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International Trade on IPR, Economic Growth, and FDI in Indonesia's Manufacturing Sector

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ABSTRACT

Purpose – Indonesia has always experienced a deficit in the balance of payments in the Intellectual Property Rights (IPR) sector. However, it is hoped that the high value of Indonesian IPR imports will be beneficial in increasing the attractiveness of FDI, encouraging economic growth, and increasing IPR exports. The purpose of this research is to examine the causal relationship between IPR imports (MIPR), IPR exports (XIPR), incoming FDI in the manufacturing sector (FDI), and economic growth (GGDP) in the case of Indonesia.
Design/Methodology/Approach – The data used in this research are time series data from the first quarter of 2004 to the fourth quarter of 2021. These data are analyzed using the VECM approach.
Findings – The study results show that MIPR has dominated Indonesia's total trade in this sector. The contribution of import value is 95 percent compared to exports, which are only 5 percent. The VECM estimation results show a one-way Granger causality relationship from the independent variables (FDI, GGDP, and XIPR) to MIPR as a dependent variable. In a short-term causality relationship, IPR imports encourage FDI inflows into Indonesia. Then, FDI in the manufacturing sector significantly impacts Indonesia's IPR exports.
Research Implications – Indonesia's outflow of money to pay for the use of foreign IPR can encourage the entry of FDI in the manufacturing sector, resulting in a technology transfer that produces domestic IPR, which can be sold abroad.

Keywords: economic growth, export IPR, FDI, import IPR
JEL Classifications: F14, F17, F21, F23, F40

I. Introduction

The production of goods and services is inseparable from research and development. Every company in a country competes to make a product acceptable to the market. To be in consumer demand, a product must have a comparative advantage. The competitiveness of a

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product can be seen easily in terms of the price, quality, and uniqueness of the product. To create competitiveness, researchers have conduct research and development to create a valuable product that competitors cannot imitate. To prevent other companies from replicating the effect, researchers or companies that finance product innovation register their intellectual property rights to obtain an IPR certificate. Developed countries generally require strict IPR provisions so that developing countries cannot easily counterfeit their products or services (Santacreu & LaBelle, 2021).

IPR registration aims to protect products, goods, and services resulting from the research and development of organizations. However, ownership of IPR does not mean that other companies cannot produce these goods. A company, both a domestic company and a foreign company, can still produce products and services that have been patented by buying the IPR from the holder. A company that wants to produce goods with an IPR registered by another company must obtain a license from the company owning the IPR. Likewise, services usually sell production licenses to other companies as a franchise in the service sector.

IPR is an appreciation or right given to those who research or create a product (Chudasama, 2021). With this IPR, the rights of researchers, creators, and companies can be adequately protected. IPR can also encourage further innovation for future product development. This is because IPR, in its development, has created superior goods and services, encouraging other companies to produce the same product. This is the driving factor for IPR trade between countries. IPR purchases from abroad will be recorded in the import column in the balance of payments. Conversely, IPR sales to foreign companies will be recorded in the export column of a country's balance of payments. In the context of IPR trade between countries, WTO member countries have formed an agreement.

With the development of the international trade system, especially as related to the global value chain (GVC) system, IPR trade between countries is the same as trade in products or services. The IPR trade is inseparable from international business activities and the expansion of multinational companies. Selling a product license to a foreign company is an essential and easy strategy a company can take to expand overseas. This is because licensing is a mode of entry into a country for multinational companies. Entry mode by selling licenses abroad has various advantages, such as low risk, not requiring venture capital, and so on.

Indonesia is a country that imports significant IPR. The value of IPR imports in the last five years has consistently been higher than that of exports. In other words, Indonesia has always experienced a deficit in international trade related to IPR. Because IPR is not directly consumed, but rather goes through the production process, it is expected to benefit the economy. In other words, IPR is a critical production input, like foreign investment. An essential question in this research is how imports benefit the economy: in this case, namely the role of imports in economic growth. According to Bakari and Mabrouk (2017), in the case of Panama, imports are very beneficial for the country, especially in encouraging economic growth.

Generally, the modes chosen in a company's expansion abroad are two; first is the mode of entry without equity (selling IPR), such as licenses and franchises, though both modes of entry have equity. This mode of entry with equity occurs when multinational companies invest in a destination country for expansion. These entry modes can be interrelated. To see the link between IPR exports and imports with direct investment activities or foreign direct investment (FDI), it is necessary to do a test. For this reason, this study will examine the relationship between FDI inflows and IPR exports and imports.

IPR as a research and development product will significantly influence an IPR-importing country. This can be seen from the perspective of technology and knowledge transfer. This means that IPR can be a prototype for importing countries to develop a product or service further. Thus, importing countries can be encouraged to

produce IPR and export this IPR. Gentile (2017) states that companies that use IPR from abroad have affiliations with companies that own IPR, so these domestic companies receive a technology transfer. IPR protection, including patents, can encourage technology source companies to innovate and commercialize the results (Briggs & Park, 2014). This was also expressed by (Bruno et al., 2022), which stated that innovation activities carried out by multi-national companies could run effectively, especially in countries that protect against IPR.

