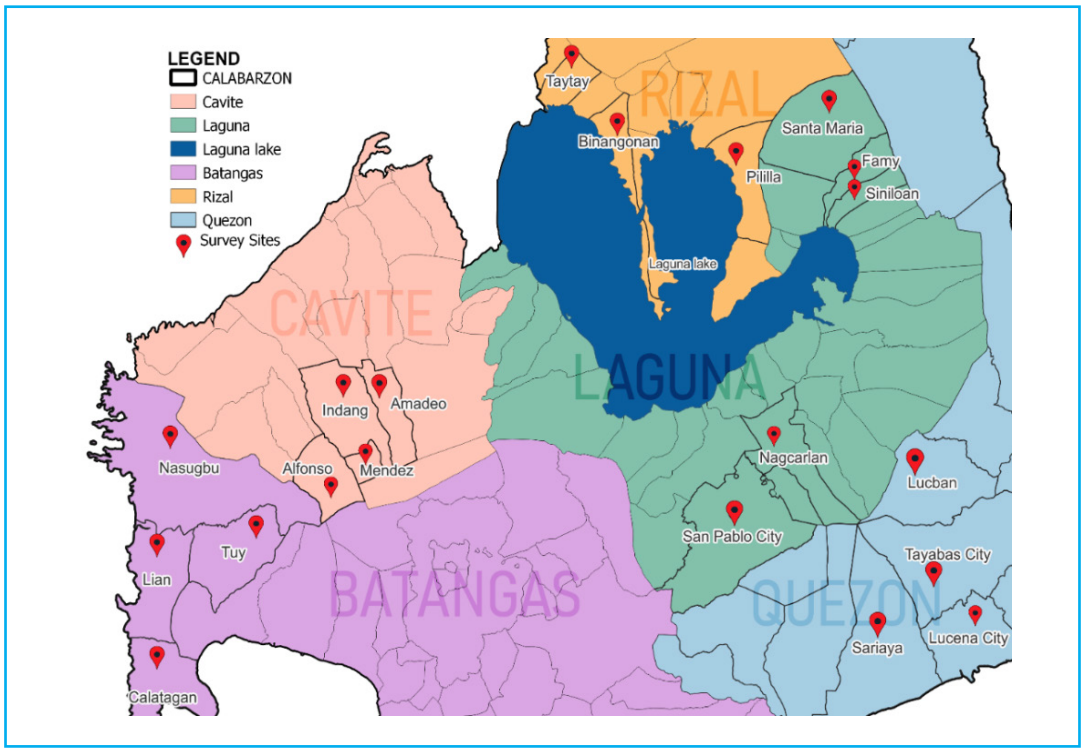
2. Sample and Sampling Size

The study utilized primary data collected from a total of 773 *pinakbet* vegetable farmers who were then personally interviewed using a pre-tested interview schedule. From the list of vegetable farmers obtained from the Municipal Agriculture Offices, respondents were selected using disproportionate stratified random sampling technique. Municipalities were identified from the list of top *pinakbet* producing provinces in CALABARZON provided by the Provincial Agriculture Offices. Data collected include: socio-economic characteristics, gadgets used to communicate with key players, access to the Internet and social media use, and practices in using gadgets and online selling platforms, among others.

3. Analytical Tools

The methodologies used by Horrigan (2016) and Roberts and Hernandez (2019) were adapted for this study. Roberts and Hernandez (2019) stated that there were five constituent elements of technology access: availability, affordability, awareness, ability, and agency. Considering these five elements, an adaptation made for this study was to replace agency with the attitude of the user, or possible user, and the addition of accessibility (usability) as another element. Respondents were requested to indicate the level of agreement/ disagreement (1=strongly disagree and 5=strongly agree) on the five indicator statements for each of the six elements. Each element has a subtotal score of 25 owing to the highest score of 5 per indicator statement. Since there are 6 elements with the highest possible score of 25 each, the overall total score is a maximum of 150 points. This was then allocated for the five levels of readiness, as discussed by Horrigan (2016). Thus, unprepared corresponds to a score ranging from 1 to 30; traditional has a score of 31 to 60; reluctant encompasses 61 to 90; cautious clicker is 91 to 120; and digitally ready ranges from 121 to 150. The digital readiness levels of the vegetable farmers where then correlated to the socio-economic characteristics to determine which among these factors affect digital readiness. Probit regression analysis was also performed to determine factors affecting the adoption of digital marketing.

Fig. 2. Map of Calabarzon and Included Municipalities in the Survey



V. Results and Discussion

1. Profile of Pinakbet Vegetable Farmers

Pinakbet vegetable farmer-respondents in CALABARZON are male-dominated (58%), except in Laguna, where the majority are female (52%). According to the respondents, most male farmers spend their time farming, while women do the selling activities. Their average age was computed to be 52, with the youngest being 19 and the oldest 98. A higher percentage (76%) are married with high school (7-10 years of schooling) as the predominant level of educational attainment, but in Cavite, there are those who went into graduate school (39%). The majority (84%) are primarily dependent on farming, while some were government employees (51%). The average household size is 4, and the average monthly household income is PhP 19,359, significantly above the PhP 12,940 poverty threshold for a family of five in CALABARZON in 2021 (Congressional Policy and Budget Research Department House of Representatives, 2021). About 73 percent are members of different organizations.

2. Number of Respondents Practicing Digital Marketing/Online Selling

Most (86%) farmer-respondents were non-users of digital marketing platforms (DMP). They preferred to sell produce either directly (face-to-face) to end-consumers or traders since they do not know how to use gadgets. However, some respondents were considered “users” even if it was a daughter/son/wife that facilitated online transactions. The largest fraction of DMP users came from Cavite (35%), with the fewest from Rizal province (4%) (Table 1).

Table 1. Distribution of Pinakbet Vegetable Farmer-Respondents Practicing Digital Marketing/Online Selling, by Province, 2021

Area	Users		Non-Users		Total	
	No.	%[a]	No.	%a	No.	%[b]
Batangas	22	18	97	82	119	13
Cavite	43	35	79	65	122	13
Quezon	16	7	228	93	244	26
Rizal	6	4	131	96	137	15
Laguna	20	13	135	87	155	17
Sub-total	107	14b	670	86b	773	100

Note: [a]Percent of the total for the province, [b]Percent of overall total.

Cellular phones were the most common gadget used when communicating with suppliers of inputs, as well as with buyers and logistic providers. One reason is that cellular phones are relatively cheaper than other gadgets. In some instances, they were just given or provided by family members (usually hand-me downs). These gadgets are also easier to use, but more commonly, they are "dumb" phones (as opposed to smart phones) that have very limited functionalities to facilitate digital marketing. Laptop usage was rare.

3. Access to the Internet and Social Media Use

Internet usage was found to be 66 to 87, or an average of 75 percent. This implies that people have access to more information online that they can use for whatever purpose they need and want, which may include online selling and buying. Home Wi-Fi and cellular data were the most popular connections used. Most *pinakbet* farmer-respondents in Batangas (62%) and Quezon (39%) frequently used cellular data. However, a higher percentage of respondents in Cavite (63%), Rizal (41%), and Laguna (34%) make use of home Wi-Fi (Table 2). These three provinces have better ICT infrastructure, which is quite understandable because of its strategic location vis-à-vis Metro Manila. The presence of many industries in Cavite could have been a contributor because the farmer-respondents in Cavite, Rizal and Laguna can better afford to pay the monthly subscription. Conversely, some respondents do not have any Internet access due to the low specifications or features of their mobile phones, and some have none at all.

In terms of social media accounts, the most utilized platform is Facebook with usage rate of 60 to 75 percent. Only a few farmers in the region have accounts on Instagram (4%) and Tiktok (1%), which they only use for entertainment. Although a majority of the respondents have social media accounts, about 30 percent do not have any (Table 2). They do not own a gadget, or they feel that they are too old to use these social media accounts.

For online selling platforms, an average of 43 percent does not have online selling accounts. However, in all covered study areas, the most frequent platform used was Shopee, primarily because they find its interface easy to use, and it provides a wider range of delivery services compared to Lazada. Those that preferred Lazada claim it to be more reliable and safer to use. They also said that the marketing strategies of Lazada through commercials on televisions and social media platforms boost their trust in the application.

On average, 63 percent of the farmer-respondents claimed that there are more than two

Internet providers in their area, while those who reported only one were found to be 12 percent. There were about 10 percent with no idea on how many Internet service providers are present in the area, as they are either not interested or have not heard of the service providers. Some of the service providers mentioned are Converge, PLDT, Smart, and Globe.

In terms of the quality of Internet connectivity, the region has a fair (35%) connection. This means that there are times that it is stable, but this can be unstable as well, especially when it rains. Although this was the case, there were about 18 percent experiencing unstable connections. Thus, they claim that they are not satisfied. Similar findings were reported by Pafumi and Arimbi (2022) for youth entrepreneurs in East Africa that faced problems of poor connectivity, limited smartphone ownership, and digital illiteracy.

4. Practices Using Gadgets and Online Selling Platforms

There were farmer respondents that reported never using any gadget in transactions related to farming business, with the highest proportion found in Laguna and the lowest in Cavite. However, the majority claimed that they used their gadget/s within a day, with the highest usage reported by those in Cavite. High gadget usage is due to the distance of farms from the town proper where trading occurs.

Social media usage was even lower, with average range of 7 to 12 percent. Those in Laguna had the highest share at 12 percent. Among the platforms, Facebook was the most popularly used (Table 2). This is because Facebook app can be accessed through the free data promo of most cellular networks in the Philippines. It was also shared that they use Facebook as they were influenced either by family members or friends.

For those using online selling/buying platforms, Shopee and Lazada were the most popular, although very few vegetable farmer-respondents did this only a few times. There were a small percentage of vegetable farmers in Batangas, Cavite, and Quezon able to sell produce via Facebook Marketplace, as influenced by family members. Very few reported to have used existing agricultural marketing platforms such as Agrifood Hub, E-kadiwa, and Mayani because they prefer direct selling to trading centers/markets and the direct buying (pick-up) of traders from the farm.

5. Cost of Adoption of Digital Marketing

In the numerous aspects of digital marketing, one of the main considerations, aside from uncertainty of use, is the cost associated with adoption. Adopters are DMP users that have experienced selling produce online at least once. For ease of comparison, standardization on the volume sold (15 kg bundle) as well as computed marketing costs was done. The costs borne by non-adopters were transportation (25.67%), packaging (15.68%), miscellaneous (9.04%), and labor (49.61%). Adopters incurred Internet expense (27.76%), packaging (17.32%), and labor costs (54.92%). There were also miscellaneous costs that covered the food allowances of the traders, as well as toll fees and tickets incurred during delivery (Table 3).

Adoption of digital marketing generally lessened the marketing costs incurred. The lowest cost incurred by the farmer adopters was observed in Rizal province at USD1.2121 per bundle of 15 kilograms, and the highest was USD1.7853 for those in Cavite. In comparing the differences in costs incurred by the non-adopters and adopters, t-tests revealed that those in Cavite and Quezon were statistically significant at 10 percent, and Rizal at a 5 percent level of probability. However, the overall mean differences were found not significant (Table 3).

6. Digital Readiness Level

Digital readiness scores by element show that overall, the farmer respondents lack the ability to move to digital readiness with an average score of 14.04 out of a possible maximum of 25. Ability was measured in terms of knowledge on connecting

Table 2. Distribution of Internet Access and Social Media Use, 773 Vegetable Farmer- Respondents, by Province, CALABARZON, Philippines, 2021

Particular	Batangas (n=119)	Cavite (n=122)	Quezon (n=244)	Rizal (n=133)	Laguna (n=155)	Total (n=773)
			Percent			
Internet Access						
Yes	80	87	75	69	66	75
No	20	13	25	31	34	25
Internet Connection Used						
Home Wi-Fi	15	63	35	41	34	37
Broadband/ Pocket Wi-Fi	3	4	5	1	4	3
Cellular Data	62	18	39	24	27	34
None	20	14	20	33	32	24
Online Selling Platform Used or Currently Have an Account With						
Shopee	26	34	23	34	31	29
Lazada	25	38	22	32	22	27
None	49	29	55	34	47	45
Number of Internet Providers in the Area						
One	16	16	12	a	19	12
Two	33	33	23	6	13	19
More Than Two	46	46	57	82	59	62
No Idea	5	5	8	11	9	7
Current State of Internet Connection						
Very Stable	3	6	2	0	0	2
Stable	16	23	24	30	28	24
Fair	32	35	37	27	39	35
Unstable	20	20	22	16	9	18
Very Unstable	12	2	2	a	1	3
No Internet	20	13	13	26	23	18

Note: [a]less than one.

to Wi-Fi and installing relevant applications to mobile devices; navigating the internet and finding/uploading information; completing online forms; and online banking and other financial transactions. In terms of ability, the highest score was noted in Cavite, and the lowest was in Rizal. Awareness, on the other hand, had the highest score at 18.23. This element is related to the recognition of the benefits of online selling/buying and other online transactions. Again, those in Cavite were found to have the highest awareness score (18.42), and those in Rizal had the lowest (16.39). The accessibility score was 18.04, with the highest found in Laguna (19.72) and the lowest in Rizal (16.04) (Table 4). This element is related to usability, or the user-friendliness of the online platforms and absence of barriers to entry and exit when using the technology. Laguna is home to numerous industrial parks and research and academic institutions that usually require Internet usage, knowledge of which is, to some extent, being transferred or spilled-over to the farmers (Table 2).

Another element is attitude, and it had a fairly low score of 17.57. Those in Rizal had the lowest score at 12.61. One of the reasons for this is the presence of physical markets that are accessible to the farmers. In contrast, those in Quezon province had the highest score at 17.77 mainly because many of the farmers are in the hinterlands, and they wanted to reach farther markets via digital marketing. Affordability deals more with the cost of investment (gadgets and internet connection, etc.), and it had the third lowest overall score at 16.46. Cavite had the highest score for this at 17.39, and Rizal had the lowest at 14.73. In the same manner, for availability (presence of gadget,

Table 3. Cost Comparison between Adopters and Non-Adopters of Digital Marketing, 773 Vegetable Farmer-Respondents, CALABARZON, Philippines, 2021

Cost Items	Batangas	Cavite	Quezon	Rizal	Laguna	Average	Share (%)
			USD[a]/15 kg bundle				
Non-Adopters							
Transportation Cost	0.4370	0.5383	0.1794	0.4047	0.7372	0.4593	25.67
Packaging Cost	0.2641	0.3053	0.1751	0.3055	0.3530	0.2805	15.68
Miscellaneous Cost	0.1421	0.0828	0.1401	0.2143	0.2297	0.1617	9.04
Labor Cost	1.2627	0.7677	1.2009	0.2099	0.9983	0.8879	49.61
Total Cost	2.105	1.694	1.695	1.134	2.318	1.789	100.00
Adopters							
Internet Expense	0.2547	0.5141	0.5665	0.3974	0.4055	0.4272	27.76
Packaging Cost	0.2641	0.2281	0.2919	0.1973	0.3530	0.2669	17.32
Labor Cost	0.8566	1.0430	0.7159	0.6175	0.9983	0.8463	54.92
Total Cost	1.375	1.7853	1.5746	1.2121	1.7567	1.5409	100.00
Difference	-0.73	0.0913	-0.1204	0.0781	-0.5614	-0.2481	
Pr (T<t)	0.6853	0.0529*	0.0846*	0.0492**	0.7278		
Overall t-test				Pr (T<t) = 0.1323			

Notes: 1. [a] Conversion rate is PhP49.2634 per US Dollar.
2. *Significant at 10% level of probability; **Significant at 5% level of probability.

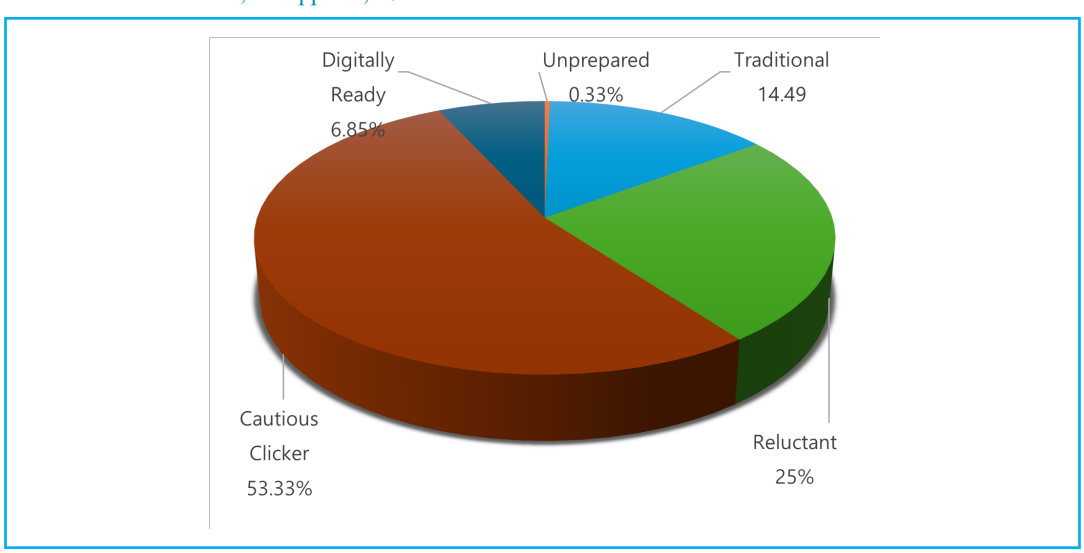
internet connections, and online marketing platforms), Cavite (17.35) and Rizal (14.90) had the highest and lowest scores, respectively. The overall score for availability was 16.23 out of the perfect score of 25 (Table 4).

Overall, those digitally ready were found to be 6.85 percent, and traditional and unprepared vegetable farmers were also low at 14.49 percent

Table 4. Readiness Score by Element and by Province, 773 Vegetable Farmer-Respondents, CALABARZON, Philippines, 2021

Readiness Element	Batangas (n=119)	Cavite (n=122)	Quezon (n=244)	Rizal (n=153)	Laguna (n=155)	ALL (n=773)
	Score					
Availability	15.44	17.35	15.67	14.90	16.04	16.23
Affordability	16.56	17.39	15.96	14.73	16.03	16.46
Awareness	18.04	18.42	18.05	16.39	17.88	18.23
Accessibility	17.10	18.23	17.11	16.04	19.72	18.04
Ability	13.43	15.45	13.96	12.61	13.12	14.04
Attitude	16.98	17.30	17.77	15.56	17.68	17.57
TOTAL	97.55	104.14	98.53	90.22	100.47	100.57
Interpretation	Cautious Clicker	Cautious Clicker	Cautious Clicker	Reluctant	Cautious Clicker	Cautious Clicker

Fig. 3. Distribution by Level of Digital Readiness, 773 Farmer- Respondents, Selected Provinces, CALABARZON, Philippines, 2021



and 0.33 percent, respectively (Fig. 3). By definition, the unprepared have a lower degree of technological adoption, do not use the Internet for learning, require assistance in setting up new technology equipment, and are unfamiliar with technology jargon. The unprepared are unsure about their computer skills and whether they can find reliable information online. The traditional have gadgets and are active learners, but they are less likely to use the Internet for the purpose of learning. They have concerns about online information being trustworthy (Horrigan, 2016).

Those reluctant were found to have a 25 percent share among the total 773 vegetable farmer-respondents. They are characterized by higher levels of digital skills than the unprepared, but they have low levels of awareness of new technology concepts resulting in a relatively lower usage of the Internet for learning. Meanwhile, the digitally ready are keen learners eager to enrich their knowledge. They also have gadgets/technology and are sure of their digital skills and abilities to find trustworthy online information. The cautious clickers have high levels of gadget/technology ownership, and they have confidence in their online skills and abilities to find trustworthy information. However, they are less familiar with online learning terms and less capable than the digitally ready to use online tools for learning and other activities (Horrigan, 2016) (Fig. 3).

Province-wise, more or less the same scenario is depicted, but the cautious clickers were found to be lowest in Laguna at 0.65 percent; even with gadgets and network coverages, vegetable farmers in this area still prefer to do business face-to-face since physical markets are highly accessible. Among the identified cautious clickers, Batangas had a relatively lower share at 58.82 percent. Meanwhile, the unprepared were only found in Batangas and Cavite with almost negligible shares of 0.84 and 0.82 percent, respectively (Table 6). These unprepared farmers are those situated in hilly areas, where even the use of mobile phones is rare as there is practically no network coverage.

Traditional vegetable farmers were highest in Laguna with a 63.87 percent share, and lowest in Rizal (0.73) (Table 5). The high percentage of traditional vegetable farmers in Laguna was again due to the presence and accessibility of numerous markets and stalls. In addition, the interviewed vegetable farmers in Laguna stated that they still found it more worthwhile to make physical engagements as they ensure more informed and satisfying purchases.

Table 5. Distribution by Level of Digital Readiness and Province, 773 Farmer-Respondents, CALABARZON, Philippines, 2021

Province	Level of Digital Readiness				
	Unprepared	Traditional	Reluctant	Cautious Clicker	Digitally Ready
	In Percent				
Cavite (n=122)	0.82	0.82	16.39	66.39	15.57
Laguna (n=155)	0.00	63.87	35.48	0.65	0.00
Batangas (n=119)	0.84	3.36	26.89	58.82	10.08
Rizal (n=137)	0.00	0.73	18.98	77.37	2.92
Quezon (n=244)	0.00	3.66	27.24	63.41	5.69
Average Share	0.33	14.49	25.00	53.33	6.85

The proportion of vegetable farmer-respondents digitally ready was highest in Cavite with a 15.57 percent share (Table 5). This is to be anticipated since Cavite is nearer to Metro Manila and more urbanized than the other provinces. This implies that it has a higher tendency to be advanced in terms of information and communication technology infrastructure. Higher exposure to infrastructure encourages the usage of applications that utilize these facilities. Digitally ready vegetable farmers were also found in Batangas (10.08%) and Quezon (5.69%), but were noticed to be lowest in Rizal with 2.92 percent only, while there were none in Laguna. The relatively low percentage of those digitally ready in Rizal can be associated to the fact that the majority lack knowledge with regards to online selling platforms aside from Shopee and Lazada. Furthermore, they also explained that they are not interested in about learning other online selling platforms since there are existing markets within their area at which can easily sell produce. The same is true in Laguna, where farmers have better access to physical markets, but also have limited network coverage in the province. For example, in Calangay, one of the barangays in the municipality of Sta. Maria in Laguna, the only medium for online communication is through "piso-wifi" that can only accommodate up to 10 devices at a time (Fig. 4). "Piso-wifi" is an internet vending machine where customers connect mobile phones by inserting a one peso coin as payment for a designated period of Internet connectivity. Connection is automatically disconnected once the amount of time is reached.

Fig. 4. Piso-Wi-Fi Machine in Calangay, Sta. Maria, Laguna

7. Association between Digital Readiness and Farmer Socio-Economic Characteristics

For better understanding, digital readiness and the socio-economic characteristics of the interviewed respondents were correlated. Results revealed negative weak to moderate positive correlation only with the highest for educational attainment (0.56) and age (-0.21) (Table 6). These suggest that higher educational attainment has a higher tendency to promote digital readiness, while younger people correlate to a greater tendency to become digitally ready. This phenomenon is to be anticipated since the usage of digital devices would require understanding not only of how the digital device works but also on how certain applications are navigated. Those with higher educational attainment have this advantage. Similarly, the younger generation is more attuned to the use of digital devices because they were born in the information age and practically grew with them.

Table 6. Correlation Analysis Results between Socio-Economic Characteristics and Level of Digital Readiness, 773 Vegetable Farmer-Respondents, CALABARZON, 2021

Characteristic	R- Square	Interpretation
Sex	-0.07	Weak
Age	-0.21	Weak
Household Income	0.16	Weak
Household Size	0.05	Weak
Educational Attainment	0.56	Moderate
Civil Status	-0.03	Weak

8. Factors Affecting Adoption of Digital Marketing

While the narratives above could have narrowly related digital readiness to the socio-economic characteristics of the respondents, there is a high possibility that the costs associated with digital marketing and readiness level could have been hindrances as well in the adoption of digital marketing. A more precise analytical tool was deemed necessary to verify said relationship, hence Probit regression analysis was performed.

Results verified that educational attainment, household income, cost of adoption, and digital readiness were significant factors that affect the decision of vegetable farmer-respondents to adopt digital marketing. In particular, both level of education and level of digital readiness positively affected said decision; that is, the tendency to adopt digital marketing increases as the respondents obtain higher levels of these factors. An increase in cost of adoption and household income decreases the probability of adoption (Table 7). This is because farmers view digital marketing as inflicting additional costs, and since they have their "*suki*", or regular buyers, they believe that they do not need to adopt digital marketing just to increase an already high income.

Table 7. Probit Regression Analysis Results for the Factors Affecting Adoption of Digital Marketing, 773 Vegetable Farmer-Respondents, Selected Provinces, CALABARZON, 2021

Variables	Coefficient	Std. Error	Z	P>|z|	[95% Confidence Interval]	
Age	-0.0880062**	0.09652	-0.77	0.032	-0.1144	0.0794
Civil Status	-0.7254147	0.13548	-2.40	0.257	-0.2271	0.2182
Educational Attainment	0.4472853**	0.12755	2.15	0.015	0.1656	0.4248
Household Size	0.2552781	0.06472	2.08	0.275	0.2786	0.0013
Household Income	-0.1094520*	0.09985	-1.20	0.072	-0.2944	0.0756
Costs of Adoption	-0.6178586*	0.45231	-1.96	0.052	-0.2868	0.4286
Readiness Level	0.2785492**	0.25614	2.15	0.025	0.0738	0.6260
Number of Observations			773			
LR Chi (6)			15.74			
Prob > chi2			0.0045			
Pseudo R2			0.0523			

Note: *significant at 10%, **significant at 5%, ***significant at 1%.

VI. Conclusions and Recommendations

The findings of this study point to the conclusion that majority of *pinakbet* vegetable farmers in CALABARZON are cautious clickers, due mainly to a lack of ability and the unavailability/ inadequacy of Internet infrastructure. Farmers are uncertain about information that comes from online selling platforms, and this is aggravated by the scams and fraud seen on and heard from social media. Agricultural marketing platforms such as Agrifood Hub, E-kadiwa, and Mayani are rarely patronized. Level of education and level of digital readiness positively affected the decision to adopt digital marketing, while an increase in the cost of adoption and household income decrease the probability of adoption. Based on these, the following are thus recommended.

1. Conduct Targeted Trainings and Digital Literacy Programs

It is recommended that for digital education, training and digital literacy, programs should be location- and readiness level-specific. For example, in Cavite, they should be focused to meet the needs of the reluctant and cautious clickers because they are dominant in the area. The same is true in Rizal, Quezon, and Batangas. However, for Laguna, literacy programs should be centered on the requisites of the traditional and the reluctant. Traditional farmers should be given practical training on how to find online information from reliable and trustworthy sources, while for the reluctant and cautious clickers, emphasis is for explaining technological jargons/terms, and how they could utilize online technologies to improve knowledge on business processes including

marketing. For cautious clickers with gadgets to use, it is necessary to improve familiarity with digital platforms and eventually adopt them. The unprepared need to be taught how to connect to Wi-Fi, install relevant applications on mobile devices, navigate the Internet, and find/upload reliable information. For all levels, training should be hands-on and include completing online forms and undertaking safe online banking and other financial transactions. Overall, considering that age decreases the probability of adoption, and that Filipino farmers are quite aged already, it is crucial that age-appropriate training programs be designed. Innovations in the delivery of lessons should be implemented for more effective teaching-learning process.

2. Improve Internet Infrastructure in Major Growing Areas

Internet connectivity has been one of the major hindrances of going digital. The Philippines is a country tagged with poor Internet connectivity resulting from deficient Internet infrastructure (Attaché Docs, 2023). Improving this will increase the usage rate of Internet that may lead to the shift to digital marketing, which will also catalyze the economy through its impact on both the demand and supply sides facilitated by marketing logistics. An important consideration in the provision of Internet infrastructure is location vis-à-vis the major growing areas. This study revealed that those with better access to and nearer physical markets rarely resort to digital marketing, but those in the far flung areas like Quezon province have a more positive attitude toward this because they want to reach more markets. This suggests that boosting Internet connectivity in market centers will have a weaker effect than when those in the hinterlands are boosted. Adequate infrastructure can likewise help reduce the cost of adoption and possibly the cost of gadgets as well.

3. Institutional Support to Prevent Scam and Fraudulent Transactions

Through the support of both public and private institutions, vegetable farmers will most likely be encouraged to utilize digital marketing. Institutional support can be in terms of protecting the general public from fraudulent activities such as online scams. In other words, digital safety and security should be enhanced through partnerships and collaborations among the government and organizations that have the technical capability to track down fraudsters, while the law enforcement power of the government should be able to strictly penalize them, eventually serving as fraud deterrent.

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An Empirical Study of the Impact of Three Shipping Freight Rate Indices on Shipping Company Stock Prices

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ABSTRACT

Purpose – In this study, stock data of shipping companies were selected from three countries, USA, China, and Korea, to investigate the impact of fluctuations in different shipping freight indices on shipping company stock prices.

Design/Methodology/Approach – Johansen cointegration tests were used in this study to look at the long-run equilibrium relationships between shipping freight indices and the stock prices of shipping companies. Next, the short-term adjustment effect of different shipping freight indices on shipping company stock prices was analyzed by establishing a VECM model. Finally, the responses of shipping company stock prices to shocks from different shipping freight indices were analyzed by forecast error variance and impulse response functions based on the VECM model.

Findings – The cointegration test demonstrated a long-run equilibrium relationship between each shipping company's stock price and the three shipping freight indices (BDI, BDTI, SCFI). The results of IRF and forecast error variance decomposition showed that the response of shipping company stock prices to shocks from the SCFI is weak compared to the shocks from the BDI and BDTI. The BDI has the same explanatory power for the forecast error variance of HMM and MATX, and the shocks from the BDTI contributed the most to explaining the forecast variance error of COSCO_SH.

Research Implications – The analysis findings of this research are meant to give investors within the market certain reference information to reduce investment risks.

Keywords: BDI, BDTI, IRF, SCFI, variance decomposition, VECM
JEL Classifications: C32, F14, F18

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I. Introduction

One sector that is sensitive to the dynamics in the global economic situation is the shipping industry (Bae & Park, 2019), and the shipping industry can be divided into bulk dry cargo transportation, container transportation, and tanker transportation. Since Europe developed the American colonies in the 15th century, the maritime industry has occupied the majority share of global trade by volume due to advantages such as low freight and large transportation volume. In global trade activities, an essential component of the vast logistics system is maritime transit. In 2021, the total seaborne cargo volume was 12 billion tons, an increase of 3.4 per cent over the prior year, and more than 75% of all worldwide trade was carried out through maritime shipping, measured in terms of volume (Lane & Pretes, 2020).

As a major indicator of international trade and an index reflecting the trajectory of the global dry bulk shipping business, the yield and volatility of BDI (Baltic Dry Index) have also received more attention (Zhang & Pei, 2018). The Baltic Shipping Exchange was established in London in 1985, and it provides a dry bulk freight quotation and trading platform for enterprises to freely trade. The Baltic BDI is a systematic index made up of the freight rates for 23 conventional, international dry bulk shipping routes in accordance with each route's relative significance and share in the shipping industry (Alizadeh, 2013). Similar freight rate indices designed for the container shipping industry are becoming stricter and stricter as a result of the increasing containerization of seaborne cargo (Karamperidis, 2013). Despite the fact that other container freight indices have been released, only the CCFI and SCFI have so far drawn more attention from academics (Schramm & Munim, 2021). Since the Shanghai Change is the most sensitive, and the most important in China's overall export index, the Shanghai Containerized Freight Index (SCFI) better reflects market volatility. Maritime tanker shipping accounts for approximately 80% of total oil and petroleum product shipments. The Baltic Dirty Tanker Index (BDTI) is an important assessment indicator for the worldwide dirty tanker maritime industry (Fan et al., 2013).

Stock price refers to the price at which a stock is bought and sold on the stock market, and it is affected by many factors (Zhu, 2022), with the stock market reflecting world economic activity (Dar et al., 2023). The shipping market is highly volatile and is characterized by a long-term fixed-cost structure (Yun & Cho, 2022). As a result, the market risk associated with changes in freight rates is high. The volatility of shipping rates can affect the profitability of shipping companies, as mentioned in the prior study (Hsiao et al., 2014). The BDI has the statistically meaningful predictive ability for a range of stock indices (Kim & Park, 2019), and it is also confirmed that a strong association exists between shipping company stock prices and changes within the container freight index. Açık et al. (2021) provided valid evidence that some container freight indices have a volatility spillover effect on the stock values of some companies, and some stock investors locate portfolios in the market based on the information flow from the freight index. The high volatility of sea tanker freight rates is heavily influenced by changes in oil prices (Tsouknidis, 2016), considering that tanker freight rates are subject to the same volatility as stock market returns (Moiseev, 2021). Therefore, it can be seen that there exists some relationship between the shipping freight indices and the volatility of stock prices. Investors can forecast the trend of stock prices in future years by noticing the trend of the index if it can be demonstrated that there is an ongoing equilibrium association between the index and stock price, which can highlight the lagging influence of the relevant index on the stock price of shipping companies in the near term. The current studies on the shipping freight index and stock market mainly focus on the impact of the shipping freight index on the stock market composite index. Fewer studies have investigated the volatility and association of the alternation in freight rate indices with the changes in stock prices of shipping

companies. Based on this, Johansen cointegration tests were used in this study to look at the long-run equilibrium relationships between the BDI and shipping company stock prices, the SCFI and shipping company stock prices, and the BDTI and shipping company stock prices. Next, the short-term adjustment effect of different shipping freight indices on the shipping company stock prices is analyzed by establishing a VECM model. Finally, the responses of shipping company stock prices to shocks from different shipping freight indices are analyzed by forecast error variance and impulse response functions based on the VECM model. Differences in investment risk due to information asymmetry are a common phenomenon in international capital markets (Chang, 2023). The analysis findings of this research are meant to give investors within the market certain reference information to reduce investment risks.

II. Literature Review

The BDI index can be employed to predict prices on the global stock market (Alizadeh & Muradoglu, 2014). There is an information spillover of economic significance between the stock market (DJIA) and the maritime market (BDI). The degree of information spillover varies over time under market-specific conditions, and price is an indispensable factor (Erdogan et al., 2013). Researchers have examined the connection between stock markets, pricing, and shipping indices using a variety of econometric models. For example, Choi and Kim (2019) empirically analyzed the effect of the change in the BDI index on the volatility of Korean stock prices using the EGARCH model in conjunction with the Granger causality test, which concluded that the dynamic in the shipping freight index can predict the volatility of the Korean stock market. The study found that the coefficient of BDI significantly negatively affects all scale indicators. The change in the index has a greater impact on the volatility of small-cap stocks than that of large-cap stocks. In addition, the results of the Granger causality test showed that the BDI leads the financial and construction industries.

Manoharan and Visalakshmi (2019) used the VAR-SURE model to learn and analyze the connection between the shipping market, Indian stock index (NIFTY), and the Chinese stock index (Shanghai Composite Index). Using the sample data from January 1, 2011, to December 31, 2015, for the empirical analysis, the results showed that the BDI slightly impacts both the Indian stock index (NIFTY Index) and the Chinese stock index (SSE Index). Zhang (2018) investigated the effect of the reorganization of the COSCO Group on the correlation between the volatility of COSCO stocks and BDI. The daily data of four stocks (ZYHK, ZYHN, ZYHF, and ZYHT) from 2007-2017 were selected to study the impact of BDI. Using the VAR model, Granger causality test, and Chow test, it was found that COSCO stocks and BDI affected each other, but the influence on each stock was different. Lin et al. (2019) analyzed the spillover effect of BDI on the stock market using a VAR-BEKK-GARCH-X trivariate model. The time frame of the sample data was from October 1 to October 31, 2007, and the results of the empirical analysis found that the spillover effect changed over time. In particular, during the financial crisis, BDI was a short-term indicator of the stock market rather than a long-term indicator.

At present, the empirical analysis of the study for the connection between the shipping industry and stocks in the academic circle focuses on national trends, such as the Korean stock market (Choi & Kim 2019), American stock market (Alizadeh & Muradoglu, 2014), Indian and Chinese stocks (Manoharan & Visalakshmi, 2019), and Chinese shipping company stock (Zhang, 2018). Moreover, some studies pointed out that the volatility, as well as the return of the stock index, might be attributed to the trend of the shipping industry (Alizadeh & Muradoglu, 2014), but there are few studies related to the influence of the shipping freight index volatility on stock price for a particular shipping company. Based on this, this study is expanded and improved upon based on the previous research. This paper analyzed the

influence of BDI, SCFI, and BDTI on the stock price volatility of shipping companies in Korea (HMM), Shanghai (COSCO_SH), and the United States (MATX, KEX).

III. Methodology

1. Cointegration Test

Engle and Granger (1987) co-integration theory and its techniques conclude a new solution for non-stationary sequence modeling. Pseudo-regression can happen in non-stationary sequences, and the purpose of co-integration is to determine if the causal relationship given by the regression equation is pseudo-regressive. It is known as co-integration to describe the long-term stable equilibrium relationship between variables when two or more non-stationary variable sequences exhibit stationarity following a linear combination.

It is precise because the co-integration test can investigate whether there is an ongoing, stable equilibrium connection between non-stationary time series variables so that obtaining the results from the co-integration test. Therefore, the co-integration test has been widely applied in various research, including oil futures market efficiency (Crowder & Hamed, 1993), energy consumption (Eden & Jin, 1992), exchange rate and trade (Arize, 1994), futures market efficiency (Chowdhury, 1991), US money demand (Hafer & Jansen, 1991), overall U.S. healthcare spending (Murthy & Ukpolo, 1994), and Chinese savings and investments (Narayan, 2005).

When there is an ongoing cointegration association, the normalized cointegration vector is $(1, -\beta')$. Then, the ongoing equilibrium connection between X_t and Y_β can be considered:

$$Y_\beta = \beta' X_t + \mu_t \quad (1)$$

Where X_t and Y_β are both I (1) processes, μ_t is an I (0) process, and can be expressed as a stationary autoregressive process.

2. VECM (Vector Error Correction-Model)

The significance of the VECM is the co-integration vector and error correction, which is to discuss the error correction of the co-integration system (Engle & Granger, 1987). VECM is typically appropriate to non-stationary sequences with known co-integration relations since it is a constrained VAR model and has co-integration constraints in explanatory variables. The number of existing co-integration relationships is usually determined by the co-integration test, and VECM is established based on the results of the Johansen co-integration test. VECM can provide an estimation of short-term behavior, long-term cointegration relationships, and short-term adjustment coefficients. The adjustment coefficient measures how quickly the short-term departure from the long-term equilibrium is adjusted.

Predecessors have used this model to find excellent practical results in different research fields. For example, Kim (1998) found that there was a co-integration relationship between inflation, exchange rate, money supply, income, and interest rate in the United States. The dollar exchange rate had a major adverse effect on inflation indicated by the producer price index, according to the co-integration analysis of the data from 1973 to 1995 used for empirical study. Maysami & Koh (2000) proved through research that there was a substantial positive relationship between the Singapore stock market and the Japanese stock market, as well as the American stock market, and that alternation in the level of the Singapore stock market was correlated with alternation in the price level, money supply, short- and long-term interest rate, and exchange rate. The shifting connection between macroeconomic variables and the Japanese stock market was investigated by Mukherjee and Naka (1995). According to their empirical research results, it was confirmed that VECM had better forecasting ability than the vector autoregression model in terms of forecasting ability. Based on this, we believe that this is a mature and very suitable econometric

model for the study of the sea transport index.

Its equation form is generally expressed as follows:

$$\Delta X_t = \alpha ecm_{t-1} + \sum (i = 1 \to (p-1)) \Gamma_i \Delta X_{t-i+} + C^* d_t + \varepsilon_t \quad (2)$$

ΔX_t is the first-order main variable, Γ is the coefficient matrix of the differential variable historical value, d is the determination term vector, C is the response coefficient matrix, p is VAR past parallax, ε is the error correction term, and ECM is the error correction term.

3. Impulse Response

The Impulse Response (IR) function, based on the estimated coefficients of the VECM, represents how all variables within the model respond over time when a shock of a certain value is imposed on one of the variables within the model. The purpose is to analyze movement of the response of a dependent variable to a shock in the error term, tracking the effect of such shock over a period of time in the future. It is assumed that a normal time series exists and follows $VAR(p)$; $VAR(p)$ can be in the form of a Vector Moving Average Process VMA(∞).

$$y_t = \alpha + \varepsilon_t + \psi_1 \varepsilon_{t-1} + \psi_2 \varepsilon_{t-2} + \cdots = \alpha + \sum_{i=0}^{\infty} \psi_i \varepsilon_{t-i} \quad (3)$$

ψ_i is the n-dimensional square matrix.

The "marginal effect" of ε_{t-1} on y_t is ψ_i. It can be proved as follows:

$$\frac{\partial y_{t+s}}{\partial \varepsilon'_t} = \psi_s \quad (4)$$

where $\partial y_{t+s}/\partial \varepsilon'_t$ is the partial derivative of the n-dimensional column vector y_{t+s} with respect to the n-dimensional column vector ε'_t, so that the $n*n$ Matrix B is obtained. Assuming that $n = 2$, then:

$$\frac{\partial y_{t+s}}{\partial \varepsilon'_t} = \psi_s = \begin{pmatrix} \frac{\partial y_{1,t+s}}{\partial \varepsilon_{1t}} & \frac{\partial y_{1,t+s}}{\partial \varepsilon_{2t}} \\ \frac{\partial y_{2,t+s}}{\partial \varepsilon_{1t}} & \frac{\partial y_{2,t+s}}{\partial \varepsilon_{2t}} \end{pmatrix} \quad (5)$$

The matrix ψ_s is the dynamic multiplier of the S-period in the 1-dimensional, and the j-th column of the i-th row is $\partial y_{i,t+s}/\partial \varepsilon_{jt}$.

This represents the effect on the value ($y_{i,t+s}$) of the i-th variable in period (t+s) when the j-th variable's random error term ε_{jt} is increased by 1 unit in period t (both other variables and other random error terms remain unchanged).

4. Variance Decomposition

Variance decomposition is used to further analyze how each structural shock contributes to the shift in endogenous variables (typically measured by variance) and assesses the significance of various structural shocks, in contrast to the impulse response function, which tracks how each variable within the model reacts to impacts as time passes. In other words, variance decomposition is used to determine how much of the variance of the prediction error of each variable can be explained by the exogenous impact on other variables. In the VECM model, variance decomposition analysis decomposes the variance of the prediction error from each variable into explanatory power explained by its own variable and other variables (He et al., 2020). To determine to what extent the variance of each variable's prediction error can be explained by the exogenous effects of other variables, we used variance decomposition (Lütkepohl, 2005).

To analyze this, the covariance matrix of the error terms was transformed into an orthogonal matrix and used to decompose the variance

of the prediction errors for each variable. The multivariate model VAR(p) model for the multiple-time-series X_t is shown in the equation below:

$$y_t = v + A_1 y_{t-1} + \cdots + A_P y_{t-p} + u_t \quad (6)$$

It can be changed to the VAR(1) structure by writing in form of:

$$Y_t = V + AY_{t-1} + U_t \quad (7)$$

$$A = \begin{bmatrix} A_1 & A_2 & \dots & A_{p-1} & A_P \\ I_k & 0 & \dots & 0 & 0 \\ 0 & I_k & \dots & 0 & 0 \\ \cdot & \cdot & & \cdot & \cdot \\ \cdot & & \cdot & \cdot & \cdot \\ \cdot & & \cdot & \cdot & \cdot \\ 0 & 0 & \dots & I_k & 0 \end{bmatrix}, Y = \begin{bmatrix} y_1 \\ \cdot \\ \cdot \\ \cdot \\ y_p \end{bmatrix}, V = \begin{bmatrix} v \\ 0 \\ \cdot \\ \cdot \\ 0 \end{bmatrix}, U_t = \begin{bmatrix} u_t \\ 0 \\ \cdot \\ \cdot \\ 0 \end{bmatrix}$$

where k' s dimensional column vectors y_t, v, and u, Y, V, and U are all column vectors of kp dimensions, while A is a kp by kp dimensional matrix. The h-step prediction of variable j has a mean squared error of:

$$MSE\left[y_{j,t(h)}\right] = \sum_{i=0}^{h-1}\sum_{l=0}^{k}\left(e'_j \Theta e_l\right)^2 = \left(\sum_{i=0}^{h-1} \Theta_i \Theta'_i\right)_{jj} = \left(\sum_{i=0}^{h-1} \Phi_i \sum_u \Phi'_i\right)_{jj} \quad (8)$$

and here, e_j means the j^{th} column of I_k, and subscript jj is the element in the matrix.

$\Theta_i = \Phi_i P$ where P is a lower triangular matrix that is given from a Cholesky decomposition of Σ_u and thus $\Sigma_u = PP'$, in which Σ_u is the covariance matrix of errors u_t.

$\Phi = JA^i J'$ in which $J = [I_k\ 0\ \dots\ 0]$. Therefore, J is a k-by-kp dimensional matrix. The percentage of exogenous shocks to Variable l that account for the prediction error variance of variable j is indicated by $\omega_{jl,h}$.

$$\omega_{jl,h=} \sum_{i=0}^{h-1} \left(e'_j \Theta_i e_l\right)^2 \Big/ MSE\left[y_{j,t(h)}\right] \quad (9)$$

IV. Empirical Results and Discussion

1. Date Profile

South Korea and China are transportation hubs for liner shipping, with numerous large mother and feeder ports accompanied by a high frequency of trips (Hwang and Kim, 2023). The People's Republic of China customs' statistics show that the total value of China's foreign trade imports and exports in 2022 will be 7.7% higher than in 2021, accounting for 13.5% of the total global trade in goods. China has the greatest shipping transportation scale and market demand globally, and the container throughput handled by Chinese shipping companies globally is huge. The China Ocean Shipping (Group) Company (COSCO), the largest shipping company in China, is also one of the largest ocean transportation companies in the world. The total container throughput of COSCO's terminals has been first globally for six consecutive years, and its equity throughput has risen to number two in the world. South Korea is surrounded by sea on three sides, the shipping industry is one of the most important economic backbones of South Korea. Since Hanjin Shipping went bankrupt, the competitive strength and market influence of South Korea's shipping industry has dropped dramatically. Hyundai Merchant Marine (HMM), as a major shipping company in South Korea, has been strongly supported by the South Korean government since the bankruptcy of Hanjin Shipping (Can, 2019). The U.S., as one of the largest economies in the world, is also one of the largest shipping markets in the world, with its shipping market size ranking second after the shipping market in China. Maston (MATX) has been the largest shipping company in the United States for over a hundred years, and has an excellent reputation globally. Maston is a

mature financial public company in this industry, so the study of this company is of high reference value (Ouyang, 2021). Kirby (KEX) operates the largest inland and offshore tank barge fleets in the United States. Kirby's industry leading fleet of inland tank barges transport bulk liquid cargoes, including petrochemicals, black oil, refined products, and agricultural chemicals for customers on the Mississippi River, its tributaries, and the Gulf Intracoastal Waterway. Kirby Corporation, as the premier tank barge operator in the United States, was included in this study due to the inclusion of the Baltic Dirty Tanker Index in this study. Stock data of four listed maritime companies were selected from three countries, USA, China, and Korea, to investigate the impact of fluctuations in different shipping indices on shipping company stock prices in three countries, and Table 1 provides a summary of the factors employed in the investigation. Data for this study was sourced from Investing and Wind.