The requirements for technology transfer for foreign investors in Indonesia are expected to strengthen Indonesia's competitiveness in international trade (Arini et al., 2021). With this technology transfer, it is hoped that domestic Indonesian companies can develop this technology and create innovations that can be exported abroad. Thus, purchases of IPR abroad recorded as imports in the balance of payments are expected to increase the innovation and development of domestic IPR. For this reason, this study also measures the relationship between IPR imports and IPR exports.

II. Literature Review

IPR is a crucial product resulting from research and artistic activities. IPR is needed in terms of the production of goods and services. In international trade, exports are understood as a source of money entry into a country, while imports are purchases of goods that reduce a country's foreign exchange. Several related articles discuss IPR from the point of view of a country's commitment to law enforcement and its impact on FDI, which in turn affects economic growth. Research discussing IPR from a trade point of view (export and import of IPR) has yet to investigate this matter. For this reason, this article will fill the gaps in the theory regarding the impact of buying IPR from abroad on the inflow of FDI and Indonesia's economic growth.

As a developing country, Indonesia needs capital for its economic activities. Foreign investment is one essential solution to meet these needs. The concern of every president in Indonesia is to attract foreign investment to Indonesia. In this regard, several researchers have examined the relationship between IPR and FDI inflows. Adams (2010) found that increased attention to IPR positively impacted FDI increases in developing countries. It was further explained that strengthening FDI was critical in building foreign investor confidence to invest in developing countries. Furthermore, Ayappan and Chin (2018) argued that the types of FDI that enter a country are in the form of FDI that carries IPR in the form of trademarks and FDI related to design, where two types of FDI enter along with the entry of IPR. In other words, investors bring FDI and holders of trademarks and designs.

Ayappan and Chin (2018) found that countries that strongly implemented IPR increased the confidence of investors, resulting in the investment of their capital. The presence of FDI will positively impact economic growth. Saravia et al. (2017), using a proxy for institutional environment efficiency using an indicator of economic freedom, found that IPR protection significantly encouraged the entry of FDI, especially in countries classified as institutionally efficient.

Yuldoshboy et al. (2022) examined the relationship between IPR and FDI in Central Asian countries. The results showed that increasing the use of patents increased FDI coming into Central Asian countries. Tivatyi et al. (2022) examined the relationship between imports, exports, and economic growth variables in several African countries. The results of this study indicated that exports had a two-way long-term relationship with economic growth in several countries such as Botswana, Namibia, and Zimbabwe. Research on the relationship between exports and imports was also carried out by Tivatyi et al. (2022). The study found that the two variables had a two-way causality relationship.

Raizada and Singh Dhillon (2017), using the VECM approach, examines the relationship between international trade in the commodity

sector and IPR exports and imports. This study found a one-way Granger Causality relationship where trade variables significantly influenced IPR export and import variables. Raizada and Singh Dhillon (2017) also stated that IPR laws benefit technology transfers to India and make India an attractive country for investors for FDI. Using the same method, (Swilam, 2017) examined the potential benefits of IPR on economic development. The results of this study indicated that the IPR variable had no short and long-term relationship with economic development and FDI.

Kusumawardhana et al. (2020) examined innovation and technology's impact on economic growth. The variables used in this study were patent applications as part of IPR, economic growth, research and development expenditures, and labor variables. The results found that the application of patents significantly affected economic growth. The other three variables, such as FDI, exports, and labor, significantly affected real GDP.

In the context of the effect of exports and imports on economic growth, previous research, namely Bakari and Mabrouki (2017), used the VAR method to estimate the relationship between variables. In addition, Usman and Bashir (2022) also used VAR to test the effect of imports on growth. The results indicated that import growth had a negative effect on economic growth, while economic growth has a positive effect on import growth. The inclusion of IPR also had a positive effect on innovation for companies that use production input resources from within the country, and a negative effect for companies that used production input resources from abroad (Chu et al., 2018). Increased innovation due to the existence of this IPR is significant in encouraging IPR exports in the future. Furthermore, research by Yew et al. (2015) found a significant relationship between IPR, FDI, and increased exports in ASEAN countries individually by country. Briggs and Park (2014) found that IPR had a substantial impact on export and licensing activities in developed counties, and in developing countries, IPR had an impact only on licensing activities.

III. Data and Research Model

The data used in this research is secondary data. This data comes from Bank Indonesia (BI) in 2022. The data is in the form of quarterly time series data. The time series data period is from the first quarter of 2004 to the fourth quarter of 2021. The data is in the form of FDI realization data in the manufacturing sector, imports, and IPR import data on Indonesia's balance of payments, with data on Indonesia's economic growth.

The method used to estimate the data in this study is a multiple linear regression analysis of time series data using the VAR/VECM model. The use of the VAR or VECM model will be determined after conducting initial testing. These tests are stationarity testing, cointegrating relationship testing, optimum lag length testing, and then Vector autoregression (VAR) or Vector Error Correction Model (VECM) testing.

Stationarity testing is carried out to determine whether the variable is stationary. In other words, the variable no longer contains a unit root, making the estimation results inaccurate. The stationarity testing method in this study is Augmented Dickey-Fuller (ADF) after determining the order of stationarity variables. The next step is to test the cointegration relationship. Cointegration testing uses the Johansen Cointegration Test approach. This cointegration test is crucial to determine the estimation model to be carried out. If each variable has a cointegration relationship, then the test will use the VECM model. The estimation will use the VAR model if it does not have a cointegration relationship.

The general form of the VECM equation for one variable affected by the lag is as follows.

$$\Delta y_t = \beta_1 e_{t-1} + \beta_2 \Delta y_{t-1} + \beta_3 \Delta y_{t-2} + \beta_x \Delta y_{t-n} + \varepsilon_t \quad (1)$$

Where Δit is a vector of the first different order for the dependent variable, then Δit-1 is the first derivative vector of the dependent variable which becomes the independent variable at the first lag, et-1 is the error correction term (ECT),

εt is the residual vector, and α is the cointegration coefficient matrix. If the four variables in this study are included, namely the FDI variable in the manufacturing sector (*FDI*), the economic growth variable (*GGDP*), the IPR import variable (*MIPR*), and the IPR export variable (*XIPR*), then Formulas 2 to 4 in the first lag can be written as follows.

$$\Delta FDI_t = \alpha_a e_{t-1} + \beta_a \Delta FDI_{t-n} + \gamma_a \Delta GGDP_{t-n} + \theta_a \Delta MIPR_{t-1} + \mu_a \Delta XIPR_{t-n} + \varepsilon_t \quad (2)$$

$$\Delta GGDP_t = \alpha_b e_{t-1} + \beta_b \Delta FDI_{t-n} + \gamma_b \Delta GGDP_{t-} + \theta_b \Delta MIPR_{t-1} + \mu_b \Delta XIPR_{t-n} + \varepsilon_t \quad (3)$$

$$\Delta MIPR_t = \alpha_c e_{t-1} + \beta_c \Delta FDI_{t-n} + \gamma_c \Delta GGDP_{t-n} + \theta_c \Delta MIPR_{t-1} + \mu_c \Delta XIPR_{t-n} + \varepsilon_t \quad (4)$$

$$\Delta XIPR_t = \alpha_d e_{t-1} + \beta_d \Delta FDI_{t-n} + \gamma_d \Delta GGDP_{t-n} + \theta_d \Delta MIPR_{t-1} + \mu_d \Delta XIPR_{t-n} + \varepsilon_t \quad (5)$$

The hypothesis testing for VECM estimation in the above equations involves testing long-term and short-term causality. The hypothesis for long-term causality tested is as follows.

H_A: $\alpha_a e_{t-1} \neq 0$ means that all independent variables in Formula (2) have a long-term causality relationship with *FDI*.

H_A: $\alpha_b e_{t-1} \neq 0$ means that all independent variables in Formula (3) have a long-term causality relationship with *GGDP*.

H_A: $\alpha_c e_{t-1} \neq 0$ means that all independent variables in Formula (4) have a long-term causality relationship with *MIPR*.

H_A: $\alpha_d e_{t-1} \neq 0$ means that all independent variables in Formula (5) have a long-term causality relationship with *XIPR*.

For short-term causality, the variables to be tested for the hypothesis are as follows.

H_A: $\beta_{(a,b,c,d.....n)} \neq 0$, which means that variable ΔFDI_{t-n} significantly influences the dependent variable in the short term.

H_A: $\gamma_{(a,b,c,d.....n)} \neq 0$, which means that variable $\Delta GGDP_{t-n}$ significantly influences the dependent variable in the short term.

H_A: $\theta_{(a,b,c,d.....n)} \neq 0$, which means that variable $\Delta MIPR_{t-n}$ significantly influences the dependent variable in the short term

H_A: $\mu_{(a,b,c,d.....n)} \neq 0$, which means that variable $\Delta XIPR_{t-n}$ significantly influences the dependent variable in the short term