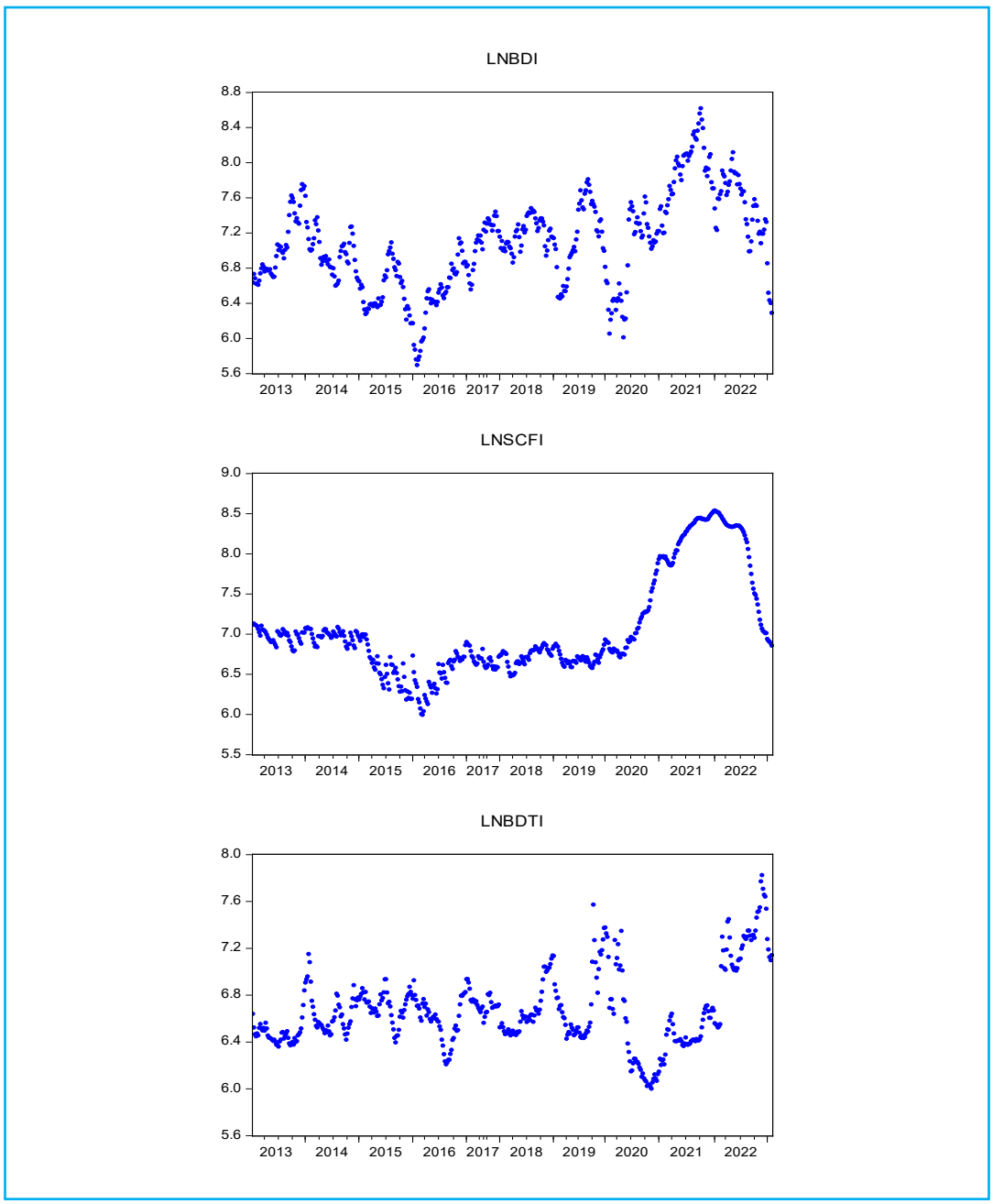
Table 1. Selected Variables for Empirical Analysis

Variable	Sample Interval	
BDI	Baltic Dry Index	2013. 01-2023. 02 (Dates by week)
SCFI	Shanghai Containerized Freight Index	
BDTI	Baltic Dirty Tanker Index	
COSCO_SH	China Ocean Shipping (Group) Company	
MATX	Matson Navigation Company, Inc	
KEX	Kirby Corporation	
HMM	Hyundai Merchant Marine	

Fig. 1 shows the fluctuating changes of the three shipping freight rate indices over the study period. The freight rate of dry bulk transportation market has fluctuated greatly with the changes in the world economy. Global trade has seen stoppages and delays since the outbreak of COVID-19 in 2020 (Park and Liu, 2022), and BDI was also badly hit by COVID-19. More than the decrease in port visits would suggest, the COVID-19 epidemic specifically has had a significant impact on dirty tankers and dry bulk. The BDI will decline by 0.03%, and the BDTI will decline by 0.046% for every 1% rise in coronavirus cases reported globally (Michail & Melas, 2020). Although it has been restored with control of COVID-19 in 2021, due to the downturn in the real estate market and the slowdown in steel demand, BDI fell to a new low in the second half of 2022. Initially affected by the epidemic, the development of the container transportation industry is hindered, but because of mobility during the COVID-19 period and maritime trade wars, alternative routes, empty containers, oil price fluctuations led to a 480% increase in the world container index between January 2020 and August 2021 (Koyuncu & Tavacioğlu, 2021). BDTI is the most prevalent indicator in the crude oil shipping sector, and many scholars have conducted empirical research and analysis on this, including, but not limited to, the financial crisis (Chen et al 2017; Tsouknidis, 2016), the ecological crisis (Van Fan et al., 2018; Wang et al, 2018), the crude oil agreement (Lam and Wong, 2018; Psaraftis, 2018), market competition (Sahoo, 2018), and COVID-19 (Gavalas et al., 2022; Li et al., 2022; Michail and Melas, 2020). Li et al. (2022) found that the Baltic Dirty Tanker Index was

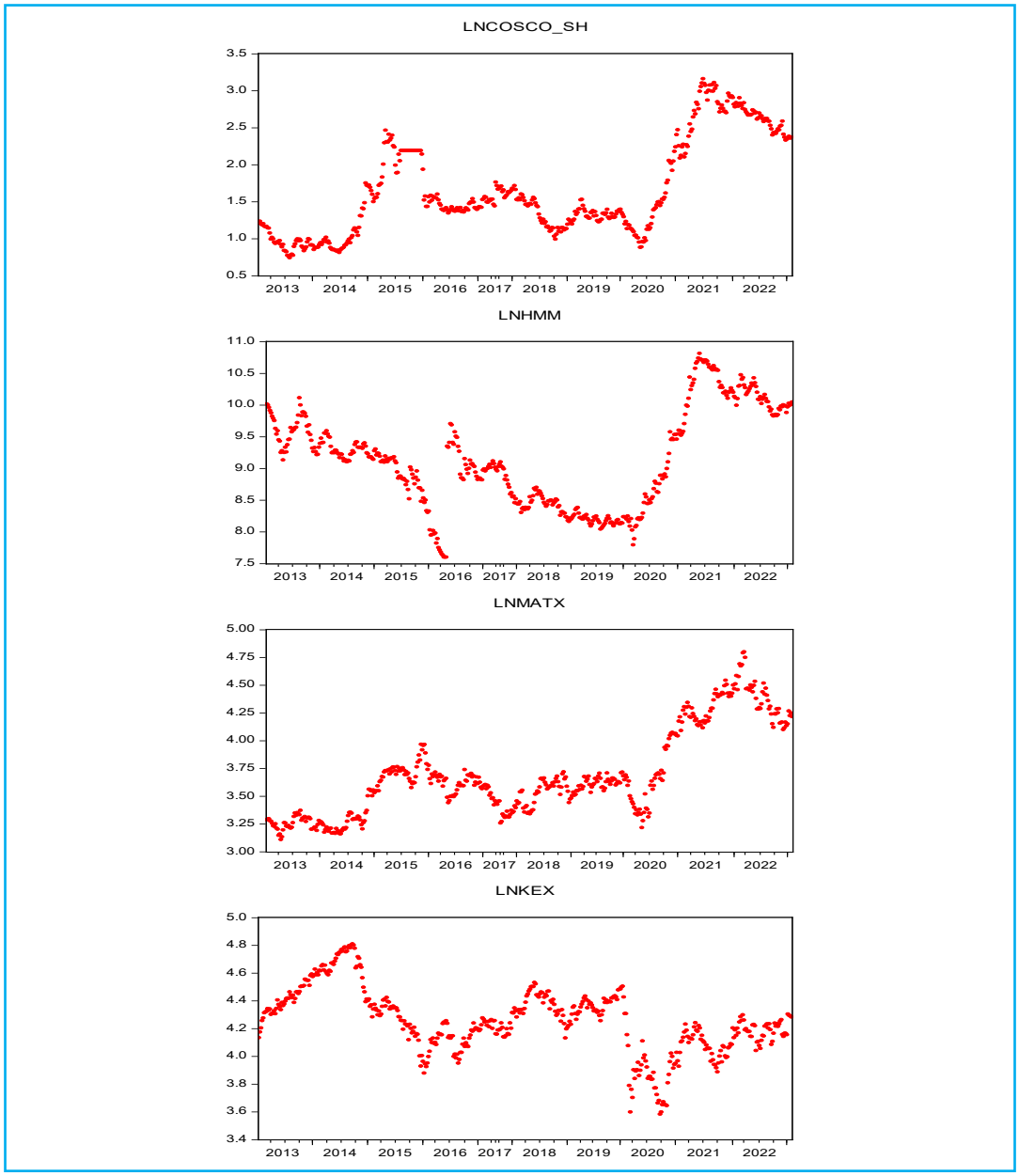
inefficient and unpredictable during COVID-19. The Baltic Dirty Tanker Index not only showed a downward trend due to the impact of COVID-19, it was also highly affected by economic demand (Michail & Melas, 2020).

Fig. 1. Trends of Different Indices



A comparative analysis of Fig. 1 and Fig. 2 shows that when the freight rate index fluctuates sharply, the shipping company stock prices also fluctuate in the same direction. Fig. 2 shows the trend of the stock prices of the four shipping companies. Fig. 2 shows that the four share prices of COSCO, HMM, MATX, and KEX experienced a significant increase during 2020, followed by a downward trend from the second half of 2021 onwards.

Fig. 2. Trends of Share Prices of Shipping Companies in Different Countries



2. ADF Unit Root Test

An ADF test was run to see whether the time series variables were stable, and the results are displayed in Table 2.

First, we took the natural logarithm of the time series variables and ran the ADF-test, which showed that all variables were non-stationary time series; the null hypothesis was accepted since there was a unit root at the 1% significance level. Next, the natural logarithms of the variables were first-order differential, and then ADF tests were performed. The results showed that all the first-order differential variables were stationary time series, and the null hypothesis that a unit root exists was rejected at the 1% level of significance.

Table 2. ADF Unit Root Test

Variable	Original Data	Return
LNBDI	-0.395410	-14.9232***
LNSCFI	-0.279220	-21.6321***
LNBDTI	0.121769	-18.1223***
LNCOSCO_SH	0.339813	-20.0826***
LNMATX	0.641400	-22.2774***
LNKEX	0.006767	-23.3454***
LNHMM	-0.126710	-21.6632***

3. Cointegration Test

As the use of the first differential may lose crucial information regarding the long-run relationship among the variables, Johansen's cointegration test was used to ascertain whether a long-run equilibrium relationship existed among the variables. Before proceeding with Johansen's cointegration test, the optimal lags of the model should be established by the Akaike Information Criteria (AIC) and Schwarz Information Criteria (SC) (Abdullah, 2019). According to the empirical results (Table 3 - Table 6), the optimal lag between each shipping company stock price and the shipping freight indices is 2.

Table 3. Results of the VAR Lag Order Selection Criteria between LNCOSCO and Freight Rate Indices

Lag	LogL	LR	FPE	AIC	SC	HQ
1	2103.115	NA	1.93E-09	-8.71447	-8.575120	-8.659690
2	2157.837	107.61510*	1.64e-09*	-8.876145*	-8.597451*	-8.766586*
3	2166.357	16.61398	1.69E-09	-8.84492	-8.426870	-8.680580
4	2176.186	19.0008	1.74E-09	-8.81915	-8.26176	-8.600030
5	2186.025	18.85694	1.78E-09	-8.79342	-8.096690	-8.519530

Table 4. Results of the VAR Lag Order Selection Criteria between LNHMM and Freight Rate Indices

Lag	LogL	LR	FPE	AIC	SC	HQ
1	1846.712	NA	5.63E-09	-7.643890	-7.504550	-7.589110
2	1897.757	100.38360	4.86e-09*	-7.790215*	-7.511521*	-7.680657*
3	1907.525	19.04652	4.99E-09	-7.764190	-7.346150	-7.599860
4	1921.552	27.11811*	5.03E-09	-7.755960	-7.198570	-7.536840
5	1932.688	21.34190	5.14E-09	-7.735650	-7.038920	-7.461750

Table 5. Results of the VAR Lag Order Selection Criteria between LNMATX and Freight Rate Indices

Lag	LogL	LR	FPE	AIC	SC	HQ
1	2223.67	NA	1.17E-09	-9.217830	-9.078480	-9.163050
2	2276.765	104.41580	9.99e-10*	-9.372713*	-9.094019*	-9.263154*
3	2287.708	21.33900	1.02E-09	-9.351600	-8.933560	-9.187260
4	2298.886	21.60847	1.04E-09	-9.331470	-8.774080	-9.112350
5	2315.208	31.28178*	1.04E-09	-9.332810	-8.636080	-9.058920

Table 6. Results of the VAR Lag Order Selection Criteria between LNKEX and Freight Rate Indices

Lag	LogL	LR	FPE	AIC	SC	HQ
1	2255.059	NA	1.02E-09	-9.348890	-9.209540	-9.294110
2	2311.433	110.86570*	8.64e-10*	-9.517466*	-9.238772*	-9.407908*
3	2322.552	21.68089	8.82E-10	-9.497090	-9.079050	-9.332750
4	2334.578	23.24769	8.97E-10	-9.480490	-8.923100	-9.261380
5	2344.729	19.45457	9.19E-10	-9.456070	-8.759340	-9.182180

Yoo and Ku (2009) submitted that verifying whether there is a cointegration relationship among unstable time series variables is necessary. After determining the optimal time lag, we used the Johansen cointegration test to find that shipping freight indices have a cointegration association with shipping line stock price, which means that a long-term equilibrium connection between the variables exists.

Table 7. Results of the Co-integration Test between LNCOSCO and Freight Rate Indices

Hypothesized # of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None*	0.086739	80.94860	47.85613	0.0000
At most 1*	0.058012	37.30556	29.79707	0.0057
At most 2	0.010643	8.559702	15.49471	0.4077
At most 3	0.007071	3.413092	3.841466	0.0647

$$\text{Normalized Cointegrating Equatio} = \text{LNCOSCO\_SH} + 8.9248\text{LNBDI} - 24.1581\text{LNBDTI} - 5.2212\text{LNSCFI}$$

In the normalized cointegrating equation of the Johansen model, which represents the long run, coefficients signs should be reversed. When the target variable is LNCOSCO_SH, the BDTI and SCFI positively impact the China Ocean Shipping Company stock index, and the BDI negatively affects the China Ocean Shipping Company stock index.

In the results of Table 6, the first line shows significance, which means there are more than zero cointegration connections in chosen variables, and the second line also shows significance, meaning more than one cointegration relationships exist in the chosen variables. The results show that there is at least one cointegration relationship between COSCO shipping company stock price and shipping freight indices at $p<0.05$. Thus, it provides evidence of a long-run equilibrium relationship between the freight rate indices and the COSCO stock price index.

Table 8. Results of the Co-integration Test between LNHMM and Freight Rate Indices

Hypothesized # of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None*	0.080402	81.07318	47.85613	0.0000
At most 1*	0.057328	40.75626	29.79707	0.0019
At most 2	0.019084	12.35958	15.49471	0.1405
At most 3	0.006406	3.091237	3.841466	0.0787

$$\text{Normalized Cointegrating Equation} = \text{LNHMM} - 4.0188\text{LNBDI} + 9.4526\text{LNBDTI} + 1.3350\text{LNSCFI}$$

BDI will cause positive shocks when LNHMM is the target variable, and BDTI and SCFI negatively affect the Hyundai Merchant Marine stock index.

In the results of Table 7, the second line also shows significance, which means more than one cointegration relationships exist in the chosen variables. The results show the rejection of the null hypothesis of the non-existence of a cointegrating relationship at the 5% significance level, indicating the existence of two cointegrating relationships. Thus, it provides evidence of a long-run equilibrium relationship between the freight rate indices and HMM stock price index.

Table 9. Results of the Co-integration Test between LNMATX and Freight Rate Indices

Hypothesized # of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None*	0.105320	92.29864	47.85613	0.0000
At most 1*	0.060747	38.76831	29.79707	0.0036
At most 2	0.010208	8.623746	15.49471	0.4013
At most 3	0.007639	3.688391	3.841466	0.0548

$$\text{Normalized Cointegrating Equation} = \text{LNMATX} + 0.9297\text{LNBDI} - 4.1360\text{LNBDTI} - 0.8992\text{LNSCFI}$$

When LNMATX is the target variable, BDTI and SCFI have a positive impact on the Matson Marine stock index, while BDI has a negative impact on the Hyundai Merchant Marine stock index.

In the results of Table 8, the first line shows significance, meaning there are more than zero cointegration connections in the chosen variables, and the second line also shows significance, which means more than one cointegration relationships exist in the chosen variables. The trace test indicates the existence of two cointegrating relationships at the 0.05 level. Thus, this provides evidence of a long-run equilibrium relationship between the freight rate indices and the MATX stock price index.

Table 10. Results of the Co-integration Test between LNKEX and Freight Rate Indices

Hypothesized # of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None*	0.083490	82.30040	47.85613	0.0000
At most 1*	0.057819	40.36555	29.79707	0.0021
At most 2	0.017867	11.71833	15.49471	0.1709
At most 3	0.006314	3.046837	3.841466	0.0809

$$\text{Normalized Cointegrating Equation} = \text{LNKEX} - 1.0691\text{LNBDI} + 3.0184\text{LNBDTI} + 1.0574\text{LNSCFI}$$

When LNKEX is the target variable, BDTI and SCFI have a negative effect on the Matson Navigation Company stock index, while BDI has a positive effect on the Hyundai Merchant Marine stock index.

In the results of Table 9, the results show that there are two cointegration relationships between each shipping company stock price and shipping freight indices at $p<0.05$. Thus, this provides evidence of a long-run equilibrium relationship between the freight rate indices and the KEX stock price index.

4. VECM Model Empirical Analysis Results

After the long-term stability of the co-integration connection between the variables is confirmed, the VECM model can be developed. The error correction factor indicates how quickly the model will adjust to restore equilibrium after any disturbance.

Table 11. Vector Error Correction Estimates

Error Correction	D(LNCOSCO_SH)	D(LNHMM)	D(LNMATX)	D(LNKEX)
CointEq1	0.001328	-0.00149	0.006244*	-0.00279
t-statistics	[1.88282]	[-1.18812]	[2.71571]	[-1.31874]

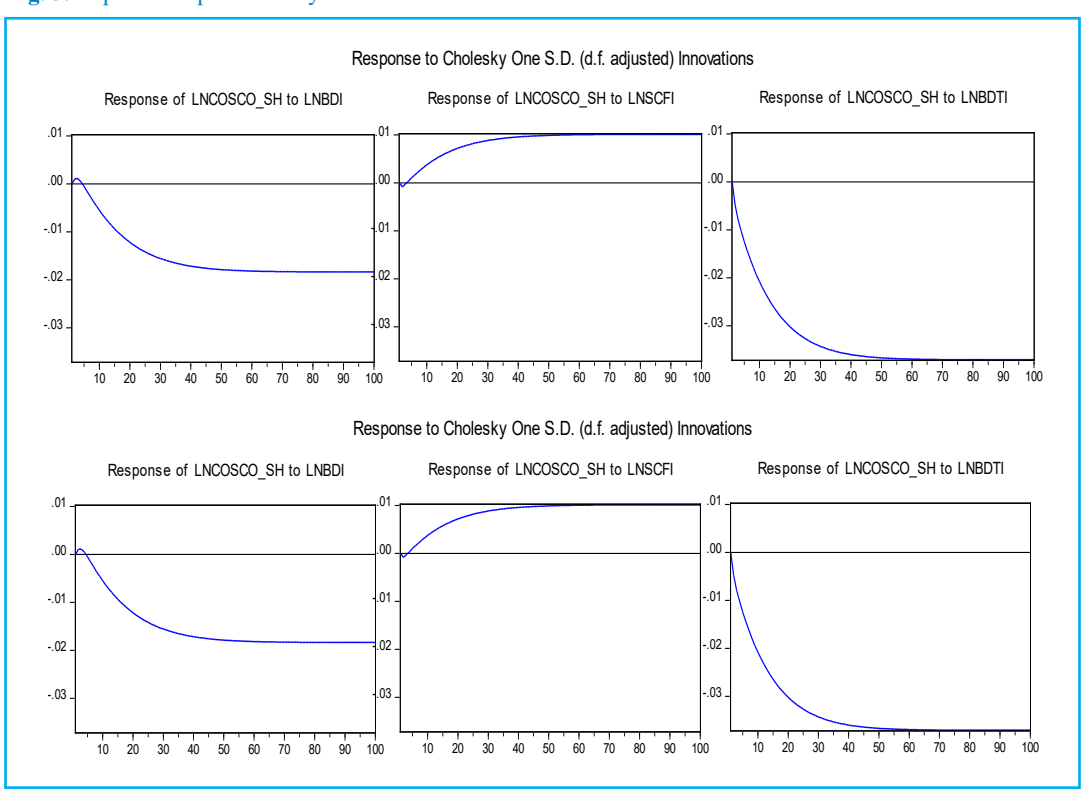
Notes: 1. *t* statistics in parentheses.
2. $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$.

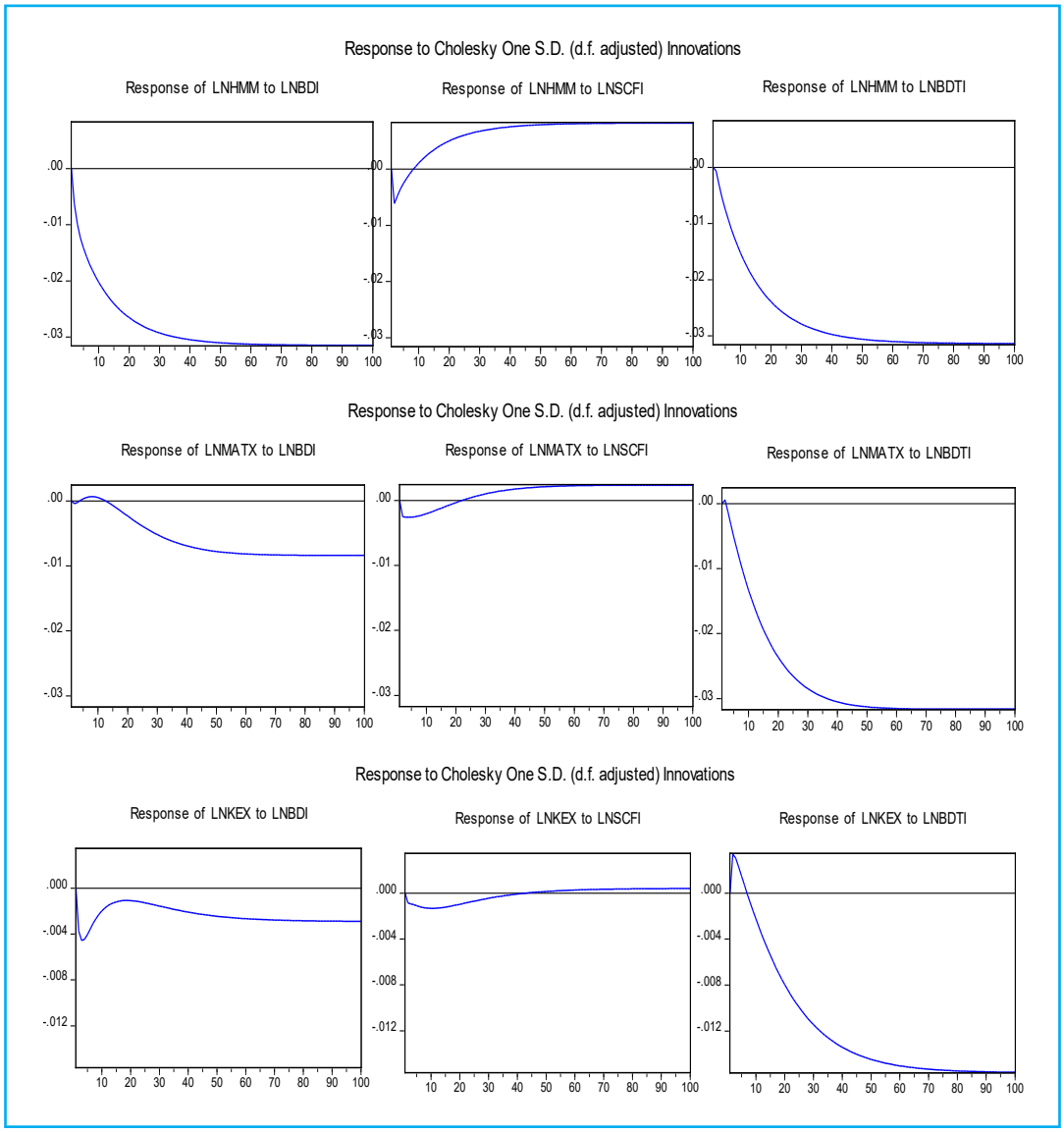
Within the empirical test results, only the error correction term for the MATX stock price was statistically significant, and the coefficient of the error correction term for LNMATX was positive, indicating that there was a convergence from short-run dynamics to long-run equilibrium. This means that the 0.55% deviation from the long-run equilibrium in the previous period will be recovered in the next period.

5. Impulse Response Analysis

The impulse response function (IRF) can be used to calculate the impact of an exogenous shock on a variable within the dynamic path of each variable in the model (Wang et al., 2016). It can also show the dynamic impact of various shocks in the future (Kari & Saddam, 2014).

Fig. 3. Impulse Response Analysis Results





First, from the results of the impulse response analysis of COSCO shipping company's stock price, the shock from the BDTI index has the most effect on COSCO's stock price, with a one-time shock from BDTI, COSCO_SH will be down by 4%, and a one-time 1% increase in BDI results in permanent reductions in COSCO_SH of 2%. Although SCFI has a positive impact on COSCO shipping company's stock price, the shock effect is not significant.

The impulse response analysis of the HMM shipping company's stock price shows a 3% response to shocks from both BDTI and BDI, and for a 1% shock from BDTI and BDI, LNHMM will continue to decrease for 100 time periods. The SCFI index has a positive impact on HMM shipping company's stock price, but the shock effect is also not significant.

Table 12. Variance Decomposition Results

Variance Decomposition of LNCOSCO_SH:					
Period	S.E.	LNCOSCO_SH	LNBDI	LNBDTI	LNSCFI
1	0.068889	100	0.00000	0.00000	0.00000
2	0.101198	99.75677	0.012012	0.219333	0.011881
3	0.125603	99.43415	0.015665	0.539493	0.010694
4	0.146027	99.0799	0.012520	0.899517	0.008067
5	0.16400	98.69153	0.010866	1.290814	0.006787
6	0.180283	98.26706	0.016283	1.708961	0.007697
7	0.195318	97.80904	0.031342	2.148617	0.011002
8	0.209388	97.32250	0.056734	2.604139	0.016631
9	0.222685	96.81327	0.092142	3.070197	0.024386
10	0.235346	96.28717	0.136760	3.542048	0.034021
Variance Decomposition of LNHMM:					
Period	S.E.	LNHMM	LNBDI	LNBDTI	LNSCFI
1	0.116972	100	0.00000	0.00000	0.00000
2	0.166162	99.71801	0.144856	0.00057	0.136567
3	0.203637	99.49458	0.334251	0.023161	0.148009
4	0.235168	99.26868	0.525641	0.069055	0.136621
5	0.262944	99.03461	0.710437	0.133854	0.121095
6	0.288077	98.79198	0.888017	0.213984	0.106023
7	0.311223	98.54157	1.059248	0.306461	0.092725
8	0.332808	98.28478	1.224944	0.408745	0.081534
9	0.353125	98.02328	1.385622	0.518663	0.072431
10	0.372386	97.75882	1.541550	0.634360	0.065268
Variance Decomposition of LNMATX:					
Period	S.E.	LNMATX	LNBDI	LNBDTI	LNSCFI
1	0.116972	100	0.00000	0.00000	0.00000
2	0.166162	99.71801	0.144856	0.00057	0.136567
3	0.203637	99.49458	0.334251	0.023161	0.148009
4	0.235168	99.26868	0.525641	0.069055	0.136621
5	0.262944	99.03461	0.710437	0.133854	0.121095
6	0.288077	98.79198	0.888017	0.213984	0.106023
7	0.311223	98.54157	1.059248	0.306461	0.092725
8	0.332808	98.28478	1.224944	0.408745	0.081534
9	0.353125	98.02328	1.385622	0.518663	0.072431
10	0.372386	97.75882	1.541550	0.63436	0.065268
Variance Decomposition of LNKEX:					
Period	S.E.	LNKEX	LNBDI	LNBDTI	LNSCFI
1	0.049583	100	0.00000	0.0000	0.00000
2	0.06798	99.43132	0.301285	0.257193	0.010203
3	0.082234	99.15220	0.513975	0.317378	0.016443
4	0.09429	99.06079	0.614974	0.302586	0.021649
5	0.104923	99.06226	0.644982	0.265811	0.026947
6	0.114544	99.10318	0.636968	0.227395	0.03246
7	0.123400	99.15536	0.610689	0.195929	0.038026
8	0.131654	99.20424	0.576948	0.175367	0.043449
9	0.139422	99.24253	0.541375	0.167531	0.048565
10	0.146787	99.26686	0.506764	0.173115	0.053264

The impulse response analysis of MATX shipping company's stock price shows that the impact of the BDTI shock has the strongest effect on MATX shipping company's stock price, and for a 1% shock, MATX will continue to decrease for 100 time periods. One-time volatility shocks from BDI results in permanent reductions in MATX shipping company's stock price of 1%. MATX has a negative response to shocks from SCFI in the first 40 periods, after which time the response to shocks transitions into a positive effect, but the effect of shocks remains insignificant.

Impulse response analysis of KEX shipping company's stock price shows that the BDTI shock has the most effect on KEX shipping company's stock price, with a positive impact in the first period, then transmuted to a negative effect, dissipating in the 100th period. There is a shock from BDI which initially has a negative effect, but it is weak after the 10th period on KEX Marine's stock price. The impact on KEX shipping company's stock price is not strong. For shocks from SCFI, the initial impact is negative and weak in the long run.

The reactions of shipping company stock prices to the shocks from BDTI and BDI are both negative, but different. For the BDTI shock, the effect is strongest, but dissipated in the 100th period. The response of shipping company stock prices to shocks from the BDI index is not as strong as the impact from BDTI, but the impact is more permanent. Also, the results of the empirical analysis reveal that SCFI has the weakest effect on shipping company stock price.

6. Variance Decomposition

To calculate each shock's contribution to the variance of the prediction error, regression was performed on the variance decomposition (Campbell, 1991). The variance decomposition provides evidence of informative similarity with the IRF.

Table 12 includes the outcomes of the variance decomposition for each shipping line's stock price separately. The contribution of shocks brought by the BDTI index to explain the variance error of the LNCOSCO_SH is 3.54%. This shows that the volatility of BDTI significantly impacts LNCOSCO_SH in the long term, but both BDI and SCFI had under a 1% effect on COSCO shipping company's stock price in the 10th period. The BDI index has the same explanatory ability of 1.5% for the variance of the prediction errors of LNHMM and LNMATX. The contribution of shocks from the SCFI index to explain the prediction variance errors of all four shipping company stock prices is insignificant.

V. Summary and Conclusion

The shipping industry is a typical cyclical industry, and the operating effects of shipping companies with the fluctuation of global trade shows cyclical changes. Therefore, the widely used intrinsic value analysis and the general relative valuation method are less adaptable in estimating shipping company stock price. Finding a more intuitive and efficient method to estimate the stock price of shipping companies can help investors be more rational and efficient when investing in shipping company stocks. In this study, the stock data of four listed maritime companies were selected from three countries, USA, China, and Korea, to investigate the impact of fluctuations in different shipping indices on shipping company stock price in three countries. The long-run equilibrium relationships between each shipping company stock price and three shipping indices (BDI, BDTI, and SCFI) were examined in this study using Johansen cointegration tests. Next, the short-term adjustment effect of different shipping freight indices on shipping company stock prices was analyzed by establishing a VECM model. Finally, the responses of shipping company stock prices to shocks from different shipping freight indices were analyzed by IRF and forecast error variance decomposition based on the VECM model. Finally, the following conclusions are drawn.

First, the cointegration test demonstrated that

each shipping company stock price and the three shipping indices (BDI, BDTI, SCFI) have a long-run equilibrium relationship. The long-term equilibrium relationship among shipping freight indices and shipping company stock prices can be attributed to various factors (Su et al., 2019), including global trade volume, shipping demand and supply dynamics, macroeconomic factors, and geopolitical events; these are all influenced by market fundamentals. These fundamentals can impact both the freight rates, as reflected in the shipping freight index, and the financial performance and prospects of shipping companies, as reflected in their stock prices. It can be seen that the shipping freight rate indexes and the shipping company stock prices are moving in the same direction.

Second, by constructing a vector error correction model, the speed of correction in restoring equilibrium is evaluated. In accordance with the findings, only the error correction term for the MATX stock price is statistically significant, and the error correction term coefficient for LNMATX is positive, indicating that short dynamics are convergent with long-term equilibrium.

Third, the reactions of shipping company stock prices to the shocks from BDTI and BDI are both negative, but different. For the BDTI shock, the effect is strongest, but dissipated in the 100th period. The response of shipping company stock prices to shocks from the BDI index is not as strong as the impact from the BDTI, but the impact is more permanent. Also, the results of the empirical analysis revealed that SCFI has the weakest effect on shipping company stock price. Based on the price formation hypothesis, the dry bulk shipping industry is almost entirely competitive, and supply and demand dictate freight prices, reflecting economic trends. The tanker shipping market is influenced by geopolitical factors, and supply and demand also dictate freight prices. However, there is a price monopoly in the container shipping sector, wherein freight rates are set by shipping alliances (Hsiao et al, 2014), so the SCFI index is less volatile when compared to BDI and BDTI. Therefore, the impact from the container freight index was weaker on shipping company stock prices.

Fourth, the BDI index has the same explanatory ability of 1.5% for the variance of the prediction errors of LNHMM and LNMATX. The contribution of shocks brought by the BDTI index to explain the variance error of LNCOSCO_SH is 3.54%. This shows that the volatility of BDTI significantly impacted LNCOSCO_SH in the long term, but the impact on the share price of other shipping companies was not obvious. The contribution of shocks from SCFI to explain the prediction variance errors of all four shipping company stock prices is insignificant.

By summarizing the results of the empirical analysis, we propose the following recommendations. First, in the long run, because of the existence of the long-term equilibrium relationship, the fluctuations of shipping company stock prices and freight rate indices will eventually converge, despite the deviation of the stock prices of shipping companies from the three shipping freight rate indices. Therefore, rational investors should not abandon investments when there is a momentary fluctuation in stock prices. In the short term, the fluctuation impact of BDI and BDTI on the stock price of shipping companies is stronger, and the strength of the impact on the stock price of each shipping company is also different; therefore, for different shipping company stock prices, it can be used to consider the corresponding shipping freight index as an important reference for analyzing the future trend of the stock price. Shipping companies can employ the volatility of the shipping freight rate indices to predict the trend of the company stock price, and then determine the best timing and strategy for financing. Ordinary investors can have a more intuitive basis to judge the volatility trend of the stock prices of the shipping companies, according to the shipping freight rate index, and make the best investment decisions by integrating other information.

There are also some limitations in this study. The shipping industry has seasonal characteristics, and this study does not take seasonality into account for empirical research. At the same time,

stock prices are affected by various factors, such as short-term liquidity effects or the herding effect of investors, which may have an impact on stock prices. Therefore, these factors need to be taken into consideration in future studies in order to more accurately evaluate the stock price trend of shipping companies.

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Bridging Bytes and Behaviors: Unraveling the Multifaceted Interplay of Technology and Employee Dynamics Over Time Through Text-mining and Systematic Literature Review*

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ABSTRACT

Purpose – The study is conducted to explore the complex relationship between technological integration and its consequences for employees, examining the multifaceted impacts of advanced technologies on organizational operations and workforce dynamics over the past four decades.

Design/Methodology/Approach – To accomplish this, the study employs a robust approach involving rigorous text-mining analysis and a systematic literature review encompassing a vast dataset of 7,000 articles published from 1983 to 2022. This methodology is meticulously designed to discern the evolution of technology-related research by tracing prevalent topics and keywords throughout the extensive literature corpus.

Findings – The study's findings indicate mixed effects of technology on employee parameters. While technology integration can lead to negative impacts such as increased turnover intention, anxiety, and health issues, recent literature also points to a paradigm shift, highlighting the contrast between technology-mediated and traditional face-to-face interactions.

Research Implications – Organizations should consider the dual nature of technology's impact on the workforce. There is a critical need for integrating technology in a way that boosts productivity while also prioritizing employee well-being. The study suggests that redefining work-life dynamics is essential to maintain a harmonious balance in the increasingly digitalized workplace. The findings lay the groundwork for future research on understanding the complex effects of technology in organizational settings.

Keywords: evolution, management, systematic literature review, technology, text-mining

JEL Classifications: O03, O32, M15

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I. Introduction

Over the past decade, the surge in digital technology adoption has transformed organizational operations with various integrated advanced tools such as big data analytics, cloud computing, and artificial intelligence (AI) (e.g., ChatGPT, BARD, and DALE III; Bharadwaj et al., 2013; McKinsey. Com, 2023; Tilson et al., 2010). Digital transformation (DT), described as organizational adaptations prompted by digital technologies, empowers firms to rejuvenate their business models and equips them to navigate a modern volatile business landscape (Hanelt et al., 2020; Warner & Wäger, 2019).

This technological pivot has marked our lives and work, with a significant body of research documenting these shifts (Dos Santos et al., 2014; Kim & Roh, 2023). As technology continues to evolve, understanding its future impact is crucial. Notably, 40% of the organizations are escalating their AI investments and anticipating transformative outcomes, especially in knowledge-driven sectors (McKinsey, 2023; OpenAI, 2023).

Scholars and practitioners are becoming increasingly interested in DT (Westerman et al., 2011). However, this is often misinterpreted as a mere technological evolution. DT encompasses broader human and organizational metamorphoses steered by technology (Kane, 2019). Given rapid technological advancements and burgeoning discourse on the intersection of technology with management, it is pivotal to chart its academic evolution and discern its future trajectory (Nambisan et al., 2017).

This study meticulously examined seminal papers indexed on the Web of Science (WoS), focusing on the evolutionary trajectory of technology-related research. This study was initiated in 1983 and marked the onset of significant technology-related studies in the WoS database. We purposefully chose this starting point to trace the evolution of technological research over four decades, culminating in 2022. This timeframe enabled a comprehensive understanding of the field's progression and its contemporary relevance. Our approach involved a detailed text-mining analysis of titles, abstracts, and keywords from a carefully selected subset of 21 journals in the management and information technology disciplines. These journals, which are part of the highly cited *Financial Times 50* journals, were selected because of their global recognition and significant impact on the scholarly community. This selection process led to the identification of 7,000 technology-related articles published from 1983 to 2022. Text-mining analysis has been instrumental in revealing how technology studies have evolved over time, particularly in relation to employee and workplace technology interaction. After a thorough review of the patterns and progression of technological studies, this study focuses on the trajectories and patterns of research examining the interplay between technology and employees over the past four decades. In addition to text-mining analysis of technology-related studies, 1,046 articles were identified under the technology and employee keywords. We reviewed them based on the abstract and title, and selected 18 articles for systematic literature reviews.

Thus, our study provides a valuable reference point for scholars by answering the research question, '*How has the evolution of technology research, particularly in relation to employee and workplace dynamics, transformed over the past four decades, and what implications does this transformation hold for understanding and anticipating the future intersection of technology and management in the workplace?*' This historical lens helps contextualize present-day studies within a broader academic lineage, fostering a richer understanding of how past research has laid the groundwork for contemporary inquiries. Furthermore, the shift from merely focusing on technology management to exploring the intersection of organizational behavior, team dynamics, and organizational success underscores the maturation of the discipline. The cross-pollination of ideas across traditionally distinct domains such as computer science, psychology,

sociology, and business ethics offers an interdisciplinary lens that enriches the theoretical depth and breadth of management research. For instance, integrating computer science with organizational behavior has led to novel insights into how technology influences workplace behavior, whereas the combination of sociology and business ethics offers a new understanding of ethical issues in technology-driven workplaces. Additionally, through a meticulous, systematic review, we emphasize the multifaceted impact of technological advancements on individual employees, offering insights ranging from tangible effects on job roles to more nuanced psychological and emotional ramifications. Finally, our findings accentuate the redefined essence of work in the contemporary digital age, underscoring the imperative to delve deeper into qualitative shifts in employment perceptions and roles in a world increasingly intertwined with AI and advanced technologies.

II. Evolution of Technology-Related Studies

Academic research themes continuously evolve with societal and chronological shifts (Thomas, 2011). Recognizing these transformations is instrumental in forecasting academic trajectories and unearthing novel research topics (Morillo et al., 2003). Our study explored the metamorphosis of academic themes over time by leveraging topic modeling (Blei et al., 2003) on the abstracts of scholarly statistics sourced from international journals between 1983 and 2022. This analysis will unearth myriad insights into past and current academic development trajectories, facilitating the discernment of academic trends, excavation of emergent research themes, comprehension of contemporary research dynamics, and probing of interdisciplinary potential (Börner et al., 2003).

In our contemporary information-centric society, an immense amount of data is generated, underlining the importance of effectively analyzing and harnessing this deluge (Hilbert & López, 2011). By applying topic modeling to academic studies, this study aims to mine embedded values and insights from previous studies related to technology (Lafferty & Blei, 2009). Consequently, the primary aim of this study was to meticulously trace and analyze the evolution of scholarly focus within the realms of technology and management. By examining topic trends across four distinct time periods (1983–1992, 1983–2000, 1983–2010, and 1983–2022), we sought to understand how academic research has progressively responded to and influenced real-world technological and organizational development. This analysis not only highlights the dynamic shifts in academic priorities, but also aims to identify emerging patterns that offer practical insights for contemporary and future applications in technology management. Our findings provide invaluable insights for future studies and researchers from diverse disciplines during their research journeys (Chen, 2006).

1. Method

1.1. Text-Mining Approach

Academic discourse continues to embrace and integrate technological advances to refine its methodology. One such method, text mining, facilitates the extraction of meaningful insights from extensive unstructured text data through techniques that span natural language processing (NLP), information retrieval (IR), and machine learning (Feldman & Sanger, 2007). This method is crucial for identifying prominent patterns and gaining insights into document corpora. As a specialized realm within text mining, topic modeling, an unsupervised learning technique, is used to identify subjects within a collection of documents (Blei et al., 2003). Unsupervised learning refers to the process in which an algorithm learns patterns from untagged data without any explicit instruction on what patterns to find, making it well-suited for discovering hidden thematic structures in large textual datasets (Hoffman et al., 2010). This methodology has

recently garnered significant attention, and has been applied in various academic disciplines.

Widespread recognition of the potential of topic modeling is evident in studies which highlights the complexities of individual research topics within business studies and illuminates interdisciplinary research possibilities. Their findings significantly underpin our extensive topic modeling approach in previous studies on technology. Moreover, Lee and Bozeman (2005) emphasized the need to understand international research trends in academic journals. Their approach motivated us to survey academic transformations from a global perspective using the Web of Science International Academic Database. Although Börner et al. (2003) aimed to offer the academic directionalities required in actual fields, our study pivots more towards directly utilizing topic modeling rather than visualization.

Building on these foundational studies, our study aims to systematically explore changes in academic topics over time through extensive topic modeling of academic databases. These endeavors are expected to shed light on the trajectories of academic development in the past and present, further aiding the forecasting of future research subjects and directions. With the massive amounts of data generated in our digital era, as emphasized by Hilbert and López (2011), effectively analyzing and utilizing these data has become paramount. From this standpoint, our study analyzed more than 7,000 academic studies recorded in 21 *Financial Times 50* listed journals via topic modeling to excavate their inherent value and insights. Our research relies on insights and knowledge gained from previous studies and anticipates that the outcomes will provide valuable material to researchers across various fields (Chen, 2006). By evolving and building on the results of prior studies, our research offers robust methodologies and approaches for visualizing academic subject transformations over time and illustrates how they can be harnessed to predict future research trends.

1.2. Data and Preprocessing

Data were collected from the Web of Science database based on 21 journals, including the *Academy of Management Journal* (*AMJ*), *Administrative Science Quarterly* (*ASQ*), *Human Relations* (*HR*), *Human Resource Management* (*HRM*), *Information Systems Research* (*ISR*), *Journal of Applied Psychology* (*JAP*), *Journal of Business Ethics* (*JBE*), *Journal of Business Venturing* (*JBV*), *Journal of International Business Studies* (*JIBS*), *Journal of Management* (*JOM*), *Journal of Management Information Systems* (*JMIS*), *Journal of Management Studies* (*JMS*), *Management Science* (*MS*), *MIS Quarterly* (*MISQ*), *Organization Science* (*OS*), *Organization Studies, Organizational Behavior and Human Decision Processes* (*OBHDP*), *Research Policy* (*RP*), *Sloan Management Review* (*SMR*), *Strategic Entrepreneurship Journal* (*SEJ*), *Strategic Management Science* (*SMJ*), and amassed 7,000 scholarly articles from 1983 to 2022. These articles were sourced from various academic journals, including 1,655 from *Research Policy* and 734 from *MIS Quarterly*. The selection of these 21 journals, which predominantly focused on management, strategy, and technology, was deliberate. This choice aligns with our research objective of examining the evolution of technology-related studies and their impact on organizational employees. By focusing on journals that closely interlink technology with management and strategy, we ensured that our review comprehensively covered the multifaceted ways in which technology intersects with organizational dynamics and strategic decision-making This approach facilitates an inclusive glimpse into diverse academic development trends by ensuring a comprehensive scope within the stipulated timeframe.

Topic modeling, a statistical model employed to discern topics within a collection of documents, has been used to analyze the evolution of academic subjects (Blei et al., 2003). Given its recent surge in popularity across various academic disciplines,

this is a powerful, unsupervised learning technique. To implement the Latent Dirichlet Allocation (LDA) model, an integral for this research, we utilized the Python library *tomotopy*. The LDA operates on the premise that each document comprises multiple topics, and learns to associate distinctive word distributions with each topic (Blei et al., 2003). The model underwent 200 iterations, with the log-likelihood values produced at each stage to provide real-time insights into the model's performance enhancement. The top 10 words from multiple topics were extracted to discern the essence of each topic.

The preprocessing phase is crucial for data refinement. Using the Natural Language Toolkit (nltk) package, a comprehensive suite of libraries and programs for symbolic and statistical natural language processing (NLP) in the English language, we retained English stems and excised extraneous elements such as special characters. The nltk is widely used in text mining for tasks such as tokenization, stemming, and tagging, making it an appropriate choice for ensuring the accuracy and consistency of linguistic analysis. Additionally, English stop words were excluded to ensure a focus on core semantic content (Bird et al., 2009). To achieve a granular analysis of data from 1983 to 2022, the research duration was segmented into four distinct intervals: 1983–1992 (Time period 1), 1983–2000 (Time period 2), 1983–2010 (Time period 3), and 1983–2022 (Time period 4) to see how studies have evolved. The use of overlapping periods was integral to our approach, allowing us to observe the cumulative and evolving nature of this research. By separately examining periods such as 1983–1992 and 1993–2002, we identified distinct trends within each decade. However, overlapping periods are necessary to fully understand the evolution and additive impact of research over time. For instance, examining 1983–1992 and then extending this to include 1993–2000 reveals not only the continuation of trends from the first period, but also the emergence of new ones, providing a clearer picture of the study's evolutionary trajectory. By doing so, we can trace evolutionary paths and key topics by investigating trends with overlapping periods. Topic modeling was executed for each segment, enabling a structured understanding of the evolution of academic subjects over time. After the model training, the primary themes were interpreted using the top words associated with each topic. These interpretations are underscored as one of the principal outcomes of this study.

1.3. Exploratory Data Analysis and Optimization

Embarking on the preprocessed data, this study applied an LDA topic-modeling algorithm. Determining the most appropriate number of topics is crucial for modelling precision and efficiency. The coherence and perplexity metrics map the evolution of academic research topics over time. A grid-search method was used to identify the optimal parameter values during the model learning phase. This grid encompasses Alpha and Eta values, considering cases such as [0.01, 0.05, 0.1, 0.2, 0.3] and topic number k as [5, 8, 10, 12, 15, 20, 25, 30]. After training the LDA model for each combination, coherence and perplexity values were computed, leading to the selection of the best parameter combination (Röder & Hinneburg, 2015). Coherence, which exemplifies the congruence of words within a topic, indicates optimal performance with higher values. By contrast, perplexity shows the model's capability to predict new data; lower values indicate more desirable outcomes (Newman et al., 2010). The decision to use 10–20–20–30 topics across the four phases was based on the results of the grid search (Table 1). We aimed to balance the granularity of topics with the overall coherence of the models. As the volume and complexity of the data increased over time, progressively larger topic numbers (from 10 in the earliest phase to 30 in the latest) offered the best balance between detailed topic representation and model coherence.

Table 1. Results of Parameters and Hyper-Parameter for Optimization

Time period	Alpha	Eta	K	Best Coherence	Perplexity
1983-1992	0.01	0.1	10	0.575	142.249
1983-2000	0.3	0.05	20	0.488	1578.080
1983-2010	0.2	0.3	20	0.537	2028.227
1983-2022	0.1	0.3	30	0.549	2344.293

In the LDA learning phase of our study, we used an optimal combination of parameters to ensure the high reliability of topic modeling. This approach allowed us to focus on the evolution of research subjects as reflected in the incremental increase in the number of topics discerned from the optimization process. This increase from 10 to 30 topics across the four periods (1983–1992, 1983–2000, 1983–2010, and 1983–2022) mirrors fluctuations in technological and sociocultural trends. In evaluating these topic trends, we deliberately chose not to consider topic frequencies. This decision was made to avoid potential biases arising from the disproportionate representation of certain topics in the larger datasets. Hence, our focus was on the diversity and evolution of topics rather than their frequency. Regarding the data presented in Table 1, a direct comparison of different time periods with varying data point sizes (24, 1,177, 3,495, and 7,000) presents a unique challenge. The stark contrast in data-point volumes across these periods necessitates a nuanced approach to analyzing and interpreting the evolution of topics. This is particularly evident when juxtaposing the initial period (1983–1992) with subsequent periods, as the expansion in data points reflects not only the growth of the field, but also the broadening scope of the topics explored.

1.4. Increasing the Amount of Data over Time

One of the pivotal observations of this study was the rapid proliferation of academic papers over time, as depicted in Fig. 1. This surge in data led to the decision to extract varying numbers of topics scaled following the growth in the number of documents: 10–20–20–30 topics across delineated time intervals. This approach ensures that the primary topics of each period do not merely represent the themes emerging during that epoch, but more crucially, reflect the relative frequency of their coverage in academic discussions. By adopting this strategy, the study transcends the mere chronological mapping of topic evolution and successfully captures fluctuating academic interests across different timeframes.

1.5. Results and Interpretation of Topic Evolution over Time

Diving into topic modeling outcomes for each period yields the following insights (Table 2):

Time period 1 (1983-1992): During this nascent phase of technological advancement, the primary emphasis was on "Information Technology Management and Problem-solving." This highlights the initial stages of computer technology and the emergence of the Internet, in which research has been chiefly centered on optimizing IT resource management and devising innovative problem-solving methodologies using these technological instruments.

Time period 2 (1983-2000): This interval heralded a more diverse scholarly landscape, encompassing subjects such as "Research Methodology and Performance Measurement Analysis," "Technological Development and Organizational Information Systems," and "Technology Innovation and Industry Adoption

Dynamics." This period reflects academia's proactive response to swift technological advancements, emphasizing the intersection of technological development and organizational management methodologies.

Time period 3 (1983-2010): During this period, salient themes emerged, such as technological innovation, industrial policy and research models, and information system management. Simultaneously, the emergence of themes such as "Team Management and Project Development Performance" and "Organizational Change and Social Theory in Technology" emphasize the growing confluence of organizational behavior and technological breakthroughs. Such themes underscore the increasing significance of technological policies, management of information systems, and the nuanced dance between organizational metamorphoses and technological progress.

Time period 4 (1983-2022): The most recent scholarly trends gravitate towards Firm Performance and Investment Value," "Technology Policy and Innovative Science," and "Research Models and Technology Development." Concurrently, subjects such as "Product Pricing and Market Dynamics in Technology" and "Organizational Learning and Knowledge Management" have garnered significant academic attention. This indicates a sophisticated evolution in research priorities from preliminary technological management considerations to a holistic evaluation of organizational performance in the face of technological advancements and their strategic implications.

Table 2. Keywords and Labelled Topic Name from Team Period 1 To 4

Time period	Topic number and labelled topic name
Time period 1 (1983-1992)	Topic #0: Group Behavior Analysis & Organizational Functionality Topic #1: Software Development & Quality Assurance in Business Topic #2: Planning & Environmental Impact on Product Design Topic #3: Cellular Layout & Operational Performance Topic #4: Application Development & Project Management Topic #5: System Adoption & Research in Implementation Strategy Topic #6: Organizational Theory & Technology Diffusion Roles Topic #7: Information Technology Management & Problem Solving Topic #8: Professional Threats & Opportunity Identification Topic #9: Group Decision Support & Time-Based Experience Comparison
Time period 2 (1983-2000)	Topic #0: Technology Innovation & Industry Adoption Dynamics Topic #1: Research Methodology & Performance Measurement Analysis Topic #2: Product Development & Strategic Manufacturing Topic #3: Competitive Market Strategy & Venture Success Topic #4: Small Firm Growth & Entrepreneurial Strategies Topic #5: Group Dynamics & Decision Support in Teams Topic #6: Communication Theory & Social Media Utilization Topic #7: Venture Investment & Value in Capital Funding Topic #8: Performance Improvement & Time Efficiency Topic #9: Network Alliances & Collaborative Partnerships Topic #10: Corporate Internationalization & Global Activity Topic #11: Science Policy & Industrial Technology Research Topic #12: Technological Development & Organizational Information Systems Topic #13: Project Management & Problem Solving Models Topic #14: Investment Value & Market-Based Customer Services Topic #15: Knowledge Transfer & Organizational Learning Capability

Time period 2 (1983-2000)	Topic #16: Business Management & Executive Strategic Planning Topic #17: Organizational Design & Structural Theory Topic #18: Patent Evaluation & University Technology Applications Topic #19: Information Systems & Decision Support Technologies
Time period 3 (1983-2010)	Topic #0: Ethics in Business Technology & Professional Responsibility Topic #1: Firm Performance & Entrepreneurial Venture Strategies Topic #2: Contract Management & Outsourcing Risks in Investments Topic #3: Team Management & Project Development Performance Topic #4: Professional Training & Employee Skill Development Topic #5: Service Quality & Employee-Customer Satisfaction Topic #6: Technology Innovation & Industrial Policy Topic #7: Firm Competitive Advantage & Resource Integration Topic #8: Company Strategy & Technology Management Topic #9: Product Marketing & Consumer-Centric Pricing Topic #10: Patent Research & University Intellectual Property Topic #11: User Behavior & Technology Adoption Influences Topic #12: Information Network Systems & Privacy in Technology Adoption Topic #13: Knowledge Transfer & Organizational Learning in Innovation Topic #14: Organizational Change & Social Theory in Technology Topic #15: Investment Value & Performance Measurement in Technology Topic #16: Group Dynamics & Communication in Decision Support Topic #17: Research Models & Information System Management Topic #18: Internationalization & Foreign Investment in Technology Firms Topic #19: Firm Alliances & Industrial Network Strategies
Time period 4 (1983-2020)	Topic #0: Consumer Online Behavior & Service Experience Topic #1: Product Pricing & Market Dynamics in Technology Topic #2: Employee & Human Capital Development Topic #3: Supplier Management & Outsourcing Relationships Topic #4: Competitive Advantage & Sustainable Business Strategy Topic #5: Digital Platforms & Internet Service Development Topic #6: Decision-Making & Information Control Systems Topic #7: Software Efficiency & Cloud Computing Optimization Topic #8: Academic Research & University-Industry Collaboration Topic #9: Project Management & Software Implementation Quality Topic #10: Strategic Alliances & Partnership Management Topic #11: Patent Analysis & Intellectual Property Licensing Topic #12: Firm Performance & Investment Value Topic #13: Technology Policy & Innovative Science Topic #14: Research Models & Technology Development Topic #15: Technology Adoption & Industrial Market Dynamics Topic #16: Group Communication & Electronic Support Systems Topic #17: Employee Training & Professional Ethics in the Workplace Topic #18: Entrepreneurial Ventures & Start-up Investments Topic #19: Social Network Analysis & Peer Influence Topic #20: Institutional & Ethical Practices in Organizational Change Topic #21: Team Performance & Virtual Work Relationships Topic #22: User Behavior & Trust in Information Systems Topic #23: Internationalization & Global Firm Knowledge Topic #24: Organizational Learning & Knowledge Management Topic #25: Healthcare Systems & Patient Data Management Topic #26: Firm Innovation Performance & Resource Management Topic #27: Fraud Detection & Risk Management in Auctions Topic #28: Cybersecurity & AI-Driven Risk Management Topic #29: Company Strategy & Business Technology Adaptation

In summary, topic modeling elucidates the discernible evolution in research emphasis across various epochs. From foundational themes centered on IT management at the dawn of the technological age to the intricate considerations of technological policies, organizational performance metrics, and investment implications in contemporary times, this evolution underscores academia's dynamic response to the symbiotic relationship between technology and management. Such shifts reiterate the critical role of advanced analytical methods, such as topic modeling, in shaping the trajectory of scholarly endeavors, ensuring that they remain agile and pertinent in a perpetually evolving technological and managerial milieu.

Academic research's beauty lies in its ability to trace the ebb and flow of intellectual curiosity over time. Examining the evolution of specific topics in our study makes it evident that the scholarly focus has shifted and transformed, echoing larger societal and technological changes. As an illustration, "Topic 7" from Fig. 2 (1983 to 1992) was dominantly classified as "Information Technology Management and Problem Solving", emblematic of a nascent period when information technology and problem-solving management were of prime interest. However, this topic morphed into broader and more sophisticated arenas as decades passed. By 2000, it transmuted to "Topic 12", emphasizing "Technological Development and Organizational Information Systems", and by 2010, it had evolved yet again to "Topic 3", shedding light on "Team Management and Project Development Performance". This dynamic shift from a focus on technology management to the nuanced aspects of team dynamics and project success within organizations signals a maturation in academic pursuits, culminating in 2022 with "Topic 6", "Decision-Making and Information Control Systems".

Such mutable narratives of a single topic encapsulate how academic interests are not static but reflective of broader societal, technological, and organizational shifts. This is further illustrated by the Sankey Diagram (a powerful visualization tool widely used across sectors such as marketing and energy analysis), as shown in Fig. 2. While the volume of data for the period up to 1992 was deemed insufficient for comparison, the visualization from 1983 to 2000 elucidates the flux in popular topics over time, offering a holistic overview of interconnected academic trajectories.

Fig. 2 provides a panoramic view of the flow of popular topics through 2000, 2010, and 2022. It meticulously traces the progression from micro-level insights such as "Product Development and Strategic Manufacturing" to macroscopic evaluations focusing on "Investment Value and Performance Measurement in Technology" and, eventually, "Firm Performance and Investment Value." This trajectory mirrors a broader shift in research emphasis from an initial focus on tangible product development and operational efficiency to a broader, long-term perspective on organizations' overall value and performance in the technological landscape.

Moreover, the transformation from "Technological Development and Organizational Information Systems" to themes like "Organizational Change and Social Theory in Technology" and "Organizational Learning and Knowledge Management" underscores a nuanced evolution. Organizations have transcended merely altering their internal processes and information systems to strategically position themselves within larger societal narratives. The elevated emphasis on continuous learning and knowledge management foregrounds the importance of technological advancements and accentuates the intricate interplay between intra-organizational dynamics and external technological changes. This intricate interplay highlights the importance of management research for technology-related studies. Understanding its ramifications for organizational structures, processes, and strategies becomes paramount as technology continues its inexorable march forward. Thus, management research bridges technological advancements with organizational realities, ensuring that innovations are harnessed effectively, ethically, and strategically.

In the nexus between interpretation and introduction of new technologies, the increasing

centrality of technology's role in shaping workplace dynamics becomes evident. The interpretive journey from initial technological product development to its current profound influence on organizational value and performance emphasizes the intrinsic relationship between technological advancement and management. Organizations have evolved from viewing technology as a tool for operational optimization to recognizing its fundamental role in shaping organizational structures, processes, and long-term strategies. Such an evolution parallels scholarly recognition that the successful adoption of new technologies hinges significantly on employees' willingness and capability to integrate these technologies into their work roles and practices (Blanka et al., 2022; Eller et al., 2020). The introduction and adaptation of new technologies in the workplace are not solely a function of the technologies but are interwoven with the broader organizational fabric. As technology becomes an institutional infrastructure component, its effects resonate beyond mere operational facets, shaping the sociotechnical contexts in which employees operate (Barley & Kunda, 2001; Orlikowski & Barley, 2001). This evolving symbiotic relationship underscores the imperative for management scholars to delve deeper into the nuanced interplay between technology and its human and organizational implications. Ensuring that the benefits of technology are harnessed while mitigating potential disruptions requires a holistic understanding of both technological tools and the organizational and individual contexts in which they are situated.

Fig. 1. Social Conditions of an Innovative Firm

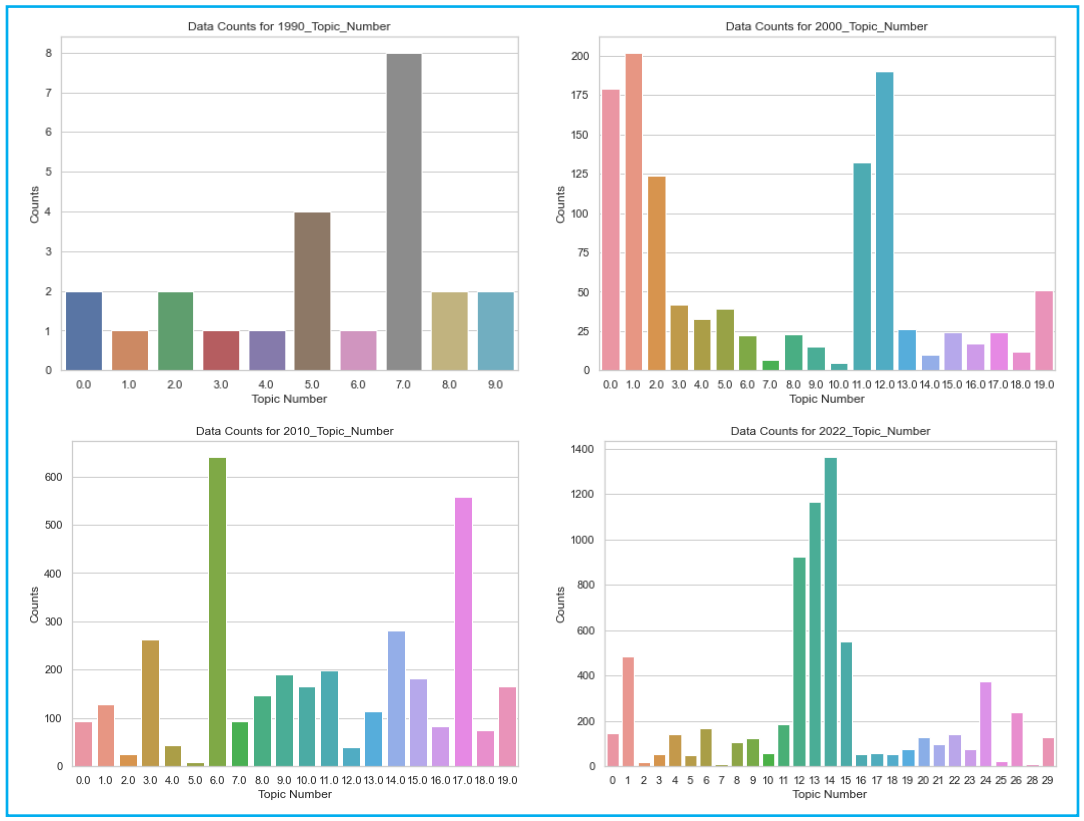
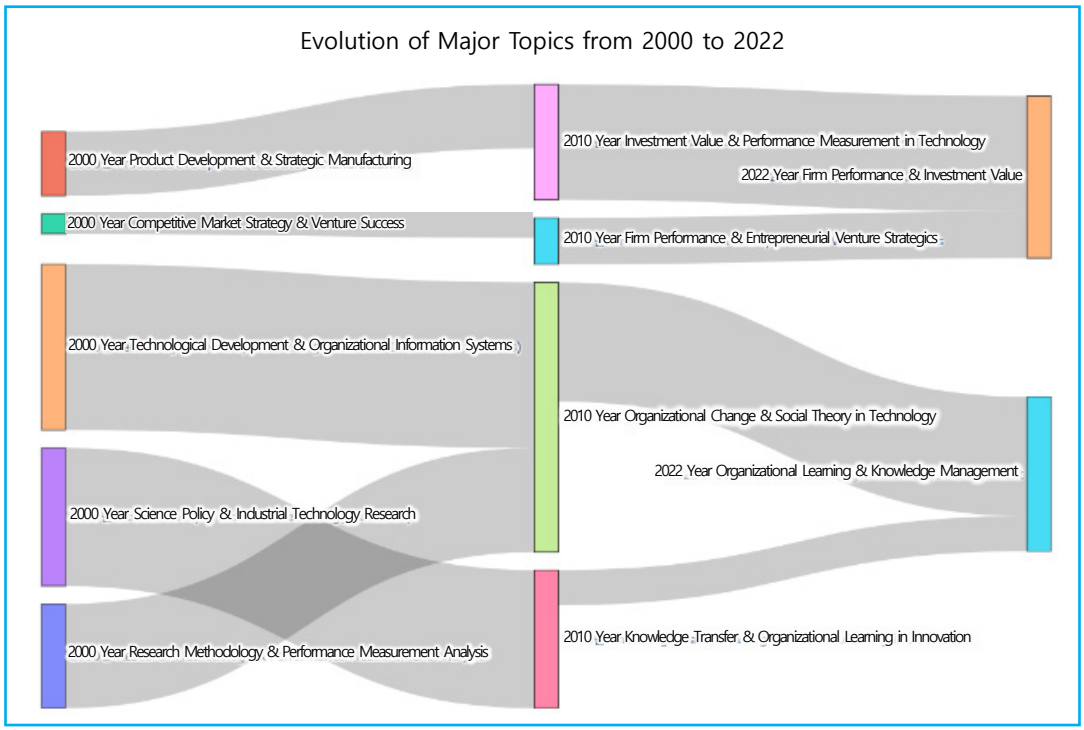


Fig. 2. Evolution of Important Topics over Time



III. Evolution of Management and Technology-Related Studies

The transformation of scholarly focus from early IT management to the broad implications of technology in organizational contexts, as delineated in our topic analysis, sets the stage for a deeper dive into the evolution of management- and technology-related studies. This progression underscores the necessity of examining the role of technology within organizational structures and employee dynamics, a focus explored in detail in the following section. As we transition to discussing the evolution of management- and technology-related studies, it becomes imperative to understand how these shifts in academic focus, from the tactical use of technology to its strategic implications, have influenced the development of organizational theory and practice. The forthcoming section further elaborates on this by providing empirical insights and theoretical frameworks that reflect the intricate relationship between technology, organizational structures, and employee behaviors.

1. Foundations of Technology on Work

The adaptation of technology can cause a change in the patterns of social organization and organizational structure by considering the context of technological usage (Barley, 1986,1990; Rousseau, 1979), and technology is part of the institutional infrastructure in the organization (Orlikowski & Barley, 2001). Rousseau (1977) emphasized context and organization as interconnected components, including a social structure to relate employees to technology and technology to transform raw materials into output. Therefore, incorporating information technology into the organizational context is necessary to

understand employees and corporations (Barley & Kunda, 2001).

New information technology has represented an opportunity for competitiveness and innovation and a new organizational attitude and behavior perspective, leading to positive and negative consequences (Zuboff, 1989). For example, Brynjolfsson (1993) explains the productivity paradox of technology adaptation and finds no strong relationship between information technology and performance. Additionally, a meta-analysis of the adaptation of telecommuting technology found no detrimental effects on workplace-related outcomes (Gajendran & Harrison, 2007). Likewise, we have seen mixed results of technology on organizations and employees and have understood the role of context in adopting technology in the organization. Therefore, it is critical to consider the impact of technology in the socio-techno context (Barley, 1986, 1990).

To understand how organizational attitudes and behaviors are affected by context, we must assume that employees are the agencies affected by the structure (i.e., rules and resources) and can affect the structure simultaneously (Whittington, 2015). Based on the theory of structuration (Giddens, 1992), the duality of the technology concept was developed to explain technology as enacted by human agency and institutionalized in structure (Yates & Orlikowski, 1992). In this context, changes related to technology adaptation can be explained either by the technology applied by the employee (Grint & Woolgar, 2013) or by the context in which employees are involved (Barley & Kunda, 2001). The study of change has received considerable attention from practitioners and scholars because employees and organizations struggle to adapt to changing environments. Cognitive and affective aspects are antecedents that explain how individuals and organizations are ready for change (Rafferty et al., 2013). Furthermore, when employees experience organizational changes, including technological advances and strategic transformation, these changes impact their affective and cognitive attitudes (Fedor et al., 2006).

2. New Technologies in the Workplace

Organizational scholars have long recognized the importance of technology adoption in organizations (e.g., Aldrich, 1972; Blau et al., 1976; Rousseau, 1977; Thompson & Bates, 1957). They proposed that adopting new technologies could affect organizational structure, decision-making processes, performance, and survival (Giddens, 1984; Rousseau, 1977; Sutton & Rousseau, 1979).

One consistently recognized notion in this tradition is that employees play a crucial role in adopting and utilizing new technologies (Blanka et al., 2022; Eller et al., 2020; Verhoef et al., 2021). Even when a technology is formally adopted by top management, were it not for the employees' willingness and capability to learn and leverage the focal technology at work, the focal technology may not practically contribute to organizational effectiveness (Xiong, 2022).

3. Systematic Literature Review

To identify the effects of new and advanced technology usage, we conducted empirical studies that focused on the relationship between new and advanced technology usage and employee and organizational outcomes. Based on a systematic search of published research published in 21 journals and leading research journals in *Financial Times* 50 out of 7,000 articles, we identified 1,046 empirical studies. We reviewed them to examine the relationship between technology usage and employee outcomes. We excluded unpublished studies (e.g., working papers and dissertations) and studies published in non-English languages. We selected and reviewed the 18 most relevant articles, generating interesting findings for the targeted relationships. The studies included in this review are summarized in Table 3.

First, when Orlikowski and Scott (2008) analyzed 2027 articles from leading journals, only 100 were directly related to the role and influence of technology in organizations. Likewise, our analysis found that 1,046 (2.3%) are directly associated with the role and influence of technology out of 7,000

articles. Second, as shown in Table 3, there are mixed results regarding the use of technology on employee outcomes, including attitudes, emotions, productivity, and performance. However, there is a negative impact on individual-level variables, including turnover intention, anxiety, and health.

The table provides an insightful exploration of the empirical relationship between implementing new and advanced technological tools and their associated outcomes, particularly regarding their impact on employees. In particular, the earliest study by Long (1993) delved into the effects of introducing new information technology on job quality, noting a significant gendered disparity in its impact. This lays the groundwork for understanding how technology can affect diverse employee groups. Fast forward to More recent studies, such as Pirkkalainen et al. (2019a), Benlian (2020), and Becker et al. (2021), reveal a recurrent theme of "technostress." These studies collectively underscore the emerging challenges that modern employees face owing to the ubiquity of technology, emphasizing the need for proactive and reactive coping mechanisms to mitigate the adverse effects of technology-induced stress. These findings serve as poignant reminders of the dual-edged nature of technological integration in the workplace.

Studies such as those by Chapman et al. (2005) and Golden and Fromen (2011) highlight the shifting paradigms in job interviews and managerial dynamics in a digital era. They emphasized the perceptual and experiential differences between technology-mediated interactions and traditional face-to-face encounters. Furthermore, Morris and Venkatesh (2010), Bala and Venkatesh (2016), and Tong et al., (2021) focused on the strategic adoption of technology in organizations, with a keen focus on its effects on job satisfaction, operational efficiency, and performance feedback. These studies emphasize the value of understanding the broader organizational implications of technological implementation, specifically, the need for organizations to remain adaptive and cognizant of the evolving technological landscape.

Lastly, Boswell and Olson-Buchanan (2007), Derks et al. (2016), and Zoonen et al. (2021) delve into the realm of telecommunication, emphasizing its role in shaping work-life dynamics. These studies underscore the increasing convergence of professional and personal domains brought about by the proliferation of digital communication tools. The implications for work-life balance, role conflict, and the boundaries between professional and personal spheres are salient in these discussions.

4. Future Research Direction

As we stand on the ice of a new era of organizational dynamics and technological integration (Ling, 2023; Gao & Jin, 2023), it is imperative to anticipate and understand the evolving landscape of the workplace. The rapid proliferation of advanced digital technologies, coupled with changing societal norms and expectations, challenges traditional paradigms and necessitates the reevaluation of established constructs. The intersections of humans and machines, the meaning and essence of work, and the spatiotemporal dimensions of the workplace have undergone a profound transformation. In this context, we recommend that scholars and practitioners explore three avenues that provide promising directions for future research.

First, the meaning of work in the age of AI and generative technologies must be further investigated. The digitization of the workplace, as reflected in the studies in Table 3, underscores the evolving dynamics between technology and the workforce. A logical progression of this trend would necessitate researchers to delve deeper into the qualitative facets of employment in the digital age, particularly the "meaning of work." As AI, robots, and generative technologies have become more pervasive, there has been a transformative shift in job roles and responsibilities. While technology might automate repetitive tasks, it simultaneously places a premium on uniquely human attributes such as creativity, empathy, and complex problem-solving. Future research could explore how employees derive personal values, meaning, and growth opportunities in professions that are increasingly intertwined with

Table 3. A Summation of the Empirical Evidences for the Relationship between New and Advanced Technology Usage and Outcomes

Study	Outlet	Method	Independent variables	Dependent Variables	Contingency	Findings
Long (1993)	HR	Quantitative + Interview	Use of new information technology	-Job quality of white-collar workers (+) -Females larger impact than male	-Gender (female and male) -Occupational group (Secretarial, technical, and managerial employees) -Industrial sector (Primary, manufacturing, and services)	Comparison between female and male as well as among types of workers (cross-sectional data)
Chapman et al. (2005)	JAP	Quantitative (Signal theory)	Videoconferencing interview	-Perception of fairness (-) -Higher job acceptance intentions (-)	-Number of offers an applicant received	Technology-mediated interview has less favorable reaction than face-to-face one to applicants (data collected in a field sample)
Gajendran & Harison (2007)	JAP	Meta-analysis	Telecommuting using electronic media	-Perceived autonomy (+) -Job satisfaction (+) -Job Performance (+) -Role stress (-) -Work-family conflict (-)	-telecommuting intensity	Reviewing 46 studies with 12,883 employees resulting in positive view of telecommuting (Causal relationship tentative)
Boswell & Olson-Buchanan (2007)	JOM	Quantitative	Using telecommunication technology after working hours	-Work-to-life conflict (+) -Ambition (+) -Job involvement (+)		There are positive and negative outcomes using telecommunicating technology (effects across an organization rather than a specific job group and cross-sectional data).
Morris & Venkatesh (2010)	MISQ	Quantitative (Job characteristics model)	Job characteristics (Task significance, identity, skill variety, autonomy, feedback)	-Job satisfaction	-Buffering impact of use of enterprise resource planning (ERP) systems on skill variety, autonomy, and feedback on job satisfaction	Adding of new knowledge to existing findings through use of ERP systems and proving implementation of ERP (sample from single organization)

Golden & Fromen (2011)	HR	Quantitative (Social exchange theory)	Telework Virtual work	-Work experience (feedback, empowerment, development, workload) (less positive than traditional work) -Subordinate's job satisfaction (-) -Higher turnover intentions (+)	-Subordinate work modes (traditional and virtual)	Suggesting the importance of manager's work mode (Cross-sectional and self-report data)
Ayyagari et al. (2011)	MISQ	Quantitative (Person-environment fit)	-Perception of technology presenteeism (PTP) -Perception of Technology anonymity (PTA)	-Work-home conflict (+) -Invasion of privacy (+) -Work overload (+) -Role ambiguity (+)	-Stressors(work-home conflict, invasion of privacy, work overload, role ambiguity) as a predictor of strain	Extension of past stress research: predictors of strain due to ICTs and determinants of technostress
Butt et al. (2015)	AMJ	Quantitative (Affective events theory)	-Electronic communication (negative) affective tone (ECAT) -Time required for electronic communication (TREC)	-Anger (+ with ECAT) -Happiness (- with ECAT) -With-in person anger (+ with TREC) -Work-to-nonwork conflict (+ TREC)	-Abusive supervision -Communication sender -Segmentation preference	Finding the mechanism between affective process to work-to-nonwork conflict (Sampling method and measurement of within-person item)
Derks et al. (2016)	HR	Quantitative (Boundary theory)	Smartphone use after hours	-Work-family conflict (-) -Family role performance (+)	-General segmentation preference (integrators or segmenters)	Different results of smartphone use on work-family-conflict (Self-report measures)
Venkatesh et al. (2016)	ISR	Quantitative + Interview	Implementation of information and communication technologies (ICT)	-Operational efficiency (-) -Job satisfaction (-) -Customer satisfaction (-)	-Pre and post implementation	Conducting multimethod longitudinal study and finding traditional barriers to ICT implementation (Single sample in an India)
Bala & Venkatesh. (2016)	MS	Quantitative (Coordination theory)	Collaboration technology use	-IT-enabled collaboration capability (+) -Collaboration satisfaction (+)	-Process orientations (exploration, exploitation, ambidexterity)	Process orientation (ambidexterity) strengthens the relation between collaboration tech. use and IT-enabled collaboration capability and satisfaction (cross-sectional data and operationalization of moderator through functional affiliations).

Pirkkalainen et al. (2019a)	JMIS	Quantitative (Technostress)	Technostress creators	-IT-enabled productivity (-)	-Proactive coping (Positive reinterpretation and IT control) -Reactive coping (Distress venting and distancing from IT)	Theorizing and validating proactive and reactive coping behavior related to technostress (Self-report data and specific coping behavior)
Benlian (2020)	MISQ	Quantitative (Technostress)	Technology challenge stressor (TCS) Technology hinder stressor (THS)	-Partnership satisfaction (+ with TCS) -Partnership satisfaction (- with THS)	-Work-home role integration -Perceived organizational support in work-home boundary management	Conceptualization of work stressor framework and emphasizing daily technology-drive work stressors (potential reverse causality and timing of data collection)
Becker et al. (2021)	JOM	Quantitative (Resource based view)	Electronic communication	-Level of anxiety (-) -Health (-) -Relationship quality (-)	-E-mail triggered anxiety	Extension of job-related stressors and suggestion of role of e-anxiety (Crossover effects of study 2)
Wu & Kane (2021)	OS	Quantitative	Adopting an expertise search tool	-Employee work performance in billable revenue (+)	-New connections -Information diversity	Finding the mediating effect of network connections and information diversity and larger impact from two type of employees
Tong et al. (2021)	SMJ	Quantitative	Performance feedback using artificial intelligence (AI)	-Deployment effect: job performance (+) -Disclosure effect: job performance (-)	-Negatively moderating the impact with longer tenure	Positive and negative impact from AI feedback coexist and suggesting contingency matters
Zoonen et al. (2021)	JOB	Quantitative (Technology-assisted supplemental work (TASW))	Collaboration technology use	-TASW (+)	-Positively moderating effect of team-level response expectations -Positively moderating effect of persistence of communication	Identifying mechanism drivers of process that contribute to increase in workday span and acknowledge what constitutes afterhours work remains relevant (Cross-sectional data)

Note: AMJ: Academy of Management Journal, HR: Human Relations, JAP: Journal of Applied Psychology, JMIS: Journal of Management Information Systems, JOM: Journal of Management, MISQ: MIS Quarterly, OS: Organization Science, SMJ: Strategic Management Journal, ISR: Information Systems Research.

AI and generative technologies. Building on the foundational studies of Chapman et al. (2005) on perceptual differences in technology-mediated interactions, understanding the psychological and emotional dimensions of work in such an environment is paramount.

Second, owing to technological advances, the concept of the workforce has expanded to include robots and AI. Studies, particularly those by Morris and Venkatesh (2010) and Tong et al. (2021) highlighted the strategic adoption of technology and its implications for job satisfaction and performance. Building on these insights, future research can explore the collaborative dynamics between human workers and their AI and robotic counterparts. As the distinction between human and "human jobs" and "machine jobs" blurs, understanding the synergies, conflicts, and productivity enhancements that arise from such collaborations becomes essential. How does the presence of AI in decision-making influence job satisfaction? How do employees perceive value and meaning when working with robotic counterparts? These questions, which are rooted in technology and human resource management, are pivotal for future research.

Third, future studies should reconceptualize the workplace in terms of time and space. The emergence of telecommunications and digital technologies, as highlighted by Boswell and Olson-Buchanan (2007) and Derks et al. (2016), has paved the way for a reimagined concept of the "workplace." Future research should focus on understanding the implications of unconventional work policies, such as the 4-days-a-week model, on employee productivity, well-being, and work-life balance. Additionally, as mixed reality (MR) and virtual reality (VR) technologies mature, the potential of mixed-reality workplaces has become an exciting avenue for exploration. What are the dynamics of team collaboration in a VR office setting? How do the MR environments influence job roles, training, and onboarding processes? Although futuristic, these research directions are rapidly becoming pertinent to the evolution of the digital workplace.

IV. Conclisions

1. Academic Contributions

This study contributes to existing literature in several ways. First, it offers an evolutionary perspective on scholarship on technology, illuminating how academic inquiry has transformed in alignment with broader societal, technological, and organizational shifts over time. Drawing from Yoo et al. (2010) and Yoo et al. (2012), we exemplify the nuanced transition from the infancy of technological studies, primarily focused on IT management, to contemporary complexities entailing interwoven technological and managerial considerations. By adopting a text-mining approach, we provide a methodological bridge to understanding such evolutionary trajectories, highlighting the dynamism inherent in academic pursuits vis-à-vis technology.

Second, this systematic review underscores the nuanced, multidimensional relationship between technological advancements and their implications for employees and organizations. Early studies such as Long (1993) emphasized the gendered impact of technology on job quality, suggesting the need for future research that considers intersectionality when assessing the impact of technological tools. As the role of technology in organizations has become more pervasive, themes such as technostress have emerged, as evidenced in more recent works, such as Pirkkalainen et al. (2019b) and Benlian (2020), indicating a growing area of concern for organizational scholars. This evolution points to a theoretical trajectory wherein initial explorations of technology integration into the workplace have given way to more complex psychological, emotional, and behavioral considerations. Moreover, the shift from focusing purely on technological tools to understanding the broader implications of technological ecosystems suggests a maturing discourse urging scholars to adopt a more holistic, system-oriented perspective on the role of technology in organizational settings.

Third, we emphasize the profound shifts

awaiting future work, particularly in understanding the essence of work in the age of ubiquitous digital technologies. Building on foundational works such as Chapman et al. (2005), our study highlights the imminent need to explore the qualitative facets of employment. With the growth of AI, robots, and generative technologies, scholars are increasingly interested in exploring qualitative shifts in how individuals perceive their roles, derive meaning, and navigate professional trajectories in environments intertwined with advanced technologies.

2. Practical Contributions

As organizations continue their inexorable march toward digital transformation, leaders and managers must recognize the profound implications of technology for the workforce (Lee et al., 2021). Our findings emphasize that technology integration has diverse impacts, ranging from enhancing operational efficiencies to nuanced challenges such as technostress. Thus, organizations must strategically align their technological adoption with human-centric considerations to ensure that the tools and platforms they deploy enhance productivity and promote employee well-being and satisfaction.

Given a rapidly changing technological landscape, continuous learning and adaptation are vital. Our study underscores the need for organizations to invest in training programs that cater to the evolving demands of the digital age. This is particularly relevant when AI, robotics, and generative technologies are present in a workspace. A well-structured training regimen can help employees navigate these technologies confidently, minimize anxiety, and maximize productivity.

As highlighted in our findings, the emergent challenges of technostress bring the importance of employee mental health and well-being. Organizations must recognize these challenges and proactively introduce measures to combat them. This could range from fostering a culture that promotes regular digital detoxes to introducing counseling and support services that help employees navigate the complexities of a digital-first work environment.

Finally, as AI and robotic entities become integral parts of organizational teams, managers must foster an environment that promotes seamless collaboration between human employees and their digital counterparts. Clear communication, role delineation, and regular feedback loops can optimize the synergy between humans and machines, paving the way for enhanced productivity and innovation.

3. Limitations

Although this study makes theoretical and practical contributions, it has some limitations. First, although our research concentrated on the evolution and movement of various topics, it is plausible that more intricate shifts and changes went unnoticed. Moreover, with the escalation in data quantity, it became evident that topics were not merely evolving or transitioning, but entirely new subjects emerged at a higher rate. This potentially indicates a limitation in our study, as the content we could conclusively categorize as "evolved" might be relatively less than the actual data volume. To alleviate this problem, distributing the data uniformly or in approximate values across each segment would yield a clearer depiction of the evolutionary process.

Second, dividing our research span from 1983 to 2022 into four distinct intervals, we revealed disparities in data quantities across these segments, thereby altering the appropriate number of topics per period. Extracting an equivalent number of topics from each era becomes challenging when the number of documents significantly surges during specific times, necessitating a larger number of topics in those periods. Too much data combined with topics can increase the perplexity, complicating the topic evolution analysis. Conversely, limited data with fewer topics may be inadequate for evolutionary scrutiny. Therefore, assigning consistent topics to each segment, combined with the corresponding parameters and hyperparameters, is crucial.

While our systematic review provides a comprehensive overview of the relationship between advanced technology usage and employee and organizational outcomes, it is bound by certain constraints inherent to its methodology. A significant limitation is the exclusive focus on articles published in English, which could potentially overlook important insights or perspectives presented in non-English journals and publications. This language bias may limit the global applicability and comprehensiveness of our findings. Furthermore, by confining our study to only 21 journals from the *Financial Times* 50 and excluding unpublished works, there may be pertinent studies, gray literature, or emerging research themes not captured in our review. Consequently, while thorough within the chosen parameters, our insights may not represent the entirety of the discourse surrounding the impact of new and advanced technologies on employees and organizations.

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Analysis of Competitiveness in the Domestic Semiconductor Cluster Using Entropy Technique: Based on the GEM-ESG Model*

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ABSTRACT

Purpose – The study aims to conduct an empirical analysis of semiconductor cluster integrated competitiveness with a focus on the GEM-ESG model. Specifically, the study seeks to compare and analyze the development factors of semiconductor clusters in different regions. The results of the empirical study will reveal a clear concentration phenomenon in the semiconductor industry clusters of some regions.

Design/Methodology/Approach – Previous research has established the factors influencing the competitive advantage of industrial clusters. The study collected competitive indicators from major South Korean cities and regions, incorporating these into the GEM model, and exploring ESG indicators relevant to the semiconductor industry. The study utilized Entropy Technique analysis to empirically assess the competitiveness of the South Korean semiconductor cluster and conduct comparative testing of the research findings.

Findings – The results revealed a concentration phenomenon in the semiconductor industry clusters of Yongin and Chungbuk Province. Additionally, the study highlighted the importance of factors such as "groundings (G)", "enterprise management (E)", "market conditions (M)", and ESG practices in determining competitiveness.

Research Implications – Through empirical analyses, the study emphasizes the significance of GEM and ESG factors in the analysis of industrial clusters, particularly in contributing to long-term sustainability and competitive advantage focusing on the collaboration and alignment of ESG values.

Keywords: cluster, competitiveness, entropy technique, ESG management, GEM-ESG, semiconductor
JEL Classifications: L16, M21, O12

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I. Introduction

Global competition following the COVID-19 pandemic is influenced by various factors such as digitalization, localization, ESG management, supply chain stability, and technological innovation (Bauer et al., 2020; Lee et al., 2021; Lee et al., 2023). Events like COVID-19 and the US-China trade war have disrupted supply chains, particularly in the global semiconductor sector (Stephens, 2022).

In response, governments and companies are implementing strategies such as new cluster collaboration systems (Lee & Lee, 2016; Chen, 2023) to improve supply chain stability. For example, the US has allocated $25 billion through the "Endless Frontier Act" to support the semiconductor industry, demonstrating the government's commitment to cluster development. This investment is crucial for sustainable development and global competitiveness. In Austin, Texas, "SEMATECH" is promoting semiconductor development through collaboration, highlighting clusters as innovation hubs. Japan and Germany are also investing in semiconductor clusters to address supply chain crises, with Japan designating the semiconductor industry a key sector, and providing substantial support.

Korea is addressing global supply chain stability through measures such as regional production dispersion, supplier diversification, and quality management (J. Lee, 2022). In the semiconductor industry, which is vital to Korea's economy, leading companies are strategically incorporating ESG considerations (H. G. Lee, 2022; Kim, 2022), focusing on waste disposal, energy efficiency, and greenhouse gas emissions mitigation. Socially, they prioritize job creation, community collaboration, and sustainable growth. Corporate Social Responsibility (CSR) covers industrial accidents, human resources, labor relations, and supply chain management. Transparent practices within clusters are essential for growth, and compliance with ESG indicators enhances company sustainability and social trust (Hoang et al., 2020; Porter & Kramer, 2014; Sung, 2014). Korea's strategic initiatives emphasize adaptability, collaboration, and a comprehensive ESG framework for resilient economic development.

While recognizing the significance of semiconductor cluster development and the increasing focus on ESG factors, there is a need for empirical research to investigate the impact on competitiveness, innovation, and sustainability, including operational mechanisms.

This research aims to establish a framework for the sustainable advancement of semiconductor clusters integrating ESG management, drawing from recent environmental changes and established theories. Investigating industrial cluster concentration enhances competitiveness, with positive effects on regional economic growth and national competitiveness. The amalgamation of ESG management with innovative technologies requires reconfiguring "business models and cluster models" for the sustainable progression of semiconductor clusters, fostering innovation and fortifying sustainable competitiveness.

II. Literature Review

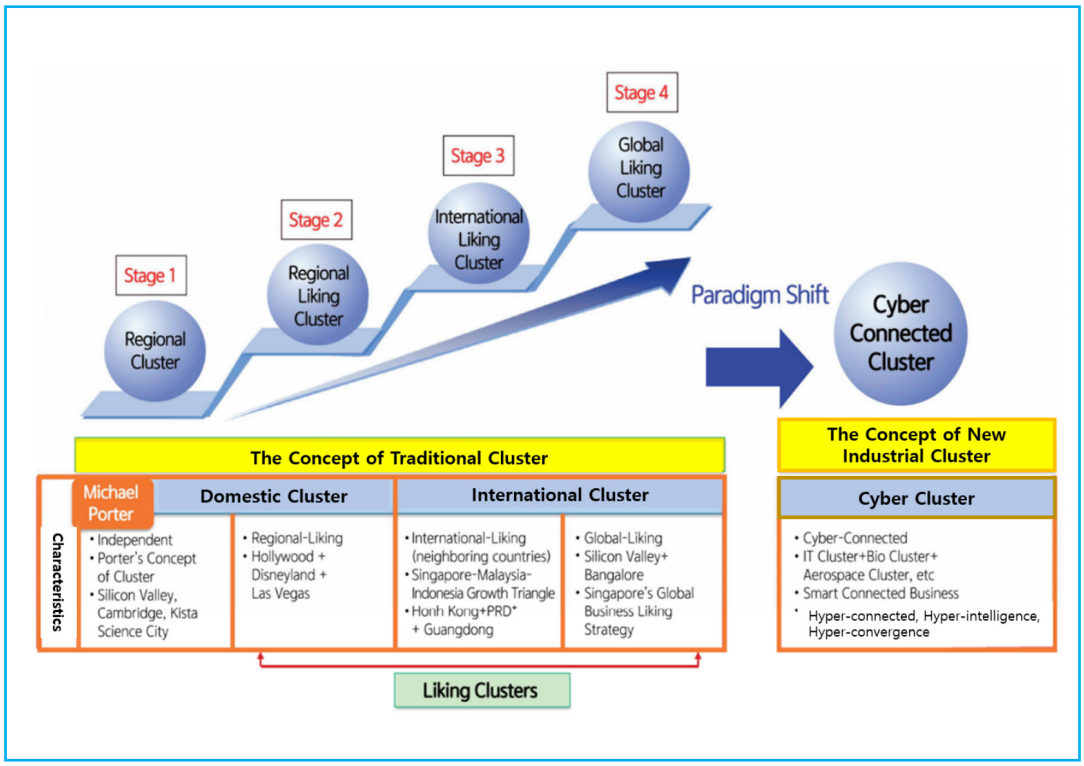
1. Cluster Theory and Research Trends in Domestic Semiconductor Industry Clusters

The theory of industrial clusters, initially proposed by Marshall (1980), and further elaborated upon by Porter (1990, 1998), elucidates economic cooperation among geographically proximate firms to enhance competitiveness and foster growth.

It advocates vertical collaboration for efficient production, and horizontal collaboration for market exploration, playing a crucial role in economic advancement and innovation.

Expanding on this concept, our research focuses on the development of clusters, specifically examining "internationally linked clusters", as discussed by Moon and Jung in 2008. These clusters transcend national boundaries, contributing to sustained competitive advantage.

Fig. 1. Evolution of Clusters.



Note: *PRD: Pearl River Delta.
Sources: Jung (2023), Jung and Lee (2018) and Moon and Jung (2008).

With the advent of Fourth Industrial Revolution technologies, clusters have evolved into cyber-connected entities that transcend the traditional constraints of time and space (see Fig. 1).

A review of literature on the sustainable development of clusters indicates a consensus regarding the need for continual changes and advancements to improve competitiveness. Scholars have investigated transition strategies for clusters, with a focus on implementing sustainable development approaches (Choe, 2021; Jung et al., 2017; Jung & Woo, 2021; Kim, 2012; McKernan & McDermott, 2022; Moon & Jung, 2008; Park et al., 2020; Park & Lee, 2022).

Moon and Jung (2008) conducted a case study on prominent clusters, such as Silicon Valley and Sista, deriving novel concepts and strategies for cluster development. Jung and Lee (2018) underscored the significance of new driving forces, including cyber-connected clusters, for sustainable development in traditional manufacturing industries. Li et al. (2022) explored the relationship between maritime industry clusters and port city redevelopment, emphasizing the importance of port city regeneration for maritime industry cluster activation.

In the context of the competitive position of the domestic semiconductor industry, early 20th century historical research focused on development and status, later shifting to output competitiveness and value/supply chain analysis influenced by global dynamics (Kim, 1989). Modern research adopts an empirical approach, utilizing indicators for analysis. Jang (2006) employed MS, EBI,

and IE indices to identify strategies to enhance the industry, while Kim and Seo (2021) assessed competitiveness using the MS, TSI, RCA, and ESI indices. Quantitative methods have also been utilized to analyze technological competitiveness.

In the early 21st century, amidst global challenges, research on domestic semiconductors has shifted focus to ESG, data transformation, and industrial clusters. ESG has become a crucial guideline for companies, enhancing semiconductor enterprise value and ensuring sustainable operations (Jeong & Kim, 2023).

2. ESG Management in Clusters

The significant industrialization of Western nations since the 1960s has resulted in various environmental challenges compared to the environmental conditions of that era. As industrialization advanced, human activities negatively impacted the environment, as evidenced by Rachel's "Silent Spring (1962)", which highlights the complex relationship between economic growth, global population shifts, consumer behavior, and limited environmental resources. Scholars like Maler (1974) have suggested regulations to decrease greenhouse gas emissions, while O'Riordan (1981) advocated for the practical implementation of environmentalism beyond theoretical discourse. Stahel's (1986) approach laid the groundwork for "industrial ecology", concentrating on prolonging product lifespan and establishing circular systems within industries. Conversely, Frosch and Gallopoulos (1989) introduced the concept of a "circular system of industries", wherein waste serves as raw materials for new processes, reducing waste and mitigating environmental risks within clusters. These concepts contributed to the evolution of industrial ecology. In 2011, the United Nations Industrial Development Organization (UNIDO) introduced ESG as part of the sustainable development framework. Woźniak (2022) examined the case of the Polish industrial cluster ecosystem from a business and corporate-based strategy perspective, supporting ESG practices. Liu and Stephens (2019) and Lopez et al. (2022) investigated the influence of corporate social responsibility (CSR) strategies on management and governance axes for sustainable growth. ESG, sustainable development, and the circular economy are interconnected within industrial cluster ecosystems. ESG factors are essential to responsible social and environmental operations within industrial clusters (Babkin et al., 2023). Active involvement in ESG activities and collaboration among companies within a cluster enhance overall sustainability and competitiveness. Industrial clusters promote competition and cooperation, facilitating the sharing and interaction of ESG activities. Industrial clusters also play a crucial role in relationships with local communities. Collaboration between cluster companies and local communities fosters regional development and social value creation, contributing to sustainable regional development (Kao, 2023). Governments are encouraged to integrate sustainable management (ESG management) into the strategies of industrial clusters, as emphasized by Kao (2023). Progressive company efforts to implement sustainable development indicators, including ESG, within clusters promote sustainable environmental development across the industry. Bhattacharya and Bhattacharya (2023) examined key factors influencing the business model of the biopharmaceutical industry and proposed ways in which ESG management could drive business model innovation. Ali (2023) identified ESG as a quantitative predictive variable for the life cycle stages of industrial clusters, proposing frameworks that apply ESG indices. These frameworks, such as the one proposed by Ali (2023), enable companies to enhance supply chain sustainability through cluster participation.

3. ESG Management

The ESG (Environmental, Social, Governance) strategy refers to a business approach in which companies take into account environmental, social, and governance issues in operations. The concept of ESG emerged in the late 20th century,

and gained momentum through international initiatives such as the "Earth Declaration" and the "Action Plan for Sustainable Development" in 1992. The universalization of ESG gained prominence in the early 21st century, with the United Nations Environment Program (UNEP) and the European Investment Bank (EIB) issuing ESG-focused investment guidelines in 2006. The COVID-19 pandemic in 2020 further emphasized the importance of sustainable development for economic growth, thereby amplifying the significance of ESG (Boffo & Patalano, 2020).

ESG management has become essential for corporate survival and prosperity, leading companies to adopt ESG practices. Research on ESG typically focuses on evaluating a company's ESG issues and analyzing the impact on the company's value. Methodologies for ESG evaluation encompass social, environmental, and governance responsibilities. In the context of domestic companies aiming to establish an "innovation ecosystem" for global growth, Zhen et al. (2023) emphasized the critical moderating role of ESG management in the relationship between electric vehicle attributes and purchase intent, showcasing the diverse applications of ESG in shaping consumer behavior.

In the realm of cluster-related policies, governments active promote an innovation ecosystem by creating institutional infrastructure, supporting supply chain inspections, facilitating international trade negotiations, enhancing internal and external communication for ESG improvement, and aiding the ESG activities of small and medium-sized enterprises (SMEs). The government also aligns SME growth with social values, expanding models for sustainable growth (Clément et al., 2023). Strategies that integrate ESG management and clusters involve enhancing industrial complexes through ESG, digitalization, greenification, and tailored support, as exemplified by initiatives like the Gumi Industrial Complex and Pangyo Techno Valley.

Achieving harmonious development between an industry and the environment requires integrating ESG with cluster development. To enhance cluster competitiveness, it is crucial to have both a "vertical understanding" of development levels and trends, and a "horizontal understanding" of cluster strengths and weaknesses. This study aims to analyze the current ESG status of clusters by incorporating ESG into the evaluation of cluster competitiveness, and conducting empirical analyses based on this integration.

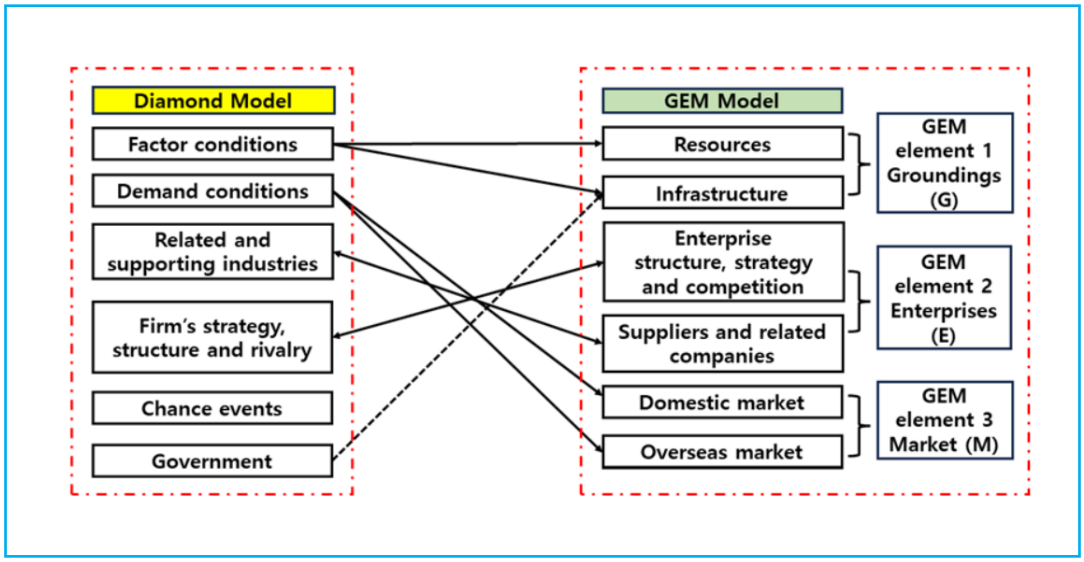
4. GEM Model vs. Diamond Model

The GEM model is composed of three essential components: Groundings (G), Enterprises (E), and Markets (M), which collectively impact the competitiveness of regional clusters. Groundings encompass the vital resources and infrastructure necessary for production, playing a fundamental role in national competitiveness by fostering innovation and competition. Enterprises encompass a company's strategy, structure, competition, and related industries, influencing its competitiveness through efficient resource allocation, capabilities, and collaboration. Markets refer to the domestic and international markets wherein companies operate, with the domestic market providing a foundation for growth, and international markets offering new opportunities.

Derived from the diamond model, the GEM model emphasizes the interconnectedness of its elements and the role of local governments in cluster development. Scholars have expanded and enhanced the GEM model, introducing variations that consider additional factors. For instance, the GEM-S model by) includes technological factors, analyzing regional technological innovation capabilities. The GEM-N model by Liu and Liu (2010) and Pang and Liu (2017) integrates innovation capability factors into the GEM model, focusing on regional innovation capabilities. Zhang et al. (2017) proposed the GEM-Pearson-VC model, adding methodological aspects for adversarial analysis, enhancing accuracy and flexibility. Mao and Yang (2021) introduced the G2 EM-CI model, incorporating government and value chain factors, emphasizing their roles in competition.

These modified models enrich the GEM model

Fig. 2. Comparison of the Diamond Model and GEM Model.



Note: In the diamond model, external factors are considered, while in the GEM model, internal factors such as infrastructure development are considered and represented by dotted lines. Additionally, the arrows representing the relationship between related and supporting industries, as well as the strategies, structure, and competition of enterprises, remain the same in both models. However, chance events are excluded from the GEM model.

Source: Yang and Yang (2003).

by considering a broader range of factors in the analysis of regional competitiveness. The diversity of studies contributes to the formulation of comprehensive policies and strategies for regional development.

III. Research Design

1. Enhancing Cluster Performance through the Innovation of Groundings (G)

In the context of resource-efficient cluster development, technological innovation stands out as a pivotal factor in enhancing competitiveness. Firms within a cluster can rapidly innovate through knowledge sharing and collaboration, playing a crucial role in accelerating technological advancements. This innovation serves the dual purposes of improving production efficiency and utilizing clean energy sources for environmental protection. Higher education and technology are indispensable in achieving these goals, with the aim of producing specialized researchers for technological research being a key objective of higher education.

Simultaneously, the research findings of Miao (2022) highlight the significant impacts arising from the fusion development of "finance + technology" on credit loans and risk levels. Integrating Miao Cheng's insights emphasizes the diverse influences on cluster dynamics. Technological research, whether conducted by specialized departments, individuals, or institutions, enhances production technology, resource utilization, and the discovery of new energy sources. Resource efficient manufacturing clusters, driven by R&D capabilities, technological innovation, and open innovation, not only cut

production costs and boost economic benefits but also optimize specialization and improve industrial status within the production chain (Shin & Lim, 2014; Yoon & Choi, 2008).

The establishment of industrial clusters positively impacts venture companies, as indicated by Seo et al. (2012), who found collaborative networks, R&D professionals, intellectual property rights, and technological excellence to be influential factors. Entrepreneurial spirit, highlighted by Jang and Park (2010), has positive effects on technological competitiveness, excellence, innovative product sales, and innovation activities. Factors influencing the formation of clusters in the Seoul area, such as transportation convenience, play a significant role (Jang & Park, 2010). In studies on the Incheon bio-industry cluster, transportation and logistics convenience, bio-industry integration, and suitable business locations significantly impact overall site satisfaction (Ko & Yoo, 2014).

Aging production facilities within a cluster can detrimentally affect productivity and efficiency, leading to decreased competitiveness. Preventing aging and promoting modernization are crucial to maintain and improve competitiveness. Collaborative efforts, including information sharing on modernization and maintenance, as well as collaborative research and development, contribute to sustaining and naturally developing the overall competitiveness and growth of the cluster (Cho, 2005).

H1: The innovation of Groundings (G) can enhance cluster performance.

2. Promoting Cluster Performance through the Innovation of Enterprises (E)

Corporate innovation, which refers to a company's capacity to generate original concepts, products, services, and procedures to gain a competitive advantage and foster growth, is closely associated with cluster performance. Clusters, which are geographic concentrations of similar industries, promote competitiveness and innovation through collaborative efforts and the exchange of knowledge among companies (Burns et al., 1994; Hull and Hage, 1982; Moon & Jung, 2008; Porter, 1990). The established relationship between corporate innovation and cluster performance has been well-documented (Jeong et al., 2016). Within clusters, companies achieve innovation through collaborative endeavors, such as joint research and development with rival firms, or by leveraging technology and knowledge sharing to create new products and services. Clusters function as centers for specific technologies, knowledge, and human resources within an industry, thereby facilitating easier access to new innovations (Lee et al., 2011). Moreover, companies that innovate within clusters tend to surpass competitors, gaining a competitive edge and expanding market share. The efficient utilization of human and material resources through technology and knowledge sharing in clusters leads to cost savings and economic advantages (Choi & Kim, 2016). As a result, achieving innovation within clusters is a critical factor in enhancing the competitiveness and growth of companies and industries. Companies that develop innovative products or services and actively participate in cluster collaborations contribute not only to the success of the cluster itself but also to the overall growth and economic benefits of the entire industry.