IV. Empirical Analysis

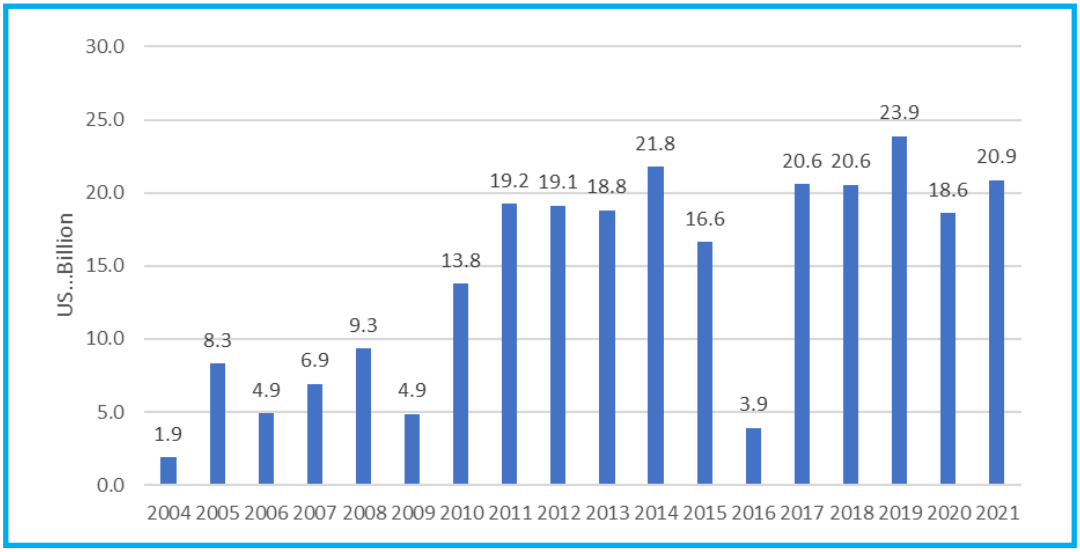
1. Realization of FDI in the Indonesian Manufacturing Sector

As a developing country, Indonesia needs funding sources to support domestic production and industry. This prompted the government to promote increased foreign investment. Success in bringing in investment is an essential indicator of the success of a leader in Indonesia. This is no exception in the Indonesian manufacturing sector.

Over the last two decades (2004-2021), the value of FDI flowing into Indonesia in the manufacturing sector was recorded at an average of USD 14 billion. During this period, Indonesia recorded the highest FDI inflows in the sector in 2019, at USD $23.9 billion. Meanwhile, the lowest realized value of FDI was USD $3.9 billion in 2016. The realized value of FDI in the Indonesian manufacturing sector from 2004 to 2021 is presented in Fig. 1 as follows.

If grouped on a five-year basis, the initial period of 2004-2009 was the first period of the administration of President Susilo Bambang Yudhoyono (SBY), and FDI in this sector grew by 27 percent. The average value of FDI in the manufacturing sector during this period was USD $6 billion. The lowest value of FDI realization in the early period of President SBY was USD $1.9 billion, which occurred in 2004, and the highest reached USD $9.3 billion in 2008. In the second period of President SBY's administration, the average value of FDI realization in the country rose 207 percent from the previous five year

Fig. 1. Realized Value of FDI in the Indonesian Manufacturing Sector from 2004 to 2021



average. The average growth of FDI in this second period was 45 percent, with the highest value reached at the end of the period (2014), amounting to USD $21.8 billion, and the lowest in 2010, amounting to USD $13.8 billion.

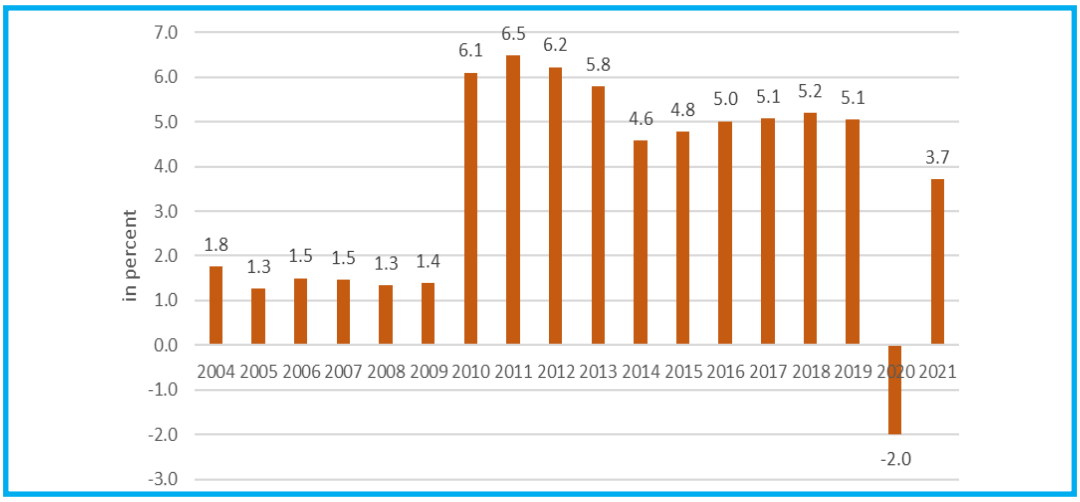
In 2014, there was a leadership change in Indonesia when President Joko Widodo (Jokowi) replaced President SBY. In the first period of President Jokowi's administration from 2014 to 2019, the average realized value of FDI in the manufacturing sector increased by 2 percent, with an average realized value of USD $17.1 billion. In 2015, the realized value was USD $16.6 billion, which then decreased significantly to USD $3.9 billion and reached the highest value of USD $23.9 million at the end of the first period in 2019. Entering the second period of President Jokowi's administration, Indonesia and the world are experiencing an economic slowdown caused by the COVID-19 pandemic. However, investment activity in the Indonesian manufacturing sector continues. The realized value of FDI in the manufacturing sector was USD $18.6 billion in 2018, down 22 percent from 2019. This value rose again by 12 percent to USD $20.9 billion in 2021.