H2: The innovation of Enterprises (E) can promote cluster performance.

3. Increasing Cluster Performance through the Expansion of the Market (M)

Jang et al. (2016) research emphasized the significant influence of company capabilities and the domestic market environment on the management performance of agricultural food processing firms. The study also highlighted the impact of cluster performance on the overall performance of these companies. Market performance, which includes metrics such as sales, exports, revenue, and market

share, is essential for competing effectively in the market (Lee et al., 1998; Kwon, 1996; Park & Lee, 2010). Conversely, cluster performance is assessed through collaborative factors such as cooperation among competing companies, joint research, and knowledge sharing within a specific region or industry group (Eun, 2015; Kwon & Lee, 2005; Park & Yoo, 2007). The market performance and cluster performance of firms are mutually influential and interactive. Collaborative activities within clusters promote improved relationships among competing companies, thereby enhancing competitiveness in the market and contributing to the development of superior products or services (Yoon & Choi, 2008). Furthermore, cluster collaboration enables companies to secure more resources and manpower, leading to increased economic benefits for individual companies, and higher productivity for the entire industry group (Lim et al., 2006; Nam & Lee, 2013). Consequently, within an industry group, cluster performance positively affects market performance. Companies engaged in cluster collaboration, maintaining collaborative relationships within clusters, often achieve higher performance compared to competitors. Active cluster collaboration not only benefits the growth of individual companies but also contributes to the overall development of the industry group, and positively impacts regional economic growth (Kim et al., 2015; Park & Lee, 2010).

H3: The expansion of the Market (M) can increase cluster performance.

In the previous theoretical discussion, a review of prior research on industrial cluster competitiveness was conducted. Previous studies on cluster competitiveness did not include the importance of ESG concepts in the evaluation system. Therefore, in this study, we constructed a GEM-ESG model by adding important indicators of ESG, which represent sustainable development, to the basic GEM model. After constructing the GEM-ESG model, we aim to comprehensively evaluate the competitiveness scores of semiconductor industry clusters in each city (or region) based on the weights determined using the entropy method. The research model follows.

4. Increasing Cluster Performance through ESG Management Strategies

Based on the findings of Lee et al. (2023), the integration of ESG strategies in Chungcheongbuk-do is anticipated to yield favorable outcomes for the advancement of the bio-industry cluster. Furthermore, Wu et al. (2023) demonstrated the significant influence of a company's ESG strategy on industrial carbon emissions. Previous studies have also examined the effects of ESG on the sustainability and effectiveness of supply chains, particularly within intricate industrial clusters characterized by multifaceted supply networks involving numerous firms. In the context of financial implications, Kwon and Shin (2022) and Zhu (2022) contributed insights by highlighting that ESG management can enhance corporate (stock price) value, showing a significant positive correlation. This underscores the broader impact of ESG strategies on the financial performance of companies, providing a comprehensive perspective on value proposition. Consequently, the following hypothesis is proposed based on the existing body of research.

H4: ESG management strategies can increase cluster performance.

5. Enhancing the Performance of Clusters by Concentrating Industrial Activities within the Cluster

A study conducted by Liu and Wang (2022) demonstrated that the utilization of agricultural industry clusters can effectively improve the competitiveness of environmentally friendly agricultural product brands. Additionally, research conducted by Marco et al. (2022) indicated that the competitive edge of innovative cocktail development is associated with industrial clusters and collaborative efforts.

H5: Industrial cluster concentration can increase cluster performance.

This article investigates the semiconductor industry cluster effect in various regions of Korea by examining GEM theory, ESG research, and industrial cluster theory.

The study employs a research model, depicted in Fig. 3, to analyze the impact of GEM·ESG·R on the semiconductor cluster. The entropy method, a multi-index comprehensive evaluation, is utilized to objectively determine weights for indicators, reflecting relative importance. Key functions of the entropy technique include enabling multi-index comprehensive evaluation, facilitating scientific weight allocation, supporting differential analysis, ensuring data standardization, and providing decision support.

In summary, the entropy technique serves as a robust tool to scientifically evaluate and compare the competitiveness of the semiconductor industry across regions, offering valuable assistance to decision-makers.

Fig. 3. Research Model.

$$S_i = \sum_{j=1}^{m} \omega_j r_{ij} = GEM \cdot ESG \cdot r_a$$

In this context, the variable "S_i" represents the final score, "w_j" denotes the weight determined by the entropy method, "r_{ij}" represents the index value, "i" refers to the sample city (or region), and "j" represents a dimensionless value. Furthermore, considering the issue of industrial concentration that affects the influence of industrial clusters, this study added the value of r (EG coefficient). In the process of calculating concentration (industrial concentration), it is not necessarily the region with the highest industrial concentration that has the highest industrial agglomeration, as the value of location entropy (LQ analysis) does not reflect the difference in regional economic development levels. The Herfindahl index (G_a), a measure of spatial concentration, also has the same drawback as location entropy (LQ analysis). In other words, the Herfindahl index (spatial Gini coefficient) does not accurately reflect the spatial concentration of industries, as it ignores differences in regional areas. Therefore, in this study, we selected the "modified EG coefficient", and its formula follows.

$$r_a = \frac{\frac{G_a}{1-\sum X_i^2} - \frac{1}{n}}{1 - \frac{1}{n}} \quad (1)$$

In the case where G_a is the spatial autocorrelation coefficient, the equation is as follows. $G_a = \sum_{i-1}^{M} (s_i - x_i)^2$, In the case where a is the spatial autocorrelation coefficient, the equation is as follows. X_i represents the ratio of the specific industry size in region i to the overall size of the industry. S_i represents the ratio of the overall industry size in region i to all industries. n is the number of firms in the respective industry within the region. The original GEM model consists of three elements: Groundings (G), Enterprises (E), and Market (M). The GEM-ESG model, developed in this study, is a newly created model that incorporates ESG indicators into the basic GEM model.

IV. Definition of Variables

Table 1 presents the variables of the research model. The first dimension consists of the GEM model and the ESG model. The Groundings (G) of the GEM model includes detailed items such as the number of semiconductor cluster researchers, production facilities for advanced ceramics by region, human resources in the advanced ceramics industry, national research and development project expenditures, government R&D investment, and transportation culture index. Enterprises (E) include variables such as the business innovation Inno-Biz index, the

number of businesses in the advanced ceramics industry, research and development expenses in the advanced ceramics industry, and management innovation index. Market (M) includes variables, such as the proportion of advanced ceramics sales to total company sales, per capita GDP by city (or region), sales of the advanced ceramics industry, and total sales of semiconductors.

In the ESG model, the Environment (E) includes variables such as energy consumption (e.g., fuel, electricity) and air pollution levels, while Social (S) includes variables such as the population engaged in volunteer activities, employment rate of people with disabilities, and social welfare investment. Governance (G) includes variables such as the ratio of male to female executives and the proportion of external directors in companies. This study aims to evaluate the development level (competitiveness) of semiconductor clusters in each region based on these indicators.

Table 1. Definitions of Variables in the Research Model

One Dimensional Metrics		Two Dimensional Metrics	Three Dimensional Metrics
GEM Model	Groundings (G)	Number of researchers in the semiconductor cluster	G1
		Production facilities for advanced ceramic industries by region	G2
		Workforce in the advanced ceramic industry	G3
		Amount of national research and development projects	G4
		Government investment in research and development	G5
		Transportation culture index	G6
	Enterprises (E)	Business innovation Inno-Biz index	E1
		Number of companies in the advanced ceramic industry	E2
		Research and development expenses in the advanced ceramic industry by companies	E3
		Management innovation index	E4
	Market (M)	Proportion of advanced ceramic industry sales to total company sales	M1
		GDP per capita by city (or region)	M2
		Sales revenue of the advanced ceramic industry	M3
		Total sales revenue of the semiconductor industry	M4
ESG Management	Environment (E)	Energy consumption (e.g., fuel, electricity)	E'1
		Air pollution level	E'2
	Society (S)	Number of volunteers engaged in community service	S1
		Employment rate of people with disabilities	S2
		Amount of social welfare investment	S3
	Governance (G)	Proportion of male and female executives	G'1
		Proportion of external directors in companies	G'2

1. Sample Characteristics

The purpose of this study is to compare the competitiveness of major semiconductor clusters in South Korea, and to provide implications to enhance the competitiveness of semiconductor clusters. To achieve this research objective, it is important to select representative urban samples that can accurately compare the differences and similarities of various city (or region) semiconductor clusters. By correctly comparing multiple cities, valuable conclusions and implications can be derived.

Appropriate sampling methods and target selection are crucial in increasing reliability in data collection. Maintaining accuracy in the data collection process is also necessary. In this study, various statistical and government agency websites were utilized to enhance the accuracy and reliability of the data. Government agency data is generally reliable as it is managed in an official and trustworthy manner, adhering to standardized procedures and regulations for data collection and management, ensuring data consistency.

In this study, a competitiveness evaluation model incorporating ESG capabilities for sustainable development was constructed to measure the competitiveness of semiconductor clusters. Before analyzing the competitiveness of semiconductor clusters, cities or regions with a certain scale of semiconductor clusters were selected as sample cities. The selection criteria were based on the high level of "total value added of the semiconductor industry" and the high "export value of semiconductors" in the local area. The semiconductor industry in Korea is mainly concentrated in the central and metropolitan areas, with the Chungcheongnam-do, Chungcheongbuk-do, and Gyeonggi provinces as the most prominent. Additionally, the development of clusters in Gangwon-do province and Incheon city, where new semiconductor companies are entering, is emphasized. Therefore, these four locations (two cities and two regions), Chungnam province, Chungbuk province, Gyeonggi (Youngin city), and Incheon city, were selected as sample cities and regions for this study.

2. Hypothesis Testing

After data collection, the entropy method and geographic space analysis (using GeoDa) were used. The entropy method is an analytical approach used to evaluate the relative values of alternatives in multi-criteria decision-making problems. It measures how well alternatives satisfy each criterion, and calculates the relative values. It is commonly used for alternative selection and weight assignment in multi-criteria decision-making problems.

GeoDa is a specialized statistical software for spatial analysis that allows for the analysis of Moran's I. Moran's I is a statistical indicator that measures the spatial autocorrelation of spatial data, indicating the spatial self-correlation of spatial data. This index can be used to identify spatial patterns and determine if there is spatial autocorrelation. In other words, through the analyses of Moran's I index, the spatial autocorrelation, spatial concentration dispersion, and local interactions of the semiconductor industry can be examined. Moran's I value ranges from -1 to 1, wherein positive values indicate positive correlation representing spatial autocorrelation, and negative values indicate negative correlation. Significance test results are also examined to determine if the spatial autocorrelation is statistically significant.

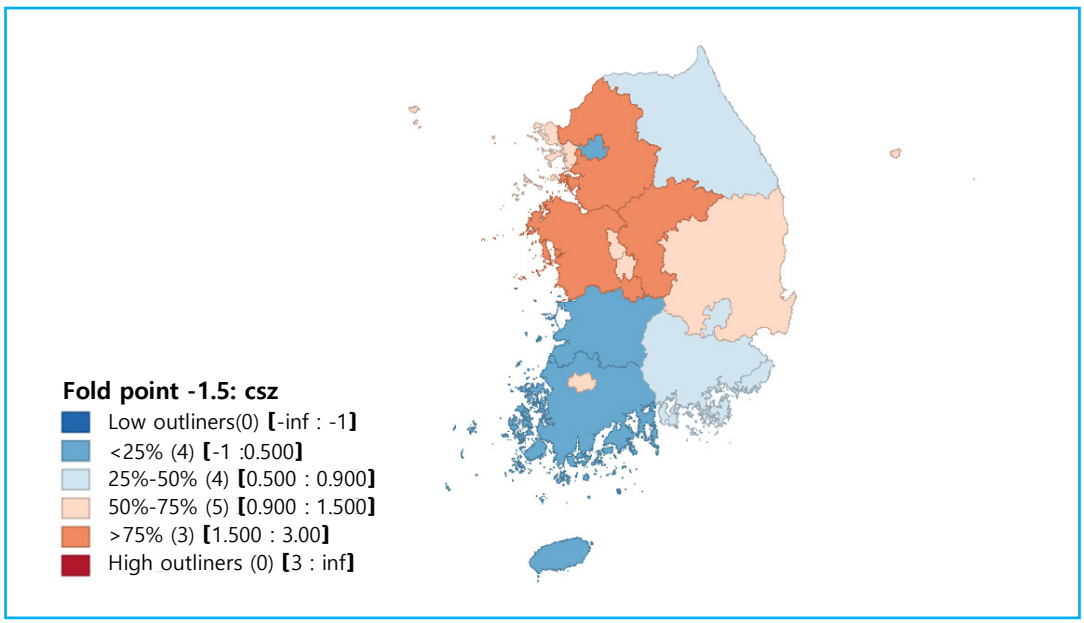
3. Research Findings

3.1. Regional Coefficients and Lisa Analysis in Advanced Industries

The Lisa analysis in Fig. 4 reveals that the semiconductor industry in Korea is primarily concentrated in Seoul, Incheon, Gyeonggi, Chungbuk, and Chungnam. This geographical concentration gives rise to large-scale clusters radiating into the surrounding areas, which aligns with the characteristics of industrial clusters. In these areas, the presence of cluster phenomena was indicated by Lisa values greater than 0.5, but less than 1. When Moran's I is greater than 0, it

signifies a positive spatial correlation in the data, with higher values indicating a stronger spatial correlation. Conversely, when Moran's I is less than 0, it indicates a negative spatial correlation (Anselin, 1995).

Fig. 4. A Comparison of *G* and *EG* Coefficients across Different Cities and Regions

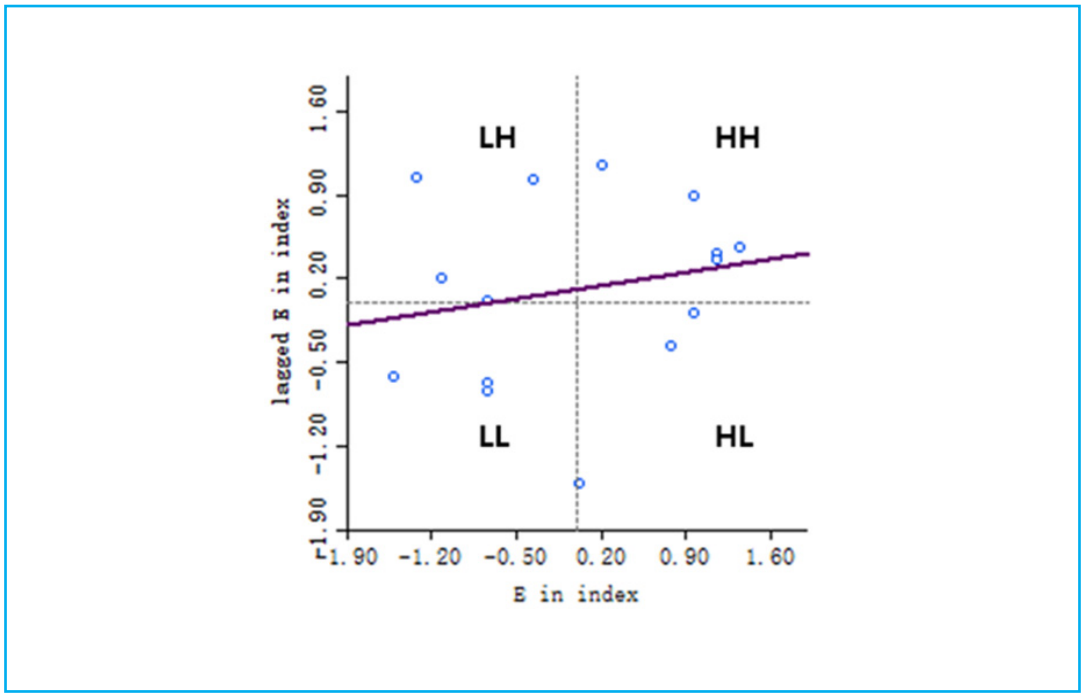


These findings indicate the validation of the process in which industrial clusters evolve from being "regional clusters" to "interconnected clusters" formed between regions, as demonstrated in the step-by-step cluster study conducted by Moon and Jung (2008). This also confirms the fact that the majority of domestic semiconductor companies are concentrated in the central area of Seoul. According to the survey, domestic semiconductor production is concentrated in the metropolitan area (production market share in 2021, 80.7%). This is due to the fact that the main companies, Samsung Electronics (Hwaseong, Pyeongtaek, Giheung) and SK Hynix (Icheon), have their main production facilities located in Gyeonggi Province, and when combined with the adjacent Chungcheong Province (=Chungcheongbuk-do + Chungcheongnam-do) (production market share, 15.8%), these two regions account for 96.5% of domestic semiconductor production.

3.2. Moran's I Analysis

The horizontal axis of Fig. 5 represents the standardized values (z-scores) of the variable for a given unit, while the vertical axis represents the average values (z-scores) of the variable for neighboring units. In other words, it represents the standardized values. Fig. 5 can be divided into four parts: LH, HH, LL, and HL, based on the horizontal and vertical axes. The HH region includes Daejeon, Sejong, Chungnam, Chungbuk, and Gyeonggi, while the LH region includes Gangwon, Seoul, Jeonbuk, and Daegu. Further, the HL region includes Incheon, Gyeongnam, and Gwangju, while the LL region includes Jeonnam, Gyeongnam, Jeonbuk, and Busan.

Fig. 5. The Moran's I Analysis for the Semiconductor Industry (0.56 < Moran's I < 1)



Note: The HH region encompasses the areas of Daejeon, Sejong, Chungcheongnam-do, Chungcheongbuk-do, and Gyeonggi-do. The LH region includes Gangwon-do, Seoul, Gyeongsangnam-do, and Daegu. The HL region comprises Incheon, Gyeongsangbuk-do, and Gwangju, the LL region encompasses Jeollabuk-do, Jeollanam-do, and Busan.

When combining Fig. 4 with Fig. 5, it can be observed that the semiconductor industry, as a traditional manufacturing sector, exhibits a clear trend of concentration in regions such as Daejeon, Sejong, Chungnam, Chungbuk, and Gyeonggi. Among these regions, semiconductor companies in Gyeonggi, Chungbuk, and Chungnam account for approximately 80.7% of the national semiconductor industry, and employ around 800,000 people, making it the most prominent semiconductor cluster in Korea. The scale and concentration of the Korean semiconductor cluster make it a representative cluster. Therefore, this study aims to analyze the competitiveness of the cluster by integrating the concept of sustainable development.

V. Empirical Analysis

1. Comparison of Industrial Concentration in Each Regional Cluster

To address the distortion issue of the spatial Gini coefficient, which measures the geographical concentration of industries, Ellison and Glazer proposed a new concentration index based on the concept of the Herdahl index in 1997. The spatial Gini coefficient does not necessarily indicate industrial concentration or clustering as it does not consider differences in company size. For example, the Gini coefficient of a region may increase if there are large-scale companies present, but there may not be a distinct concentration or cluster.

However, the EG index, constructed with the help of the Herfindahl coefficient, can overcome this limitation when comparing the concentration of industries.

From Table 2, the following research findings can be derived. When examining the results for the right spatial coefficient, it can be observed that each value is greater than 0 in sequential order. Youngin city (Gyeonggi Province) ranked first, followed by Incheon city, Chungbuk Province, and Chungnam Province. Through data analysis, it is evident that there are significant differences in the size of company in each city or region. However, solely relying on the G (spatial) coefficient cannot accurately determine the concentration of industrial clusters (Ellison & Glaeser, 1999). Therefore, in order to address the limitations of the G coefficient, this paper also considers the analysis of the EG coefficient in relation to company size.

Table 2. A Comparison of G-coefficients and EG Spatial Coefficients across Different Cities and Regions

	Regional	Si			G (Spatial) Coefficient	EG Coefficient
		2019	2020	2021		
By city	Incheon (Songdo)	-0.00020	-0.00056	-0.00020	0.01396	-0.005
	Yongin (Gyeonggi)	0.00638	0.00379	0.00569	0.01600	0.015
By region	Chungbuk	0.00059	0.00074	0.00112	0.01388	0.012
	Chungnam	0.00045	0.00037	0.00043	0.00400	0.003

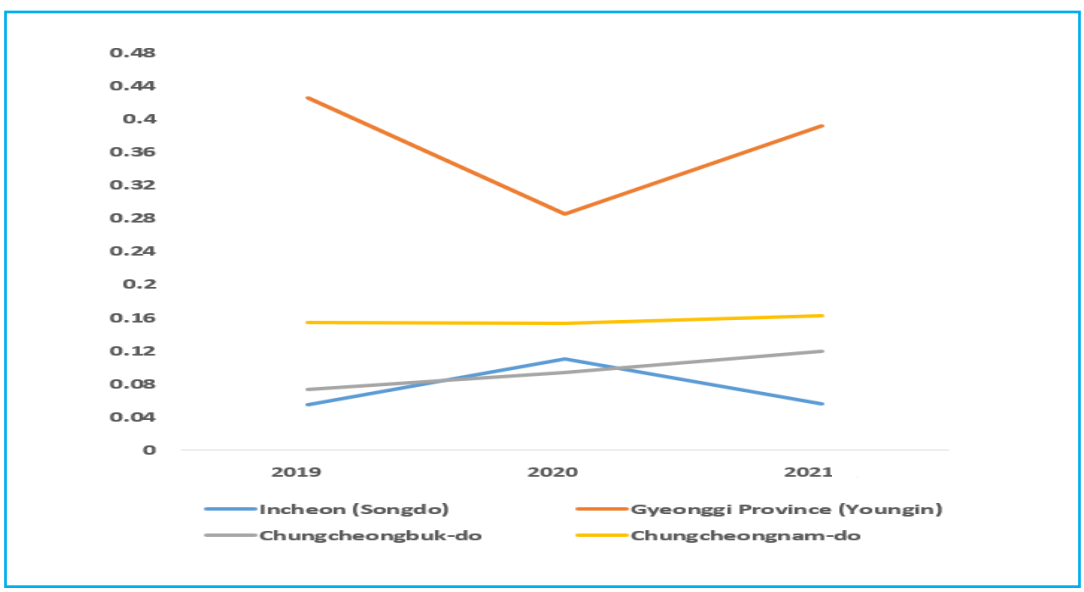
In Table 2, the analysis of the *EG* coefficient on the far right indicates that when the *EG* coefficient is less than 0.02, it signifies a significant dispersion of industrial distribution within the land area. When the *EG* coefficient is in the section of $0.02<r<0.05$, the spatial distribution of the industry is judged to be relatively uniform. In addition, when the *EG* coefficient is $r>0.05$, the industrial space is relatively concentrated; in this case, the industrial concentration or integration is judged to be high (Ellison & Glaeser, 1999). In examining the *EG* coefficients in this study, the values for Yongin (Gyeonggi Province) and Chungbuk are 0.015 and 0.012, respectively. Due to the limitation of the sample data, these values can be considered close to 0.02. Based on this data, it can be inferred that the concentrations of the semiconductor industry in Yongin (Gyeonggi Province) and Chungbuk are relatively even, while the semiconductor industries in other regions are relatively dispersed. Looking at cities, the reason why the concentration of the semiconductor industry in Yongin (Gyeonggi Province) (0.015) is higher than in Incheon (-0.005) is that Yongin (Gyeonggi Province) has been the economic center of Korea for a long time, and has laid a foundation for the semiconductor industry since its early stages. The electronics industry developed in Yongin (Gyeonggi Province) since the 1970s, which has served as a basis for the semiconductor industry. Additionally, Gyeonggi Province is home to various companies in the semiconductor and related industries, maintaining close relationships with technology and partner companies for production and research and development. Gyeonggi Province is also known for its concentration of world-renowned universities and research institutions, making it easy to secure manpower related to the semiconductor industry. The government also strategically emphasizes the semiconductor industry, promoting research and development and investment, contributing to enhancing the competitiveness of Gyeonggi

Province. Furthermore, Gyeonggi Province is a region with developed transportation and infrastructure facilities, providing favorable conditions for logistics and manufacturing. Looking at regions, the concentration of the semiconductor industry in Chungbuk (0.012) is higher than in Chungnam (0.003). Although Chungnam is stronger than Chungbuk in terms of semiconductor R&D and innovation, market, and industrial scale, Chungnam lags behind in terms of the number of semiconductor industry employees. Chungnam ranks second in the number of semiconductor businesses nationwide (first being Gyeonggi), and third in the number of employees (first being Gyeonggi, second being Chungbuk). While the number of businesses in Chungnam continues to increase, the number of employees has significantly decreased. In summary, although Chungnam has some advantages in terms of the scale of the semiconductor industry, Chungbuk still possesses advantages in attracting semiconductor talent and environmental aspects. Furthermore, when comparing cities and regions, the spatial concentration coefficient (G coefficient) of the Incheon (Songdo) semiconductor cluster (0.01396) is higher than that of the Chungbuk semiconductor cluster (0.01388), and the EG coefficient is lower in Chungbuk. Therefore, it is difficult to determine whether a higher spatial coefficient leads to a higher level of cluster concentration. This is because it disregards the size of companies (Ellison & Glaeser, 1999).

2. Comparison of the Comprehensive Competitiveness of Industrial Clusters

Fig. 6 presents a graph comparing the competitiveness of semiconductor industries in the representative cities of each city and region. According to the results, Gyeonggi Province (Youngin) is considered to have the highest competitiveness score in the semiconductor industry cluster over the past three years. Chungbuk, Chungnam, and Incheon are significantly different from Gyeonggi. It can be observed that Gyeonggi's semiconductor cluster is the best in terms of cluster size and the implementation of the concept of sustainable development among all semiconductor clusters in Korea.

Fig. 6. Comprehensive Competitiveness Based on the GEM-ESG Model



The reasons for this can be anticipated as follows. Firstly, the semiconductor industry in Gyeonggi Province is at the forefront in terms of scale. This reason can also be easily seen through EG coefficient analysis. Secondly, the domestic and international markets are enormous, and the export trade value of Gyeonggi Province's semiconductor industry far exceeds that of other cities (or regions) in the country. Thirdly, the research and development level of Gyeonggi Province's semiconductor industry is significantly higher than that of other regions. The semiconductor industry is an industry that places importance on innovation and creativity compared to other cities, and the level of research and development is crucial in determining value and status in the market. However, if the COVID-19 situation prolongs, the shipment volume of memory semiconductors may decrease due to the stagnation of upstream industries, and the competitiveness of Gyeonggi Province's semiconductor industry is expected to have suddenly declined in 2020 due to the impact of COVID-19 on semiconductor export contracts and equipment utilization rates. Although other regions' semiconductors have also been relatively affected to some extent, it is believed that Gyeonggi Province has been particularly affected. Semiconductor companies in Chungcheongnam-do are mainly engaged in pursuing Chungcheongnam-do semiconductor companies, and they are considered to have a stronger competitiveness than Chungcheongbuk-do or Incheon. Chungcheongnam-do semiconductor companies are actively engaged in activities such as cultivating semiconductor talents and government research support, which is increasing competitiveness. Chungcheongbuk-do initially had a lower level of semiconductor competitiveness than Incheon. However, Chungcheongbuk-do was catching up with Chungcheongnam-do in 2021. Chungcheongbuk-do can be seen as having made significant efforts to enhance competitiveness in the semiconductor industry. Incheon, when analyzing the GEM-ESG comprehensive competitiveness evaluation, has been continuously growing from 2019 to 2020, surpassing Chungcheongbuk-do in 2020, but its comprehensive competitiveness has been declining since 2020. The reasons for this are speculated to be issues such as labor supply (infrastructure), inadequate related regulations, and cluster ecosystems in Incheon's semiconductor industry.

3. A Comparison of GEM-ESG Indicators in Industrial Clusters

This paper aims to analyze sustainable semiconductor corporate innovation and ESG development, which are divided into three parts: E (Environment), S (Social), and G (Governance). Competitiveness scores for each city's semiconductor cluster were calculated for each level.

According to the analysis in Fig. 7, Gyeonggi Province is the economic center of South Korea with high population density and a concentration of various companies and industries. Additionally, Gyeonggi Province has well-developed transportation and infrastructure facilities, which is economically advantageous in terms of logistics and trade. Moreover, these regions have a concentration of excellent universities and research facilities, which can foster talent development and research and development activities. For these reasons, the basic indicators of Gyeonggi Province may be higher than those of other regions. According to the score analysis in Fig. 8, Gyeonggi Province has the highest innovation capacity among the semiconductor cities, which can be attributed to large-scale capital investments in technology and product research and development. In 2019, research and development investments flowing into Gyeonggi Province from the central government accounted for 11.7% of the total national research and development investment (Korea Science and Technology Statistics Yearbook). Comparing the number of patents filed nationwide in 2019, patent applications in Gyeonggi Province increased by 5.32% compared to the previous year (Korea Science and Technology Statistics Yearbook). In terms of regional research and development investment in 2019, Gyeonggi Province accounted for 51.6% (45.9 trillion won), followed by Seoul with 15.1% (13.4 trillion won),

and Busan with 8.7% (7.7 trillion won). This data indicates that Gyeonggi Province (Youngin) has significantly higher corporate innovation capacity and strong actual innovation capabilities compared to other cities. Following Gyeonggi Province, Chungcheongnam-do has relatively strong innovation capacities. These two semiconductor industrial clusters continuously enhance innovation margins to increase the competitiveness of the semiconductor industry. As shown in Fig. 9, Gyeonggi Province and Chungcheongnam-do are more active in the semiconductor market compared to other cities. This is because Chungcheongnam-do is located in the central region of South Korea, and is adjacent to the capital region (Seoul and Gyeonggi Province). The geographical location of this region provides logistical and transportation convenience, making it easy to transport semiconductor wafers and components. Additionally, various research institutes and universities are located in this area, leading to active semiconductor technology research and development. Furthermore, semiconductors are essential components used in various technological applications, and the semiconductor industries in Gyeonggi Province and Chungcheongnam-do can meet domestic and international demand. In Fig. 10, it can be observed from the data that the Chungbuk region has a competitive advantage in the field of semiconductor environmental protection while promoting economic benefits in the semiconductor industry.

In Fig. 11, it can be observed that Gyeonggi has a higher level of social enterprise activity compared to other cities (or regions). This suggests that Gyeonggi is ahead in terms of corporate social responsibility (CSR) activities, and contributes more to social welfare. The government in Gyeonggi actively supports social enterprise consulting programs to enhance competitiveness. Gyeonggi province identifies and selects social contribution companies within the region, and actively promotes these to foster a society wherein people can live together. In order to activate CSR in the social aspect of ESG, Gyeonggi province has been implementing the "Gyeonggi Province Ordinance on the Activation of CSR for Public Institutions and Small and Medium-Sized Enterprises" since 2016. Fig. 12 presents the aspect of corporate governance. Gyeonggi has the highest level in terms of corporate governance indicators, such as the ratio of male to female directors and the proportion of outside directors. This indicates that Seoul has a strong competitive advantage in this area. Sound and transparent governance is an important corporate strategy in achieving sustainability. As the capital city of Korea, Gyeonggi is home to the central government and important government agencies. These institutions make efforts to maintain transparency in public service provision and policy-making. In addition, Gyeonggi has created conditions for the widespread disclosure of public information, and for citizens to access and monitor information in advance of other cities, which has contributed to greater transparency in corporate governance.

VI. Conclusions

1. Discussion of the Analysis Results

Forming clusters is a highly efficient way to enhance the competitiveness of a country or region. In particular, the semiconductor cluster in Korea holds a significant position in the overall Korean economy, and therefore, the Korean government has recently promoted policies to foster clusters in key industries for national advanced strategic industries. The core industries included in this initiative are semiconductors, displays, secondary batteries, and bio-industries.

Existing research on semiconductor clusters has mainly focused on characteristics, ripple effects, and performance. However, there is a lack of empirical research comparing the competitiveness of semiconductor clusters. Furthermore, with the increasing importance of ESG during the cluster development process, enhancing the sustainable industrial competitiveness of each country's clusters has been emphasized, and demand for ESG management has also been increasing. Therefore, in this study, we investigated the ESG management

Fig. 7. GEM(G) Indicator Analysis

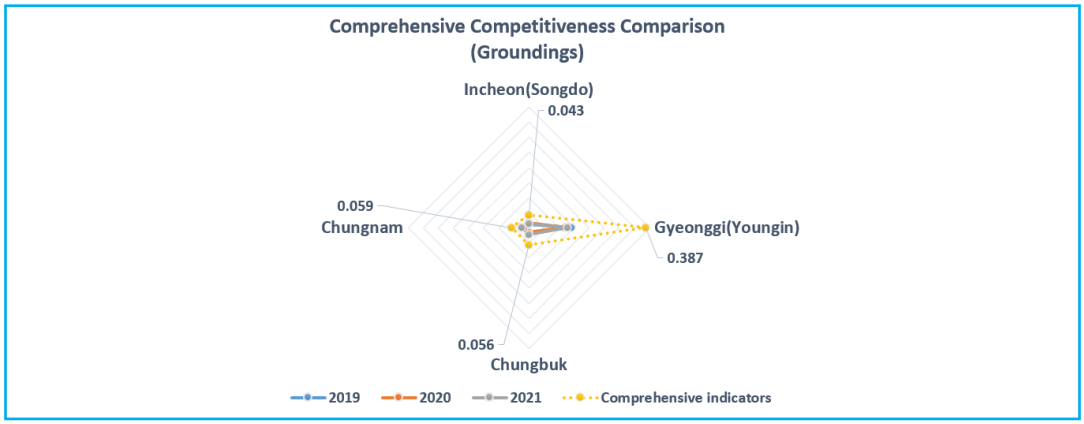


Fig. 8. GEM(E) Indicator Analysis

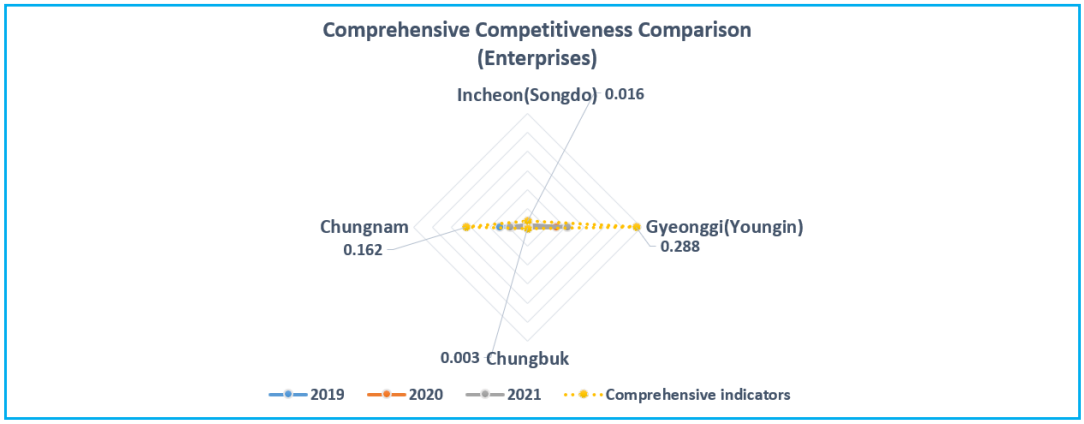


Fig. 9. GEM(M) Indicator Analysis

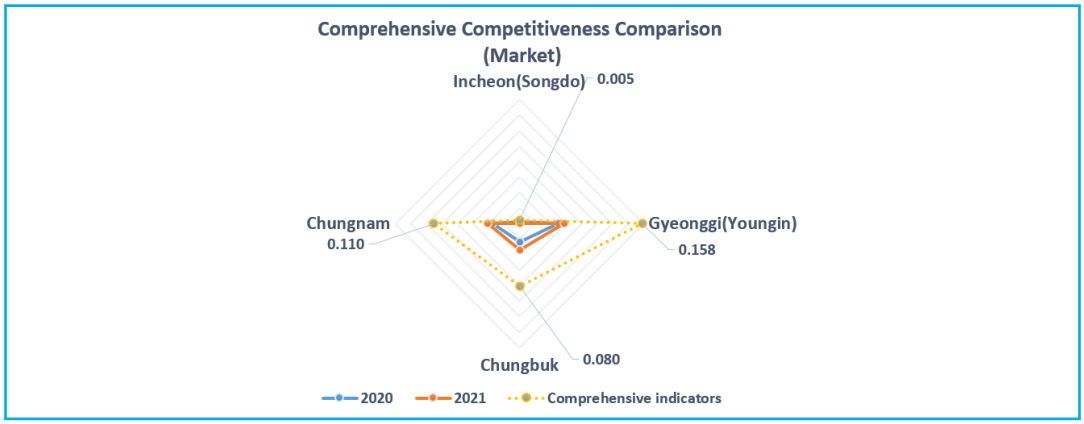


Fig. 10. GEM-ESG (E) Indicator Analysis

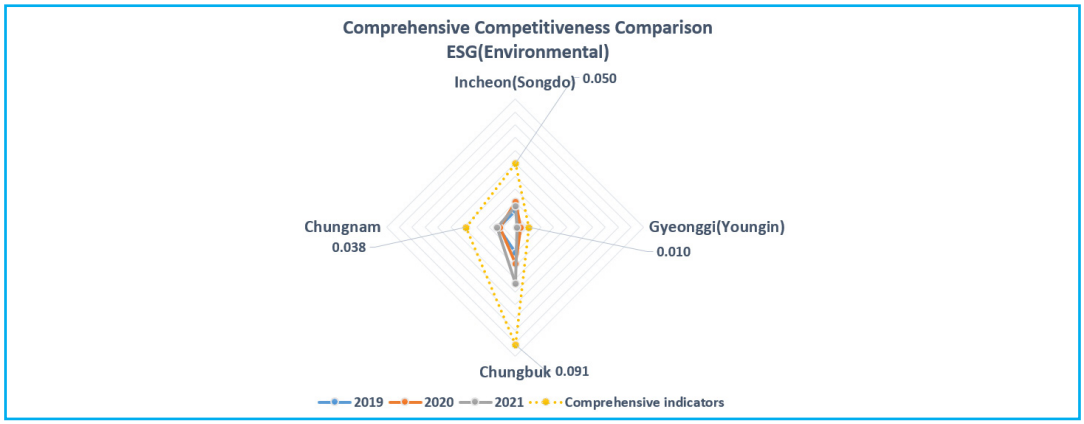


Fig. 11. GEM-ESG (S) Indicator Analysis

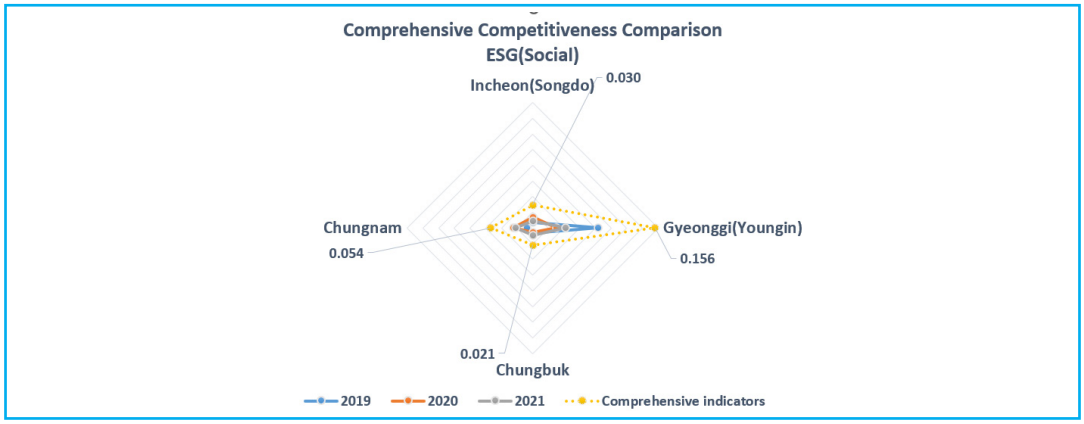
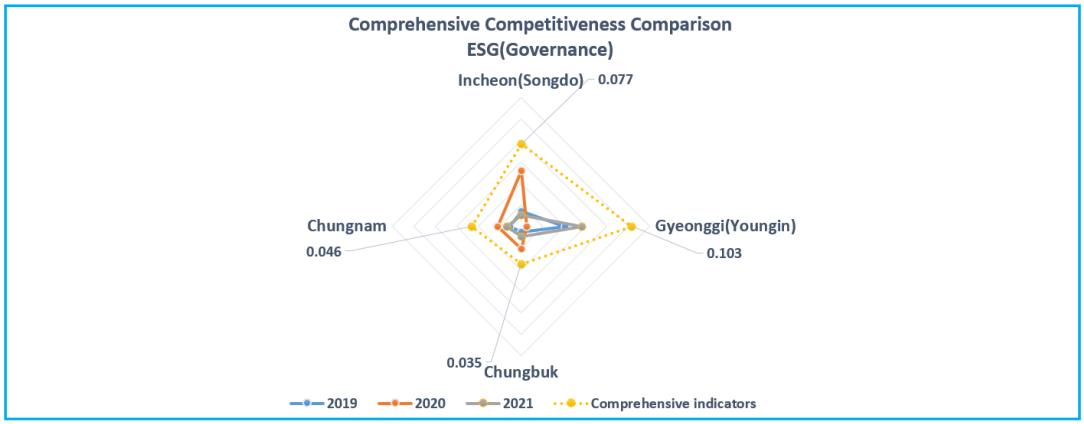


Fig. 12. GEM-ESG (G) Indicator Analysis



activities of each regional semiconductor industry in Korea. In the process, we further developed the research model by adding ESG evaluation indicators to the existing GEM research model. We then validated the ranking of the regional semiconductor industry's competitiveness using this model.

First, based on the location coefficient and Lisa analysis results, it can be determined that the spatial concentration of the semiconductor industry in Korea, excluding Jeollanam-do, Gyeongsangnam-do, and Jeonnam-buk-do, is high. The reason for this is that the semiconductor industry has relocated to the capital region due to government policies and favorable geographical conditions. In particular, Gyeonggi-do is the central basis for semiconductor production and technological hubs, with a concentration of the semiconductor supply chain centered around Samsung Electronics and SK Hynix. Within the cluster, semiconductor companies have strengthened communication and collaboration, enabling them to learn from each other's excellent operations and management know-how, and to cooperate in expanding into overseas markets, thereby increasing competitiveness.

Second, according to the GEM-ESG comprehensive competitiveness evaluation analysis, Gyeonggi-do has a relative competitive advantage. Incheon's semiconductor industry maintained its leading competitiveness until 2019, but its competitiveness began to decline from 2020. This is due to limitations in collaboration with domestic large companies in Incheon. There were difficulties mainly related to collaboration with large company infrastructure. In addition, regarding the government's policy to foster the packaging sector, Incheon is judged to have been somewhat inadequate.

Third, through EG coefficient analysis, it can be observed that Gyeonggi-do's semiconductor industry has a higher industrial concentration compared to other regions. This is because the semiconductor industry in Gyeonggi-do has a greater influence than the overall concentration of one region. This reality demonstrates that industrial clusters in Gyeonggi-do are highly concentrated and have a radiating effect on the surrounding areas.

Fourth, looking at the ESG analysis results among the GEM-ESG comprehensive competitiveness evaluation models, Chungbuk and Incheon are considered to have competitiveness in the environmental protection and energy consumption aspects. Domestic and international semiconductor companies also use thermal oxidation to treat 90% of greenhouse gases emitted during semiconductor manufacturing to reduce environmental impact. In addition, Gyeonggi has many strengths in terms of social welfare compared to other cities or regions in terms of social aspects. This is because the role of global semiconductor company social responsibility has become increasingly important. In terms of governance, Gyeonggi and Incheon have a favorable competitive advantage. This is because the Gyeonggi and Incheon regions receive high evaluations in terms of exercising corporate legal rights, preventing corruption within companies, and fair trade.

2. Theoretical Implications for Scholar

This research aims to evaluate industrial competitiveness by comparing levels of industrial concentration across different regions in South Korea. The results suggest that industrial concentration is influenced not only by geographical location but also by industry scale, aligning with the findings of Ellison and Glaeser (1999). This empirical evidence provides valuable insights for future research on industrial clusters.

Additionally, the study proposes an extension of the GEM model to incorporate ESG factors into the framework to assess competitiveness. This expansion sets the stage to integrate sustainability dimensions into the broader field of competitiveness research, and encourages scholars to consider ESG factors in theoretical frameworks.

Furthermore, the study contributes to the academic community by enhancing the understanding of post-COVID-19 global trends

and the impact on the semiconductor industry. It urges scholars to explore the influence of external factors, such as epidemics and geopolitical events, on industry competitiveness.

3. Practical Implications for Business Managers and Policymakers

Publishing the results of this study aims to provide semiconductor companies and policymakers with directions and strategies for the development of semiconductor industry and clusters. Semiconductor companies within the cluster can achieve sustainable economic growth in the medium- to long-term by sharing and collaborating on ESG values. For example, companies within the cluster can improve environment-friendly production and energy efficiency by sharing environmental policies and collaborating. Furthermore, companies within the cluster can engage in collaborative projects with the local community and seek solutions to local social issues, demonstrating social responsibility. Moreover, clusters can contribute to the establishment of corporate governance systems among companies. This is because ESG management emphasizes transparency and ethical governance. In other words, companies within the cluster can enhance trust, sustainability, and competitiveness by establishing fair governance systems and practicing transparent management.

Next, we will describe more detailed practical implications for business managers and policymakers. First is enhancing regional competitiveness. Policymakers at the regional level can utilize these insights to enhance the competitiveness of semiconductor industry clusters. This may entail making investments in infrastructure, cultivating a skilled workforce, and fostering ecosystems that facilitate innovation and sustainable development.

Second is strategic management for corporations. Managers of semiconductor companies can leverage the findings to devise strategic approaches for integrating GEM-ESG-R considerations into business models. This encompasses embracing sustainable practices, establishing collaborative networks within the cluster, and aligning business strategies with global trends.

Third is the formulation of government policies. Policymakers can employ research findings to formulate policies that bolster the sustainable development of semiconductor clusters. This could encompass creating incentives for ESG practices, fostering collaboration among industry stakeholders, and providing financial support for the research and development of environmentally friendly technologies.

Fourth focuses on strategies to mitigate risks. The study underscores the significance of ESG management in mitigating risks associated with global challenges such as supply chain disruptions. Managers and policymakers can devise strategies to mitigate risks by integrating sustainability practices, promoting supplier diversity, and enhancing the resilience of semiconductor clusters. By offering theoretical and practical implications, this study aims to bridge the gap between academic knowledge and real-world applications, providing valuable insights to researchers, industry practitioners, and policymakers alike.

4. Limitations and Future Research

Despite the theoretical and practical significance of this study, there are several limitations. First, during the data collection process, there was a lack of G-related indicators in the quantification of ESG. Nevertheless, it was deemed possible to objectively reflect these differences. However, if G-related variables are added in future research, more detailed analyses can be conducted. Additionally, cluster development can evolve into regional clusters, regional-interlinking clusters, and international-linking clusters. In future research, comparing domestic and international semiconductor clusters according to these stages of development may reveal more in-depth insights. Despite these limitations, the significance pursued by this study remains intact, and these limitations can be addressed as promising issues for future research.

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The Benefits of Cross-Border Corporate Venture Capital Investment on the Likelihood of a Venture Firm''s IPO*

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ABSTRACT

Purpose – Extant research indicates that CVC investments create value for venture firms and generally enhance the likelihood of a successful venture exit. In particular, despite the globalization of CVC investments, the impact on venture firm exit performance has been largely overlooked. Thus, this study explores the impact of cross-border CVC investments on the likelihood of a venture firm's IPO. We argue that the foreignness of CVCs increases the likelihood of IPO, but this positive relationship is weakened when CVC units have a tight structure.

Design/Methodology/Approach – The hypotheses are tested with 1,874 high-technology venture firms in the U.S. that received CVC investments between 1994 and 2009. A two-stage analysis was employed to address potential selection bias. In the first stage, we employed a probit model to predict the probability of receiving cross-border CVC investment. In the second stage, we conducted a probit regression analysis on the likelihood of IPO, incorporating the inverse Mills ratio to address selection bias.

Findings – We found that the foreignness of CVCs increases the likelihood of a venture firm's IPO. However, this positive impact is weakened when CVCs have a tight governance structure.

Research Implications – This study highlights the benefits of cross-border CVC investments and enriches resource dependence theory by reconciling it with institutional theory, depicting the importance of both reducing resource constraints to create value for venture firms and the institutional logic pursued by CVCs. This study suggests that entrepreneurs should be careful with CVC units that prioritize strategic objectives.

Keywords: corporate venture capital, institutional theory, resource dependence theory, venture capital, venture firms

JEL Classifications: G24, M10, M13

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I. Introduction

Recently, corporate venture capital (CVC) has emerged as a prominent source in the venture capital ecosystem, participating in about 20% of VC deals in the United States in 2022 (NVCA, 2023). CVC is financial capital for venture firms provided by established firms for strategic purposes, reducing external resource dependence (Hallen et al., 2014). For venture firms, CVCs provide not only financial capital but also manufacturing and marketing resources, along with access to technological assets such as equipment, skilled personnel, and patents (Alvarez-Garrido & Dushnitsky, 2016; Basu et al., 2011; Katila et al., 2008; Park & Steensma, 2012). In exchange for providing financial capital, established firms gain access to emerging technological discontinuities (Maula et al., 2013), alleviate information asymmetry in M&A deals (Benson & Ziedonis, 2009), and enhance product demand through increased complementarity with invested ventures (Riyanto & Schwienbacher, 2006; Wang, 2023).

Extant research indicates that CVC investments create value for venture firms and generally enhance the likelihood of a successful venture exit (Huang & Madhavan, 2021). However, prior research has focused on the value creation of CVCs over independent venture capitals (IVCs), and has not examined differences among CVCs in value creation for venture firms. In particular, despite the globalization of CVC investments, the impact of CVCs from foreign countries on venture firm exit performance has been largely overlooked. The participation of foreign CVCs in the U.S. goes back to the 80s, when Japanese companies initiated CVC programs, and their investments in the U.S. VC market rose from 3% in 1983 to 12% in 1989 (CB Insights, 2017). Since then, the proportion of cross-border CVC investments in the U.S. has increased because of the nation's leadership in emerging technologies (Kang et al., 2021).

In this study, we postulate that the foreignness of CVCs will have a positive impact on the likelihood of a venture firm's IPO. Based on resource dependence theory, Huang and Madhavan (2021) argued that CVC investments were positively related to a successful venture exit because they reduce the resource constraints of ventures in the technology commercialization process. In a similar vein, cross-border CVC investments benefit invested ventures financially by providing resources, knowledge, and networks to overcome the liability of foreignness in the venture firm internationalization process. As such, resource dependency theory emphasizes the importance of collaborating with external partners to alleviate resource constraints (Hillman et al., 2009).

However, resource dependence theory generally assumes that the resource providers are opportunistic. Thus, prior research on CVC investments has considered corporate partners as "sharks" that misappropriate the technology of venture firms (Katila et al., 2008). Yet, not all CVCs have the same opportunistic propensity (Kim et al., 2019), and there are different types of CVCs for value creation (Bugl et al., 2022). This heterogeneity in CVCs can be explained by the direction of isomorphism (Balz et al., 2023; Souitaris et al., 2012). A loosely structured CVC unit, which refers to a dedicated fund managed by external IVCs or an investment subsidiary established outside the parent company (Dushnitsky, 2012), would focus its isomorphism externally toward the VC industry ("exoisomorphism") (Souitaris et al., 2012), and thus is more interested in the financial performance of venture firms. On the other hand, a tightly structured CVC unit, which is an internal department in charge of investment activities (Dushnitsky, 2012), would seek legitimacy internally within the parent company ("endoisomorphism") (Souitaris et al., 2012), and is thus more interested in the strategic objectives of its business units than in the growth of portfolio ventures (Kang, 2019; Pahnke et al., 2015). Consequently, we posit that the institutional logic of the parent company would strongly affect

the operation of a tightly structured CVC unit, diminishing the positive impact of cross-border CVC investments on venture firms.

The hypotheses are tested with 1,874 high-technology venture firms in the U.S. between 1994 and 2009 drawn from the Thomson ONE database. Since acquiring new technology is a strategic objective for established firms and technology misappropriation is the downside of CVC investments for entrepreneurs, we restricted the sample to high-technology ventures in the U.S. The dependent variable is a dummy variable concerning whether venture firms went public. Heckman's two-stage model was employed, and we found supporting results for the hypotheses.

This study contributes to the existing literature in several ways. First, it highlights the impact of cross-border CVC investments. Despite the notable prevalence of cross-border CVC investment in the U.S., there has been a dearth of comprehensive attention in the existing literature. In particular, the internationalization of venture firms is crucial as it enhances the efficiency and profitability of firms (Liu et al., 2022). However, venture firms generally lack resources for internationalization (Yang & Lee, 2023); thus, collaborating with established firms in host countries via CVC investments can accelerate the internationalization process. In this vein, this study systematically explores the benefits of cross-border CVC investments, and the conditions under which they are beneficial for venture firms.

Second, this study enriches resource dependence theory by considering that competing institutional logics may exist in a single institutional environment. While resource dependence theory traditionally centers on the alleviation of resource constraints through inter-organizational relationships (Hillman et al., 2009), the theory assumes external partners are opportunistic. Not all have the same opportunistic propensity, and this study suggests that the heterogeneity in the propensity may originate from the different institutional logics that CVC investors pursue (Souitaris et al., 2012).

II. Theory and Hypothesis

1. The Benefits of Cross-Border CVC Investments for Venture Firms

CVC investments play a crucial role in mitigating resource dependencies encountered by venture firms (Basu et al., 2011; Huang & Madhavan, 2021; Katila et al., 2008). First, CVC is a rich source of capital. Unlike IVCs, CVCs are not under the pressure of maximizing overall financial returns. Thus, they can provide "outsized cash infusions from a single source, without the venture having to court and coordinate a large syndicate of investors" (Katila et al., 2008, 301). Second, CVC investments facilitate venture firm access to the complementary resources of established firms, including manufacturing, legal, marketing, distribution, sales, customer services, and product development (Dushnitsky & Lenox, 2005b; Katila et al., 2008; Park & Steensma, 2012). Third, CVC investments provide venture firms endorsements that convey a positive signal regarding the venture's quality to other stakeholders (Stuart et al., 1999). This, in turn, enhances the likelihood of venture firms securing resources from other stakeholders. Therefore, CVC-backed venture firms are more likely to exit successfully (Gompers & Lerner,1998) or receive higher M&A premiums (Ivanov & Xie, 2010), especially when specialized complementary assets are required for technology commercialization (Park & Steensma, 2012).

Cross-border CVC investments play a pivotal role in mitigating the resource dependencies of venture firms aiming for globalization, and this advantage is further heightened with the foreignness of corporate investors. First, venture firms focusing on a geographically distant market encounter a more substantial liability of foreignness, and cross-border CVC investments can be particularly advantageous. The liability of foreignness is defined as additional costs that a foreign firm would incur due to unfamiliarity with the local environment, a lack of legitimacy in the

market, and spatial distance (Zaheer, 1995). Cross-border CVC investment mitigates the liabilities of foreignness by providing not only related knowledge and resources for internationalization but also legitimacy in foreign countries (Devigne et al., 2013; Mäkelä & Maula, 2005; Wang, 2023), and by reducing the social costs of internationalization (Eden & Miller, 2004). For instance, consider a U.S.-based venture firm entering into Chinese and Canadian markets. The endeavor to overcome the liability of foreignness is more financially burdensome when entering the Chinese market as compared to that in Canadian, given the greater unfamiliarity of the venture with the Chinese market. Consequently, establishing a cross-border CVC investment relationship with a Chinese corporation holds more significant value than a similar relationship with a Canadian counterpart.

Second, forming investment relationships with established firms in foreign countries serves as a catalyst for learning and innovation within venture firms. Knowledge spillovers are geographically localized, and the diffusion process is slow (Jaffe et al., 1993). Hence, cross-border CVC investments have the potential to expose invested ventures to the unique requirements of foreign markets, thereby expanding the knowledge base of venture firms. Network resources brought by cross-border CVC investments may help invested ventures overcome competency traps and stimulate innovations (Levinthal & March, 1993). Venture firms "may learn more from foreign partners with dissimilar national backgrounds and cultures than from domestic partners that have emerged in the same national environments, and thus share national resources, values, beliefs, and social norms" (Lavie & Miller, 2008, 625).

Consequently, the adoption of cross-border CVC investments facilitates the seamless entry of venture firms into foreign markets, thereby contributing to the accelerated growth trajectory.

H1: The foreignness of the corporate investors of a focal venture firm will increase the likelihood of the venture firm's IPO.

2. The Governance Structure of CVC Investors

Although CVC investments benefit venture firms by removing dependencies on complementary resources, prior research has assumed that CVC investments trigger a new constraint in the form of technology misappropriation by the parent companies of CVCs, often referred to as "sharks" (Katila et al., 2008). Thus, it is suggested that venture firms adopt powerful defense mechanisms to prevent misappropriation while collaborating with established corporations (De Clercq et al., 2006; Hallen et al., 2014). Venture firms must disclose technological details to receive CVC investments, and this heightens the risk of knowledge leakage. Anecdotal evidence also indicates concerns among some entrepreneurs about potential constraints imposed by CVC, such as limitations on selling to rival ecosystems associated with the corporate investor's competitors (Huang & Madhavan, 2021).

However, not all have the same opportunistic propensity (Kim et al., 2019). Some are more opportunistic than others, and some CVCs even create enormous value for venture firms (Balz et al., 2023; Bugl et al., 2022). This heterogeneity may originate from the presence of competing institutional logics in the environment (Souitaris et al., 2012). Organizations are under pressure to resemble other organizations that face the same set of environmental conditions (DiMaggio & Powell, 1983). Yet, in the absence of a dominant logic, competing logics may exist in a single institutional environment. In the CVC context, a CVC unit may seek to align with its parent company's norms or the VC industry. The former is called "endoisomorphism", and the latter is "exoisomorphism" (Souitaris et al., 2012).

The two competing institutional logics are substantially distinct. The parent corporations of CVCs are more interested in the strategic objectives of the corporate business units than the financial outcome of the investment itself (Pahnke et al., 2015). Thus, they prefer venture firms execute long-term, but strategically important,

innovation projects that would not have otherwise been pursued internally. On the other hand, IVCs pay more attention to the growth of venture firms to maximize the financial return of the investment (Pahnke et al., 2015). They favor short-term projects on a milestone basis for staged financing. These two logics are not well coordinated, and CVCs struggle to figure out which institutional logic is more important for survival (Souitaris et al., 2012).

Therefore, we argue that the governance structure of a CVC unit would moderate the positive impact of cross-border CVC investments because it determines which voice should take precedence in the organization (Arthurs et al., 2008; Hoskisson et al., 2002). Dushnitsky (2012) categorized the governance structure of a CVC unit as tight or loose, depending on the level of the parent company's involvement. A tight structure refers to an internal department that operates CVC investment activities, while a loose structure is a subsidiary, independent of the parent company, specialized for investments, or a dedicated VC fund co-managed with other IVCs (Dushnitsky, 2012). Hence, a CVC unit with a tight structure seeks to align with the corporate norms, whereas a CVC unit with a loose structure seeks legitimacy from the VC industry.

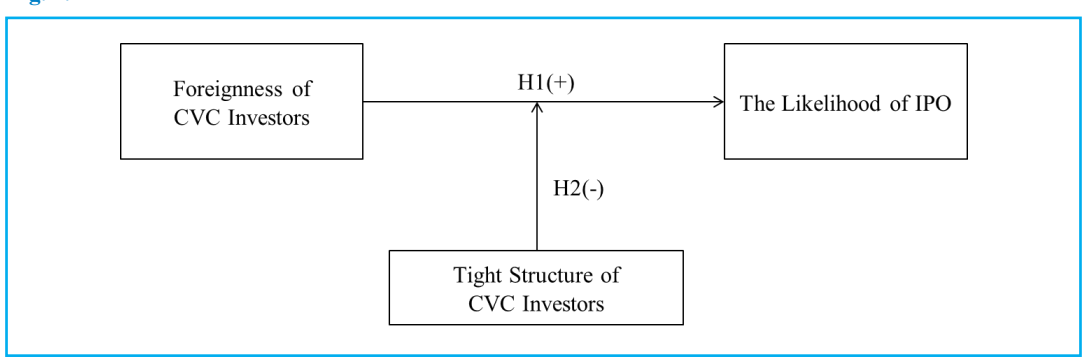
First, when CVCs pursue a corporate parent's norms, corporate investors may harbor a greater interest in appropriating the intellectual property of venture firms rather than furnishing the complementary resources for growth (Dushnitsky & Shaver, 2009; Katila et al., 2008). Established firms strategically invest in venture firms with the motivation to acquire emerging technological knowledge (Basu et al., 2011; Dushnitsky & Lenox, 2005a; Wadhwa & Kotha, 2006). If corporate investors succeed in imitating the technology, they may no longer be motivated to maintain the relationship, and may even try to exit (Zahra & Allen, 2007), in which case venture firms may not gain the needed complementary resources.

Second, even if venture firms secure complementary resources from corporate investors, this may not necessarily translate into growth (Kang, 2019). Power imbalances (Casciaro & Piskorski, 2005) or asymmetrical dependence (Gulati & Sytch, 2007) are inherent attributes of CVC investments. The complementary resources that render corporate investors appealing to venture firms also endow investors with heightened bargaining power (Casciaro & Piskorski, 2005), leaving venture firms vulnerable to the risk of failing to appropriate the value generated from CVC investment (Bae & Gargiulo, 2004). Thus, we posit:

H2: The positive relationship between the foreignness of corporate investors and the likelihood of the venture firm's IPO will be weakened when the foreign corporate investors have a tight structure.

The research model is summarized in Fig. 1.

Fig. 1. Research Model



III. Methods

1. Data and Sample

The hypotheses are tested with 1,874 high-technology venture firms[1] in the U.S. that received CVC investments and had first and last funding rounds between 1994 and 2009. The sample was drawn from the Thomson ONE database in 2014. The sample was restricted to venture firms in the U.S. because the coverage of the database is the most comprehensive in the U.S. (Maats et al., 2011). Second, global firms are attracted to the U.S. VC market due to its leadership in emerging technologies. We chose the right end of sample year 2009 because, to minimize the right censoring issue, we need to set at least a five-year gap to track whether the sample venture firms went public or not. Then, we collected the data from 1994 and set a 25-year time frame to track all CVC investments of the venture firms.

The sample was constructed as follows. To identify a CVC investor and its parent company, we first sorted investors categorized as 'Corporate PE' by the database. Then, we manually searched the parent company of the investors using Google and Lexis-Nexis, but excluded those that were financial or non-profit organizations. We classified a CVC investment as cross-border if the headquarters of the parent company was located outside the U.S. The final sample consisted of 1,874 venture firms. 63% of the venture firms received CVC investments from established firms in the U.S., and the rest had at least one cross-border CVC investment. About 65% of the sample had only one CVC investment, but the other 35% consisted of multiple CVC investments, ranging from two to thirteen, with 1.6 on average. We took the average values of the variables for CVC investor characteristics.

2. Econometric Approach

The unit of analysis in this study is the venture firm, and a two-stage analysis was employed to address potential selection bias, following the methodology proposed by Heckman (1979) and Shaver (1998). In the first stage, we employed a probit model to predict the probability of a venture firm receiving a cross-border CVC investment. A value of one was assigned if the venture firm received at least one cross-border CVC investment, and zero otherwise. In the second stage, we conducted a probit regression analysis again with the likelihood of IPO as the dependent variable, together with the inverse Mills ratio (Lambda) to address the selection bias. We opted for the Heckman model instead of the instrumental variable method since identifying suitable exogenous variables for each stage is challenging. For example, employing time-lagged variables as exogenous variables was deemed inadequate due to their high correlation.

3. Measures

3.1. Dependent Variable: Likelihood of Venture Firm's IPO

Prior research considers an initial public offering (IPO) to be success for a venture firm (e.g. Gompers & Lerner, 1998; Park & Steensma, 2012). Thus, we assigned one if a venture firm had gone public as of February 2014, and zero otherwise. As in Park & Steensma (2012), we have at least a five-year gap after the last funding round in tracking whether venture firms had IPOs.

3.2. Explanatory Variable: Foreignness of CVC Investors

To measure the foreignness of CVC investors, we manually identified the location of the headquarters of CVC parent firms using COMPUSTAT, Google, and Lexis-Nexis. Since venture firms in the sample received investments from 1.6 CVC investors on average, we measured the average value of the foreignness of all CVC

1. High-tech venture firms are those between VEIC (Venture Expert Industry Code) 1000s and 5000s.

investors in the syndicate. The foreignness variable can be measured with four dimensions: cultural, institutional, geographic, and economic distances (Ghemawat, 2001). First, for cultural distance, we used GLOBE Project data (House et al., 2004) instead of Hofstede's cultural dimensions. The GLOBE Project consists of nine dimensions, and we measured the average squared differences of each dimension by $\sum_{d=1}^{9}(C_{dc}-C_{du})^2/9V_d$, where C_{dc} is the value of each cultural dimension d for country c, u indicates the United States, and V_d is the intercountry variance of each dimension. Second, we used six aggregate country governance indicators of World Bank data to measure the institutional distance (Kaufmann et al., 2005). We computed institutional distance via the formula $\sum_{j=1}^{n_{it}}\left|I_{kc_j}-I_{ku}\right|/n_{it}$, where I_k is the institutional dimension k, c_j is the country of CVC investor j, u is the United States, and n_{it} refers to the number of CVC investment venture firm i in year t. Third, to measure the economic distance, we used the World Bank's World Development Indicators data on country gross domestic product per capita (*GDPpc*). We calculated economic distance with the formula $log\left(1+\sum_{j=1}^{n_{it}}\left|GDPpc_{c_j}-GDPpc_u\right|/n_{it}\right)$. Fourth, we measured the geographic distance between two nations from the CEPII distance data and logged it to reduce skewness. The CEPII geodesic distance is calculated using the latitudes and longitudes of the most important cities in terms of population (Mayer & Zignago, 2011). To construct a composite measure, we operated principal factor analysis with a varimax rotation on the four dimensions. The analysis produced a single factor with an eigenvalue of 7.109, and we operationalized the factor score as the foreignness of CVC investors.

3.3. Moderating Variables

Similarly, to measure whether a CVC investor has a tight structure, we first assigned one if the CVC investor in the syndicate of an invested venture has an internal department responsible for CVC investment activities, and zero otherwise. Then, we averaged all values of CVC investors to calculate a venture firm level value.

3.4. Control Variables

First, following Katila et al. (2008), we controlled the resource needs of venture firms. We operationalized manufacturing resource needs as the industry (four-digit SIC) average ratio of fixed assets to sales in each investment year. We used the yearly industry value of 'Property, Plant, and Equipment' (*PPENT*) and 'Revenue' (*REVT*) items from the COMPUSTAT North America database. Then, we calculated $\sum_{INV=1}^{n}(PPENT_{SIC_i,t_{INV}}/REVT_{SIC_i,t_{INV}})/n$, where SIC_i is the industry of the venture firm i, t_{INV} represents the investment year of each CVC investment that venture firm i received during its fundraising period, and n represents the number of CVC investments venture firm i received. Similarly, we calculated $\sum_{INV=1}^{n}(XSGA_{SIC_i,t_{INV}}/REVT_{SIC_i,t_{INV}})/n$, where $XSGA_{SIC_i,t_{INV}}$ is the industry average of 'Selling, General and Administrative Expenses' (*XSGA*) in year t_{INV}. To calculate financial resource needs, we took the natural logarithm value of the total equity amount (in million US dollars) that venture firm i received during its fundraising period.

Second, we also controlled the timing of CVC investments. This was derived by taking the natural logarithm value of the average round numbers of the CVC investments that the venture firm had during its fundraising period. The formula is $ln\left(\sum_{tr=1}^{n}Round\ Number_{i,tr}/n\right)$, where $Round\ Number_{i,tr}$ is the round number of each CVC transaction tr that venture firm i had.

Third, we controlled the industry overlap between the venture firm and the parent firms of its CVC investors. We assigned a value of one if each CVC investor's parent firm operated in the same industry (four-digit SIC) as the venture firm,

and zero otherwise. Then, we averaged all values to derive a venture firm variable.

Fourth, we also considered variables related to investor characteristics. *Experience of CVC Units* is the logged value of the average of the months passed until the focal investment date following the unit's first investment. *Fund Size of CVC Units* is the average size of all CVC funds that the venture firm received during its fundraising period. The fund size was measured by using the category provided by the database. *Number of CVC Investors* is the logged value of the number of different CVC investors that invested in the focal venture.

Fifth, we also considered environmental dimensions. We originally considered the four dimensions, but left out the concentration and uncertainty variables due to their high correlation with other variables. Hence, we included only two variables:industry size and growth. *Industry Size* refers to the total sales amount of the industry (four-digit SIC) in which the venture firm operates, and *Industry Growth* is the regression slope of industry sales over the previous five year period. We also included the *Internationalization Opportunity* variable. It is the relative size of the industry trade (export and import) amount to the industry size. We used National Bureau of Economic Research to collect the export and import amount in the U.S., and the COMPUSTAT North America database to generate industry variables. We measured these three variables in the first round year and in the last round year plus one. The two separate time frames were considered because we used a two-stage analysis to adjust self-selection bias.

Sixth, we also accounted for venture firm characteristics. *Venture Cluster Region* is assigned a value of one if the venture firm is located in either "California", "Massachusetts", or "Texas", and is zero otherwise. We also included the industry of the venture firm as a dummy variable and a year dummy to account for any unknown effect. In the first stage, the first round year of each venture firm was used as a year dummy, and the last round year was considered in the second stage.

IV. Results

Tables 1 and 2 depict the correlation matrixes of variables used in the first and second stages. Multicollinearity appears not to be severe, except for the correlation between Total Financial Resource Needs and Round Number variables (0.493, $p < 0.001$). However, this correlation remains below 0.5, and the Value Inflation Factor (VIF) for both the first and second stages is below 5. Table 3 presents the probit model predicting whether venture firms received cross-border CVC investment. The coefficients for Tight Structure and Industry Overlap variables are negative and significant, indicating that venture firms tend to avoid CVC investors from the same industry, as well as those with a tight structure. Additionally, the positive and weakly significant coefficient for Round Number suggests that venture firms are more likely to secure cross-border CVC investment in later stages. The characteristics of foreign CVC investors are also outlined, revealing that they tend to be less experienced with larger fund sizes. Variables such as Number of CVC Investors, Internationalization Opportunity, Industry Size, and Venture Cluster are all significant, suggesting that venture firms receiving cross-border CVC investment are inclined to form multiple CVC investment relationships, operate in larger industries with more globalization opportunities, and are situated in venture cluster regions, indicating a focus on ventures with growth potential.

Table 4 presents the probit analysis in the second stage. In Model 1, comprised of control variables only, the Financial Resource Needs variable is positive and significant, indicating that venture firms succeeding in IPOs possess excellent growth potential. Negative and significant Round Number and Fund Size variables imply that early involvement of CVC investors increases the likelihood of IPO, while participation in later stages may not significantly contribute to a venture firm's IPO. The positive and significant Foreignness of CVC Investors variable across all models supports Hypothesis 1, suggesting

Table 1. Correlation Matrix for the FirstStage Model

Variables	Mean	S.D.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Cross-border CVC Involved	.367	.482													
(2) Tight Structure of CVC Investors	.416	.441	.090***												
(3) Round Number (ln)	.999	.573	.078***	.017											
(4) Industry Overlap	.272	.402	.107***	.097***	-.004										
(5) Manufacturing Resource Needs at t_{INV}	.269	.292	.034	.044	-.021	-.007									
(6) Marketing Resource Needs at t_{INV}	.388	.138	.029	-.022	.019	-.021	-.307***								
(7) Total Financial Resource Needs (ln)	3.552	1.077	.077***	-.108***	.493***	-.017	.110***	-.039							
(8) Experience of CVC Unit (ln)	4.125	1.153	-.024	.091***	.124***	-.023	.017	-.054*	.009						
(9) Fund Size of CVC Unit	1.635	1.175	.094***	.251***	-.008	.029	.018	.031	.055*	-.092***					
(10) Number of CVC Investors (ln)	.322	.483	.273***	-.079***	.193***	.016	.012	-.004	.299***	.067**	.027				
(11) Internationalization Opportunity at t_{FR}	.207	1.049	.039	-.001	-.017	-.019	.052*	-.112***	-.005	.015	-.005	.002			
(12) Industry Size (ln) at t_{FR}	10.913	1.278	.023	.042	-.085***	-.109***	.101***	.251***	.011	.042	-.019	-.022	-.225***		
(13) Industry Growth at t_{FR}	15.843	10.912	.007	-.066**	.053*	.045*	-.009	.127***	.101***	-.152***	.065**	.132***	.015	-.056*	
(14) Venture Cluster Region	.660	.474	.107***	-.015	.042	-.030	-.033	.005	.050*	-.010	.041	.051*	.020	.019	.005

Notes: 1. N=1,874 venture firms.
2. $^{\dagger}p<0.1$, $*p<0.05$, $**p<0.01$, $***p<0.001$.

Table 2. Correlation Matrix for the Second Stage Models

Variables	Mean	S.D.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) Likelihoof of IPO of Venture Firm	.118	.323														
(2) Foreignness of CVC Investors	.021	.997	.044†													
(3) Tight Structure of CVC Investors	.416	.441	-.056*	.085***												
(4) Manufacturing Resource Needs at t_{INV}	.269	.292	.055*	.041†	.044†											
(5) Marketing Resource Needs at t_{INV}	.388	.138	-.016	.014	-.022	-.307***										
(6) Total Financial Resource Needs (ln)	3.552	1.077	.190***	-.012	-.108***	.110***	-.039†									
(7) Round Number (ln)	.999	.573	.074**	-.007	.017	-.021	.019	.493***								
(8) Industry Overlap	.272	.402	-.020	.129***	.097***	-.007	-.021	-.017	-.004							
(9) Internationalization Opportunity at t_{LR+1}	.165	.594	.002	.039†	-.015	.062**	-.176***	.001	-.038†	-.038†						
(10) Industry Size (ln) at t_{LR+1}	11.289	1.249	-.040†	.039†	.032	.129***	.296***	.080***	.038	-.113***	-.248***					
(11) Industry Growth at t_{LR+1}	8.778	8.781	.133***	-.035	-.042†	.059*	.038	-.115***	-.051*	-.030	-.083***	-.034				
(12) Experience of CVC Unit (ln)	4.125	1.153	-.009	-.079***	.091***	.017	-.054*	.009	.124***	-.023	.014	.047*	-.053*			
(13) Fund Size of CVC Unit	1.635	1.175	-.040†	.063**	.251***	.018	.031	.055*	-.008	.029	-.020	-.022	-.035	-.092***		
(14) Number of CVC Investors (ln)	.322	.483	.056*	.033	-.079***	.012	-.004	.299***	.193***	.016	-.028	.004	-.003	.067**	.027	
(15) Venture Cluster Region	.660	.474	-.005	.102***	-.015	-.033	.005	.050*	.042†	-.030	.019	.032	.042†	-.010	-.010†	.051*

Notes: 1. N=1,874 venture firms.
2. $^{\dagger}p<0.1$, $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$.

Table 3. Probit Analysis for Cross-Border CVC Investment Decision

Dependent Variable: Cross-border CVC Involved	First-stage model
Tight Structure of CVC Investors	-0.300*** (0.078)
Round Number (ln)	0.115† (0.067)
Industry Overlap	-0.482*** (0.086)
Manufacturing Resource Needs at t_{INV}	0.074 (0.120)
Marketing Resource Needs at t_{INV}	0.376 (0.276)
Total Financial Resource Needs (ln)	0.003 (0.037)
Experience of CVC Unit (ln)	-0.105*** (0.029)
Fund Size of CVC Unit	0.069* (0.028)
Number of CVC Investors (ln)	0.855*** (0.071)
Internationalization Opportunity at t_{FR}	0.117† (0.067)
Industry Size (ln) at t_{FR}	0.090** (0.030)
Industry Growth at t_{FR}	0.003 (0.004)
Venture Cluster Region	0.294*** (0.068)
Constant	-1.094** (0.404)
Industry Dummy	INCLUDED
Year Dummy (Yerar of First Round)	INCLUDED
Log likelihood	-1086.41
Pseudo R2	0.118

Notes: 1. N=1,874 venture firms.
2. †p<0.1, *p<0.05, **p<0.01, ***p<0.001.

Table 4. Probit Analysis for the Likelihood of a Venture Firm IPO

Dependent Variable: Likelihood of Venture Firms' IPO				
	Model 1	Model 2	Model 3	Model 4
Foreignness of CVCs		0.130** (0.043)	0.131** (0.043)	0.202** (0.056)
Tight Structure of CVCs			0.164 (0.138)	0.173 (0.139)
Tight Structure X Foreignness				-0.186* (0.095)
Manufacturing Resource Needs at t_{INVs}	0.008 (0.158)	0.007 (0.160)	0.001 (0.160)	0.001 (0.160)
Marketing Resource Needs at t_{INVs}	0.322 (0.371)	0.364 (0.374)	0.273 (0.382)	0.288 (0.382)
Financial Resource Needs (ln)	0.621*** (0.063)	0.630*** (0.064)	0.630*** (0.063)	0.630*** (0.064)
Round Number (ln)	-0.203* (0.091)	-0.192* (0.091)	-0.209* (0.092)	-0.202* (0.093)
Industry Overlap	0.084 (0.156)	0.104 (0.156)	0.206 (0.178)	0.205 (0.179)
Internationalization Opportunity at t_{LR+1}	-0.079 (0.095)	-0.081 (0.093)	-0.100 (0.092)	-0.097 (0.097)
Industry Size (ln) at t_{LR+1}	-0.054 (0.042)	-0.059 (0.043)	-0.074 (0.045)	-0.075 (0.045)
Industry Growth at t_{LR+1}	0.008 (0.006)	0.007 (0.006)	0.008 (0.005)	0.007 (0.006)
Experience of CVC Unit (ln)	0.044 (0.043)	0.048 (0.043)	0.072 (0.048)	0.074 (0.048)
Fund Size of CVC Unit	-0.092* (0.046)	-0.097* (0.046)	-0.100* (0.046)	-0.104* (0.046)
Number of CVC Investors (ln)	-0.223 (0.190)	-0.182 (0.192)	-0.360 (0.244)	-0.353 (0.244)
Venture Cluster Region	-0.091 (0.112)	-0.097 (0.112)	-0.164 (0.126)	-0.165 (0.126)
Correction for self-selection (λ)	-0.424 (0.311)	-0.320 (0.314)	-0.634 (0.412)	-0.638 (0.412)
Constant	-1.275 (0.940)	-1.464 (0.939)	-1.127 (0.983)	-1.247 (0.987)
Industry Dummy		INCLUDED		
Year Dummy (Yerar of Last Round)		INCLUDED		
Log likelihood	-540.36	-536.00	-535.30	-533.34
Pseudo R2	0.208	0.214	0.215	0.218

Notes: 1. N=1,874 venture firms.
2. $^{\dagger}p<0.1$, $*p<0.05$, $**p<0.01$, $***p<0.001$.

that cross-border CVC investment enhances the likelihood of venture firm IPO by mitigating resource dependencies for globalization and promoting learning and innovation.

Hypothesis 2 posits that the positive impact of cross-border CVC investment on the likelihood of a venture firm's IPO will diminish when corporate investors have a tight structure. In Models 3 and 4, the direct effect of the tight structures of CVC investors is not evident, and the coefficients are statistically insignificant. However, the negative and significant interaction term in Model 4 supports Hypothesis 2, suggesting that when a foreign corporate investor has a tight structure, cross-border investment may yield more harm than benefit.

V. Discussion and Conclusion

Cooperative strategies play an important role in promoting technological innovation (Andal, 2023). Recently. CVC investments have become more popular in bridging established firms and entrepreneurial ventures. In this context, our research aimed to ascertain whether cross-border CVC investment holds advantages over its domestic counterpart, revealing a positive correlation between the foreignness of CVC investors and the likelihood of venture firms achieving an IPO. This positive association stems from the role of cross-border CVC investment in aiding venture firms in surmounting the challenges associated with foreignness during the internationalization of sales and operations. Furthermore, cross-border CVC investment serves as a catalyst for learning and innovation within venture firms. Nevertheless, the positive impact of cross-border CVC investment may be attenuated in instances where CVC units adopt a tight structure, which refers to an internal department responsible for CVC investment activities. CVC units with a tight structure are less autonomous in both the investment process and portfolio company management, and tend to prioritize the strategic objectives of the corporate parent, potentially leading to the appropriation of value generated from cross-border CVC investments.

This study contributes to the existing literature in several ways. First, it highlights the benefits of cross-border CVC investments. The existing body of research has predominantly been concentrated on the affirmative impact of CVC investments on venture firms. However, prior research has not examined how the attributes of CVC investors could cause differences in the performance of invested ventures. In particular, despite the notable prevalence of cross-border CVC investment in the U.S., there has been a dearth of research on this topic. For instance, LiPuma (2006) attempted to show the benefits of CVC investments in the internationalization of venture firms without success. Although this study does not directly address the internationalization of venture firms, it suggests that the unexpected results of LiPuma (2006) may be due to not considering the foreignness of CVCs.

Second, this study also enriches resource dependence theory by reconciling it with institutional theory. While resource dependence theory traditionally centers on the alleviation of resource constraints through inter-organizational relationships (Hillman et al., 2009), the theory assumes external partners are opportunistic. In this vein, prior literature has emphasized the importance of employing defense mechanisms to protect against technology misappropriation by CVCs (Hallen et al., 2014, Kang, 2019; Katila et al., 2008). However, not all have the same opportunistic propensity (Kim et al., 2019). Souitaris et al. (2012) suggest this heterogeneity may originate from the presence of competing institutional logics in the environment. CVCs can be categorized depending on whether they focus their isomorphism externally toward the VC industry ("exoisomorphism") or internally toward the parent ("endoisomorphism"). Recently, Balz et al. (2023) examined how this typology would determine the efficiency of venture firms, showing a negative impact with endoisomorphic CVCs. However, Balz et al. (2023) examined the direct effect of CVC isomorphism and did not consider

the aspect of resource dependence theory. On the other hand, this study reveals the importance of both reducing resource constraints to create value for venture firms and the institutional logic pursued by CVCs.

The managerial implications derived from our findings are straightforward. Venture firms should carefully consider cross-border CVC investment as a strategy to enhance the likelihood of going public. While foreign CVC investors offer positive contributions to performance, an overreliance may diminish the probability of a successful IPO. Furthermore, when contemplating cross-border CVC investments, venture firms are advised to be careful with CVC units that prioritize strategic objectives over the growth of venture firms.

Despite the contributions, some limitations should be acknowledged. First, the study did not account for the effects of IVCs, which constitute a significant portion of cash infusion for venture firms. However, we purposely excluded IVC transactions to highlight the degree of foreignness in CVC investment. Second, the technological capability of venture firms was not considered in the analysis due to the inherent challenges in operationalizing such unknown factors. Last, while the study has explored cross-border investment from the perspective of venture firms in the U.S., examining the reverse scenario, such as a U.S. CVC investing in a Korean venture firm, would be an interesting topic for future research. In situations where venture firms in Korea seek entry into the U.S. market, the benefits of cross-border CVC investment may outweigh the associated risks.

As cross-border CVC investment continues to gain prevalence in the context of globalization, future research on this topic is imperative to deepen the understanding of its characteristics. Such research will provide valuable insights for practitioners and policymakers navigating an increasingly globalized landscape.

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The Role of Human Resources in the Financial Performance of the Lodging Industry: Evidence Based on Financial Accounting Numbers in Korea

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ABSTRACT

Purpose – This study investigates the role of human resource investment in the tourist accommodation sector of Korea. Specifically, it aims to explore the impact of human resource investment, particularly through employee education and training, on both the short-term and long-term financial performance within the Korean lodging industry.

Design/Methodology/Approach – Utilizing data from private firms for 2011-2020, the study examines how financial performance, including sales growth, is related to expenditures on education, training, and benefits as proxies for human resource investment. The research primarily employs a series of multivariate regression analyses.

Findings – The findings reveal that human resource investment itself does not affect short-term financial performance, but complements and supports financial outcomes of capital expenditure (PPE investment). However, the sales-based performance attributable to human resource investment becomes apparent within two years, and the supporting effect on financial performance generated due to capital expenditure still holds. Additionally, these results are significant for large-sized firms, but not for those small.

Research Implications – Overall, human resource investment plays a critical role in firm performance by serving as a key factor in managing company resources efficiently. This study highlights the need for the simultaneous periodic management of capital- and human resources. Furthermore, this study sheds light on the role of human resource investment in the lodging industry by providing empirical results based on financial accounting numbers, an aspect that has not previously been extensively considered.

Keywords: capital expenditure, financial performance, human resources investment, lodging industry, sales growth

JEL Classifications: M10, M12, M40

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I. Introduction

South Korea, renowned for its abundant cultural heritage, scenic natural landscapes, and contemporary urban centers, draws a substantial number of tourists annually, bolstering the nation's economic development. Notably, the tourism sector, encompassing the accommodation industry, plays a pivotal role in the country's Gross Domestic Product (GDP). The sector generates considerable revenue through diverse avenues such as hotels, guesthouses, resorts, and various other accommodation facilities. This sector accounted for approximately 2.8% of the total industry in South Korea as of the year 2020 (Park, 2020).

The lodging industry encompasses a spectrum of business endeavors focused on constructing and operating facilities that offer temporary accommodation and ancillary services to travelers and tourists. This sector includes a diverse array of establishments, each tailored to meet the varied needs and preferences of its clientele. For firms within this industry, multiple factors are instrumental in determining business success, which ultimately contributes to an increase in sales. These factors include the implementation of effective marketing strategies, achieving high levels of customer satisfaction, and providing comprehensive job training for employees. Crucially, the efficient utilization of both capital and human resources, in conjunction with the provision of high-quality services, plays a pivotal role in shaping the success and reputation of lodging establishments within this industry.[1]

The lodging industry is predominantly characterized by its high capital intensity, particularly in the initial investment in fixed assets such as facilities. This sector's business operations are fundamentally reliant on providing customers with accommodations, food, and various amenities. From a financial perspective, the operational profitability of this industry is largely dependent on the returns generated from these assets, as indicated by Atkinson et al. (1995) and Coltman et al. (2001). Consequently, lodging firms can realize long-term profitability through the expansion of facilities, which necessitates intensive initial investment. Furthermore, as Rutherford (2003) noted, these firms have effectively employed strategies involving the enhancement and luxury augmentation of their facilities through capital investment. This approach not only serves as a marketing strategy but also significantly improves profitability.[2] Consequently, firms with this capital structure are predisposed to elevated operational risks. Indeed, the accommodation sector is notably susceptible to fluctuations stemming from seasonality (e.g., peak and off-peak seasons) and economic cycles (such as periods of expansion and recession). This vulnerability often results in erratic business performance, influenced by factors beyond the control of operational management.

Conversely, in contrast to industries that generate products through mechanization, the advancement of technology, and resource utilization, the lodging industry is distinguished by its creation of added value predominantly through human resources, as highlighted by Rutherford (2003). In this sector, the quality of service is gauged by consumer satisfaction, which is attained when the service rendered meets or exceeds customer expectations. Furthermore, the efficacy of service in the lodging industry is often propagated through word-of-mouth endorsements from consumers, thereby realizing substantial marketing effects (Kwon & Shin, 2022; Shim et

1. The financial performance of the lodging industry is influenced by various determinants that can impact profitability and overall financial health. These determinants can vary depending on factors such as location, type of accommodation, market conditions, and management practices. However, since the physical condition and maintenance of the property mainly impact customer satisfaction, which leads to sales, capital resource investment is a key element for financial performance.
2. In the accounting perspective, capital investment in facilities that accounts for a high proportion of assets allocated to ‘expense (i.e., depreciation expense)’, and can be a negative factor for operating income. This study focuses on whether these investment expenditures actually generate an increase in sales, not net income.

al., 2022). Therefore, in response to the evolving landscape of human resource management, it is imperative to invest in employee education and training for continuous human resource development.

This investment aims to enhance the skills, knowledge, and attitudes of employees (Barzegar & Farjad, 2011; Chen & Klimoski, 2007; Ilgen & Pulakos, 1999; Vandewalle & Cummings, 1997). Numerous studies, including those by Jacobs and Washington (2003) have reported that employee education and training not only elevate customer satisfaction but also improve employee job satisfaction, ultimately leading to enhanced corporate performance. However, despite these benefits, the high turnover rate in the lodging industry often discourages managers from investing in employee education and training, as noted by KLI (2001), due to the associated costs.[3]

In this context, this study aims to explore the impact of human resource investment, particularly through employee education and training, on both short-term and long-term financial performance within the Korean lodging industry. The effectiveness of employee education and training can be assessed through various dimensions, encompassing both quantifiable data, such as productivity, and qualitative indicators, like changes in individual attitudes. However, this study intends to focus on quantitative indicators, specifically those measurable through accounting figures, such as sales growth reflected in comprehensive income statements. This approach aims to provide a quantitative assessment from an accounting perspective, thereby testing the financial performance outcomes of employee education and training, which have predominantly been evaluated using qualitative data, such as surveys, until now.

This study initially examines the influence of human resource investment on both short-term and long-term sales growth within the lodging industry. However, as previously mentioned, in this sector, both capital and human resources are integral to business performance. Consequently, this research aims to analyze the incremental effect of human resources on short- and long-term sales growth, particularly in augmenting financial performance resulting from capital resource investments. Intriguingly, it seeks to explore the variance in the impact and timing of human and capital resources on prospective sales growth, and to ascertain the complementary interplay between these two critical elements of firm resources. The first hypothesis posited in this study is that human resource investment in the lodging industry is positively correlated with future sales growth. Furthermore, the second hypothesis posits that human resource investment in this sector incrementally enhances financial performance derived from capital expenditures.

This research is crucial because comprehending the interaction between capital expenditure and human resource investment is pivotal in evaluating the performance of the lodging industry. It empowers managers to make data-driven decisions that optimize resources, enhance financial outcomes, and ultimately drive the success and sustainability of their businesses. Moreover, this exploration is particularly significant given the absence of empirical studies that have concurrently analyzed these factors.

Utilizing longitudinal data from 2011 to 2020 on firms in the Korean tourist accommodation sector, our research primarily employs a series of multivariate regression analyses. The findings indicate that while human resource investment does not directly impact short-term financial performance, it does play a complementary role in enhancing the financial outcomes of capital expenditure, particularly in property,p, and equipment (PPE) investment. Notably, the sales-based performance attributable to human resource investment becomes evident within a two-year

3. As of 2012, it was reported that accommodation and restaurant businesses were the highest in the proportion of under-skilled employees (Kim et al., 2012).

timeframe, and its supportive effect on the financial performance resulting from capital expenditure persists. Furthermore, these results are significant for large-sized firms, although they are not as pronounced for smaller entities. Overall, human resource investment is a pivotal factor in firm performance, crucially contributing to the efficient management of a company's resources. This study underscores the necessity for simultaneous and periodic management of both capital and human resources.

This study offers both academic and practical contributions. Firstly, by empirically demonstrating the relative significance of material and human resource investments in influencing an organization's operational performance, it extends previous research on the efficient utilization of corporate resources. Notably, it illuminates the role of human resources in the lodging industry, providing empirical findings based on financial accounting data, an aspect previously underexplored. Additionally, it provides insights for future research designs, suggesting ways to more effectively investigate human resource-related topics using accounting data.

Secondly, by analyzing the mechanisms through which human resources impact financial performance, this study imparts a heightened awareness of the importance of human resource investment to managers and practitioners. This understanding is expected to motivate a more active investment in human resources in practical settings. Moreover, by considering the effective interaction between human resources and capital investments, firms can develop new strategies for asset optimization and productivity enhancement.

Most studies emphasizing the significance of human resources rely on survey-based methods. In contrast, this study distinguishes itself by utilizing actual accounting numbers representing a firm's financial performance. Furthermore, it stands out as there is a lack of prior research exploring the perspective from which the impact of human resources interacts with the performance of tangible assets to generate overall corporate performance.

The structure of this paper is organized as follows. Section II delineates the development of the hypotheses. Section III elaborates on the research methodology, encompassing variable measurement and the specification of the test model. Section IV presents the results of the empirical analysis. The paper concludes with Section V.

II. Hypothesis

This study investigates the impact of human resource investment on enhancing both short-term and long-term financial performance in the Korean lodging industry. As previously discussed, this industry significantly relies on human resources to generate added value, underscoring the need for investment in employee education and training for ongoing human resource development, as evidenced by Barzegar and Farjad (2011), Chen and Klimoski (2007), Ilgen and Pulakos (1999), and Vandewalle and Cummings (1997). This study posits that investment in employee education and training activities will positively influence future financial performance (specifically, sales growth), irrespective of capital resource investment. Numerous qualitative studies have demonstrated that these employee education and training activities enhance financial or sales performance. The prevailing argument in these studies is that employee education and training not only boost customer satisfaction but also elevate employee job satisfaction. This, in turn, leads to a reduction in job turnover rates and an increase in productivity or job efficiency, ultimately contributing to an increase in future firm performance, as highlighted in research by Jacobs and Washington (2003).

Therefore, the first hypothesis is set as follows.

H1: Human resource investment in the lodging industry is positively related to future sales growth.

Given that operational profitability in the

lodging industry is fundamentally contingent upon facilities that provide customers with lodging and related services, it is likely that human resources play a complementary role in enhancing customer satisfaction, thereby contributing to firm performance. This synergistic effect aligns with the tenets of entrepreneurial resource theory, which advocates that harmonizing physical and human resources is a crucial strategy for organizational sustainability and survival (Barzegar & Farjad, 2011; Bourne et al., 2013). Accordingly, if human resource investment positively influences future financial performance, it should also augment performance derived from capital resource investment. In essence, when human and capital resources are concurrently invested, the financial performance of a company is hypothesized to be greater than that achieved through capital resource investment alone.

Thus, the second hypothesis is set as follows.

H2: Human resource investment in the lodging industry has an incremental effect on the financial performance of capital expenditure.

III. Methodology

1. Variable Measurement

1.1. Human Resource Investment (ΔINV_{Human}) and Capital Expenditures ($\Delta INV_{Capital}$)

For the empirical analysis, we employ the main variables of investment from financial statement items. Human resource investment is generally captured by changes in education and training expenses, and benefits expenses come from the income statement.[4] We measure human resource investment (ΔINV_{Human}) as the percent change in the sum of education and training expenses and benefits expenses.

Next, capital expenditure indicates net cashflows in PPE on the cash flow statement. That is, the purchase of equipment, building and structures, land, tools, appliance, fixtures, and vehicles is included in the capital expenditure. We measure capital expenditure ($\Delta INV_{Capital}$) as the percent change in the net cashflows in PPE.

1.2. Financial Performance: Sales Growth (*SalesGrowth*)

With respect to the tourist accommodation sector, firm performance can be measured in a variety of dimensions: financial or economic, operational, competitive, and organizational or social.[5] Focused on the financial dimension, we use changes in the sales revenues item on the income statement as a proxy for firm performance. Sales growth is considered a general measurement of firm profitability in the lodging industry, in which firm financial performance depends largely on sales (Garrigós-Simón et al., 2005). Although a few ratios utilizing operating income or net income on income statement (i.e., ROA) can also be measurements as a proxy for financial performance, on an accounting basis, they reflect only firm-wide performance, which does not reveal profit until investment expenditures (cost) are recovered. To examine the instant and consecutive effect of investment on financial performance, we utilize changes in sales, which is a primary resource of revenues, in the form $SalesGrowth_{t+n}$.

4. The salaries and wages expense is considered a fixed cost determined in initial employment, and it is difficult to capture the extent of investment for employee ability improvement.
5. The financial dimension is based on mainly accounting data, such as operating profitability indicators (Yeung & Lau, 2005), sales profitability (Garrigós-Simón et al., 2005) and equity profitability. The operating dimension concerns the company's success with its customers, and is mainly measured by employment rate, average price per room, or turnover on the number of rooms sold (Chung, 2000). Finally, the organizational dimension considers the satisfaction of various corporate stakeholders, particularly property and employees (Bagnaresi et al., 2019).

2. Model Specification

Using regression analysis, we conduct a series of tests to examine the relationship between human resource investment and firm performance. To test the hypotheses, we form the regression models as follows.

$$SalesGrowth_{t+n} = Const. + \alpha_1 \Delta INV_{Capital} + \alpha_2 \Delta INV_{Human} + \gamma Controls + \varepsilon \quad (1)$$

$$SalesGrowth_{t+n} = Const. + \beta_1 \Delta INV_{Capital} + \beta_2 \Delta INV_{Human} + \beta_3 \Delta INV_{Capital} \times \Delta INV_{Human} + \gamma Controls + \varepsilon \quad (2)$$

In Equation (1), we capture the effect of human resource investment on financial performance. $SaleGrowth_{t+n}$ is the dependent variable of firm i in time $t+n$, indicating sales growth in several periods (n=1, 2, and 3) following investment. $\Delta INV_{Capital}$ represents the independent variable of firm i in time t, representing capital expenditure. ΔINV_{Human}, our main interesting variable, represents the human resource investment of firm i in time t.

This model controls the financial effect of capital expenditure ($\beta_1 \Delta INV_{Capital}$) which is regarded as another crucial resource in achieving financial profit in the lodging industry. If the manager exertion for employee job competency improvement leads to sales growth in the next periods (n=1, 2, and 3), the coefficient α_2 of ΔINV_{Human} is expected to show a significantly positive value.

Equation (2) includes the interaction term of human resource investment (ΔINV_{Human}) with capital expenditure ($\Delta INV_{Capital}$) to examine the synergistic effect of these variables on financial performance. Although human resources are increasingly emphasized to achieve company objectives from the perspective of human resource management, physical resources are a fundamentally critical base upon which to compose an organization. This is in line with the entrepreneur resource theory that argues that harmonizing physical and and human resources is a key strategy for an organization to be sustainable and survive. If there exists a synergistic effect of human resources and capital expenditure, the coefficient β_3 of $\Delta INV_{Capital} \times \Delta INV_{Human}$ will be statistically significant. Specifically, the incrementally positive effect of the interaction is expected to show positive coefficient of β_3.

For control variables, *SIZE* represents firm size, calculated as a natural log of total assets. *LEV* represents firm leverage or financial distress, measured as the ratio of total liability to total equity. *TAN* is property, plant, and equipment (PPE) intensity, the ratio of PPE to total assets, which is controlled for the inherent tangible asset effect on financial performance. *ADV* represents the advertisement expense, scaled by the total S&A expense, which affects firm performance. *ROA* is returns on assets, which need to be controlled as current performance. *LARGE* is an indicator of the law-based category of firm size. *ESI*, economic sentiment index, which combines the business survey index (BSI) and the consumer sentiment index (CSI) obtained from the Bank of Korea, and GDP growth rate are both included into the model as proxies for the macro-economy effect on firm performance. *ΣFixed* is the year dummy variable, used for controlling time-fixed effects, and ε is the error term in the regression equation. Finally, the firm-clustered standard error is used in the statistical significance test on the estimated coefficients.

IV. Empirical Analysis Results

1. Sample Criteria

The analysis is conducted using private firms in the lodging industry in the Korean tourist accommodation sector over the period of 2011 to 2020. The financial data used in analysis were retrieved from the FnGuide database (www.fnguide.com), and the economic sentiment index and GDP were obtained from the Bank of Korea (www.bok.or.kr). From the available financial data, the final sample consists of 1,060 firm-year observations.

2. Descriptive Statistics

Table 1 provides the descriptive statistics of the test variables. . *SaleGrowth,* a proxy for financial performance, ranges from -0.696 to 6.966, and has a mean value of 2.656, meaning the current sales increase 265% on average.[6] The main explanatory variables, $\Delta INV_{Capital}$ and ΔINV_{Human}, are measured as percent changes in capital expenditures, education and training, and benefits expenses, respectively. The mean value of $\Delta INV_{Capital}$ is 12.074, meaning current increases of 1,200% in PPE investment on average, while the median value shows an investment decrease of 2.7%. ΔINV_{Human} shows a mean (median) value of 0.657 (0.033), representing the increasing tendency toward human resource investment in the lodging industry.

A few firm characteristics (firm size, leverage, tangible asset intensity, advertisement expense, and investment returns) and the economic index (economic sentiment and GDP) that are likely to have influence on corporate financial performance (sales growth) are included in the test model. For firm size, the lodging industry consists of around 45% large-sized firms (mean value of 0.45 in *LARGE*), and shows an average of 25.296 as the natural logarithms of total assets. Mean values of 75.5% in *LEV* and 71.4% in *TAN* represent the industry characteristics, which are relatively high leverage and tangible asset intensity. The sample shows relatively low investment in advertisement (0.002) in *ADV* and negative investment performance on average (-0.014) in *ROA*.

3. Correlation Analysis

Table 2 presents the Pears on correlation of the main variables. While $\Delta INV_{Capital}$ is positively and significantly related to all periods of financial performance ($SaleGrowth_t$, … , $SaleGrowth_{t+3}$), ΔINV_{Human} occasionally has a positive relation with financial performance. However, the intersection term of $\Delta INV_{Capital}$ with ΔINV_{Human}, which is our interesting variable, shows consistently positive correlation with the future financial performance currently and for the following two years. This suggests that the positive impact of human resource investment on financial performance may not be direct, but rather occurs through its interaction with physical resource investment. However, this observation merely indicates a simple correlation among individual variables. To gain a more comprehensive understanding, it is essential to examine empirical results through multiple regression analysis, wherein other variables influencing firm financial performance are accounted for and controlled. This approach allows for a more nuanced interpretation of the relationship between human resource investment and financial performance.

6. However, the sample shows a median value of 0.044, which means current sales growth of 4.4%, indicating that a relatively high mean value is responsible for extreme sales growth firms in the sample.