2. Indonesian Economic Growth

An essential indicator of a country's success is its positive economic growth. From 2004 to 2019, Indonesia has continually recorded positive economic growth. Indonesia's average economic growth in the last two decades is 3.6 percent. The highest economic growth of 6.5 percent occurred in 2011, namely during the second period of President SBY's administration. The lowest occurred during the COVID-19 pandemic, namely in 2020, with negative 2 percent. Indonesia's economic growth in the last two decades is shown in Fig. 2.

In the first five years from 2004-2009, the first period of President SBY's administration, Indonesia recorded an average economic growth of 1.5 percent. This value increased significantly in the second term of President SBY at 5.8 percent. During President Jokowi's first term (late 2014 to 2019), Indonesia's economy grew by an average of 5 percent. Thus, since 2010, Indonesia's economy has grown above 5 percent. In President Jokowi's second term, the Indonesian economy fell by 2 percent due to a decline in economic activity caused by the COVID-19 pandemic. Economic growth continued in 2021 at 3.7 percent.

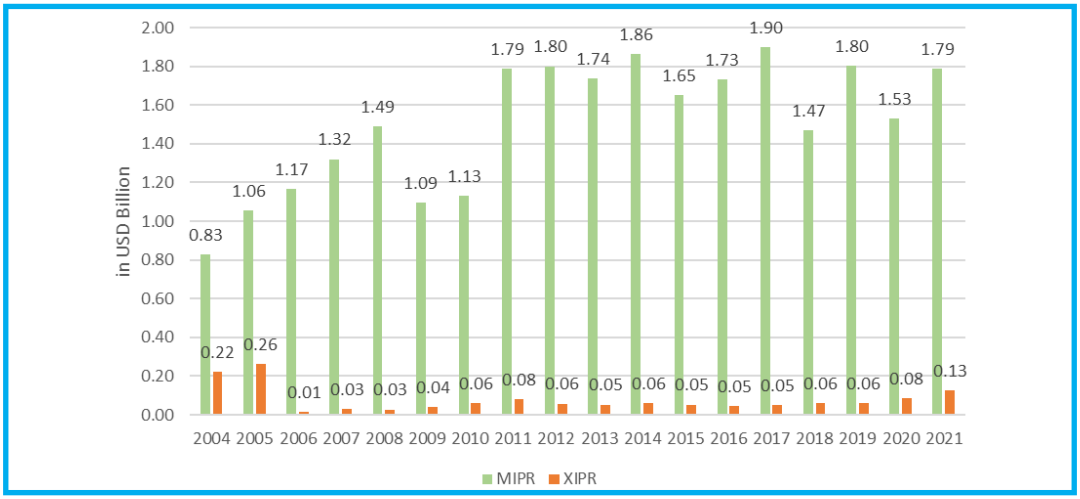
Fig. 2. Indonesia's Economic Growth (%) from 2004 to 2021



3. Indonesian International Trade Activities in the Field of IPR

Indonesia has consistently experienced a deficit in its balance of payments in the field of IPR trade over the last two decades. This is caused by an average of 95 percent of the total international trade in the IPR sector coming from imports. The import value of Indonesian intellectual property rights in 2004-2021 averaged USD $1.9 billion. Meanwhile, Indonesia's IPR exports averaged USD $76.7 million. It reached USD $1.9 billion in 2017. The value of exports and imports of Indonesian Intellectual Property Rights in the last two decades is presented in Fig. 3 as follows.

Fig. 3. Value of Exports and Imports of Charges for the Use of Intellectual Property by Indonesia from 2004 to 2021



In the first five years (2004-2008), Indonesia's import value of the use of foreign IPR had an increasing trend. During this period, imports increased from USD $0.83 billion in 2004 to USD $1.49 billion in 2008. In 2009, the value of imports experienced the second lowest point at USD $1.13 billion, and increased again to USD $1.13 billion in 2010. From 2011 to 2017, the value of Indonesian IPR imports was consistently above USD $1.6 billion. During the COVID-19 pandemic, this import value only decreased by 15 percent from USD $1.8 billion in 2019 to USD $1.53 billion in 2020. This import value rose again to USD $1.79 billion in 2021, in line with the protocol for preventing the spread of COVID-19.

The export value of Indonesian IPR abroad reached its highest value at the beginning of the period, namely in 2004, amounting to USD $0.22 billion and increasing to USD $0.26 billion in 2005. The export value of Indonesian IPR then fell significantly to USD $0.01 billion in 2006. The highest value of IPR exports after 2006 is USD $0.13 billion, which occured in 2021. The export value of IPR has experienced quite good growth in the last five years (2017-2021), with an average increase of 24 percent. The highest increase occurred in 2020-2021, reaching 50%.