Table 1. Descriptive Statistics (n=1,060)

Variable	1%p	Q1	Mean	Med	Q3	99%p	Std.D.
SaleGrowth	-0.696	-0.043	2.656	0.044	0.139	6.966	69.984
$\Delta INV_{Capital}$	-2.071	-0.082	12.074	-0.027	0.085	14.216	417.631
ΔINV_{Human}	-0.843	-0.084	0.657	0.033	0.187	12.318	7.943
SIZE	22.131	24.307	25.296	25.124	26.214	30.064	1.445
LEV	0.046	0.354	0.757	0.572	0.827	3.072	2.046
TAN	0.006	0.579	0.714	0.811	0.925	0.988	0.263
ADV	0.000	0.000	0.002	0.001	0.002	0.034	0.009
ROA	-0.290	-0.023	-0.014	0.004	0.026	0.233	0.621
LARGE	0.000	0.000	0.451	0.000	1.000	1.000	0.498
ESI	93.62	95.74	100.43	98.24	105.19	114.05	6.09
ΔGDP	-0.112	-0.002	0.051	0.068	0.108	0.206	0.083

Variable Definitions

SalesGrowth	Sales growth rate, the percent change in current sales revenues;
$\Delta INV_{Capital}$	Capital expenditure, the percent change in net cash flows in PPE;
ΔINV_{Human}	Human resource investment, the percent change in the sum of the education and training expenses and benefits expenses;
SIZE	Total assets-based firm size, the natural logarithms of total assets;
LEV	Leverage, the ratio of total liability to total equity;
TAN	PPE intensity rate, the ratio of PPE to total assets;
ADV	Advertisement expenses, scaled by the total S&A expense;
ROA	Returns on total assets, as net income divided by total assets;
LARGE	Law-based firm size, an indicator variable in which large sized firms correspond to 1, and 0 otherwise;
ESI	Economic sentiment index, which combines the business survey index (BSI) and consumer sentiment index (CSI) obtained from the Bank of Korea;
ΔGDP	GDP growth rate per capita.

Table 2. Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)
(1) $SaleGrowth_t$						
(2) $SaleGrowth_{t+1}$	0.114 (0.000)					
(3) $SaleGrowth_{t+2}$	0.157 (<.001)	0.077 (0.016)				
(4) $SaleGrowth_{t+3}$	-0.027 (0.411)	0.092 (0.006)	0.052 (0.123)			
(5) $\Delta INV_{Capital}$	0.143 (<.001)	0.119 (0.000)	0.097 (0.002)	0.059 (0.077)		
(6) ΔINV_{Human}	0.364 (<.001)	0.042 (0.176)	0.131 (<.001)	0.002 (0.963)	0.110 (0.000)	
(7) $\Delta INV_{Capital} \times \Delta INV_{Human}$	0.267 (<.001)	0.094 (0.002)	0.106 (0.001)	0.027 (0.416)	0.677 (<.001)	0.673 (<.001)

Note: The figures in parentheses are *p*-values. Variables are defined in Table 1.

4. Univariate Test

The aim of this study is to examine the role of human resource investment in firm financial performance in the lodging industry. As shown in the correlation matrix, given the interaction effect of human resource investment and physical resource investment on financial performance, this study conducts a univariate test to examine whether human resource investment incrementally enhances physical resource investment-based performance. Table 3 provides the simple relationship between human resource investment (ΔINV_{Human}), capital expenditure ($\Delta INV_{Capital}$), and each period of future financial performance from t+1 to t+3 performance ($SaleGrowth_{t+1}$, … , $SaleGrowth_{t+3}$). We divided both ΔINV_{Human} and $\Delta INV_{Capital}$ into quintiles, respectively, to investigate whether the incremental effect of the interaction of the two variables ($\Delta INV_{Capital} \times \Delta INV_{Human}$) exists.

The findings of this study indicate that, generally, a higher level of both human and physical resource investment correlates with improved future financial performance. This enhancement is evident in the incremental effect arising from the interaction between these two variables, although this effect is not consistent across all periods. Specifically, in Panel A, we observe that the conditional future sales growth performance ($SaleGrowth_{t+1}$) is 0.525 at the lowest investment level (1/1), and increases to 0.680 at the highest investment level (5/5), resulting in a notable difference of 0.155. However, the impact of such investment diminishes over time, as evidenced by a reduced effect of 0.007 in t+3. This trend highlights the dynamic nature of the relationship between investment level and financial performance over different time horizons.

Table 3. Univariate Test: Sales Growth by Capital / Human Resource Investment

Panel A: Future Sales Growth (t+1)

		ΔINV_{Human}					
		1 (Low)	2	3	4	5 (High)	5-1
$\Delta INV_{Capital}$	1 (Low)	0.525	0.548	0.441	0.483	0.529	0.005
	2	0.424	0.384	0.421	0.495	0.570	0.146
	3	0.417	0.352	0.439	0.501	0.440	0.024
	4	0.423	0.411	0.515	0.469	0.547	0.125
	5	0.549	0.540	0.398	0.497	0.680	0.130
	5-1	0.024	-0.007	-0.043	0.014	0.150	
		High Investment – Low Investment = 0.155					

Panel B: Future Sales Growth (t+2)

		ΔINV_{Human}					
		1 (Low)	2	3	4	5 (High)	5-1
$\Delta INV_{Capital}$	1 (Low)	0.550	0.504	0.486	0.465	0.548	-0.002
	2	0.425	0.481	0.365	0.469	0.510	0.085
	3	0.462	0.384	0.455	0.421	0.513	0.050
	4	0.450	0.523	0.399	0.491	0.538	0.088
	5	0.532	0.542	0.524	0.570	0.664	0.132
	5-1	-0.018	0.038	0.039	0.105	0.115	
		High Investment – Low Investment = 0.113					

Panel C: Future Sales Growth (t+3)

		ΔINV_{Human}					
		1 (Low)	2	3	4	5 (High)	5-1
$\Delta INV_{Capital}$	1 (Low)	0.615	0.529	0.436	0.519	0.496	-0.119
	2	0.448	0.458	0.458	0.493	0.556	0.108
	3	0.444	0.430	0.460	0.477	0.511	0.067
	4	0.511	0.456	0.426	0.453	0.490	-0.021
	5	0.521	0.454	0.477	0.529	0.622	0.101
	5-1	-0.094	-0.076	0.041	0.010	0.126	
		High Investment – Low Investment = 0.007					

Note: This table presents the incremental effect of the interaction of the two variables ($\Delta INV_{Capital} \times \Delta INV_{Human}$). Both ΔINV_{Human} *and* $\Delta INV_{Capital}$ are divided into quintiles, respectively. The figures in parentheses are t-statistics. The notations *, **, and *** indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Refer to Table 1 for variable definitions.

5. Regression Analysis

In this section, the study employs a multiple regression analysis to more comprehensively investigate the incremental effect of human resource investment on future financial performance. Specifically, the analysis seeks to determine whether human resource investment further enhances the financial performance attributable to capital resource investment. The results of this analysis are detailed in Table 4. These findings substantiate the hypothesis that human resource investment positively influences future financial performance (t+1) resulting from capital resource investment. The regression analysis of Eq. (1) in Panel A shows that future sales growth is affected only by capital resource investment ($\Delta INV_{Capital}$ =0.126, t-statistic=3.54), and not by human resource investment itself (ΔINV_{Human} = 0.023, t-statistic=0.75).

However, the significantly incremental positive effect of human resource investment on future financial performance appears in Eq. (2) in Panel B, showing that the coefficient of $\Delta INV_{Capital} \times \Delta INV_{Human}$ is 0.211 (t-statistics=2.25). Subsequently, the coefficients of both $\Delta INV_{Capital}$ and ΔINV_{Human} were found to be statistically insignificant. This suggests that capital resource investment, in isolation, is unlikely to significantly contribute to future financial performance. These results imply the necessity of accompanying human resource investment with capital resource investment to effectively achieve desired financial outcomes. This finding underscores the importance of a balanced and integrated approach to resource allocation in enhancing financial performance.

Table 4. Capital /Human Resource Investment and Sales Growth

Dependent Variable = $SalesGrowth_{t+1}$				
	Eq. (1)		Eq. (2)	
	Coeff.	t-stat.	Coeff.	t-stat.
Const.	0.246	5.15 ***	0.321	5.37 ***
$\Delta INV_{Capital}$	0.126	3.54 ***	0.026	0.44
ΔINV_{Human}	0.023	0.75	-0.081	-1.52
$\Delta INV_{Capital} \times \Delta INV_{Human}$			0.211	2.25 **
SIZE	-0.059	-1.39	-0.075	-1.79 *
LEV	0.033	1.15	0.004	0.11
TAN	-0.023	-0.73	-0.040	-1.20
ADV	0.037	1.27	0.033	1.16
ΔROA_t	-0.093	-2.90 ***	-0.096	-2.76 **
LARGE	0.029	1.13	0.029	1.13
ESI	0.317	6.17 ***	0.330	6.62 ***
ΔGDP	-0.404	-2.26 **	-0.407	-2.31 **
Firm-clustered S.E.	Yes		Yes	
F-stat.	10.11		10.95	
R-sq	8.85%		9.36%	
n	1,057		1,057	

Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. Statistical significance of the estimated coefficient is based on firm clustered standard error. Please refer to Table 1 for the definitions of variables. The subscript js (firm) is omitted from all variables.

A subsequent analysis is undertaken to ascertain the timeframe during which both capital and human resource investments are effective. Table 5 presents the regression results concerning the impact of these investments on long-term sales growth (t+2 and t+3). This analysis offers valuable insights into the temporal dynamics of resource investment efficacy in the context of long-term financial performance. The findings reveal that the interaction between capital and human resource investments yields effective results within a two-year period (t+2) following the investment. However, this effect does not extend to the three-year mark (t+3).

Specifically, the coefficient of $\Delta INV_{Capital} \times \Delta INV_{Human}$ is positively significant in Eq. (2) of Panel A (0.203, t-statistics=1.93), but not in Panel B (1.160, t-statistics=1.49). These findings align with the operational practices prevalent in the lodging industry, wherein the replacement cycle for physical resources typically spans a two-year period. This correlation underscores industry-specific behaviors and their implications for resource management and investment strategies.

Table 5. Capital /Human Resource Investment and Long-Term Sales Growth

Panel A: Capital /Human Resource Investment and Future Sales Growth (Dependent Variable = $SalesGrowth_{t+2}$)

	Eq. (1)		Eq. (2)	
	Coeff.	t-stat.	Coeff.	t-stat.
Const.	0.430	9.06 ***	0.480	9.95 ***
$\Delta INV_{Capital}$	0.089	2.24 **	-0.017	-0.25
ΔINV_{Human}	0.122	3.87 ***	0.016	0.29 ***
$\Delta INV_{Capital} \times \Delta INV_{Human}$			0.203	1.93 *
SIZE	-0.100	-2.63 ***	-0.097	-2.55
LEV	-0.008	-0.24	-0.010	-0.28
TAN	-0.009	-0.26	-0.010	-0.29
ADV	-0.017	-0.52	-0.018	-0.56
ΔROA_t	-0.042	-1.37	-0.040	-1.30
ΔROA_{t+1}	-0.105	-3.03 ***	-0.101	-2.90 ***
LARGE	0.047	2.03 **	0.044	1.88 *
ESI	0.179	3.71 ***	0.181	3.78 ***
ΔGDP	-0.652	-4.73 ***	-0.642	-4.66 ***
Firm-clustered S.E.	Yes		Yes	
F-stat.	6.32		6.17	
R-sq	0.0554		0.0601	
n	974		974	

Panel B: Capital /Human Resource Investment and Future Sales Growth (Dependent Variable = $SalesGrowth_{t+3}$)

	Eq. (1)		Eq. (2)	
	Coeff.	t-stat.	Coeff.	t-stat.
Const.	0.661	11.06 ***	0.701	11.11 ***
$\Delta INV_{Capital}$	0.066	1.79 *	-0.019	-0.28
ΔINV_{Human}	-0.015	-0.43	-0.098	-1.49
$\Delta INV_{Capital} \times \Delta INV_{Human}$			0.160	1.49
SIZE	-0.086	-2.01 **	-0.083	-1.95 **
LEV	-0.024	-0.58	-0.026	-0.62
TAN	0.014	0.36	0.013	0.33
ADV	0.000	0.00	-0.001	-0.03
ΔROA_t	-0.049	-1.27	-0.048	-1.24
ΔROA_{t+1}	-0.006	-0.18	-0.002	-0.06
ΔROA_{t+2}	-0.092	-2.44 **	-0.092	-2.44 **
LARGE	0.035	1.23	0.032	1.11
ESI	-0.146	-2.48 **	-0.144	-2.47 **
ΔGDP	0.097	0.54	0.104	0.59
Firm-clustered S.E.	Yes		Yes	
F-stat.	2.48		2.68	
R-sq	0.0310		0.0337	
n	897		897	

Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. Statistical significance of the estimated coefficient is based on firm clustered standard error. Please refer to Table 1 for the definitions of variables. The subscript js (firm) is omitted from all variables.

6. Additional Analysis

In the hospitality industry, there is a marked distinction between large-sized and small-sized lodging firms in terms of various operational aspects, such as management structure, resource allocation, customer service, and market positioning (Choi, 2021). Specifically, large-sized firms, benefiting from greater access to financial resources, are able to invest in more extensive properties, comprehensive marketing campaigns, advanced technology, and employee education and training programs. Conversely, small-sized firms often face constraints due to limited financial resources, which can affect the capacity for expansion, renovation, or investment in costly technology and employee education and training initiatives. This dichotomy highlights the disparate operational capabilities and strategic approaches between firms of differing sizes within the industry.

In this section, we further investigate disparities in financial characteristics between large-sized and small-sized lodging companies. Additionally, the analysis aims to determine whether the financial impact of capital and human resource investments varies between these two groups. This examination is pivotal in understanding how size influences the financial outcomes of resource allocation strategies within the lodging industry. First, the difference between large- and small- sized firms in financial characteristics is presented in Table 6, showing a statistical significance in firm size (*SIZE*), leverage (*LEV*), tangible asset intensity (*TAN*), and advertisement expense (*ADV*). Specifically, large-sized firms are relatively low in *LEV*, *TAN*, and *ADV*, which are represented by the proportion of total assets or total S&A expense. Interestingly, sales growth (*SalesGrowth*), capital/human resource investment ($\Delta INV_{Capital}$, ΔINV_{Human}), and returns on assets (ROA) are higher for large-sized firms, but not significant.

Table 6. Statistical Difference between Large and Small Firms

	Mean Difference Test			Wilcoxon Two Sample Test		
	Large	Small	t-stat.	Large	Small	Z-stat.
SalesGrowth	5.506	0.316	1.09	0.046	0.041	0.56
$\Delta INV_{Capital}$	25.166	1.321	0.84	-0.023	-0.035	1.63
ΔINV_{Human}	0.953	0.414	1.01	0.038	0.032	0.88
SIZE	26.098	24.637	18.12 ***	26.206	24.595	17.36 ***
LEV	0.642	0.852	-1.83 *	0.590	0.560	0.12
TAN	0.674	0.746	-4.51 ***	0.778	0.820	-3.92 ***
ADV	0.003	0.002	2.96 ***	0.001	0.000	5.11 ***
ROA	-0.001	-0.025	0.68	0.003	0.005	-0.85

Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. Please refer to Table 1 for the definitions of variables. The subscript js (firm) are omitted from all variables.

Table 7 presents the multiple regression results for each group, revealing that the main findings regarding the incremental effect of human resource investment are applicable exclusively to large-sized lodging firms. This distinction underscores the varying impact of human resource investment across different scales within the industry. $\Delta INV_{Capital} \times \Delta INV_{Human}$ has consistently positive coefficients for future financial performance, except for t+3 in large-sized firms, but not any coefficients in small-sized firms.

This finding implies that for small-sized lodging firms there exist specific challenges and limitations which may diminish the effectiveness of human resource investment in enhancing future financial performance. Particularly, a propensity among these firms to prioritize resource allocation for immediate operational needs over long-term investments in human capital can impede future growth and profitability. This approach may also lead to a deficiency in expertise in talent management and workforce development, potentially undermining the efficacy of investments in human resources. Such constraints highlight the need for strategic considerations in resource management, especially for smaller entities in the lodging industry.

Table 7. Capital /Human Resource Investment and Long-Term Sales Growth by Firm Size

Panel A: Large Firms

	Short-Term Sales Growth		Long-Term Sales Growth	
	t	t+1	t+2	t+3
	Coeff. (t-stat.)	Coeff. (t-stat.)	Coeff. (t-stat.)	Coeff. (t-stat.)
Const.	0.329 (3.96)***	0.418 (4.24)***	0.430 (6.55)***	0.523 (6.20)***
$\Delta INV_{Capital}$	0.030 (0.26)	-0.066 (-0.77)	-0.090 (-0.84)	-0.018 (-0.19)
ΔINV_{Human}	0.223 (2.13)**	-0.153 (-1.91)*	0.011 (0.14)	-0.117 (-1.17)
$\Delta INV_{Capital} \times \Delta INV_{Human}$	0.277 (1.91)*	0.323 (2.32)**	0.306 (2.07)**	0.154 (0.97)
SIZE	-0.038 (-0.54)	-0.073 (-1.29)	-0.077 (-1.56)	-0.070 (-1.08)
LEV	0.045 (0.88)	0.014 (0.26)	0.019 (0.38)	-0.052 (-0.91)
TAN	-0.093 (-1.33)	-0.064 (-0.94)	-0.026 (-0.41)	0.053 (0.64)
ADV	0.051 (1.04)	0.045 (0.81)	0.055 (1.22)	0.124 (2.07)**
ROA_{t-1}	-0.160 (-2.99)***			
ΔROA_t		-0.076 (-1.21)	0.014 (0.29)	-0.014 (-0.25)
ΔROA_{t+1}			-0.073 (-1.24)	0.069 (1.35)
ΔROA_{t+2}				-0.088 (-1.46)
ESI	0.154 (2.19)**	0.368 (5.53)***	0.170 (2.57)**	0.004 (0.04)
ΔGDP	-0.454 (-1.86)*	-0.515 (-1.89)*	-0.458 (-3.09)***	-0.088 (-0.30)
Firm-clustered S.E.	Yes	Yes	Yes	Yes
F-stat.	17.02***	7.29***	4.49***	1.35
R-sq	0.2421	0.0974	0.0825	0.0342
n	478[7]	476	441	410

7. Segmenting the sample based on firm size results in a reduction in sample size. Furthermore, the sample size varies depending on the presence or absence of accounting figures related to the dependent variable.

Panel B: Small Firms

	Short-Term Sales Growth		Long-Term Sales Growth	
	t	t+1	t+2	t+3
	Coeff. (t-stat.)	Coeff. (t-stat.)	Coeff. (t-stat.)	Coeff. (t-stat.)
Const.	0.358 (4.93)***	0.270 (3.31)***	0.587 (7.60)***	0.968 (12.31)***
$\Delta INV_{Capital}$	0.022 (0.33)	0.090 (1.12)	0.024 (0.27)	-0.031 (-0.35)
ΔINV_{Human}	0.282 (4.06)***	-0.019 (-0.26)	0.016 (0.21)	-0.097 (-1.26)
$\Delta INV_{Capital} \times \Delta INV_{Human}$	0.058 (0.52)	0.119 (0.97)	0.128 (0.86)	0.159 (1.18)
SIZE	0.071 (1.23)	-0.084 (-1.10)	-0.180 (-2.50)**	-0.249 (-3.40)***
LEV	0.054 (1.09)	-0.008 (-0.17)	-0.012 (-0.28)	-0.002 (-0.04)
TAN	-0.066 (-1.69)*	-0.014 (-0.34)	0.012 (0.29)	0.016 (0.36)
ADV	0.092 (2.19)**	0.016 (0.42)	-0.120 (-2.65)***	-0.179 (-3.28)***
ROA_{t-1}	-0.191 (-5.06)***			
ΔROA_t		-0.121 (-2.90)***	-0.080 (-2.16)**	-0.088 (-1.68)*
ΔROA_{t+1}			-0.113 (-2.53)**	-0.065 (-1.44)
ΔROA_{t+2}				-0.101 (-2.06)**
ESI	0.013 (0.17)	0.312 (4.42)***	0.156 (2.16)**	-0.300 (-4.08)***
ΔGDP	0.076 (0.27)	-0.376 (-1.64)	-0.673 (-3.04)***	0.357 (1.53)
Firm-clustered S.E.	Yes	Yes	Yes	Yes
F-stat.	13.00	8.18	5.40	7.47
R-sq	0.1563	0.1071	0.0684	0.1029
n	582	581	533	487

Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. Statistical significance of the estimated coefficient is based on firm clustered standard error. Please refer to Table 1 for the definitions of variables. The subscript *js* (firm) is omitted from all variables.

V. Conclusion

The lodging industry in the tourist accommodation sector, which plays a significant role in the South Korean economy, relies on a combination of human and capital resources to achieve financial performance. In this study, we investigate the role of human resource investment in lodging firms in Korea. Using private firms from 2011-2020, we examine how financial performance, including sales growth, is related to expenditures on employee education and training and benefits as proxies for human resource investment. We find that human resource investment itself does not affect short-term financial performance, but complementarily supports financial outcomes of capital expenditure (PPE investment). Still, sales-based performance attributable to human resource investment appears within two years, and the supporting effect on the financial performance of capital expenditure also remains. Additionally, these results are significant for large-sized firms, but not for those small. Overall, human resource investment plays a critical role in firm performance by serving as a key factor in managing company resources efficiently. This study suggests the need for a simultaneous periodic management of capital and human resources.

This study has academic and practical contributions. First, by empirically showing the relative weight of material and human resource investments that play an important role in an organization's operational performance, this study expands previous studies on the efficient utilization of corporate resources. Specifically, it sheds light on the role of human resources in the lodging industry by providing empirical results based on financial accounting numbers, which has not been considered. Second, by analyzing the channels through which human resources can affect financial performance, this study gives managers or practitioners an awareness of the importance of human resource investment, and motivates more active investment in human resources in practice.

Nevertheless, the limitations of this study include potential data constraints, limited generalizability of findings to different contexts, and the complexity of modeling the interaction between human resources and capital investments, which may hinder the generalization and interpretation of the model.

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Cultural Intermediaries: How Local Experts Shape the Financial Performance of Foreign Cultural Products*

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ABSTRACT

Purpose – This study examines the pivotal role of local expert reviewers in the financial success of imported foreign films (Hollywood movies) within the Chinese market. It integrates signaling theory and gatekeeping scholarship to examine how these intermediaries reduce mainstream uncertainty. We hypothesize local expert reviewers to better grasp spaces for resonance between imported films and local preferences compared to foreign critics. Moreover, we examine the moderating roles of films attributes such as production scale, prestigious awards, and local adaptation strategies.

Design/Methodology/Approach – We test hypothesized relationships and contingencies via OLS regressions on box office performance spanning 500 top-grossing Hollywood studio imports in China from 2000 2017 with data from multiple sources.

Findings – The OLS regressions reveal that local expert reviewers significantly influence cross-border film success, with the impact moderated by production budgets and awards, but potentially diminished by cultural adaptation.

Research Implications – Our study unpacks market drivers and product-level contingencies around imported creative products amidst mainstream uncertainty. The findings contribute to international business literature and cultural business by showcasing the nuanced impact of local cultural intermediaries on the financial performance of foreign cultural products. This research underscores the importance of local expert opinions in navigating the complex landscape of global content distribution and consumption, offering valuable insights for content creators and marketers aiming to optimize the global reach of products.

Keywords: box-office success, expert reviews, films, foreign cultural products
JEL Classifications: F23, Z10

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I. Introduction

The burgeoning interest in the cross-border success of cultural products has garnered much attention from scholars within the international business discipline (Gao et al., 2020; Gao et al., 2023; Kwon, 2023; Lee & Kim, 2023; Lee & Yang, 2022; Park & Choi, 2023; Wang et al., 2020). Despite significant advancements in understanding the transnational flow of creative goods, the literature has not sufficiently illuminated the role of local cultural intermediaries; a critical oversight this paper seeks to address. We investigate the influence of geographic market-specific expert reviewers on the cross-border success of imported cultural goods. Through the lens of signaling theory and gatekeeping scholarship (Boatwright et al., 2007; Hirsch, 2000; Holbrook, 2005; Lee, 2008; Verboord, 2010), this study delineates how these local professionals navigate cultural nuances to align global products with local interpretive frames.

Our empirical investigation focuses on the Chinese film market, which has experienced rapid growth in the penetration of imported Hollywood movies following its liberalization, similar to other sectors in Information and Communication Technology (ICT) (Chen, 2023; Xiao, 2022). Despite facing remaining restrictions like quota systems, Hollywood films earn over 40% of box office revenues in China, significantly higher per title than domestic releases. This success indicates competitive drivers overcoming barriers as foreign cultural products vying for market share. Industry observers highlight the influence of online buzz and engagement fueled by young, connected audiences as essential in shaping imported film popularity. This digital word-of-mouth (WOM) often propagates from opinion leader reviews before cascading through social networks.

However, when Hollywood film studios seek to extend the reach of tentpole releases into the Chinese market, they face inherent challenges connecting stories crafted for Western sensibilities with the unfamiliar imaginative horizons of local audiences socialized in a vastly different cultural context (Gao et al., 2020; Lee, 2006; Velasco et al., 2023: Shin & McKenzie, 2019). As foreign cultural imports, these creative works trigger uncertainty among Chinese viewers over likely resonance, risks, and relevance to native preferences (Holbrook, 1999; Lee, 2009). Consequently, success in overcoming barriers to mass adoption depends not only on promotional hype but, even more crucially, on signals of quality and market endorsement emanating from local gatekeepers trusted to filter meaning and relevance for mainstream consumers navigating an opaque domain (Eliashberg & Shugan, 1997; Gemser et al., 2007).

Integrating insights from signaling theory and gatekeeping scholarship, we formulate the differential effect of local versus foreign expert opinion leaders in determining success under prevailing consumer uncertainty regarding foreign creative works. Professional critics occupy privileged positions as evaluative intermediaries, leveraging reputational credibility and cultural expertise to shape mass opinion upstream. Trained discernment allows critics to decode likely resonance between global creative expressions and local interpretive sensibilities. Accordingly, these reviews act as quality signals that enable discovery, catalyze interest, and mitigate adoption risks. We argue that by reducing the mainstream market's uncertainty about the quality and relevance of foreign films, these expert reviewers serve as pivotal amplifiers of consumption in emerging markets (Basuroy et al., 2003; Boatwright et al., 2007; Debenedetti, 2006).

Furthermore, our exploration into the contingent effects of salient film attributes offers nuanced insights into the boundary conditions that delineate the extent of local gatekeeper influence. We argue that local critics better grasp spaces for cultural resonance between foreign cultural codes and indigenous horizons of meaning compared to non-native reviewers.

Shared frames of reference position local gatekeepers to read nuanced reception cues and tackle tacit barriers to imported creative acceptance. Thus, these local opinion leaders are likely to disproportionately influence the success of foreign films relative to non-local experts detached from endemic market realities. Moreover, film attributes like production scale, awards, and cultural adaptation strategies condition imported film uncertainty, altering the symbolic and informational value of critic opinions. Big budgets underwrite commercial visions resonating across diverse markets, while awards signal peer endorsers to reward creative merit (Allen & Lincoln, 2004). Both factors serve as tangible indices that reviewers subsequently decode for local relevance. Meanwhile, localization marketing decisions balancing source authenticity with accessibility prompt inferences over positioning and intended appeal. Consequently, critic opinions attuned to how signals intersect carry greater sway.

We compile a novel dataset spanning 2000 - 2017 with key variables related to gatekeeper opinions, film attributes, and box office revenues for the 500 top grossing Hollywood studio imports in China. Our empirical approach centers on elucidating the interaction effects between local cultural intermediaries and film-specific informational and symbolic cues in that enable foreign cultural products to resonate with mainstream audiences otherwise detached from the production context.

Results from OLS regressions support our core thesis on the outsized influence of local critics over non-native reviewers in determining imported film success. Award distinctions and production budgets positively moderate local gatekeeper impacts, aligning with their role resolving uncertainty compounding foreignness. Meanwhile, localized cultural adaptation via translation diminishes critic effects.

Collectively, our integrated theoretical framework and supportive findings make three key contributions. First, we bridge signaling theory with gatekeeping scholarship to explain the commercial role of local evaluators in amplifying foreign cultural imports under mainstream ambiguity. Second, we formulate the contingent effects of symbolic meanings, which shift inferences framing creative works and moderate critic influences accordingly. Finally, our empirical evidence across 18 years of Hollywood films released in China demonstrates these dynamics, shedding light on how to enhance resonance between global content and local audiences.

The paper is organized as follows. We first discuss the idea that films are experience goods with symbolic meanings that complicate consumer evaluations, especially for foreign creative works. This discussion informs our hypotheses that implicate enhanced resonance-signaling capacity and contingency effects conditioning local expert reviewer sway over box office outcomes relative to detached foreign critics. Our methods section specifies the dataset compiled across industry sources to assess drivers of imported film success in China, spanning reviewers, awards, budgets, and more. We then outline our analytic strategy and report hypothesis test results that reveal strong support for all our hypotheses. Finally, we discuss implications for global content resonating with mainstream audiences, creative industries seeking symbolic cohesion across market boundaries, and the interdisciplinary integration of information intermediary theories.

II. Literature Review: Theoretical Foundations

1. Signaling Theory in Cultural Markets

In cultural markets fraught with uncertainty and the intrinsic difficulty of assessing product quality prior to consumption, signaling theory takes on a significant role. This framework

suggests that in the face of information asymmetry, consumers rely on signals to infer the value of a product (Spence, 2002). Cultural goods, inherently complex and subjective, are often judged on intangible qualities such as entertainment value, emotional resonance, and narrative integrity, which are opaque prior to consumption (Eliashberg & Sawhney, 1994; Hirschman & Holbrook, 1982; Hennig-Thurau et al., 2009; Nelson, 1974). Within this domain, signals such as brand name, pricing, and expert reviews become critical in guiding consumer choices amidst a plethora of offerings (Rosen, 1981). These signals, including the reputation of a film's creative team and pre-release reviews, shape consumer expectations and choices (Eliashberg & Shugan, 1997; Basuroy et al., 2003).

2. Cultural Intermediary Theory

Cultural intermediaries play a crucial role in shaping consumer preferences within the cultural sector (Bourdieu, 1984). These agents, such as critics and curators, serve as bridges between content creators and audiences, providing expert evaluations that guide consumers through the complex landscape of cultural goods (Hirsch, 1972). These insights are particularly valuable in contexts wherein the quality of cultural products is subjective and varies widely, helping audiences navigate based on an understanding of cultural trends and consumer predilections (Negus, 2002; Verboord, 2010). The intricacy of appraising the originality and execution of cultural products, often complicated by inherent value ambiguity and cultural context dependence, further underscores the necessity of such intermediation (Huang et al., 2023; Yin & Phillips, 2020).

For the general public, making substantive appraisals of cultural goods is challenging, as the essential qualities are not readily apparent from simple descriptions or analyses (Debenedetti, 2006). Cultural intermediaries address this challenge by using expertise to provide credible and informative reviews. These reviews do more than just reduce uncertainty; they assist consumers in discovering content that aligns with their personal tastes, serving as a critical filter in a media-saturated environment (Eliashberg & Shugan, 1997).

Critics, as domain experts, possess extensive knowledge that enables the evaluatiiion of the quality and significance of cultural works, influencing mass-market trends (Gemser et al., 2007). This deep understanding of genre conventions and cultural movements allows the playing of a vital gatekeeping role, especially in a media landscape filled with choices (Boatwright et al., 2007; Hirsch, 2000; Holbrook, 2005; Negus, 2002). Through reviews, critics signal quality, swaying consumer interest and support for both domestic and international creative works.

Complementing this is gatekeeping theory, which examines how information is filtered for dissemination (Shoemaker et al., 2009). Cultural gatekeepers, including film critics and editors, are pivotal in deciding which cultural content is promoted and gains visibility. Their selections significantly influence which cultural products become mainstream or remain marginalized (Shoemaker et al., 2009). In today's overwhelming media environment, the role of these intermediaries is more crucial than ever in steering audience preferences and perceptions.

These gatekeepers exert influence not only through reviews but also by selecting and framing cultural content in ways that resonate with or challenge prevailing norms and trends (Shoemaker et al., 2009). They act as key nodes in the flow of cultural information, shaping the media landscape based on expertise, values, and judgments. This gatekeeping role, coupled with their function as cultural intermediaries, uniquely positions them to impact both the accessibility and perception of cultural goods in the market.

Together, cultural intermediary theory

and gatekeeping theory provide a nuanced understanding of how cultural products are evaluated, selected, and endorsed, affecting the ultimate success and mainstream integration. This dual theoretical perspective is particularly relevant for comprehending the complex role of critics and other cultural experts in navigating and shaping the intricate world of cultural consumption.

3. Integrating Signaling Theory and Cultural Intermediary Theory

Combining signaling theory with cultural intermediary theory offers valuable insights into the role of local expert reviewers in the success of imported films in the Chinese market. These reviewers reduce consumer uncertainty by providing informed evaluations that act as quality signals, drawing on a profound cultural understanding and a refined set of evaluative skills (Hirschman & Holbrook, 1982; Nelson, 1974). They gauge cultural products against established benchmarks, fostering consumer trust and affecting market outcomes (Caves, 2000; Holbrook, 1999).

Critics stand at the nexus of cultural interpretation, exercising reputational credibility, domain-specific expertise, and cultural acumen to influence public perception (Boatwright et al., 2007; Hirsch, 2000). In the diverse and expansive media landscape, wherein consumers are confronted with an array of choices, critics assume a critical gatekeeping function. They provide authoritative assessments of the quality and cultural fit of both domestic and international creative works, leveraging specialized training and analytical prowess (Holbrook, 2005; Negus, 2002). The ability to connect global creative expressions with local preferences highlights potential resonance and identifies opportunities for foreign media to engage mainstream audiences.

The reviews published by these critics serve as quality signals, steering discovery, sparking interest, and easing the perceived risk of adopting foreign cultural products (Hirsch, 2000; Holbrook, 2005). Signal strength is amplified by reputational standing, particularly when affiliated with esteemed news and entertainment platforms. These critical appraisals exert a profound influence on what becomes highlighted and celebrated within popular culture, thereby setting trends and guiding industry support.

Given the unpredictability of a cultural product's quality before firsthand experience, consumers tend to place substantial trust in the assessments of reputable experts (Debenedetti, 2006). This reliance is particularly pronounced in cultural sectors like film and fine wine, where a consensus among experts can significantly shape consumer expectations and willingness to invest time and money (Ekelund et al., 2020).

Critics, as seasoned evaluators, possess an amplified ability to influence the adoption of cultural products by mainstream audiences, who often lack the specialist knowledge to judge such goods for themselves. In cultural markets defined by credence qualities, the opinions of these experts carry great weight, serving as a guidepost for quality and cultural fit. The influential role of critics is crucial to the empirical exploration of how local expert reviewers affect the reception and financial performance of Hollywood films in the Chinese market.

By deploying extensive expertise, cultural critics and intermediaries play an essential part in the cultural consumption landscape. These critiques not only help navigate the complexities of cultural products for consumers but also contribute significantly to reduce the uncertainty faced before engaging with these goods (Debenedetti, 2006; Eliashberg & Sawhney, 1994). The insights provided by these intermediaries are instrumental, signaling not just quality but also cultural relevance, which is paramount for the market acceptance and success of foreign films in China.

III. Hypothesis Development

1. The Impact of Local Experts on the Success of Foreign Cultural Products

Local audiences often encounter heightened uncertainty when evaluating imported foreign cultural products due to unfamiliarity with the original cultural context (Gao et al., 2020; Lee, 2006, 2008, 2009; Shin & McKenzie, 2019). This ambiguity is particularly pronounced when mainstream consumers attempt to gauge the resonance of these products with local preferences. The translation of foreign creative expressions into a different cultural milieu presents unpredictability, which leads mainstream audiences to rely more on local experts than on non-local reviewers that may lack an understanding of native cultural nuances (Verboord, 2010). Local experts, with shared linguistic and cultural insights, are presumed to have a better grasp of the potential for true resonance with local audiences.

To evaluate cultural product merits, including originality, execution quality, and alignment or deviation from genre conventions, it is essential to consider each work within its cultural tradition. Studies highlight the intricate nature of such evaluations. Huang et al. (2023) demonstrated this complexity by constructing a lexicon to capture cultural features from museum reviews, emphasizing the significance of understanding cultural elements that resonate with consumers. Yin and Phillips (2020) further explored how the inherent ambiguity and meaningfulness of cultural products demand a specialized evaluative approach within cultural industries.

Cultural resonance embodies the connection between the symbolic elements of creative works and the cultural fabric of the audience (Ettema, 2005; Mahoney et al., 2021). This refers to the capacity of a work's themes, narratives, and aesthetics to align with the tastes and perspectives of consumers. For foreign imports like Hollywood films in China, there exists a persistent uncertainty as to whether these films can transcend spectacle to achieve genuine resonance with an audience rooted in markedly different narrative traditions. Local critics, with insider understanding, are adept at discerning whether imported creative works establish meaningful points of contact or dissonance with the local culture (Gemser et al., 2007). These judgments provide signals that can either affirm or question the cultural familiarity evoked by such imports (Debenedetti, 2006).

Therefore, local critics act as cross-border cultural intermediaries, reducing the uncertainty surrounding foreign content by signaling cultural resonance to a mainstream audience that values native expertise. These critiques influence public perception through word-of-mouth and generate buzz, while non-local critics may miss subtle local resonances (Basuroy et al., 2003). This disparity in cultural interpretation suggests that local experts are more influential than foreign counterparts in shaping the success of foreign cultural imports in the local market. Consequently, we propose the following hypothesis.

H1: Local expert reviewers will have a greater influence on the box office performance of Hollywood films in China than non-local expert reviewers.

2. Moderating Role of Film Attributes: Budget, Awards, and Local Translation

Film attributes such as budget, critical acclaim, and local adaptation or translation strategy influence the perceived quality and risk associated with foreign films. We explore these attributes as potential moderators of the impact that local expert reviews have on the commercial success of imported films.

High production budgets in Hollywood are often indicative of a commitment to quality and global appeal (Baker & Faulkner, 1991; Collins

et al., 2002; Ravid, 1999). These budgets are channeled toward elements such as star-studded casts and high production values, which are believed to resonate across diverse audiences (Hadida, 2010). Moreover, substantial investment often results in narratives that employ universal themes and familiar tropes, designed to appeal to a wide audience (Wasko et al., 1993). Large budgets can thus signal a movie's potential for cross-cultural appeal, encouraging local audiences to trust in the film's quality and alignment with their preferences (Lee, 2009). This trust is further reinforced when local experts, who share a cultural affinity with the target audience, endorse these high-budget films. Consequently, we posit:

H2: The larger the budget of a Hollywood film, the greater the positive influence of local expert reviews on its box office performance in China.

Prestigious accolades, such as Oscar nominations and wins, play a critical role in bestowing legitimacy and diminishing uncertainty about a film's quality (Allen & Lincoln, 2004; Brewer et al, 2009; Hadida, 2010; Simonton, 2009). These honors serve to amplify the signaling effect of local expert reviews by suggesting that a film's allure extends beyond its country of origin, resonating with diverse cultural expectations and preferences.

The recognition from key cultural arbiters heightens a film's visibility and stature, even in international markets. Achieving such high-caliber awards signifies widespread critical acclaim and broader societal acceptance. When these global endorsements align with positive appraisals from local critics that share a deeper contextual understanding with local audiences, it leads to a reinforced signaling effect. This combined validation projects a notion of universal appeal that aligns with local sensibilities.

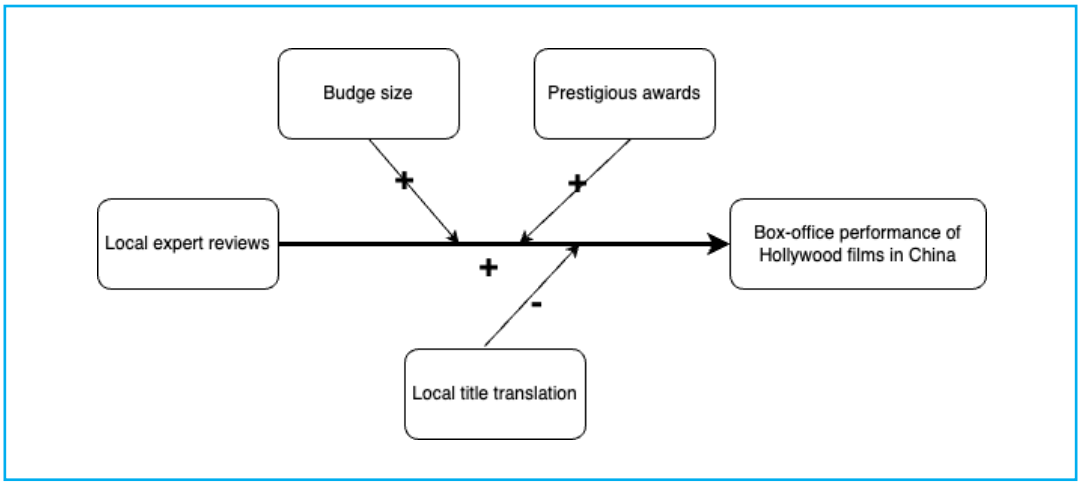
This dual affirmation, from both Western institutions and Eastern critics, provides consistent and reliable indicators of quality, influencing audience perceptions and encouraging financial success (Lee, 2009). The melding of international recognition with local validation serves as a continuous reassurance, mitigating the perceived risks associated with embracing imported creative works. Consequently, this synergy between global accolades and local expert endorsements is hypothesized to further elevate a film's market performance. Therefore, we propose:

H3: Prestigious awards increase the positive influence of local expert reviews on the box office performance of Hollywood films in China.

Translation strategies significantly affect audience perceptions of cultural proximity and the authenticity of foreign films. The choice to translate movie titles into the local language versus retaining the original English title shapes how audiences engage with and perceive the film (Alousque, 2015; Lee, 2008). Translating titles into the local language can increase accessibility and familiarity among mainstream audiences, suggesting an adaptation to local cultural sensibilities (Steenkamp & Geyskens, 2014; Wong & Merrilees, 2006). Conversely, maintaining original English titles may convey a sense of authenticity and preserve the foreign artistic essence of the film, potentially appealing to segments of the audience with global cultural exposure or English proficiency (Alashban et al., 2002; Yin, 2009).

However, this adaptation through translation can have complex implications. While local language titles may seem more accessible, they could also be perceived as diluting the film's original artistic intent. This perceived over-adaptation might lead audiences to question the film's authenticity or fidelity to the source material. In this context, the endorsements of local expert reviewers might carry less influence if the audience perceives the film as excessively

Fig. 1. Summarizes All Hypotheses Discussed Above



pandering to local tastes rather than presenting an authentic international product. In cases where the film's title is fully translated into the local language, it might suggest a prioritization of cultural adaptation over maintaining the film's original essence. This could lead mainstream audiences to view the film as less authentic or aligned with the original creative vision. As a result, local expert reviews might not be as effective in swaying audience opinions or influencing box office performance. Therefore, we propose:

H4: The translation of a film's title into the local language (Chinese) will lessen the positive influence of local expert reviews on the box office performance of Hollywood films in China.

Having conceptualized these contingent effects, we next turn to discussing the data and methodology used to empirically examine how local critic reviews combine with production scale, awards, and localization strategies to impact imported film performance in global markets.

IV. Methodology

1. Data and Sample

We compiled a dataset of Hollywood films released in China from 2000 - 2017, drawing from various sources to test our proposed hypotheses. The sample includes the top 500 grossing Hollywood studio films distributed theatrically in China during this period. Box office performance in China and rankings were sourced from 58921.com, China's leading film database, which catalogs over 34,000 domestic releases since 2003.

To gather information about Chinese audience engagement, we extracted data from Douban Movie, the largest online community in China with over half a million daily viewer comments. This provided metrics on reviews, ratings, commentary volumes, and descriptive tags.

Hollywood critical reception was sourced from Rotten Tomatoes, aggregating US professional critics reviews. Additional details such as titles, production information, genres, and awards for these top-grossing imports were obtained from IMDb Pro, a comprehensive global film meta-data portal.

After excluding entries with missing values, our final sample comprises 479 films.

2. Dependent Variable

The commercial success of a film can be directly measured through its theatrical box office gross. Our study quantifies the success of Hollywood imports in China, regarded as foreign cultural products, with gross receipts figures from 58921.com to assess commercial performance. These values are recorded in ten thousand Yuan, the Chinese currency unit.

3. Independent Variable

Expert reviews represent the assessments of film industry professionals and active online reviewers. We compiled the number of local expert reviews from Douban Movie, encompassing both industry professionals and prominent online reviewers.

The opinions of non-local critics, as indicated by Rotten Tomatoes critic ratings, were also taken into account for comparative analysis alongside local and non-local expert reviews.

4. Moderating Variables

Budget: The budget variable is represented by the production expenditure figures for each film, which were sourced from IMDb Pro. These values are recorded in US dollars.

Prestigious Awards: We counted all major awards and nominations, including the Academy Awards, Golden Globes, and BAFTA.

Title Translation: Films with titles fully translated into Chinese were coded as "1"; otherwise, they were coded as "0".

5. Control Variables

Several factors were controlled to ensure a more accurate analysis of the impact of local expert reviews on box office performance in China.

Genre: Sourced from IMDb, this variable includes a range of film genres.

Classification: Films are categorized based on IMDb rating: 'G' as '1', 'PG' as '2', 'PG13' as '3', and 'R' as '4'.

Serial: A film is marked as '1' if part of a series, and '0' otherwise, based on information from IMDb and Douban Movie.

Adaptation: Films identified as adaptations (from comics, novels, games, or real events) are coded as '1', with non-adaptations as '0', according to tags from IMDb and Douban Movie.

Prominent Filmmaker: Films associated with renowned filmmakers are coded as '1', otherwise as '0', based on data from IMDb.

Number of Non-Expert Local Reviews: The logged number of reviews by non-expert local reviewers for each film, as recorded by Douban Movie.

Company Credits: Involvement of different companies in a film's release and production, as indicated by the IMDb company meter.

Prime Show Time: Films released during major holidays and special occasions in China are coded as '1', while regular weekend releases are coded as '0'.

Length of Local Showing: The duration a film was shown in China, based on data from Douban Movie and IMDb Pro.

Release Time Gap: The logged number of days between global and China release dates, using data from Douban Movie and IMDb Pro.

Year: The release year of the film in China, sourced from 58921.coma, a China film box office database.

IV. Results

Our analysis focuses on understanding how local expert reviews influence the success of imported films in the Chinese market, as measured by box office performance. We conducted Ordinary Least Squares (OLS) regressions using STATA 17, given the nature of the continuous outcome measure. After addressing missing values in certain variables, our final sample size was narrowed to 434 films.

We present summary statistics and correlation matrices for all variables in Tables 1 and 2, respectively. To address potential multicollinearity concerns, Variance Inflation Factors (VIFs) were examined. The mean VIFs stood at 2.33, significantly lower than the conventional threshold of 10, suggesting that our models were not adversely affected by multicollinearity issues.

Table 3 displays the results of the OLS regression analyses conducted to test our hypotheses. To support Hypotheses 2 and 5, we would expect a significant positive main effect of local expert reviews on box office revenues. Additionally, this impact should be further amplified when interacting with moderating factors such as budget, awards, and cultural adaptation.

In Model 1, which includes only control variables, significant predictors of box office success were identified. These included budget ($b = 0.005$, $p<0.001$), review volume ($b = 0.274$, $p<0.001$), sequels ($b = 0.561$, $p<0.001$), Sci-Fi ($b = 0.599$, $p<0.05$), and horror ($b = 0.857$, $p<0.01$). A significant negative association was observed with release time lag ($b = -0.263$, $p<0.001$).

In Model 2, we added the variable of local expert review volume (logged). Consistent with Hypothesis 1, an increase in expert reviews positively predicted box office revenue ($b = 0.260$, $p<0.001$). Interestingly, the significance of general audience review volumes diminished when expert opinions were considered, indicating a dominant influence. Title translation was negatively associated with box office success ($b = -0.272$, $p<0.1$).

Model 3 introduced budget as a moderator of the impact of expert reviews. The interaction term between budget and expert reviews was positive and significant ($b = 0.001$, $p<0.01$), suggesting that larger budgets enhance the influence of local expert reviews on revenue. This result supports the idea that high production scale can amplify the signaling effect of expert opinions.

In Model 4, we examined the moderating role of awards volume. Both the main effect of awards ($b = 0.235$, $p<0.01$) and the interaction with expert reviews ($b = 0.182$, $p<0.05$) were significant, indicating that awards boost the commercial influence of local expert reviews.

Finally, Model 5 explored the interaction between expert reviews and title translation. The results showed a negative moderation effect ($b = -0.271$, $p<0.05$), indicating that foreign titles enhance the impact of critics, contrary to localized translations.

The interaction effects in Models 3 to 5 are illustrated in Fig. 2, Fig. 3, and Fig. 4.

V. Discussion and Conclusion

This study illuminates the pivotal role of market-specific gatekeepers or cultural intermediaries in enabling imported creative works to resonate with mainstream audiences by signaling quality and relevance amidst uncertainty. Our findings reveal that local experts or critics significantly amplify the success of foreign films in China compared to non-native reviewers detached from the endemic consumer context. Additionally, informational cues and symbolic attributes of films, such as high production budgets and prestigious honors, enhance the influence of reviewers in resolving uncertainty, while extensive cultural adaptation may diminish credibility.

Several theoretical and managerial implications emerge. These include strategies for importers navigating mainstream preference gaps, cultural brokers overcoming familiarity barriers, and the conditioning effects of symbolic drivers on product adoption. First, our research advances

Table 1. Descriptive Statistics

		Mean	S.D.	Min	Max
1	Local Box Office Performance	8.88	1.54	4.50	12.50
2	Budget	107.58	61.85	0.01	300.00
3	Prime Show Time	0.40	0.49	0.00	1.00
4	Length of Local Showing	18624.1	1770.06	14531.00	21161
5	Release Time Gap*	4.01	1.30	0.00	7.32
6	Company Credits	78.11	26.9	9.00	206
7	Local Expert Reviews*	5.47	1.37	0.00	8.90
8	Prestigious Awards*	0.13	0.40	0.00	2.48
9	Translated Title	0.93	0.25	0.00	1.00
10	Non-Expert Reviews*	11.05	1.25	5.63	13.64
11	Non-Local Critics Reviews*	5.20	0.50	1.10	7.39
12	Prominent Filmmaker	0.25	0.43	0	1
13	Adventure	0.47	0.50	0	1
14	Drama	0.12	0.33	0	1
15	Comedy	0.06	0.23	0	1
16	Fantasy	0.03	0.16	0	1
17	Family	0.05	0.21	0	1
18	Sci-Fi	0.04	0.20	0	1
19	Romance	0.02	0.15	0	1
20	Mystery	0.03	0.17	0	1
21	Crime	0.08	0.27	0	1
22	Thriller	0.02	0.15	0	1
23	War	0.01	0.08	0	1
24	Horror	0.01	0.10	0	1
25	Animation	0.00	0.04	0	1
26	Serial	0.27	0.45	0	1
27	Adaptation	0.19	0.39	0	1
28	Classification (G, PG, PG13, R)	2.84	0.70	1	4

Note: * logged.