4. VECM Model Estimation

4.1. Stationarity Test Results

The stationarity test results in Fig. 1 explain that the probability values of *FDI*, *GGDP*, and *MIPR* are below the 5 percent level, or are already stationary at the level order. Meanwhile, the probability value of *XIPR* is above 5 percent, or it still contains a unit root. To standardize the order of each variable, the test is continued in the order of the first difference. The results of the stationarity test at the first differences show that the probability value is below the 5 percent level. Thus, the order first difference will be used for the next estimation stage.

Table 1. Stationarity Test Results

Variable	Level		First Differences	
	Prob. Value	Unit Root	Prob. Value	Unit Root
FDI	0.0000	No	0.0000	No
GGDP	0.0004	No	0.0000	No
MIPR	0.0270	No	0.0000	No
XIPR	0.0884	Yes	0.0001	No

4.2. Cointegration Relationship Test Results

Based on the cointegration test results, it can be seen that each variable has a long-term relationship or cointegration. This is indicated by the probability value in each test parameter, which is below the 5 percent level. Because each variable collectively has a long-term relationship, the estimate for determining the causal relationship between variables will use the VECM model. Cointegration test results using the Johansen method are shown in Table 2

Table 2. Cointegration Test Results (Johansen)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.221943	49.26710	47.85613	0.0366
At most, 1 *	0.188959	31.95113	29.79707	0.0278
At most 2 *	0.137902	17.49998	15.49471	0.0246
At most 3 *	0.099889	7.261349	3.841466	0.0070

4.3. VECM Estimation Results

The first VECM estimation carried out is for the FDI variable as the dependent variable. This estimation is carried out to see the long-term causality relationship between *FDI* and the independent variables (*GGDP*, *MIPR*, and *XIPR*) collectively, and the short-term Granger causality relationship for each independent variable. The VECM estimation results with FDI as the dependent variable are presented in Formula 6, and the coefficient values are presented in Table 3.

$$\Delta(FDI) = \alpha_a*(\Delta(FDI_{-1}) - 5041.058*\Delta GGDP_{-1} + 148.249*\Delta MIPR_{-1} + 189.002*\Delta XIPR_{-1} - 273.768) + \beta_{a.1}*\Delta FDI_{-1} + \beta_{a.2}*\Delta FDI_{-2} + \gamma_{a.1}*\Delta GGDP_{-1} + \gamma_{a.2}*\Delta GGDP_{-2} + \theta_{a.1}*\Delta MIPR_{-1} + \theta_{a.2}*\Delta MIPR_{-2} + \mu_{a.1}*\Delta XIPR_{-1} + \mu_{a.2}*\Delta(XIPR_{-2}) + \varepsilon_t \quad (6)$$

The probability value for the ECT coefficient (α_a) shown in Table 3 is 0.13, or above 10%. This means that each independent variable does not affect FDI in the long term. For the short-term causality relationship, the FDI variable has a short-term relationship with the FDI variable at the second and third lags at the 1 percent level. A significant short-term relationship is also indicated by the *MIPR* independent variable with a probability value of 0.0038, or significant at the 1 percent level. In other words, IPR imports from abroad that are used for domestic production activities significantly affect the inflow of FDI into Indonesia in the short term. Meanwhile, IPR exports and economic growth did not affect FDI inflows in the manufacturing sector in the short term. This is different from the findings of Grace (2019), which stated that economic growth is an essential factor that encourages the entry of FDI into a country.

To measure the causal relationship between FDI inflows in the manufacturing sector, foreign IPR inflows to Indonesia, and Indonesian IPR exports abroad to economic growth, a second VECM estimation was carried out. The results of the second VECM estimation with *GGDP* as the dependent variable are presented in Formula 7.

$$\Delta GGDP = \alpha_b*\Delta(FDI_{-1} - 5041.058*\Delta GGDP_{-1} + 148.249*\Delta MIPR_{-1} + 189.002*\Delta XIPR_{-1} - 273.768) + \beta_{b.1}*\Delta FDI_{-1} + \beta_{b.2}*\Delta FDI_{-2} + \gamma_{b.1}*\Delta GGDP_{-1} + \gamma_{b.2}*\Delta GGDP_{-2} + \theta_{b.1}*\Delta MIPR_{-1} + \theta_{b.2}*\Delta MIPR_{-2} + \mu_{b.1}*\Delta XIPR_{-1} + \mu_{b.2}*\Delta XIPR_{-2} + \varepsilon_t \quad (7)$$

Table 4 shows the value of the ECT Coefficient (α_b), which is positive, and the probability value is below 1 percent. Thus, even though the probability is significant while the coefficient value is positive,