Table 2. Correlation Coefficients

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Local Box Office Performance	1													
2	Budget	0.54	1												
3	Prime Show Time	-0.05	0.02	1											
4	Length of Local Showing	0.64	0.15	-0.16	1										
5	Release Time Gap	-0.52	-0.44	0.08	-0.23	1									
6	Company Credits	0.31	0.36	0.04	0.03	-0.19	1								
7	Local Expert Reviews	0.63	0.35	-0.06	0.5	-0.34	0.37	1							
8	Prestigious Awards	0.06	0.03	-0.01	-0.06	0	0.21	0.31	1						
9	Translated Title	0.04	-0.05	-0.08	0.06	0.01	-0.04	-0.05	-0.16	1					
10	Non-Expert Reviews	0.54	0.42	0.02	0.21	-0.31	0.42	0.79	0.33	-0.03	1				
11	Non-Local Critic Reviews	0.38	0.49	0.06	0.19	-0.29	0.33	0.5	0.21	-0.05	0.54	1			
12	Prominent Filmmaker	-0.35	-0.21	0.04	-0.34	0.19	-0.06	-0.23	-0.08	0.06	-0.23	-0.16	1		
13	Adventure	0.24	0.42	-0.01	0.08	-0.2	0.1	-0.03	-0.08	-0.04	0.04	0.16	-0.21	1	
14	Drama	-0.1	-0.2	-0.04	0.01	0.1	-0.08	0.1	0.17	-0.05	0	-0.03	0.08	-0.35	1
15	Comedy	-0.08	-0.08	0.08	-0.03	0.02	0.03	-0.12	-0.08	0.07	-0.05	-0.1	0	-0.23	-0.09
16	Fantasy	-0.05	0	-0.01	-0.03	0.05	-0.01	-0.04	-0.05	0.04	-0.01	-0.07	0.05	-0.15	-0.06
17	Family	0	0.12	0	-0.05	-0.05	0.08	0.02	0	0.06	0.04	0.07	-0.02	-0.21	-0.08
18	Sci-Fi	0	-0.07	0	-0.04	0.07	0.02	0.04	0.1	-0.03	0.04	-0.01	0.05	-0.19	-0.08
19	Romance	-0.13	-0.14	-0.04	-0.11	0.08	0.01	0.06	0.15	-0.02	0.05	-0.03	0.07	-0.14	-0.06
20	Mystery	-0.05	-0.11	-0.02	0.05	0.1	0.04	0.04	0	0	0	0.01	0.06	-0.16	-0.07
21	Crime	-0.02	-0.17	-0.04	0.01	0.02	0	-0.06	-0.09	0.05	-0.07	-0.09	0.15	-0.27	-0.11
22	Thriller	-0.03	-0.04	-0.05	-0.02	0	-0.03	0.01	-0.05	0.04	-0.02	0.02	0.03	-0.15	-0.06
23	War	0.01	-0.06	0.04	-0.02	-0.01	-0.03	0.06	0.02	-0.08	0.02	-0.02	-0.04	-0.07	-0.03
24	Horror	0.01	-0.11	0.04	0.02	0.06	-0.04	-0.02	-0.03	0.03	-0.06	-0.13	0.03	-0.09	-0.04
25	Animation	-0.07	-0.05	0.05	-0.09	0.05	0	-0.06	-0.01	0.01	0	-0.01	-0.03	-0.04	-0.02
26	Serial	0.44	0.4	0.05	0.16	-0.22	0.22	0.19	-0.06	0.07	0.29	0.21	-0.17	0.24	-0.12
27	Adaptation	0.17	0.13	0.01	0.20	-0.07	0.14	0.17	-0.08	0.06	0.14	0.18	0.15	0.09	0.01
28	Classification	0.02	-0.15	-0.08	0.05	0.18	0.18	0.12	0.03	-0.03	-0.02	0.02	0.15	-0.22	0.21

Note: A correlation value above 0.1 is significant at the 0.05 level.

		15	16	17	18	19	20	21	22	23	24	25	26	27	28
1	Local Box Office Performance														
2	Budget														
3	Prime Show Time														
4	Length of Local Showing														
5	Release Time Gap														
6	Company Credits														
7	Local Expert Reviews														
8	Prestigious Awards														
9	Translated Title														
10	Non-Expert Reviews														
11	Non-Local Critic Reviews														
12	Prominent Filmmaker														
13	Adventure														
14	Drama														
15	Comedy	1													
16	Fantasy	-0.04	1												
17	Family	-0.05	-0.04	1											
18	Sci-Fi	-0.05	-0.03	-0.04	1										
19	Romance	-0.04	-0.02	-0.03	-0.03	1									
20	Mystery	-0.04	-0.03	-0.04	-0.04	-0.03	1								
21	Crime	-0.07	-0.05	-0.06	-0.06	-0.04	-0.05	1							
22	Thriller	-0.04	-0.03	-0.03	-0.03	-0.02	-0.03	-0.04	1						
23	War	-0.02	-0.01	-0.02	-0.02	-0.01	-0.01	-0.02	-0.01	1					
24	Horror	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.03	-0.02	-0.01	1				
25	Animation	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0	0	1			
26	Serial	-0.06	-0.04	0.06	-0.01	-0.09	-0.11	-0.07	-0.04	-0.05	0.03	-0.03	1		
27	Adaptation	-0.03	0.02	-0.06	0.01	0	0.01	-0.08	-0.04	0.03	0.06	-0.02	0.13	1	
28	Classification	-0.12	0.06	-0.18	0.14	0.01	0.07	0.23	0.13	0.06	0.11	-0.12	-0.03	0.12	1

Table 3. Hypothesis-Testing: OLS Regression of Factors Predicting the Box-Office Performance of Hollywood Films in China

	Model 1	Model 2	Model 3	Model 4	Model 5
Budget	0.005*** (0.001)	0.005*** (0.001)	-0.004 (0.003)	0.005*** (0.001)	0.004*** (0.001)
Prime Show Time	0.053 (0.089)	0.042 (0.088)	0.061 (0.087)	0.037 (0.087)	0.068 (0.088)
Length of Local Showing	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Release Time Gap	-0.263*** (0.036)	-0.239*** (0.036)	-0.245*** (0.036)	-0.232*** (0.036)	-0.235*** (0.036)
Company Credits	0.002 (0.002)	0.002 (0.002)	0.002 (0.002)	0.002 (0.002)	0.002 (0.002)
No. of Review Participants	0.274*** (0.044)	0.095 (0.067)	0.115+ (0.067)	0.108 (0.067)	0.091 (0.067)
No. Non-Local Critic Reviews	-0.121 (0.109)	-0.171 (0.108)	-0.130 (0.109)	-0.178+ (0.108)	-0.153 (0.108)
Translated Title	0.232 (0.158)	0.272+ (0.156)	0.287+ (0.155)	0.275+ (0.155)	1.805** (0.620)
Prestigious Awards	0.074 (0.110)	0.010 (0.110)	-0.009 (0.109)	-1.239* (0.561)	-0.028 (0.110)
Prominent Filmmaker	-0.100 (0.104)	-0.135 (0.103)	-0.124 (0.102)	-0.128 (0.103)	-0.143 (0.102)
Adventure	0.298+ (0.170)	0.326+ (0.168)	0.330* (0.167)	0.321+ (0.167)	0.321+ (0.167)
Drama	0.039 (0.192)	-0.045 (0.191)	-0.049 (0.190)	-0.060 (0.190)	-0.081 (0.190)
Comedy	0.128 (0.223)	0.196 (0.221)	0.209 (0.219)	0.179 (0.220)	0.162 (0.219)
Fantasy	-0.070 (0.277)	-0.077 (0.273)	-0.050 (0.271)	-0.098 (0.272)	-0.085 (0.271)
Family	0.230 (0.242)	0.228 (0.239)	0.203 (0.237)	0.214 (0.238)	0.210 (0.237)
Sci-Fi	0.599* (0.245)	0.571* (0.242)	0.600* (0.240)	0.613* (0.241)	0.585* (0.240)
Romance	0.099 (0.304)	-0.007 (0.301)	-0.019 (0.299)	-0.093 (0.302)	-0.054 (0.300)
Mystery	0.060 (0.269)	0.031 (0.265)	0.015 (0.263)	0.044 (0.264)	-0.015 (0.264)

Crime	0.296 (0.217)	0.355+ (0.214)	0.315 (0.213)	0.338 (0.213)	0.327 (0.213)
Thriller	0.092 (0.299)	0.046 (0.295)	0.007 (0.293)	0.051 (0.294)	0.030 (0.293)
War	0.459 (0.592)	0.143 (0.591)	0.269 (0.588)	0.201 (0.588)	0.147 (0.587)
Horror	0.857* (0.431)	0.886* (0.425)	0.829+ (0.423)	0.889* (0.423)	0.838* (0.423)
Animation	-0.366 (0.893)	-0.363 (0.880)	-0.548 (0.876)	-0.428 (0.876)	-0.403 (0.874)
Serial	0.561*** (0.101)	0.611*** (0.101)	0.605*** (0.100)	0.630*** (0.100)	0.615*** (0.100)
Adaptation	-0.177 (0.111)	-0.176 (0.109)	-0.164 (0.109)	-0.182+ (0.109)	-0.184+ (0.109)
Classification PG	0.233 (0.259)	0.216 (0.255)	0.215 (0.253)	0.190 (0.254)	0.246 (0.254)
Classification PG-13	0.445+ (0.259)	0.386 (0.256)	0.352 (0.254)	0.366 (0.255)	0.400 (0.254)
Classification R	0.525+ (0.284)	0.399 (0.283)	0.417 (0.280)	0.376 (0.281)	0.419 (0.281)
No. of Local Expert Reviews		0.260*** (0.074)	0.118 (0.092)	0.235** (0.075)	0.519*** (0.126)
No. of Local Expert Reviews x Budget			0.001** (0.001)		
No. of Local Expert Reviews x Prestigious Awards				0.182* (0.080)	
No. of Local Expert Reviews x Translated Title					-0.271* (0.106)
Year Dummies	Yes	Yes	Yes	Yes	Yes
Constant	5.764 (5.996)	5.222 (5.911)	4.637 (5.870)	6.133 (5.893)	3.443 (5.910)
Observations	479	479	479	479	479
F-values	32.73***	33.52***	33.37***	33.37***	33.52***
R-squared	0.773	0.781	0.785	0.784	0.785
Adj R-squared	0.749	0.758	0.761	0.760	0.762
Standard errors in parentheses					

Note: *p<0.001, **p<0.01, ***p<0.05, + p<0.1.

Fig. 2. The Moderating Role of Film Budget

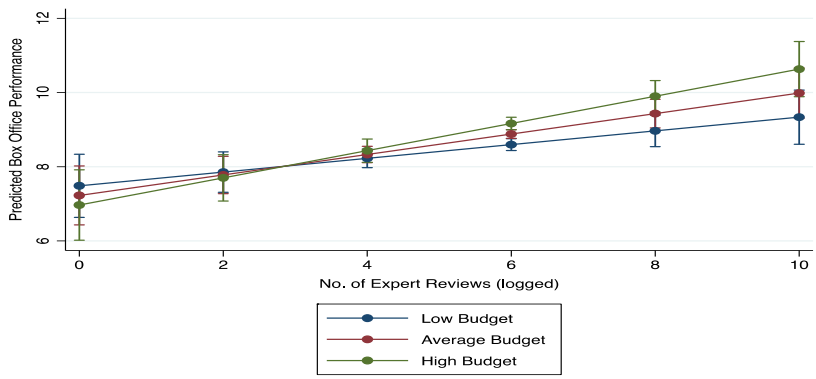


Fig. 3. The Moderating Role of Prestigious Awards

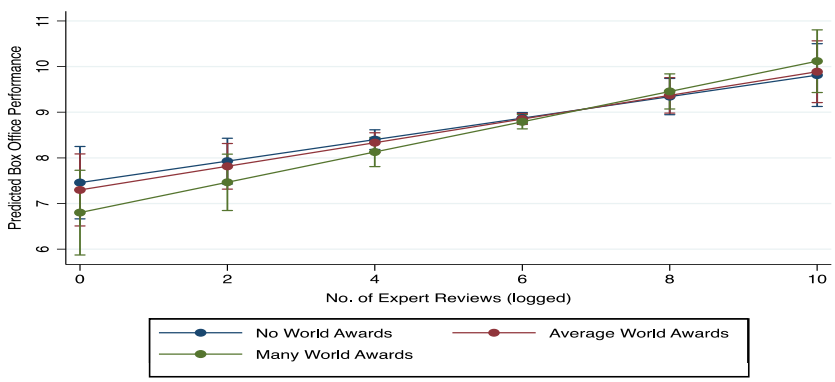
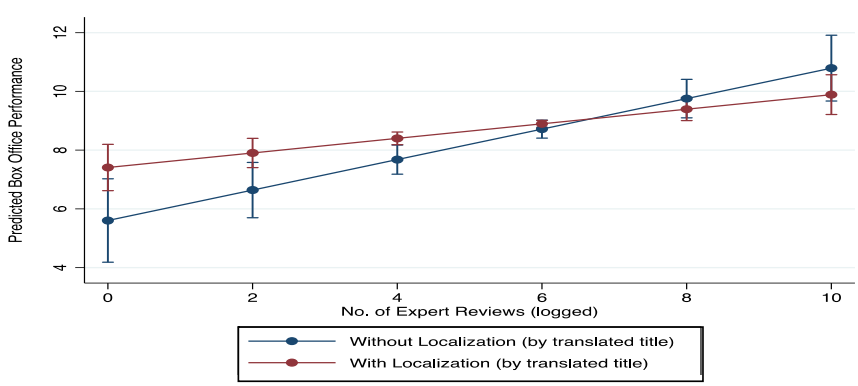


Fig. 4. The Moderating Role of Localized Titles



an integrated framework combining information economics and gatekeeper scholarship to explain the critical role of local evaluators in facilitating the adoption of foreign cultural products under ambiguity. Mainstream consumers, when faced with imported films of unpredictable quality, tend to rely on reviewers to share linguistic-cultural orientation as credibility filters. This highlights the crucial role of critics, who occupy strategic positions within social networks, as catalysts for valuation. Reputation enables them to shape preferences at an early stage, with resonance subsequently spreading through peer sharing.

However, while our study offers valuable insights, it is important to acknowledge that our findings may not be entirely generalizable outside the specific context of the Chinese market, particularly with the rising influence of OTT platforms. As these platforms gain prominence, they may alter the dynamics of film reception and critic influence in ways for which our study does not account. This limitation suggests the need for a cautious application of our findings to other markets, or in the context of different media consumption platforms. Second, we define boundary conditions around the symbolic meanings applied by marketing systems to position cultural products, and how these cues interact with expert opinions to sway uncertain consumers. Our findings reveal the interplay between production scale, external validation through honors, and accessibility adaptation strategies in framing inferences. This underscores the importance of attribute complementarity effects that either enhance or undermine quality signaling from intermediaries. Finally, our context highlights the drivers catalyzing the resonance of imported creative content within fast-evolving emerging markets transitioning beyond early adopter segments. This is particularly relevant as homegrown firms internationalize cultural output, and nations balance heritage protection with openness. Our evidence emphasizes the importance of reviewers in overcoming tacit barriers related to provenance and foreign positioning. This is crucial for global business scholars seeking to understand how credible intermediaries can bridge global products with local sensibilities.

For Hollywood studios and other foreign content producers targeting China, our findings underscore the importance of engaging credible local gatekeepers to establish and validate quality. As imported films face uncertain appraisals, mainland critics that share context with audiences can decode potential resonance and address tacit barriers related to foreignness. This informs launch strategies that balance essence importation with cultural bridging, maintaining authenticity in titles to preserve credibility where reviews confirm accessible resonance. However, with the increasing prominence of OTT platforms, these dynamics might evolve, affecting how imported content is received and critiqued. The rise of such platforms calls for a re-examination of the influence of local critics in an environment where streaming series, books, music, and other cultural goods are increasingly consumed.

In conclusion, while our study offers a comprehensive analysis within its current context, further research is needed to explore how these dynamics play out in different markets and under the changing landscape of media consumption, particularly in the context of emerging OTT platforms and other forms of digital media.

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An Impact Assessment of the European Carbon Border Adjustment Mechanism (CBAM) on the Korean Economy: A CGE Approach

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ABSTRACT

Purpose – This paper investigates the economic impact of the European Union Carbon Border Adjustment Mechanism (EU-CBAM) on Korea's economy.

Design/Methodology/Approach – The study employs the input-output model and Global Trade Analysis Project-Energy (GTAP-E) model by McDougal and Golub (2007), along with the GTAP-E version 10.1 Data Base developed by Aguiar et al. (2019). The input-output model estimates the carbon emissions of Korea's exports to the EU27, evaluating potential carbon costs and a carbon tax (measured in US dollars per ton of emissions). Utilizing the static GTAP-E model, three policy scenarios are implemented, focusing on direct carbon emissions (Scope 1), emissions from electricity usage (Scope 2), and indirect emissions (Scope 3).

Findings – Simulation outcomes reveal significant contractions in CBAM-related sectors of the Korean economy, with a decline in iron and steel production (US$ 68.00 million) and electronic industries (US$ 39.16 million). Korea's export reductions to the EU27 in CBAM-affected sectors (iron and steel, cement, aluminum) indicate a subtle impact extending to the energy, energy-intensive, and services sectors.

Research Implications – This paper provides valuable insights to policymakers and entrepreneurs in navigating the challenges and opportunities arising from the interlinkage of environmental policies and global trade dynamism. The analysis contributes to discerning perspectives essential for informed decision-making amid the complex interplay of regulatory frameworks and international trade dynamics.

Keywords: carbon border adjustment mechanism, economic impact, European green deal, GTAP-E model, Korean economy

JEL Classifications: C68, C83, D31, Q56

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I. Introduction

The debate over carbon leakage poses a significant challenge in incorporating environmental and climate issues into economic policies. Implementing a carbon tax, widely considered a critical policy measure to address carbon leakage (United Nations Conference on Trade and Development, 2022), remains a contagious topic of debate. Notably, the European Union's plan to introduce a carbon tax through the Carbon Border Adjustment Mechanism (CBAM) faces vigorous contestation from its trade partners, including advanced economies like Korea. This study aims to evaluate the consequences of CBAM on the Korean economy.

The initiative to introduce a carbon tax based on the carbon content of exports to the EU market positions the EU as a leader in global environmental issues. The European Green Deal policy framework was proposed in 2019 by the European Commission. It is a suite of policies and measures aimed at making the economies of the European Union members carbon neutral by 2050. These policies and measures address environmental and social issues by focusing on critical sectors of the economy, including agriculture, industry, transportation, buildings, and biodiversity (European Commission, 2019, 2022). However, this proposal poses severe challenges, especially the lack of adequate environmental and climate policies and measures by the EU's trading partners, which may lead to carbon leakage, seriously undermining the EU's efforts to address global environmental and climate issues.

The primary purpose of the CBAM is to curb CO_2 emission leakages and safeguard the competitive capacity of domestic industries in the EU by leveling the decarbonizing costs of production processes for European firms with those of trading partners such as Korea. The CBAM focuses on reducing the risk of carbon leakage and the adverse impact on EU firms' domestic trade competitiveness due to the expected spike in production costs within the EU27 trading bloc by surcharging imported goods based on carbon content. Initially, the sectors to be covered include electricity, fertilizer, hydrogen cement, iron and steel, and aluminum (European Union, 2023).

The European Union pegs the CBAM carbon price to the EU Emission Trading System (ETS). The carbon price involves surcharging exports by Korea and other trading partners into the EU27 market, significantly increasing the cost of trading and downgrading the competitiveness of Korean firms within the EU27 market. The increased trade costs will likely coerce Korean firms exporting to the EU market to restructure business to remain competitive. Available literature indicates that the nature of each industry in terms of mobility and the intensity of foreign trade determine the response mechanism to the increase in production costs. For instance, some sectors (such as transport) cannot relocate to countries with fewer regulations on carbon emissions, and hence have to bear extra charges due to new rules. On the other hand, Korean industries exporting CBAM-related commodities to the EU27 will likely seek new markets with less stringent environmental rules and regulations.

The European Parliament, in support of the control of carbon emissions leakage, agreed (on March 10, 2022) upon a resolution introducing a CBAM compatible with the WTO and the EU's FTA's rules and regulations of non-discriminatory and free trade (European Parliament, 2021). Most importantly, the adopted resolution suggests linking the CBAM to the European Union Emissions Trading System (ETS) while leveling the decarbonizing costs of production processes for European industries with those of trading partners. With such a framework, there is no incentive for EU domestic firms to shift production processes to regions with less ambitious emissions reduction targets (European Parliament, 2021). Implementing the CBAM involves applying a carbon tax to imported goods from industries with the potential risk of carbon leakage, especially from countries with lower regulatory mechanisms on carbon emissions than the European Union. This new regulatory mechanism's burden would be similar to the costs imposed on domestic producers in the

European Union under its ETS. In order to avoid double taxation, the European Parliament's (2021) study suggested no imposition of extra charges on imports from countries that impose identical environmental policies.

This study systematically assesses the transnational impact of the European Union's environmental policy, specifically the (EU-CBAM) carbon tax, on carbon emissions embedded in Korean exports to the EU27, utilizing the Global Trade Analysis Project-Energy (GTAP-E) model (Burniaux & Truong, 2002; Hertel & Tsigas, 1997; McDougall & Golub, 2007) and the GTAP database version 10 with a 2014 base year (Aguiar et al., 2019). Within this database, all CBAM-related sectors, except electricity, iron, and steel, are aggregations of other sectors. A significant contribution of our study is the use of the SplitCom (Horridge, 2005) tool to disaggregate CBAM-related commodities, including fertilizer, cement, and aluminum. Another essential contribution is the utilization of the input-output method to quantify embedded carbon emissions, forecast the associated carbon costs, and estimate the likely CBAM commodity carbon tax for Korean exports to the EU27 (Peters, 2008). This study's third and primary contribution is the use of a static GTAP-Energy model to comprehensively evaluate the sectoral impact of the EU27 Carbon Border Adjustment Mechanism's impact on the Korean economy.

Primarily, this study examines the micro-economic impact of the EU-CBAM on the Republic of Korea's economy, with insights from Perdana and Vielle (2022). The analysis scrutinizes changes in carbon emissions, domestic output, export volumes, and trade balance across industries. Given the technologically advanced nature of developed nations like Korea, featuring lower carbon-intensive production, the CBAM is poised to enhance competitiveness, favoring exports with reduced carbon footprints (Durant et al., 2021; Zhena, 2023).

After the background information, Section II provides a summary of related literature. Section III discusses the methods applied, while the data and simulation design description are in Section IV. Simulation outcomes are presented in Section V, while Section VI delivers the discussion and conclusion remarks.

II. Literature Review

Efforts to address global environmental and climatic challenges while maintaining sustainable economic growth require a mix of domestic and international policies. Carbon leakage is a significant concern in addressing environmental and climatic issues. According to the "pollution haven hypothesis" or the "pollution haven effect", as countries become economically wealthier, they tend to introduce stringent environmental regulations that force domestic firms to outsource or relocate polluting industries to regions with less strict environmental rules. Concerns about ecological inequality low-income economies likely face from increased pollution and environmental degradation due to hosting these relocated industries (Acar et al., 2022; Poelhekke & van der Ploeg, 2015) have been raised. Even so, global environmental sustainability and social justice through international agreements, such as the Paris Agreement on Climate Change, promote international cooperation in addressing climate change and CO_2 emissions, and have reached a fever pitch.

A wide range of literature on carbon border adjustment mechanisms focuses on policy design, implementation, economic impacts, and policy effectiveness.

1. CBAM Policy Design and Implementation

A CBAM is one of the practical instruments a country can employ to address carbon leakage and the competitiveness of domestic industries in the local market. The key idea behind CBAM is to impose a carbon price on imported goods based on carbon content to create a level playing field between domestically produced products subject

to stringent environmental policies and imported goods from countries with weaker environmental laws. Several studies review environmental policy design features such as the EU-CBAM (Böhringer et al., 2020; Brown et al., 2022; European Commission, 2021; Isip et al., 2022; McKibbin et al., 2018; Pizer, 2021; Van Asselt & Brewer, 2019; World Trade Organization (WTO), 2021; Zhena, 2023; Zheng, 2023).

2. Economic Impact of a CBAM

Designing and implementing an effective environmental and climate policy on a national or regional level, such as the EU CBAM, is complex due to the dynamic nature of ecological and climate issues. Therefore, its effectiveness and economic impact depend on many factors, such as the stringency of carbon pricing, sectors affected, trade structure, and the responses of trading partners. In the above context, the economic impact of the EU CBAM is a subject of significant interest and debate among policymakers, economists, and global stakeholders (Böhringer et al., 2020; Dechezleprêtre & Sato, 2017; Ju & Jin, 2023; Klenert et al., 2018; Van Asselt & Brewer, 2019).

Imposing strict environmental regulations can adversely affect the competitiveness of locally produced goods and services relative to imported goods from countries with lenient environmental policies. Therefore, to level the domestic trading market, the EU27 will introduce a carbon tax on exports entering its domestic market through the carbon border adjustment mechanism (CBAM). However, this raises serious issues on CBAM's compatibility with the World Trade Organization's (WTO) trade rules, and the need for clarity on using collected carbon tax revenue.

The EU-CBAM came into effect in a transitional phase on the 1st of October, 2023. Before it came into force, several studies, including that of Durant et al. (2021) and Cevik et al. (2023), indicated that economies that rely on exporting goods with high carbon content into the EU27 will be adversely affected. This potential disparity in the impact of the CBAM on different economies has raised severe concern in developing countries, which are likely to be negatively impacted regarding redesigning the carbon tax to create fairness and social acceptability. To mitigate the effect of the carbon tax on poor economies, studies like that of Durant et al. (2021) suggest the increased diffusion and uptake of environmentally friendly technologies.

In order to investigate the potential impact of the intended carbon tax on exports to the EU on different economies by income level, Acar et al. (2022), and Durant et al.'s (2021) findings showed that compared to developed economies, less developed and lower middle-income countries would be adversely affected. In contrast, a study by Chepeliev (2021) found that the impact of the carbon tax on most trading partners of the EU27 will be limited, but the impact will also vary widely among regions and sectors.

In a review of the impact of the intended carbon tax by the EU, Durant et al. (2021) found that EU-CBAM has the potential to alter global trade patterns in favor of countries with less carbon-intensive production processes. Such an impact means that the exports of developing countries to the EU27 will be adversely affected. The study suggests reinvesting some carbon tax revenue to develop cleaner production technologies in developing economies as a mitigating factor.

Unlike Durant et al.'s (2021) conclusions, Lee and Yoo's (2022) study illustrated that despite Korea's economic and technological advancement, the implementation of the EU's Carbon Border Adjustment Mechanism (CBAM) will detrimentally affect domestic production and export volumes. The study found a decline in production within energy-intensive sectors, notably the chemical, metal, and machinery industries. In mitigating the effects and harnessing the new opportunities, the research advocated for a strategic realignment toward investments in renewable energy and advancing low-carbon technologies.

Overall, while the EU's Carbon tax aims to address carbon leakage and promote global climate

action, it is crucial to consider and address the potential implications for developing countries to ensure that it aligns with fairness, equity, and sustainable development principles. Yet, the available literature on the impact of the EU CBAM on countries by income level needs to be more detailed. Furthermore, this study also seeks to quantify the contribution of the EU-CBAM to efficiency in energy production, especially in low-income countries. In summary, the effectiveness of the CBAM on carbon emissions will depend on the effectiveness of local environmental policies.

III. Methods and Data

In this section, we describe the methodologies applied to assessing the likely impact of the imposition of a carbon border tax by the EU27 on the EU27 economy and its trading partners. We exploit two models to determine the potential economic impact of the EU-CBAM. First, we implement an input-output model to estimate the CO_2 emission embedded in exports to the EU27. Then, using the most current ETS carbon prices and the estimated CO_2 emissions embedded in exports, we calculate the carbon bill and the ad valorem carbon equivalent tax on exports entering the EU27 market. Second, a computable general equilibrium (CGE) model is used to simulate the impact of the EU-CBAM using the estimated ad valorem carbon tax.

1. The Input-Output Method

1.1. Estimating CO_2 Emissions Rooted in Exports to the EU27

Calculating the CO_2 emissions rooted in exports ($\hat{e}^{r,eu27}$) to the EU27, we follow Peters (2008). Acar et al. (2022) and Chepeliev (2021) employed a similar approach to carry out a quantitative assessment of the implementation of the EU CBAM in Ukraine and Turkey, respectively. We consider country-specific CO_2 emissions per unit of output by sector, activity demand for domestically produced commodities in region *r*, and export flows from country *r* to EU27 member states.

The total CO_2 emissions associated with fossil fuel use and embodied in exports ($\hat{e}^{r,eu27}$) to the EU27 for each commodity are estimated using the formula below:

$$\hat{e}^{r,eu27} = \hat{k}^r (I - A^r)^{-1} \hat{y}^{r,eu27} \quad (1)$$

where $\hat{k}^r$ is a diagonalized matrix of region-specific emissions per unit of output by industry, I is the identity matrix, A^r is a technological matrix representing industry demand for intermediate inputs in region *r*, $(I - A^r)^{-1}$ is the Leontief inverse, $\hat{y}^{r,eu27}$ is a diagonalized matrix of export flows from region *r* to the EU27, $\hat{e}^{r,eu27}$ is a diagonalized 24*24 matrix of CO_2 emissions rooted in exports to the EU27 by its trading partners, with each row total accounting for the CO_2 emissions embodied in the related column industry exports, and *r* is the source of exports (23 EU27 trading partners), while *s* represents the EU27, which is the CBAM imposing region.

Greenhouse gas emissions are classified into three domains for a holistic carbon footpath assessment. Scope 1 includes direct carbon emissions from owned or controlled sources, Scope 2 comprises indirect emissions from purchased energy, and Scope 3 encompasses all other indirect emissions, capturing an industry's value chain. Using the I-O method, we decompose CO_2 emissions over the three different scopes, whereby the diagonal values of the e matrix account for scope one emissions embodied in exports. The electricity row accounts for scope two emissions. The remaining column estimations represent the scope three emissions embodied in imports by the EU27. Though Marcu et al. (2020) suggested accounting for all three Scopes when implementing the EU-CBAM, the initial implementation of the EU-CBAM will mainly focus on direct emissions and emissions from electricity only.

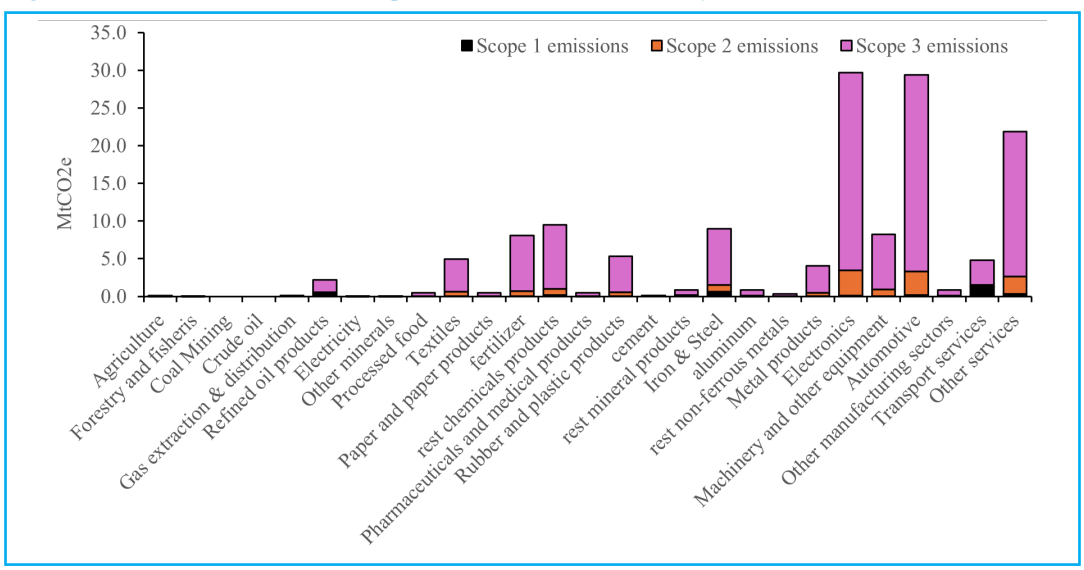
Table 1. CO_2 Emissions Embedded in Exports of CBAM Commodities by Korea to the EU27 ($MtCO_2e$)

CBAM Commodity	Scope 1 Emissions	Scope 2 Emissions	Scope 3 Emissions	All Three Scopes
Electricity	0.0004	0.0004	0.0016	0.0023
fertilizer	0.0208	0.6552	7.3985	8.0746
cement	0.0149	0.0115	0.1238	0.1501
Iron & Steel	0.6453	0.9084	7.3906	8.9443
aluminum	0.0018	0.0944	0.7262	0.8224

Source: Authors' calculations using the input-output method.

Our calculations, presented in Table 1 and Fig. 1, highlight how the amount of emissions linked to exports to the EU27 changes depending on industry. For instance, when we look at the products that fall under the Carbon Border Adjustment Mechanism (CBAM) exported from Korea to the EU27, iron and steel products have the highest imbedded CO_2 emissions at 8.9443 million metric tons, followed by fertilizer at 8.0746 million metric tons, cement at 0.1501 million metric tons, and electricity at 0.0023 million metric tons. In contrast, for exports outside the CBAM framework, electronics takes the lead with 26.6661 million metric tons of CO_2 emissions, the automotive industry follows with 29.3886 million metric tons of emissions, the remaining chemical exports having 9.4825 million metric tons of embedded emissions, and machinery and other equipment accounts for 8.2229 million metric tons of emissions. As anticipated, refined oil exports contribute 3.2 million metric tons of CO_2 emissions, while the use of petroleum products in air and sea transport services is responsible for 1.9 million metric tons of CO_2 emissions.

Fig. 1. CO_2 Emissions Embedded in Exports of CBAM Commodities by Korea to the EU27 ($MtCO_2e$)



Source: Authors' drawing based on CO_2 emissions embedded in exports to the EU27 estimated using the Input-Output method and GTAP Database Version 10A (Aguiar et al. 2019).

1.2. CBAM-Induced Carbon Bill

To assess the trade cost induced by the EU Carbon Border Adjustment (CBAM), we find the product of the carbon content in exports and the unit carbon price determined by the European Union Emission Trading System (ETS).

Table 2. Estimated Carbon Costs of CBAM-Targeted Commodities Exported into the EU

(Unit: US$ Million)

Commodity	Scope 1	Scope 2	Scope 3	Sum of 3 Scopes
Electricity	0.0	0.0	0.1	0.2
Fertilizer	1.7	53.0	598.5	653.2
Cement	1.2	0.9	10.0	12.1
Iron & Steel	52.2	73.5	597.9	723.6
Aluminum	0.1	7.6	58.7	66.5
Total Carbon Costs	55.3	135.1	1,265.3	1,455.7

Source: Authors' calculations.

In 2022, the highest recorded ETS carbon price was US$98.3/ $MtCO_2e$, while the lowest ETS price was 56.7/ $MtCO_2e$. Given the fluctuation in ETS carbon prices, different studies have employed varying CO_2 costs to estimate the carbon bill. Following Acar et al. (2022) and Chepeliev (2021), we compute the CBAM-induced carbon bill by finding the product of the carbon content in exports and the unit carbon price of 80.88 US$/ $MtCO_2e$, representing the average EU-ETS carbon price for 2022.

Table 2 reveals that if the Korean exports of the five CBAM-targeted commodities faced a charge of US$ 80.8 per million metric tons of CO_2 emissions across all scopes, the resulting carbon cost would reach 1,455.7 million USD. However, evaluating vulnerability based solely on carbon costs is insufficient to understand the potential impact on export revenue decline, specifically in the context of the Consequential Border Adjustment (CBAM), as emphasized by Acar et al. (2022).

1.3. Calculating the Ad Valorem Carbon Tax Equivalent

To gain insights into the potential impact of the Carbon Border Adjustment (CBAM) on sectoral export revenue, estimating the projected carbon tax cost as a percentage of sectoral export revenue for each country or region is beneficial. The carbon tax equivalent is determined by dividing the carbon cost associated with commodity exports by the income derived from exports to the EU27 for each respective commodity, as outlined by Acar et al. (2022) and Chepeliev (2021). Notably, research findings indicate a substantial contribution of the electricity sector to the carbon emissions embodied in exports.

Acar et al. (2022) applied a carbon price of 30 and 50 euros. The study's findings showed that the higher the carbon price used, the higher the carbon bill, and hence the expected rise in the level of vulnerability of the loss in revenue from exports into the EU. The high ETS carbon price fluctuation presents uncertainty regarding the expected returns to exporting firms and trading partners. For example, Acar et al.'s (2022) study showed that using 30/50-euros CBAM prices, the carbon cost for Turkey would be 1.1 /1.8 billion euros, respectively.

Table 3. Estimated Carbon Tax Imposed on EU's Imports from Korea

(Unit: US$/MtCO2e)

Exported CBAM Commodity	Scope 1	Scope 2	Scope 3	Sum of 3 Scopes
Electricity	0.35	0.35	1.58	2.27
Fertilizer	0.00	0.03	0.32	0.35
Cement	0.03	0.02	0.27	0.33
Iron & Steel	0.03	0.04	0.34	0.42
Aluminum	0.00	0.03	0.22	0.25

Source: Authors' calculations.

A carbon tax will likely increase the cost of traded commodities, affecting the level of production costs, final consumption, and the quantity of industry output. Therefore, relying on the carbon cost to assess the level of vulnerability from the EU CBAM may not be appropriate due to the dynamic nature of the impact of such a policy. A better way to address this is to convert the CBAM carbon bill into an ad valorem carbon tax equivalent. By employing the estimated ad valorem carbon tax in a CGE model, we can assess the overall economy-wide impact of the EU CBAM.

Table 3 illustrates the CBAM ad valorem carbon taxes for Korean exports to the EU27 calculated using the I-O model. The findings show that the impact of the CBAM varies with industry. For example, among the CBAM-targeted exported commodities, Korea's electricity exports will pay the highest ad valorem carbon tax, followed by iron and steel products, fertilizer, cement, and aluminum, respectively.

2. The GTAP-E Model

The GTAP-E model (Aguiar et al., 2019; Burniaux & Truong, 2002; McDougall & Golub, 2007), an extension of the GTAP model (Corong et al., 2017; Hertel & Tsigas, 1997), is applied to simulate the potential impact of the EU CBAM. The model introduces inter-fuel and energy-capital substitution in production, CO_2 emission taxation and accounting, and CO_2 emissions trading. In this study, the model employed is a static global multi-sector. The model incorporates a carbon accounting framework, the interactions and feedback impact between different industries and economic agents, and the possible adjustments in response to policies or external shocks. The interlinkage between countries is through export and import flows for governmental and private household consumption. In the above context, the GTAP-E model provides a valuable framework in which to evaluating the economic impact of energy and environmental policies, such as the European Union carbon border adjustment mechanism.

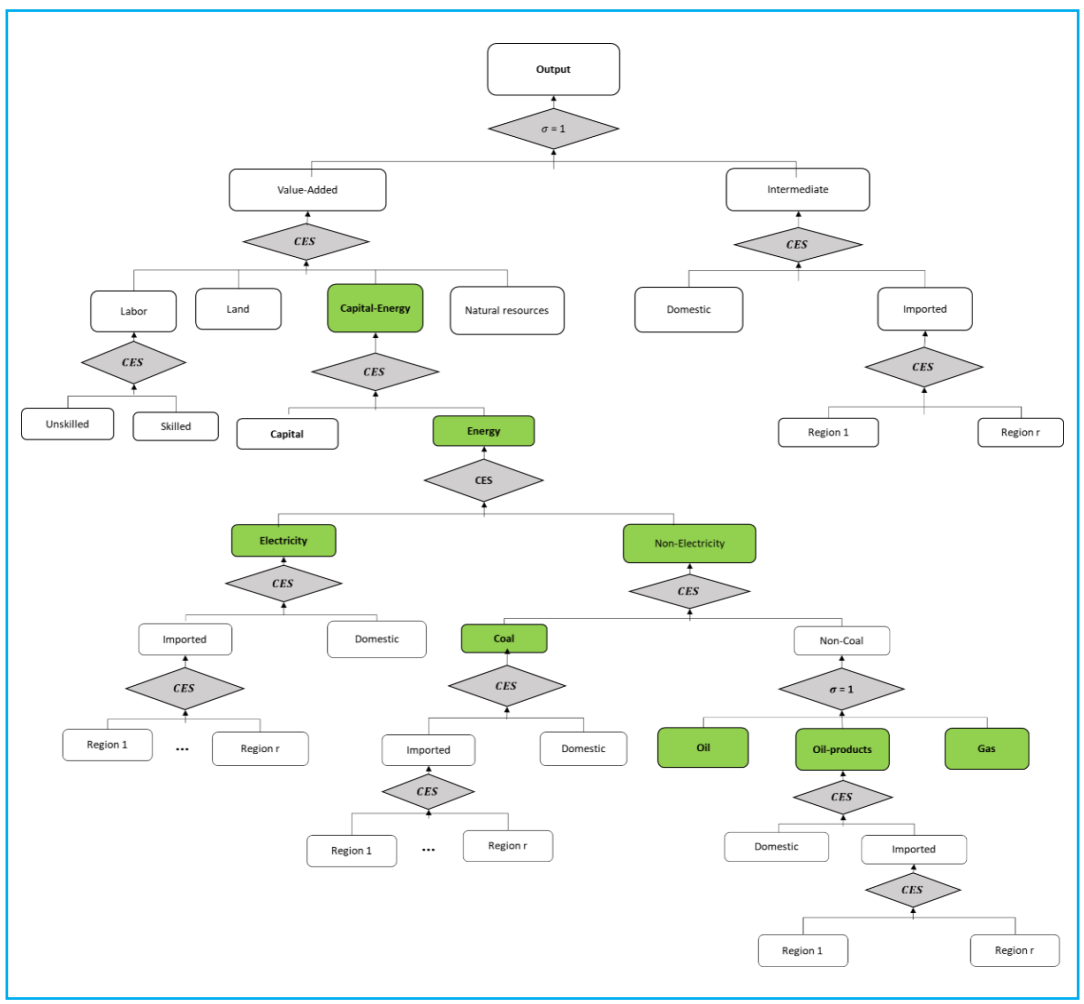
CGE models statistically replicate the general equilibrium structure of an economy based on the Walrasian general equilibrium structure, in which demand equals supply for all commodities and factors of production at a given set of relative prices.

Fig. 2 illustrates the production structure of the GTAP-E model. An eight-level nested structure formulates the input demand of industrial activities, describing firm constraints when determining the optimal share between endowment inputs of land, unskilled and skilled labor, capital, and natural resources, and between domestically produced and imported secondary inputs in the production processes. Energy, a critical component in the production process, is drawn from various

sources, including coal, oil, gas, oil products, and electricity. Aggregating the value-added and intermediate bundles at the top of the nest applies a Cobb-Douglas production function. The value-added inputs are a CES composite of the capital-energy and endowment bundles at the second nest. Aggregating the intermediate bundle employs the Armington elasticities to substitute locally produced and imported intermediate inputs. Labor is a CES aggregation of skilled and unskilled labor, and the capital-energy composite is a CES aggregation of capital and the energy composite (at the third nest).

The GTAP-E model framework holds that capital and energy are substitutes. Producers aim to maximize profits by minimizing costs under available technological constraints. The production process uses the value-added composite of capital, labor, energy, and intermediates sourced from the domestic market, or imported sources. To achieve the highest feasible outcome of substitutability, the algebraic structure of the production process

Fig. 2. Production Structure of the GTAP-E Model



Source: Authors' drawing based on Burniaux and Truong (2002).

allows a nested structure wherein the gross output is an augmented Cobb–Douglas production structure at the top nest. The above production process specification enables the full potential of technological substitution in response to changes in the price of inputs. In this regard, changes in rental rates and wages determine factor market clearing conditions.

The production process specification enables the full potential of technological substitution in response to changes in the price of inputs. In this regard, changes in rental rates and wages determine factor market clearing conditions.

The aggregation of imported intermediate inputs applies the Armington CES function, while at the fourth production nest, the energy composite is a CES aggregation of electricity and non-energy composite. Formulating domestically produced and imported electricity (at the fifth nest) employs a CES structure. The non-electricity composite is a CES aggregation of the coal and non-coal composites. The Armington CES is used at the sixth level to structure imported electricity. Coal is a CES aggregation of domestically produced and imported coal. Crude oil, oil products, and gas are combined into the non-coal composite using a Cobb-Douglas function. At the seventh level of production, the nesting of imported coal from different sources is through the Armington CES function. Crude oil, petroleum and coal products, and natural gas are all a CES aggregation of those domestically produced and imported, respectively. At the final level, the nesting of imported oil, gas, and oil products assumes the Armington CES function for different source regions.

On the demand side, the model differentiates private consumption from government expenditure and savings. Individual household consumption follows a Cobb-Douglas structure regarding non-energy and energy composites.

The Armington assumptions are employed to structure the non-energy composites where locally produced, and imported non-energy commodities are assumed to be imperfect substitutes. The energy bundle is a Cobb-Douglas structure of coal, oil, gas, petroleum, coal products, and electricity; those imported are aggregated following the Armington assumptions.

A CES aggregation of non-energy and energy bundles governs government expenditure. The non-energy composite is a CES structure of domestically produced and imported non-energy goods. The imported non-energy commodities follow the Armington assumption, in which imports differ by source.

3. Data and Simulation Procedures

3.1. Data

We apply the GTAP-E model and the GTAP database version 10.1 to calibrate the impact of the EU-CBA mechanism. The database comprises data for 147 regions in 65 sectors with endowment commodities classified into land, skilled labor, unskilled labor, capital, and natural resources (Hertel & Tsigas,1997). The base year of the database is 2014. The GTAP-E model and database are well-documented and publicly accessible.

Considering GHG emissions, GDP per capita, and the volume and structure of trade with the EU27, the authors aggregate the database into 24 regions and 27 trading sectors (Table 2). The aggregated data includes nine regions (Australia and New Zealand, EU27, Other Developed Countries, Organization of Petroleum Exporting Countries (OPEC), European Free Trade Area (EFTA), Upper-Middle Income Countries (UMIC), Lower-Middle Income Countries (LMIC), Least Developed Countries (LDC), and the Rest of the World (ROW), and 15 specific countries which include China, Japan, Korea, India, USA, Canada, United Kingdom, Russia, Ukraine, Turkey, Kazakhstan, Azerbaijan, Mexico, Brazil, and South Africa.

It is worth noting that aggregating the GTAP database to fewer regions and sectors does not affect the robustness of the simulated outcomes, but enhances the interpretation of simulated outcomes.

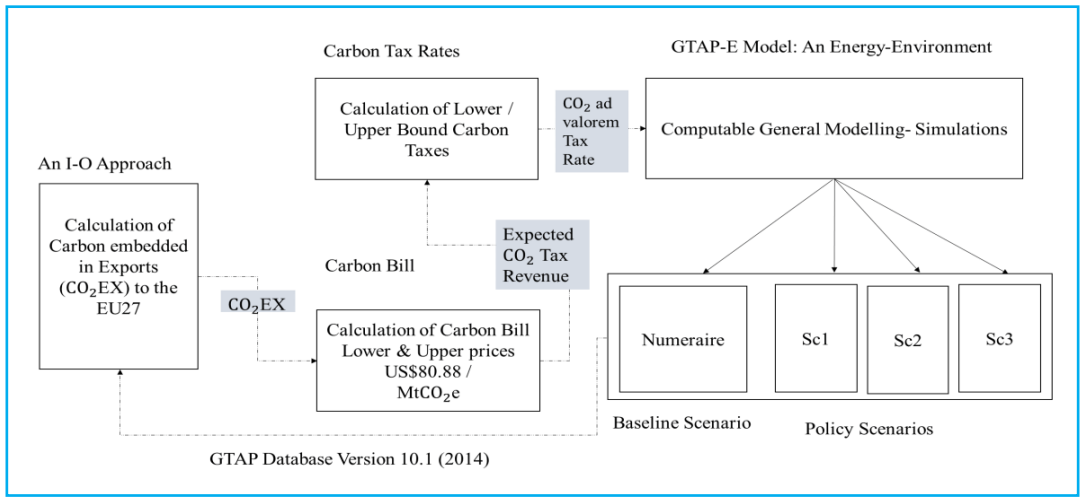
3.2 Simulation Procedures

Table 4. Regional and Sectoral Aggregation of the Model

No	Region Code	Region Description	No	Sector Code	Sector Description
1	A_N	Australia, New Zealand	1	agr	Agriculture
2	CHN	China, Hong Kong	2	ffs	Forestry and fisheries
3	JPN	Japan	3	coal	Coal Mining
4	KOR	Korea	4	oil	Crude oil
5	IND	India	5	gas	Gas extraction & distribution
6	USA	United States of America	6	oil_pcts	Refined oil products
7	CAN	Canada	7	electricity	Electricity
8	EU27	EU 27	8	oxt	Extract ion minerals
9	UK.	United Kingdom	9	pfd	Processed food
10	EFTA	European Free Trade Association	10	tex	Textiles
11	ODC	Other developed countries	11	ppp	Paper and paper products
12	OPEC	OPEC	12	fertilizer	Fertilizer
13	RUS	Russian Federation	13	rchm	Rest of chemical
14	UKR	Ukraine	14	pmr	Pharmaceuticals &medical products
15	TUR	Turkey	15	rpp	Rubber and plastic products
16	KAZ	Kazakhstan	16	cement	Cement
17	AZE	Azerbaijan	17	rnmm	Rest of non-mineral products
18	BRA	Brazil	18	i_s	Iron & Steel
19	MEX	Mexico	19	aluminum	Aluminum
20	ZAF	South Africa	20	rnfm	Rest of non-ferrous metals
21	UMIC	Upper-middle income countries	21	fmp	Metal products
22	LMIC	Lower-middle income countries	22	elec	Electronics
23	LDC	Least developed countries	23	ome	Machinery and other equipment
24	ROW	Rest of the World	24	mtv	Automotive
			25	omnf	Other manufacturing sectors
			26	tsp	Transport services
			27	osv	Other services

Source: Authors' classification using GTAP DB Version 10A (Aguiar et al., 2019).

Fig. 3. Applied Model Scheme



Source: Authors' drawing.

In order to gauge the impact of the EU Carbon Border Adjustment (CBAM) carbon tax, this study utilizes the Global Trade Analysis Project, a computable general equilibrium model. Shifts in carbon emissions, domestic output, consumption, alterations in export and import volumes, and trade balance reflect the carbon tax's impact.

Fig. 3 illustrates the model schema. It clearly shows that the input-output method is applied to estimate the carbon intensity of each commodity in each region, expected carbon bill, and ad valorem carbon tax based on carbon embedded in exports to the EU27 using GTAP-E base data version 10.1. The estimated ad valorem carbon tax is a levy on carbon content.

Table 5. Applied Policy Scenarios

Policy Scenarios/ Shocks		Description of Scenario
Policy Scenarios (All EU Trading Partners excluding EFTA members)	Scope 1 Emissions	The EU imposes an ad valorem carbon tax for direct emissions embedded in exports of each CBAM-targeted commodity from the use of own energy in the production process.
	Scope 2 emissions	The EU imposes an ad valorem carbon tax for emissions embedded in exports of each CBAM-targeted commodity from the use of purchased electricity (energy) used in the production process.
	Scope 3 emissions	The EU imposes an ad valorem carbon tax for indirect carbon emissions embedded in each CBAM-targeted commodity's exports from indirect energy sources (excluding direct and electricity) used in the production process.
A sum of all 3 Scopes		The EU imposes an ad valorem carbon tax for carbon emissions embedded in exports of each CBAM-targeted commodity from the sum of all three scopes.

Table 4 illustrates the policy scenarios implemented in this study. In developing the policy scenarios, we assume that the ad valorem carbon tax applies to all regions and goods exported to the EU, except for EFTA member countries. We simulated three policy scenarios based on CO_2 Emission Scopes 1, 2, and 3. The findings of this study assist in examining the costs and benefits of alternative policy environments, including macroeconomic aggregates, sectoral production, relative prices, employment, income, technological change, and pathways of gaseous emissions. We utilize the calculated ad valorem equivalent carbon tax rates for Scopes 1, 2, and 3 for five CBAM-targeted products, which include electricity, fertilizer, cement, iron and steel, and aluminum. Within GTAP database version 10.1, data on electricity and iron and steel are readily available; however, the other four CBAM commodities of fertilizer, hydrogen[1], cement, and aluminum are aggregated into the chemical sector, non-metallic metals, and non-ferrous metals. For this study, we applied the SplitCom application to disaggregate fertilizer and hydrogen from the chemical sector, cement from the non-metallic products, and aluminum from non-ferrous metals.