Table 3. Coefficient Value of Each Variable in Formula 6

Coefficient's Symbol	Coefficient's Value	Prob.
α_a	-0.071928	0.1361
$\beta_{a.1}$	-0.825096	0.0000**
$\beta_{a.2}$	-0.388147	0.0014**
$\gamma_{a.1}$	-2.234.980	0.2788
$\gamma_{a.2}$	-1.686.302	0.2156
$\theta_{a.1}$	1.725.053	0.0038**
$\theta_{a.2}$	5.181.661	0.1906
$\mu_{a.1}$	-6.560.153	0.8314
$\mu_{a.2}$	-4.282.618	0.8857
ε_t	1.611.672	0.9613

Note: *: Significant at 5%, **: Significant at 1%.

the result is that the economic growth variable does not have a long-term causal relationship with the dependent variables (*FDI*, *MIPR*, and *XIPR*). However, in the short term, *MIPR* in the first and second lags significantly affects *GGDP*. These results are consistent with the findings of Nasir et al. (2021), who also found that FDI significantly boosted economic growth. This means that using IPR from abroad significantly boosts Indonesia's economic growth in the short term. In import activities, a country will use its money to buy other countries' products. This also applies to imports of IPR. Meanwhile, two other variables, such as FDI in the manufacturing sector and IPR exports, do not significantly affect Indonesia's economic growth in the long term or short term. This can be caused by the low contribution of HKI exports to total international trade in this sector.

Table 4. Coefficient Value of Each Variable in Formula 7

Coefficient's Symbol	Coefficient	Prob.
α_b	0.000278	0.0000**
$\beta_{b.1}$	-0.000141	0.3194
$\beta_{b.2}$	-0.000172	0.1572
$\gamma_{b.1}$	0.167682	0.4323
$\gamma_{b.2}$	0.193338	0.1717
$\theta_{b.1}$	-0.033502	0.0000**
$\theta_{b.2}$	-0.016729	0.0001**
$\mu_{b.1}$	-0.032745	0.3077
$\mu_{b.2}$	-0.007506	0.8082
ε_t	-0.011170	0.9742

Note: *: Significant at 5%, **: Significant at 1%.

Furthermore, to see the effect of economic growth, the inclusion of *FDI* and IPR exports in encouraging the entry of foreign IPR into Indonesia, a third VECM modeling was carried out with *MIPR* as the dependent variable. The VECM model is presented in Formula 8, and the coefficient values are presented in Table 5.

$$\Delta MIPR = \alpha_c*\Delta(FDI_{-1} - 5041.058*\Delta GGDP_{-1} + 148.249*\Delta MIPR_{-1} + 189.002*\Delta XIPR_{-1} - 273.768) + \beta_{c.1}*\Delta FDI_{-1} + \beta_{c.2}*\Delta FDI_{-2} + \gamma_{c.1}*\Delta GGDP_{-1} + \gamma_{c.2}*\Delta GGDP_{-2} + \theta_{c.1}*\Delta MIPR_{-1} + \theta_{c.2}*\Delta MIPR_{-2} + \mu_{c.1}*\Delta XIPR_{-1} + \mu_{c.2}*\Delta XIPR_{-2} + \varepsilon_t \quad (8)$$

The results of the VECM test with *MIPR* as the dependent variable show that this variable has a long-term causal relationship with the other three independent variables, such as *FDI*, *GGDP*, and *XIPR*. This is indicated by the negative ECT coefficient, which has a probability of less than 1%. For the short-term causality relationship, the economic growth variable in the first lag significantly affects the value of IPR imports at the 1% level. This means that economic growth is essential in encouraging the entry of foreign IPRs into Indonesia. The short-term causality results also show that *MIPR* and *GGDP* have a two-way short-term Granger causality relationship. Another short-term variable that significantly influences *MIPR* is *XIPR*. *XIPR* has a significant effect at the 5% level.

Table 5. Coefficient Value of Each Variable in Formula 8

Coefficient's Symbol	Coefficient	Prob.
α_c	-0.006901	0.0001***
$\beta_{c.1}$	0.001710	0.7192
$\beta_{c.2}$	-0.005375	0.1874
$\gamma_{c.1}$	-2.023.231	0.0062***
$\gamma_{c.2}$	-5.901.420	0.2137
$\theta_{c.1}$	-0.268244	0.1831
$\theta_{c.2}$	0.013300	0.9226
$\mu_{c.1}$	1.657.913	0.1264
$\mu_{c.2}$	2.172.891	0.0400**
ε_t	-0.916707	0.9369

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

The fourth VECM model estimation uses the IPR export variable (*XIPR*) as the dependent variable. This test aims to determine the role of independent variables, especially IPR imports, in encouraging IPR exports. The test results with *XIPR* as the dependent variable are presented in Formula 9, and the coefficient values are presented in Table 6.

$$\Delta XIPR = \alpha_d*\Delta(FDI_{-1} - 5041.058*\Delta GGDP_{-1} + 148.249*\Delta MIPR_{-1} + 189.002*\Delta XIPR_{-1} - 273.768) + \beta_{d.1}*\Delta FDI_{-1} + \beta_{d.2}*\Delta FDI_{-2} + \gamma_{d.1}*\Delta GGDP_{-1} + \gamma_{d.2}*\Delta GGDP_{-2} + \theta_{d.1}*\Delta MIPR_{-1} + \theta_{d.2}*\Delta MIPR_{-2} + \mu_{d.1}*\Delta XIPR_{-1} + \mu_{d.2}*\Delta XIPR_{-2} + \varepsilon_t \quad (9)$$