We implement three distinct scenarios based on the scope of carbon emissions. Scenario 1 simulates the impact of direct carbon emissions from the use of sectors own resources (Scope 1). Scope 2 evaluates the carbon intensity of exported goods from the electricity sourced from electricity producers. Scope 3 accounts for carbon emissions embedded in produced goods.

IV. Simulation Results

The Carbon Border Adjustment (CBAM) has the potential to cause a decline in carbon emissions, a process that is explicitly addressed within the GTAP model framework. Carbon (CO_2) emissions, as per the model's structural framework, emanate from firm activities and the consumption of final goods and services by the government and private households. Implementing CBAM as a shadow tax is poised to augment production budgets and the prices associated with final goods and services.

A noteworthy facet of globalization lies in the intricate interlinkage of international markets through trade, creating a scenario wherein governmental interventions in one market ripple through to impact all others by instigating alterations in global prices and the demand dynamics for traded commodities across diverse nations. Given the inherent motivation of firms toward profit maximization, a probable outcome entails restructuring production processes, particularly in energy-intensive sectors. Paradoxically, this may serve as an impetus for firms to embrace environmentally sustainable technologies, concurrently fostering a proclivity for households to consume low-carbon products.

In the above context, implementing the CBAM, slated for 2026, will likely reduce carbon emissions globally. However, the likely shifts in production practices and consumption patterns underscore the multifaceted potential of the CBAM to usher in environmentally conscientious transformations within the economic landscape

Implementing a Carbon Border Adjustment Mechanism (CBAM) introduces a carbon tax on exports entering the EU27 market, increasing the cost of these goods in the domestic market. This increased cost negatively affects the competitiveness of exported goods, lowering demand in the destination market compared to domestically produced or imported alternatives. Table 6 illustrates simulation results, indicating a substantial decline in Korea's exports of the five EU-CBAM-targeted commodities. Across

1. In disaggregating the CBAM sectors for Korea, we used the Korean input-output table for 2015. However, data on hydrogen is missing. For this reason, our analysis of CBAM sectors has focused on electricity, fertilizer, cement, iron and steel, and aluminum.

the five CBAM sectors, Korea's exports to the EU27 will likely contract by US$76.25 million, accounting for 0.11% of the total export value of these CBAM commodities. Conversely, Korea's net global exports are projected to decline by US$35.58 million, less than 50% of the overall decline in Korea's total exports of all five CBAM commodities. This variance implies a potential shift in Korea's exports to new markets. Notably, fertilizer exports will likely witness the most significant drop of US$36.30 million, followed by iron and steel at US$35.00 million and aluminum at US$4.32 million.

Table 6. Impact of EU-CBAM on Export Volumes in US Million Dollars and Percent

CBAM Commodity	KOR-EU27		KOR-World Exports	
	US$ Million	Percent	US$ Million	Percent
Electricity	-0.01	-11.57	0.00	0.00
Fertilizer	-36.30	-1.97	-1.21	-0.01
Cement	-0.62	-1.67	-0.01	0.00
Iron and Steel	-35.00	-2.02	-5.15	-0.02
Aluminum	-4.32	-1.60	-0.87	-0.01
Total	-76.25	-0.11	-35.58	-0.01

Source: Authors' calculation.

Table 7. Impact of EU-CBAM on CBAM-Related Sector Trade Balance in US $ Million

CBAM Sector	Scope 1	Scope 2	Scope 3	Sum of 3 Scopes
Electricity	-0.001	-0.001	-0.007	-0.010
Fertilizer	0.120	-2.077	-33.522	-35.479
Cement	-0.055	-0.046	-0.496	-0.598
Iron and Steel	-1.569	-2.452	-25.963	-29.983
Aluminum	-0.046	-0.274	-3.132	-3.452
Total	-1.551	-4.850	-63.120	-69.521

Sources: Authors' simulations.

Table 7 shows the impact of the carbon tax on Korea's trade balance across all industries. The simulation results indicate a cumulative trade deficit of US$ 22.608 million for Korea, with the deficit spread extending from a marginal minus US$ 0.001 million in the electricity industry to a more pronounced minus US$ 35.479 million in the fertilizer sector. Delving into sector-specific trade balances, it is noteworthy that the fertilizer industry emerges as the most adversely impacted, exhibiting a trade deficit of US$ 35.479 million, closely followed by the iron and steel sector, which experiences a trade deficit of US$ 29.983 million. In contrast, the remaining industries subject to the Carbon Border Adjustment Mechanism (CBAM) do not encounter a discernible trade deficit. This analysis underscores the sector-specific intricacies inherent in the impact of the CBAM carbon tax on Korea's trade.

As illustrated in Table 8, implementing a carbon tax set at US$80.88 per metric ton of carbon dioxide equivalent ($MtCO_2e$) precipitates a noteworthy contraction in the domestic output values across diverse sectors within the Korean economy. The simulation outcomes reveal a substantial net reduction in the national domestic output, amounting to US$103.02 million. Remarkably, the decline in production is conspicuous across all five Carbon Border Adjustment Mechanism (CBAM)-targeted industries, namely, electricity, fertilizer, cement, iron and steel, and aluminum, culminating in a collective decrease of US$116.26 million. Among these sectors, the iron and steel industry register the most pronounced decline at US$68.00 million, trailed by fertilizer with a reduction of US$39.16 million, aluminum experiencing a downturn of US$4.60 million, and electricity witnessing an output decline of US$3.87 million. Notably, the cement industry exhibits the least pronounced impact, manifesting a modest reduction of US$0.63 million in output value. This comprehensive analysis underscores the differential sectoral repercussions associated with the imposition of a carbon tax within the ambit of the Carbon Border Adjustment Mechanism.

Table 8. Impact of EU-CBAM on Korea's Output Disposition CBAM-Targeted Industries

(Unit: US$ Million)

Sector	Domestic	Export	National Output
Electricity	-3.86	-0.01	-3.87
Fertilizer	-2.41	-36.75	-39.16
Cement	-0.02	-0.61	-0.63
Iron and Steel	-32.52	-35.49	-68.00
Aluminum	-0.25	-4.35	-4.60
CBAM Total	-39.05	-77.20	-116.26
National Output	-42.86	-60.16	-103.02

Source: Authors' simulations.

Table 9. Impact of EU-CBAM on Korea's Output Disposition in Other Manufacturing Industries

(Unit: US$ Million)

Industry	Domestic	Export	National Output
Coal	-0.016	0.000	-0.016
Oil	-0.023	0.000	-0.023
Gas	-0.026	0.000	-0.026
Oil Products	-14.203	-0.750	-14.953
Other Chemicals	-22.75	-5.27	-28.02
Textiles	0.156	0.124	0.280
Paper Products	0.094	0.019	0.113
Pharmaceutical and Medical Products	0.219	0.077	0.295
Rubber and Plastic Products	0.930	0.615	1.545
Fabricated Metal Products	1.570	1.561	3.131
Electronics and Electrical Equipment	6.000	10.734	16.734
Other Manufacturing Equipment	3.078	5.406	8.484
Motor Vehicle	4.273	5.930	10.203
Other Manufacturing	0.365	0.025	0.390
Transport	-0.828	-2.463	-3.292
Other Services	16.625	0.852	17.477

Source: Authors' simulations.

Table 9, shows the impact of the CBAM carbon tax on the domestic production of energy sectors (coal, oil, gas and oil products), energy-intensive sectors (other chemicals, textiles, paper products, pharmaceutical products, rubber and plastics other manufacturing industries including electronics and electrical equipment, fabricated metal products, other manufacturing equipment, motor vehicle, and other manufacturing industries), and the services industries (transport and other services). Simulated results (Table 9) reveal divergent trends in domestic output across industries, with some experiencing a decline while others witness growth. An analysis of Tables 8 and 9 underscores that the domestic output of Korea's energy-intensive sectors, including electricity, fertilizer, iron and steel, cement, other chemicals, and transport, are poised to decline. However, the magnitude of this impact varies across industries.

In contrast, many other manufacturing sectors anticipate an upswing in domestic production. Notably, the domestic output of Korea's electronics and electrical industry will likely rise by US$16.734 million, that of the

motor vehicle industry will rise by US$10.203 million, and fabricated metal products will increase by US$3.131 million. The disparity in the CBAM's impact on energy-intensive sectors can be attributed, in part, to Korea's international comparative advantage in each of the traded sectors and other unique considerations relative to competing commodities exported to the EU27. These insights contribute to a comprehensive understanding of the subtle effects of the CBAM on Korea's diverse industries.

The disparity in the impact of the carbon border adjustment mechanism (CBAM) on the domestic output across diverse economic sectors can be reviewed based on the underlying premise of the static GTAP Computable General Equilibrium (CGE) model. This model posits the condition of full employment for factors of production, thereby facilitating the free movement of endowment factors across industries. While such an assumption is crucial in determining the model's predictive accuracy, it also aids in explaining the visible disparities in the impact of the EUCBAM across diverse economic industries.

The outcomes of our study underscore the ramifications of implementing the EU-CBAM on the Korean economy. The findings highlight the intricate interaction between environmental and economic factors. These insights are critical in designing sustainable national development guidelines while harmonizing environmental and economic concerns.

V. Conclusion

In evaluating the economic effect of the EU-CBAM on the Korean economy, we simulated a US$80.88 per metric ton of equivalent carbon tax, reflecting the 2022 average EU Emission Trading System (ETS) carbon price. The ramifications of this carbon tax on various economic industries in Korea emerge as a central point, highlighting pronounced unfavorable effects on domestic production, export and import volumes, and trade balance within CBAM related sectors.

Our study illustrates that the EU-CBAM implementation significantly influences the specified CBAM-targeted sectors and all other traded sectors. Among the noticeable findings is the variance in impact across industries. This impact variance flows from disparities in carbon emissions embedded in exports to the EU27, the level of technological development, and comparative advantage, notably resource endowment. These factors are critical in determining the magnitude and direction of the CBAM's effects.

Korea is a developed country with relatively high technological development. In addition to high technology, Korea has developed relatively stringent environmentally friendly climate policies, which have lowered the carbon intensity level in domestically produced goods. Nevertheless, this study has detected tangible potential risks from implementing the EU-CAM. These peculiar features of the Korean economy, including the configuration of its exporting industry, have likely played a vital role in determining the magnitude and direction of the impact of CBAM on its economy.

As such, in navigating the challenges and opportunities from the implementation of the EU carbon border adjustment mechanism (CBAM), we offer five suggestions below.

First, exploring export market diversification to regions with relatively lenient environmental policies will likely counteract the likely losses from implementing the CBAM carbon tax by the EU27. Reducing dependence on a single market will help navigate the challenges and opportunities of similar environmental policies like the EU-CBAM.

Second, creating a system to monitor emissions by local firms and evaluating the likely impact of the EU-CBM will provide critical insights regarding local firm competitiveness in the international trading market.

Third, strengthening local environmental and climate regulations, including carbon pricing mechanisms, is vital in alleviating the likely adverse impacts of the CBAM, which may involve

establishing sturdy carbon emissions reduction targets, or promoting the adoption of renewable energy.

Fourth, to reduce the carbon intensity of domestically produced goods, Korea must prioritize the research and development of clean technologies. Doing so will lead to reduced emissions in CBAM-related sectors, which mitigates the effect of the CBAM carbon tax. This suggestion underscores the benefit of investment in green technology.

Lastly, there is a substantial potential benefit in setting up a domestic emission trading system akin to the European Union emission trading system and linking it to the EU-ETS. Such a system will internalize the cost linked to carbon emissions. By adopting such a system, Korea will mitigate the effect of the CBAM.

Our study employed a static GTAP-Energy (GTAP-E) model to assess the impact of the European Union's carbon border adjustment mechanism (CBAM), utilizing the 2014 base year of the GTAP database 10.1. Recognizing the limitations of the static model in comprehensively capturing the impact of CBAM on Korea throughout its implementation, we suggest an extended analysis using the recursive dynamic GTAP-Energy model. A recursive dynamic GTAP-Energy approach is particularly pertinent since it can account for the impact of the carbon border adjustment mechanism (CBAM) each year from 2026 to 2034 onward, coinciding with the CBAM's full implementation.

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Ethical Guidelines

Chapter 1. General Rules

Article 1 (Purpose)
The purpose of the following rules is to present the basic ethical principles and direction needed to ensure the research ethics of editorial board members, peer-reviewers, and authors who examine or submit articles to the Journal of Global Business and Trade (JGBT). The International Academy of Global Business and Trade (IAGBT)publishes these rules to present the procedure and actions for research misconduct.

Article 2 (Object of the Study and Scope)
The research is subject to sanction, investigation and judgement to determine whether research ethics were followed when any of the following occurs:

i. The study was submitted to the Journal of Global Business and Trade,
ii. The study was confirmed to be published in the Journal of Global Business and Trade,
iii. The study has already been published in the Journal of Global Business and Trade.

Chapter 2. Honesty and Social Responsibility of the Research

Section 1. Honesty in the Research

Article 3 (Honesty of the Research)

a. Researchers must conduct every research behavior (proposing research, researching, reporting and presenting research, investigating and judging) honestly and sincerely.
b. Researchers must describe the content and the importance of the study clearly and objectively, and must not delete or add results arbitrarily.
c. Researchers must carry out every study without any bias or prejudgment.

Article 4 (Ethics for Researchers)

a. Researchers must not commit research misconduct during any part of the research process.
b. A study must not be submitted if it has been published in other journals, and researchers must not request review of the study to different journals at the same time. However, a thesis or a paper presented in a conference as a working paper shall be exceptions.

Article 5 (The Record, Storage, and Report of Research Data and its Disclosure)

a. All research information must be clearly and precisely recorded, processed, and preserved so that it may be accurately analyzed and confirmed.
b. Researchers shall use proper research methods and statistics, and those shall be available to the public if necessary.

Section 2. Fairness in Researchers' Contributions

Article 6 (Collaborative Research)
Researchers must make the roles and contributions of all contributors clear if they conduct a joint study with other researchers, and shall take full responsibility for establishing this. Prior to conducting research, mutual agreement and understanding shall be made with regard to property rights and ownership issues, research director selection, authorship and the standard of order, the data collection method, individual role in the study, and expectations and objectives of the study.

Article 7 (Responsibility and Duty, Order of Authors)

a. Researchers are responsible only for the study that they carry out or are involved in as an author, and are recognized for that achievement.

b. Authors must accept requests for proof of their contributions.
c. The order of authors must accurately reflect the academic contribution by each author to the research contents or results, regardless of the authors' relative positions.

Article 8 (Corresponding Author)
a. Corresponding authors shall take overall responsibility for the results of the study and proofs.
b. Corresponding authors shall have the burden of proof with respect to the order of the author and co-author(s).

Article 9 (Affiliation of Author)
When indicating the affiliation of author(s), the author's current status in principle shall be given. However, it is possible to follow the customs of the author's academic field if their field of affiliation follows a different custom.

Chapter 3. Research Misconduct and Unethical Research Conduct

Section 1. Methods and Principles of Citation

Article 10 (Methods and Principles of Citation)
a. The author may cite a part of other researchers' studies in his/her research paper using their original text, or the translated version by introducing, referring to or making a comment on the original.
b. The author shall take all possible measures to ensure the accuracy in stating sources and making the list of references. The author must confirm all elements of a citation (author's name, number/volume of the journal, page and published year) not depending on the secondary source but solely on the original work. However, when inevitable, the author can include with acknowledgment.
c. The author must cite in a reasonable manner and use the good faith principle, so that uncited works can be clearly distinguished from cited works.
d. The author must cite published works only. However, in the case of citing unpublished academic materials that have been acquired through personal contact, paper review or proposal review, the author must acquire consent from the relevant researcher(s).
e. When the author introduces ideas or theories in his/her work that have been presented in another study, the source must be stated.
f. The author must distinguish his/her own ideas from cited materials when borrowing substantive parts from one source, so readers can clearly recognize the author's work.
g. If a reference has a significant impact on the direction of the research or can help the reader understand the contents, the author must include all such works on the list of references, except in such cases where the relevant research can theoretically and empirically be inferred.

Article 11 (Method of General Knowledge Citation)
a. If the author uses someone else's idea or a fact provided by them, the source should be provided. However, general knowledge or material that general readers will already recognize shall be an exception.
b. If the author is unsure whether any concept or fact qualifies as general knowledge, it is recommended to cite the original text.

Section 2. Research Misconduct

Article 12 (Definition of Research Misconduct)
"Research misconduct" refers to any instances of forgery, falsification, plagiarism, failure to give proper credit to co-authors or redundant publications that may emerge during the entire research process (research proposal, conduct of research, report and presentation of research, investigation and judgement).
a. "Forgery" refers to the act of presenting non-existent data or research results.
b. "Falsification" refers to the acts which artificially manipulate research processes, randomly modify, or delete data resulting in distorted research content or research results. (Here, "deletion" refers to the act of using

only favorable data and intentionally excluding the data that might cause unexpected or undesired results.).

c. "Fabrication" refers to the act of intentionally creating a document or record that does not exist.
d. "Plagiarism" refers to the acts which pirate other's work, ideas or research, using ideas, hypotheses, theories, research contents, or research results without justifiable approvals, citation, or quotations, as if those were his/her own.
    i. "Idea Plagiarism" refers to the act of using someone else's ideas (explanations, theories, conclusions, hypothesis and metaphors) in full, substantial proportions or in a fragmented revised form without giving appropriate credit to the originator of the words and ideas. Authors have moral responsibility to indicate the source of ideas through a footnote or a reference. Authors must furthermore not steal other's ideas which are known through peer review of research proposals and submitted articles.
    ii. "Text plagiarism" refers to the act of copying text from another's work without clarifying the original author.
    iii. "Mosaic plagiarism" refers to the act of combining a part of a text with a few words added, inserted or replaced with synonyms, and others without clarifying the source or the original author.
e. "Redundant Publication" refers to the act of publishing a paper that is identical or highly similar text to one that has already been published in the past in another academic journal without alerting the editors or readers of the fact that this work was previously published elsewhere. If the contents of the paper are almost the same as his/her previously published paper, the later paper is regarded as a redundant publication even if the text has a different point of view or perspective, or including a different analysis based on the same data that has been previously published. In the case in which the author would like to publish a paper using a previously published paper, he/she must acquire permission from the chairperson after providing the information about the publication and double-checking whether it is a redundant publication or duplication of a publication.
f. "Self-plagiarism" refers to the act of using images, graphs or part of one's own research already published without identifying the source, and it is regarded as redundant publication.
g. "Failing to give proper credit to co-authors" refers to the act of failing to list those who have contributed academically to the research process or results as a co-author or conversely to the act of listing those who have not made any academic contribution as co-authors.
h. The JGBT may use anti-plagiarism software to check submitted manuscripts for originality. The JGBT rejects papers that lead to plagiarism or self-plagiarism.

Article 13 (Research Misconduct and Copyright Infringement)

a. Generally, the copyright of all papers and instances published through IAGBT is assigned to the author. However, if they are utilized for public objects like education, IAGBT owns the right of use.
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Section 3. Inappropriate Writing

Article 14 (Inappropriate Writing)

The following are regarded as inappropriate writing:

i. Inappropriate citations
ii. Distorting references
iii. The act of depending on abstracts when citing the published paper
iv. Citing papers that the author did not read or understand
v. The act of partially citing despite intensively borrowing from a single source
vi. The act of reusing text

Article 15 (Prohibition of Distortion of References)

a. References must only include documents that are directly related to the article content. Unrelated references for the purpose of intentionally manipulating the citation index of the paper or academic journal should not be included.
b. As a moral responsibility, the author should not only cite the references which will be favorable to his/her data or theory, but also cite references which may contrast with his/her point of view.

Article 16 (Reuse of Text)

a. "Reuse of Text" refers to the act of re-using a part of the manuscript that he/she has used in a previous paper.
b. Text reuse is an act contradictory to ethical writing, so the author must avoid re-using text already used. In case of unavoidable text re-use, the author should not violate copyright infringement by following standardized reference practices including the use of quotation marks or proper indication.

Chapter 4. Ethical Rule Enforcement

Section 1. Research Ethics Committee

Article 17 (Ethical Rule Pledge)

New members who have enrolled in the research pool of IAGBT shall acquaint and pledge to abide by these research ethics when submitting to the "Journal of Global Business and Trade" and conducting research. Current members shall be regarded as having pledged to abide by these research ethics when initiated.

Article 18 (The Announcement of Violation of Ethical Rule)

If a member learns that another member has violated any ethical rules, he/she should endeavor to correct the mistake by helping make him/her be aware of the rules. However, if he/she does not correct the violation or the ethical violation is obviously unveiled, the member must report to the committee immediately.

Article 19 (Organization of the Research Ethics Committee)

IAGBT shall establish a Research Ethics Committee (hereinafter referred to as the "Committee") mandated to deliberate on matters falling under each of the following sub-paragraphs:

a. Matters concerning establishment and revision of these rules
b. Matters concerning acceptance and handling of misconduct
c. Matters concerning beginning actual investigation and decision, approval, and re-deliberation of investigation results
d. Matters concerning protection of informant and examinee
e. Matters concerning investigation of research integrity, handling of investigation results and follow up measures
f. All the matters concerning operations of other committees

Article 20 (Organization of Research Ethics Committee)

a. The Committee shall consist of one chairperson and members of no less than five but no more than nine persons.
b. The chairperson and the members shall be appointed by the chairman of IAGBT.
c. The members of this committee shall hold a one year term and they may be reappointed.
d. The chairperson and the members of this committee shall maintain independence and confidentiality with respect to the details relating to deliberations and decisions.

Article 21 (Organization of Research Ethics Committee)

a. The chairperson of the committee shall convene any meeting and preside over such meetings.
b. The committee's meetings shall open with the attendance of a majority of the total members including the chairperson and resolve with the concurrent vote of a majority of those present.
c. No meeting of the committee shall be open to the public. [The meeting shall not be open to the public in principle, but whenever deemed necessary, the committee can ask the related party and hear their opinions.]
d. Whenever deemed necessary, the committee can ask the related party and hear their opinions.
e. Any member who is involved in the research subject to an investigation will not be permitted to attend the concerned meeting due to a conflict of interest.

Article 22 (Authorities and Responsibilities of the Committee)

a. The committee can summon for attendance and data submission any informants, examinees, witnesses and testifiers, in the process of an investigation.
b. When the examinee refuses to attend the meeting or data submission without a justifiable reason, it could be presumed as an indication that he/she has acknowledged the allegations.
c. The committee can take substantial measures to prevent any loss, damage, concealment or falsification of research records or evidence.
d. The committee members should comply with confidentiality concerning deliberation-related matters.

Section 2. Research Integrity Investigation

Article 23 (Reporting a Fraudulent Act)

An informant can report a fraudulent act using any means available when reporting using their real name. However, when reporting anonymously, he/she must submit the title of the paper, and the evidence and detail of the misconduct in writing or by e-mail.

Article 24 (Confidentiality and Protection of Rights of Examinee and Informant)

a. The committee should not reveal the personal information of the informant unless it is necessary.
b. The committee must take action to protect the informant if the informant experiences illegitimate pressure or threats due to reporting the fraudulent act.
c. Until the investigation of a fraudulent act is completed, the committee must be careful not to infringe upon the rights or reputation of the examinee. If the person turns out to be innocent, the committee must make efforts to recover the reputation of the person.
d. The identity of the informant, investigators, testifiers, and consultants should not be disclosed.
e. All facts relating to research ethics and authenticity investigations must remain confidential and the people involved in the investigation must not reveal any information obtained during the process. If there is a need to disclose related information, the committee can vote to make such a decision.

Article 25 (Raising an Objection and Protection of Defense Right)

a. The committee must ensure the informant and examinee have equal rights and opportunities to state their opinions and objections. Such procedures must be informed to them beforehand.
b. An examinee or informant may require the avoidance of deliberation and decision after explanation in case he/she expects an unfair decision.
c. The research ethics committee must give the examinee a chance to submit their opinion and clarify any fact revealed during the first report or any additional report.

Article 26 (Preliminary Investigation of Research Misconduct)

a. The committee must investigate the presence of misconduct if there is a considerable doubt about legitimate conduct or detailed information about misconduct.
b. The chairperson can officially carry out the investigation (hereinafter referred to as the "preliminary investigation") which is a procedure to decide whether the suspected misconduct should be investigated after consultation with the chairman of IAGBT.
c. The committee shall form the preliminary investigation committee consisting of no more than five members within 30 days of reporting.
d. The committee shall inform the informant and examinee of the formation of such a committee, and give the examinee a chance to clarify within 30 days.
e. A preliminary investigation is initiated within 30 days of the formation of the preliminary investigation committee, and the investigation should be completed within 30 days of the start of the investigation except in unavoidable circumstances.
f. If it has been more than five years since a misconduct was committed, the reporting is not handled in principle even if the reporting is accepted.
g. Through preliminary investigation, the following is reviewed:
    i. Whether the reported instance qualifies as research misconduct

ii. Whether the reporting is specific and clear enough to lead to an actual investigation
iii. Whether more than five years has passed since the reported misconduct was committed

Article 27 (Report and Notice of the Preliminary Investigation Result)
a. The result of the preliminary investigation shall be notified to the informant and examinee within ten days of the committee's decision, and reported to the chairman of IAGBT.
b. The result report of the preliminary investigation must include the following:
   i. Specific information regarding the alleged misconduct
   ii. Facts regarding the alleged misconduct
   iii. Grounding for decision on whether to conduct an actual investigation

Article 28 (Raising an Objection and Protection of Right of Defense)
a. The committee must ensure that the informant and examinee have equal rights and opportunities of opinion statement and objection. Such procedure must be informed beforehand.
b. The informant and examinee can make an objection within ten days from the day of being notified of the preliminary investigation.

Article 29 (Beginning and Duration of an Actual Investigation)
a. The actual investigation begins within 30 days after a positive result from a preliminary investigation. During the period, the actual investigation committee consisting of no more than nine persons (including the preliminary investigation committee) must be formed to conduct an actual investigation.
b. The actual investigation must be completed within 90 days from the beginning date.
c. If the investigation committee decides that it cannot be completed within the specified period, it can explain the reason to the committee and request a 30 day extension (one time only).

Article 30 (Formation of an Actual Investigation Committee)
a. An actual investigation committee is composed of no more than nine members.
b. Formation and duration of an actual investigation committee is determined by the committee. The chairperson of the actual investigation committee is elected among the actual investigation members.
c. The investigation committee shall include at least two members with specialized knowledge and experience in the relevant field.
d. A person who has a stake in the investigated matter must not be included in the actual investigation committee.

Article 31 (Request for Appearance and Document Submission)
a. The actual investigation committee can request the examinee, informant(s), and testifiers to appear for testimony, and the examinee must comply.
b. The actual investigation committee can ask the examinee for submission of a document, and retain and store the relative research materials about the person involved in the misconduct after the approval of the head of the research organization in order to preserve evidence relating to the investigation.

Article 32 (Exclusion, Avoidance and Evasion)
a. The examinee or informant(s) can require exclusion by identifying the reason if there are reasons to believe that a committee member is unable to maintain fairness. When such request for exclusion is recognized, the member subjected to the request shall be excluded from the concerned investigation.
b. If the committee member is directly related to the corresponding matter, he/she shall be excluded from all deliberation, decisions, and investigation of the matter.
c. The chairperson can suspend the qualification of a member who is related to the corresponding matter in connection with the corresponding investigation.

Article 33 (Investigation Report Submission)
The actual investigation committee must submit the result to the committee within the actual investigation period, and the result must include the following:
   i. Specific details of the alleged misconduct

ii. Facts regarding the alleged misconduct
iii. Evidence, witness list and affidavits
iv. Investigation results
v. Other data useful for decisions

Article 34 (Decision)
a. The decision must be made within six months from the beginning of the preliminary investigation.
b. The committee shall make the decision confirming that the examinee committed research misconduct after reviewing the result report.

Section 3. Action after Investigation

Article 35 (Action in accordance with Investigation Result)
When a decision is made confirming the research misconduct, the committee can sanction the author with applicable punishment to each of following, or impose corresponding retribution.
i. The publication is postponed until the final decision of the research ethics committee is made even if the paper has been confirmed to the author that it will be published.
ii. The publication of the paper to which the research misconduct is related is to be canceled and deleted from the article list of the journal even if the volume has already been published.
iii. The author found to have committed such misconduct is prohibited from submitting papers to the journal for three years, and these facts are made public on the homepage of the journal (http://www. pfw.edu/jgbt).
iv. If there is an author found to have committed plagiarism or redundant publication, the editorial board stores the relevant investigation details for five years.
v. The chairperson of the organization with which the author(s) is affiliated is notified of the final decision.

Article 36 (Investigation Result Notification)
The chairperson of the committee shall immediately notify the related persons such as the informant and examinee of the committee's decision regarding the investigation result in writing.

Article 37 (Investigation Result Notification)
a. If the informant or the examinee refuses the committee's decision, he/she must submit a re-deliberation request to the committee within 15 days from receipt of the result notice as prescribed in Article 37.
b. The committee must decide whether re-deliberation is necessary within 10 days of the receipt of the re-deliberation request.
c. The committee will decide there-deliberation procedure and method.

Article 38 (Follow-ups such as Recovery of Author's Honor)
If the results of the investigation confirm that no research misconduct has been identified, the committee must take follow-up steps to recover the reputation of the examinee.

Article 39 (Storing the Record and Confidentiality)
a. All records regarding the preliminary and actual investigation are stored for five years from the date of the investigation's conclusion.
b. All facts relating to research ethics and the investigation must remain confidential and the people involved in the investigation must not reveal any information obtained during the process. If there is a need to disclose investigation information, the committee can vote to make such decision.

Article 40 (Etc.)
Matters that are not determined by these rules are to be decided by the editorial board.

Article 41 (Date of Effectiveness)
These regulations shall be effective as of January 1, 2012.

Regulations of the Editorial Board

Journal of Global Business and Trade

Chapter 1. General Rules

Article 1 (Purpose)
The purpose of the following rules is to prescribe matters regarding the editorial work and standards for the Journal of Global Business and Trade (hereinafter referred to as "JGBT") published by the International Academy of Global Business and Trade (hereinafter referred to as "IAGBT").

Chapter 2. Editorial Committee

Article 2 (Editorial Committee)
The editorial committee (hereinafter referred to as "committee") is established in order to accomplish the purpose of Article 1.

Article 3 (Formation of Editorial Committee)
a. The editorial members shall be appointed by the chairman of IAGBT, and the committee shall consist of no more than 50 members.
b. The chief editor shall be appointed by the chairman of IAGBT and is in charge of all editing.
c. The editorial committee shall be composed of two chief editors, one editor, and one managing editor. The editors are appointed by the chairman of IAGBT among editorial members.
d. The term for the chief editor is three years, and the term for the editorial members is two years, and editorial members may be reappointed.
e. This committee makes decisions with a majority attendance of the members and a majority agreement of the members present.

Article 4 (Qualification of Editorial Members)
The editorial members shall meet the following qualifications:
i. Being at least an associate professor in a domestic/international university or a person equally qualified.
ii. Someone who studies in an area within the JGBT's specialty and who has published at least 3 articles in a journal (or 1 article in an SCI, SSCI and/or SCOPUS indexed journal) within the last three years.

Article 5 (Responsibilities and Obligations of Editorial Members)
a. Editorial members are fully responsible for the decision to publish JGBT-submitted papers, confirm their integrity during the deliberation process, and observe candidates during the editing process.
b. Editorial members should respect the author's person and independence as a scholar, and make the process of the evaluation of the research paper public if there is a request.
c. Editorial members should handle submitted papers only based on the quality and submission guidelines, not based on the author's gender, age, or affiliation.
d. Editorial members should request a reviewer with specialized knowledge and fair evaluation ability in the relevant field to evaluate submitted papers. However, if evaluations of the same paper are remarkably different, editorial members can acquire advice from an expert in the relevant field.
e. Editorial members should not disclose the matters of the author and the details of the paper until a decision is made pertaining to the publication of the submitted paper.

Chapter 3. Paper Submission and Peer Review Committee

Article 6 (Qualification of Submission and Submission)

a. All the paper submitters must be members registered with JGBT.
b. All papers should be submitted through the JGBT online system (https://www.pfw.edu/jgbt or http://www.jgbt.us), and can be submitted at any time. English-language papers from authors outside of the United States of America may also be submitted using e-mail.

Article 7 (Formation of Peer Review Committee)

a. Peer reviewers are appointed by the chief editor, and selected based on the field of the reviewer's expertise. (According to circumstances, a peer reviewer who is not a member of JGBT may be appointed.)
b. Editorial members for each content subject such as international economy, international management, or practice of trade can also serve as peer reviewers.
c. The chief editor represents editorial members, handles all the matters relating to review, and reports the results of peer review to the committee.
d. The managing editor is in charge of the procedure relating to review.
e. The classification and selection of submitted papers is decided by the chief editor and the managing editor, and they report it to the committee.

Article 8 (Qualification of Peer Reviewers)

Peer reviewers shall have the following qualifications:

i. Being at least an associate professor in a domestic/international university, or a person who is as equally specialized as the person above.
ii. Someone who studies an area within the JGBT's specialty and has published at least 3 articles in a journal (or 1 article in an SCI, SSCI and/or SCOPUS indexed journal) within the last three years.
iii. Someone who presents a paper, chairs a session or serves as a discussant at an academic conference at the same level of the institution, or has served as a reviewer of a study which has been indexed in a domestic or international journal within the last three years.

Article 9 (Responsibility and Duty of Peer Reviewers)

a. Peer reviewers should evaluate papers and report the results of the evaluation to the committee within the time period set by the committee. However, if he/she believes that they are not appropriately qualified to review the paper, they should notify the committee without delay.
b. Peer reviewers should respect the author's person and independence as a scholar. Peer reviewers may request for revision of the paper with detailed explanations if needed in the evaluation of the research paper.
c. Papers are reviewed confidentially using a method in which the name and affiliation of the author is confidential to the public. Showing the paper and/or discussing the contents of the paper with a third party is not desirable unless a consultation is needed for purposes of review.

Article 10 (Unethical Behavior in the Review Process)

a. Peer reviewers must not manipulate either directly or indirectly the related research-specific information contained in the research proposal or review process without the consent of the original author.
b. Peer reviewers must be careful of the following since it could be regarded as unethical research practices in the review process:
   i. The act of handing over are quested paper to students or a third party
   ii. The act of discussing the details of a paper with colleagues
   iii. The act of obtaining a copy of the requested material without shredding it after review
   iv. The act of disgracing the honor of others or fabricating a personal attack in the review process
   v. The act of reviewing and evaluating a research paper without reading it

Article 11 (Personal and Intellectual Conflict)

a. Peer reviewers must fairly evaluate using an objective standard regardless of personal academic conviction.
b. Peer reviewers must avoid personal prejudice when reviewing a paper. If there is a conflict of interest

including personal conflict, it must be notified to the committee.
c. Peer reviewers must not propose rejecting a paper due to a conflict in interpretation or with the point of view of the reviewer.

Chapter 4. Principle and Process of Paper Review

Article 12 (Papers for Peer-review)
Review shall proceed based on the writing and submission guidelines. If the submitted paper substantially diverges from the writing and submission guidelines, the paper may not be reviewed.

Article 13 (Request for Review and Review Fee)
a. The chief editor discusses the selection of reviewers with editorial members and selects two reviewers for each paper after submitted papers pass the eligibility test.
b. The chief editor immediately requests the two selected reviewers to review the relevant submitted paper.
c. Papers are reviewed by confidential method in which the name and affiliation of the author is confidential to the reviewer, and the name of the reviewer is confidential to the author.
d. The chief editor requests a review after deleting the name and the affiliation of the author from the submitted paper, so that the reviewer cannot obtain the identity of the author.
e. A review fee shall be paid to the reviewer.

Article 14 (Review of Paper and Decision)
a. Reviewers shall submit a decision report via the JGBT's online submission system (http://www.pfw.edu/jgbt or http://www.jgbt.us) within two weeks after they are asked to review a paper.
b. The reviewer shall decide whether the paper should be published based on the following standard. However, if the paper receives less than 30 points in the suitability and creativity of the topic, it will not be published.
   i. The suitability of the topic (20 points)
   ii. The creativity of the topic (20 points)
   iii. The validity of the research analysis (20 points)
   iv. The organization and logic development of the paper (20 points)
   v. The contribution of the result (10 points)
   vi. The expression of the sentence and the requirement of editing (10 points)
   The reviewer must give one of the following four possible marks within the two week period: A (90~100 points, acceptance), B (80~89 points, acceptance after minor revisions), C (70~79 points, re-review after revision), F (Rejection), and write an overall review comment concerning the revision and supplementation of the paper.
c. In an instance where the reviewer does not finish the review within the two week period, the chief editor can nominate a new reviewer.

Article 15 (Correction of Papers according to the Editing Guideline)
a. Before holding an editorial committee meeting, the chief editor shall request editorial staff correct those papers that receive "acceptance" or "acceptance after minor revisions", using the journal's paper editing guidelines. However, if there is a paper that receives "acceptance" after the editorial committee meeting, the chief editor will request the editorial staff to correct the paper after the meeting.
b. The chief editor shall notify each author of the result of his or her paper review after receiving the corrected version of the paper from the editorial staff. However, papers which receive a "rejection" shall not be notified of their result.

Article 16 (Decision of Paper and Principle of Editing)
a. The chief editor shall call an editorial board meeting and make publication decisions after receiving finished papers from reviewers.
b. The editorial board will make decisions to publish based on the following chart. The editorial board should respect reviewers' decisions on relevant papers, but can make decisions based on the editorial policy of the JGBT.

Results of 2 peer-reviews	Overall evaluation (average)	Decision to publish
AA	A	Acceptance
AB, AC, BB	B	Acceptance after minor revisions
AD, BC, BD, CC	C	Re-evaluation after revision
CD, DD	F	Rejection

c. The paper that is awarded "acceptance" should receive a "B" or higher from reviewers or the level of overall evaluation (average) should be "B" or higher, and the paper that is awarded "acceptance after minor revisions" should have its satisfactory revisions and/or developments confirmed by the initial reviewer after re-submission.
d. The editorial board shall confirm that papers in consideration for publication are suitable to the writing and submission guideline of JGBT, look through detailed matters, and decide particular issue policies such as the number of papers and the order of them.
e. In the case where a paper was presented or submitted for review previously, it cannot be published in JGBT.
f. In the case where an author submits two or more papers for consideration, only one paper that receives "acceptance" shall be published in the same issue.

Article 17 (Notification of the Result)

a. The chief editor shall notify an author of the review result after the initial evaluation or re-evaluation is finished, but can request the author to revise and develop the paper based on the evaluation report. If the editorial board makes a final decision on publication, the author should be notified.
b. The author must be notified of the review result within one month from the day of receiving the paper or revised paper (or the deadline of submission). If it is impossible to notify the author within one month, the reason and the due date of notification must be notified to the author.
c. Unless there is a specific reason, the author must submit a file including a response to the evaluation report, revision to and/or development of the paper to the chief editor after editing the paper within the period the editorial board suggests when he/she is asked to edit the paper. The changed details must be confirmed by the editorial board as well. In case the author does not submit the revision and development to the editorial board within the period, it shall be automatically postponed until this process is finished.
d. A paper that receives a "C" in the overall evaluation (average) shall be re-evaluated after the chief editor sends the revised article and revision report to the initial reviewer(s).
e. In cases where the evaluations of the same paper are remarkably different among reviewers, the chief editor can nominate a third reviewer and request a re-evaluation. In this case, the chief editor shall send the evaluation report to three different reviewers and have them submit the final evaluation report based on the details of the paper, and the paper can be published after revision only if the final mark awarded the revised paper is higher than a "B" in the overall evaluation.
f. The chief editor will issue an acceptance letter for the papers confirmed to be published.

Article 18 (Proofreading and Editing)

a. The chief editor shall request domestic/international members to proofread and edit papers confirmed to be published.
b. Proofreading and editing members shall be recommended by the chief editor and appointed by the chairman of IAGBT.
c. The chief editor shall send the results of proofreading and editing to the original author and request the author to edit the paper appropriately.
d. The author, unless there is a specific reason, must submit the revised paper and revision report to the chief editor after editing the paper within the period the editorial board suggests when he/she is asked to edit the paper. The changed details must be confirmed by the editorial board as well.
e. Even if a paper is confirmed to be published, it will be rejected if it has not fulfilled the editing procedure following the result of proofreading and editing, or has been found to have committed research misconduct of any kind.
f. If an editing member finds plagiarism, inadequate form, or low quality in the process of editing a paper that the journal has confirmed to be published, he/she must notify the chief editor, and can suggest proper

responses to the findings.

g. The chief editor suggests whether to avoid publication of a paper or have the author re-submit the paper after revision and development according to the guidelines stipulated in Article 5. In the case of a paper requested to be revised and developed, publication can be postponed based on the degree of completion and the schedule of revision and development.

Chapter 5. Editing and Publication

Article 19 (Editing and the Date of Publication)
JGBT is published six times a year [28th February, 30th April, 30th June, 30th August, 30th October, 30th December] in principle. However, if there is a reason such as the number of submitted papers, the committee can increase or decrease the number of issues.

Article 20 (Notification of Editing)
a. The chief editor shall acquire publication consent from the authors of the confirmed papers before printing.
b. The chief editor shall report to the chairman of IAGBT when the editorial process following editorial policy is completed, and shall further follow the outlined process for printing and editing.

Article 21 (Sanction on Plagiarism and Redundant Publication)
If the ethics committee finds that a submitted paper or a published paper contains plagiarism or was published in another journal, the following sanctions will be taken:
a. Distributing after deleting the relevant paper in the journal if the journal has not been distributed yet,
b. Notification of paper deletion on the website if it the related issue has already been distributed,
c. Notification of the plagiarism or redundant publication of the relevant paper on the website,
d. Banning the relevant author from submitting papers to all journals published by IAGBT for two years from the date when plagiarism and redundant publication is found and from presenting in conference, and
e. Notifying the author's affiliated organization or institution of the fact of the plagiarism or the redundant publication, if necessary.

Article 22 (Transfer of the Rights of Publication, Duplication, Public Transmission, and Distribution)
a. The right of publication of the paper is owned by IAGBT unless specified.
b. The author(s) shall transfer the right of duplication, public transmission, and publication to IAGBT. If they do not agree, the relevant paper cannot be published in JGBT.

Article 23 (Notification of Paper on Homepage)
Papers published in JGBT shall be publicly notified on the JGBT homepage (http://www.pfw.edu/jgbt)

Article 24 (Etc.)
The matters that are not decided in these rules are either subject to the submission guidelines or decided by the editorial board.

Article 25 (Date of Effectiveness)
These regulations shall be effective as of January 1, 2022.

Author's Check List

Title of Manuscript:_____

Manuscript ID:_____

Please check ☑ to confirm fulfillment of instructions below before submitting your manuscript

1. General guidelines
- ☐ The submission contains an original manuscript, a checklist, and a copyright transfer agreement.
- ☐ The manuscript follows the journal template, using MS Word.
- ☐ The manuscript consists of a title page, abstract, keywords, JEL Classifications, acknowledgement (if any), main text, references, appendix (if any), tables and figures.
- ☐ The pages are numbered consecutively beginning with the title page.

2. Title page
- ☐ The manuscript consists of title, author(s) name(s), and affiliation(s).
- ☐ The lower area of the title page includes the name(s) of the author(s) and e-mail of the corresponding author only.

3. Abstract, Keywords and JEL classifications
- ☐ The Abstract is less than 200 words for an original article.
- ☐ Includes no more than six keywords.
- ☐ Includes no more than five JEL classifications.

4. Main text
- ☐ Subtitles are ordered according to the journal template.
- ☐ All figures and tables are cited in numerical order as they are first mentioned in the text.
- ☐ All figures and tables are referenced within the text.

5. Tables and figures
- ☐ The titles of figures and tables are set flush left above them, capitalizing the first letter of each word in these titles except for prepositions and articles.
- ☐ Vertical lines are avoided in tables.
- ☐ Pictures or photos are supplied in high resolution (minimum 300 dpi).
- ☐ Pictures or photos are supplied at a reasonably legible size for printing if they may be affected by resizing in the printing process.

6. References
- ☐ References follow APA style.
- ☐ Each entry in the reference list is cited in the main text.
- ☐ All references are listed in alphabetical order followed by the year published.
- ☐ The title of books and journals is expressed in italics.
- ☐ Complete references are included with the full title of the article and up to six author names. Where there are seven or more authors, they are identified as "et al."
- ☐ Journal articles have been double-checked as to whether the author name, (published year), title, journal name, volume (issue number) and pages are correct.
- ☐ Books have been double-checked as to whether the author name, (published year), title of book (editions, if any), place of publication, publisher's name, and pages are correct.

Copyright Transfer Agreement

International Academy of Global Business and Trade

Title of Manuscript: _____

All Authors: _____

All authors of this manuscript must agree to the following:

1. All authors certify that the manuscript does not violate any copyright and confirm its originality.
2. All authors have made an actual and intellectual contribution to this manuscript and hold responsibility for its contents.
3. This manuscript has not been published or will not be submitted to another journal for publication.
4. The "International Academy of Global Business and Trade" has rights in legal action against the infringement of copyright of this manuscript without authors' permission.
5. All authors of this manuscript confirm the transfer of all copyrights in and relating to the above-named manuscript, in all forms and media, through the world, in all languages, to "International Academy of Global Business and Trade".
6. If each author's signature does not appear below, the signing author(s) represent that they sign this Agreement as authorized agents for and on behalf of all the manuscript authors, and that this Agreement and authorization is made on behalf of all the authors.

In order for my manuscript to be accepted for publication in the Journal of Global Business and Trade (JGBT), I hereby assign and transfer to the International Academy of Global Business and Trade all rights, title, and interest in and the copyright in the manuscript, entitled.

Date:

Corresponding Author: Signature:

* Submission: You must submit a scanned file (file type: jpg, gif, or pdf) of this signed confirmation and final manuscript file (file type: MS Word) online after the manuscript has been accepted for publication.

Call for Papers

Journal of Global Business and Trade

The Journal of Global Business and Trade (*JGBT*) is the official publication of the International Academy of Global Business and Trade. *JGBT* publishes manuscripts of significant interest that contribute to the theoretical and practical basis of business, economics, and international trade studies. *JGBT*'s broad scope and editorial polices create accessible, thought-provoking content for the general academic community of business, economics, and international trade. The goal of *JGBT* is to publish insightful, innovative and impactful research on business, economics, and international trade. *JGBT* is multidisciplinary in scope and interdisciplinary in content and methodology.

Subject Coverage

JGBT is an interdisciplinary journal that welcomes submissions from scholars in business, economics, and trade disciplines and from other disciplines (e.g., political science) if the manuscripts fall within the JGBT domain statement. Papers are especially welcome which combine and integrate theories and concepts that are taken from or that can be traced to origins in different disciplines.

JGBT is a methodologically pluralistic journal. Quantitative and qualitative research methodologies are both encouraged, as long as the studies are methodologically rigorous. Conceptual and theory-development papers, empirical hypothesis-testing papers, and case-based studies are all welcome. Mathematical modeling papers are welcome if the modeling is appropriate and the intuition explained carefully.

Notes for Prospective Authors

Submitted papers should not have been previously published nor be currently under consideration for publication elsewhere. All papers are referred through a peer review process.

All manuscripts should follow the submission guidelines on the JGBT homepage (https://www.pfw.edu/jgbt).

JGBT operates an on-line submission system. Manuscripts should be submitted to the on-line submission system at https://www.pfw.edu/jgbt or http://www.jgbt.us following all prompts on the screen.

There is no firm submission deadline for papers and the submitted articles will be evaluated on a rolling basis.

Any queries should be sent to the Editor of JGBT at the following address:

Dr. Myeong Hwan Kim (Purdue University Fort Wayne), myeonghwan.kim@pfw.edu.

Guidelines for Authors (updated January 2022)

How to submit the paper

The authors submit their manuscripts (in MS Word Format) to the on-line submission system at http://www.jgbt.us

Blind Review Policy

The journal follows double blind peer review policy. The paper is sent to two reviewers appropriately qualified experts in the field selected by the editor to review the paper in the light of journal's guidelines and features of a quality research paper. For papers which require changes, the same reviewers will be used to ensure that the quality of the revised paper is acceptable.

Manuscript Preparation Guidelines

The author(s) must follow the Manuscript Preparation Guidelines in preparing the manuscript before submission.

1. Language

   The language of the manuscript must be English (American English, e.g. "color" instead of "colour").

2. Length of Paper

   The length of the paper should not exceed 30 pages (Times New Roman, 12 Font) excluding tables, figures, references and appendices (if any). Articles should be typed in double-space (including footnotes and references) on one side of the paper only (preferably Letter size) with 1 inch margin. Authors are urged to write as concisely as possible, but not at the expense of clarity.

3. Title Page

   The title page should include: (i) A concise and informative title, (ii) The name(s) of the author(s), (iii) The affiliation(s) and address(es) of the author(s), and (iv) The e-mail address, telephone and fax numbers of the corresponding author.

4. Abstract

   Please provide an abstract of 200 to 250 words. The abstract should not contain any undefined abbreviations or unspecified references. The content of abstract must include Purpose, Design/Methodology/Approach, Findings, and Research Implications.

5. Keywords and JEL Classification Code

   Please provide 4 to 6 keywords which can be used for indexing purposes.

6. Acknowledgement

   The author may use acknowledgement section in the title page of the paper (if any).

7. Subdivision of the article

   Divide your article into clearly defined and numbered sections. Sections should be numbered in Roman numerals (e.g., I, II). Subsections should be numbered using the decimal system (e.g., 1., 1.1., 1.1.1., 1.1.2., 1.2., …, 2., 2.1.). The abstract is not included in section numbering.

8. Table and Figure

   Present tables and figures within the article, not at the end of the article. Please note that the article will be published in black and white (print), although online version will contain the colorful figures (if any). However, the color print will be available in extreme cases as per the request of the author.

9. References

   Author(s) should follow the latest edition of APA style in referencing. Please visit www.apastyle.org and https://owl.english.purdue.edu/owl/ to learn more about APA style.

   ■ **Citations in the text**

   Please ensure that every reference cited in the text is also present in the reference list (and vice versa).

   ■ **Reference List**

   References should be arranged first alphabetically and then further sorted chronologically if necessary.

   ■ **Examples:**

   Reference to a journal publication:

   Berndt, T. J. (2002). Friendship quality and social development. *Current Directions in Psychological Science, 11*, 7-10.

   Caldozo, A. J., & Arapoc, J. A. (2021). Impacts of tax structure on productivity: A laboratory experiment. *Journal of Global Business and Trade, 17*(1), 39-53. http://dx.doi.org/10.20294/jgbt.2021.17.1.39

   Reference to a book:

   Calfee, R. C., & Valencia, R. R. (1991). *APA guide to preparing manuscripts for journal publication*. American Psychological Association.

   Reference to a chapter in an edited book:

   O'Neil, J. M., & Egan, J. (1992). Men's and women's gender role journeys: A metaphor for healing, transition, and transformation. In B. R. Wainrib & S. J. Nickell (Eds.), *Gender issues across the life cycle* (pp. 107-123). Springer.

   Reference to a web source:

   Timmer, H. (2021, October 26). *New GRID on the block for South Asia*. World Bank. https://blogs.worldbank.org/endpovertyinsouthasia/new-grid-block-south-asia

Manuscript Review Timeframe

Manuscripts will be initially reviewed by the Editor within two weeks from submission.

The Editor will contact the corresponding author with news of whether or not the submission will be advanced to the first round of blind reviews (or is being rejected as not suitable for publication in the journal).

Typically, the blind review process takes approximately six to eight weeks.

The JGBT does not process any submission that does not comply with complete requirements of submission guidelines.

Contributors of articles accepted for publication will receive a complimentary copy of the issue in which their article appears.