The long-term causality test results show a negative but not significant ECT coefficient. Thus, it is known that all independent variables do not significantly affect Indonesia's IPR exports abroad in the long term. In the short-term Granger causality relationship, *GGDP* and *MIPR* do not significantly affect *XIPR*. Meanwhile, besides significantly influencing IPR imports (*MIPR*), *FDI* also significantly influences IPR exports (*XIPR*). Another variable that significantly affects the short-term causality relationship is *XIPR* at the first and second lags.

Table 6. Coefficient Value of Each Variable in Formula 9

Coefficient's Symbol	Coefficient	Prob.
α_d	-0.000233	0.2354
$\beta_{d.1}$	0.000874	0.1198
$\beta_{d.2}$	0.000839	0.0801*
$\gamma_{d.1}$	-1.005.319	0.2325
$\gamma_{d.2}$	-0.511272	0.3554
$\theta_{d.1}$	-0.003323	0.8870
$\theta_{d.2}$	-0.008268	0.6061
$\mu_{d.1}$	-0.755164	0.0000***
$\mu_{d.2}$	-0.259859	0.0358**
ε_t	0.354908	0.7934

Note: *: Significant at 5%, **: Significant at 1%.

V. Conclusion

The results of a descriptive analysis of Indonesia's balance of payments show that Indonesia has experienced a balance of payments deficit in this IPR sector from 2004 to 2021. IPR imports contribute 95 percent of total trade in this sector. Meanwhile, FDI activity in Indonesia's manufacturing sector occurred even during the COVID-19 pandemic. The Indonesian economy grew above 4.4 percent in the last ten years before the pandemic (2010-2019), and only experienced negative growth in 2020.

For the Long-Term Granger Causality relationship, the VECM estimation results found that there is a one-way long-term causality relationship where the independent variables. *FDI*, *XIPR*, and *GGDP* significantly affect *MIPR* as the dependent variable. In other words, in the long term, the use of foreign IPR in Indonesia is influenced by foreign direct investment (FDI) activities in the manufacturing sector, Indonesian economic growth, and Indonesian IPR exports.

In the short-term Granger causality test, the test results show a one-way Granger causality relationship between variables. The relationship is *MIPR* when it becomes the independent variable in Formula 6, which significantly affects FDI as the dependent variable. When it becomes the independent variable in Formula 9, FDI significantly affects *XIPR* as the dependent variable. Furthermore, this study also found a two-way causality relationship that influences each other between *GDP* and *MIPR*. This is shown when *MIPR* is the independent variable in Formula 8 and *GGDP* is the dependent variable. In Formula 7, *GGDP* is the dependent variable, and *MIPR* is the independent variable.

The results of this study can be used as an input in developing IPR exports. The use of foreign IPR, especially related to high technology, can encourage the entry of FDI. Including FDI will encourage a technology transfer, which will create IPR in the country. The IPR results of domestic research and development can then be exported. This can help reduce the international trade deficit in IPR. It is hoped that further research will address the impact of the use of foreign IPR at the company level.

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A Study on the Dispute Settlement System of Regional Trade Agreements as an Alternative to the WTO Dispute Settlement System

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ABSTRACT

Purpose – The purpose of this study is to analyze the structure and characteristics of RTA-DSM, and to analyze the potential of RTA-DSM as an alternative to the WTO-DSM in the crisis of the WTO dispute sttlement system.

Design/Methodology/Approach – This paper largely is a literature review. It adopts a method of examining the texts of regional trade agreements based on the WTO RTA database. In addition, this study does not perform legal analysis as much as possible, and analyzes RTA-DSM from an institutional point of view.

Findings – RTA-DSM has a similar structure to the WTO-DSM. However, the content of RTA-DSM is insufficient compared to the WTO-DSM, and as a result, there are few cases of dispute resolution. The crisis of the Appellate Body and the rapid evolution of RTA-DSM have increased the importance of RTA-DSM as an alternative to the WTO-DSM. The introduction of dispute settlement systems in regional trade agreements is an irreversible trend, and considering the usefulness, cases of dispute resolution using RTA-DSM will increase rapidly in the future.

Research Implications – RTA-DSM cannot completely replace the WTO-DSM. In the long term, WTO-DSM should be restored, and RTA-DSM should play a supplementary role. The centrality of the WTO, which supports the multilateral trade system, must be maintained through the restoration of the WTO-DSM.

Keywords: dispute settlement system, regional trade agreements, WTO
JEL Classifications: F13, F15, F51

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I. Introduction

Since its launch in 1995, the WTO has greatly contributed to the stability of the global trade system by providing a rule-based, predictable dispute settlement system. The fact that most of the 617 disputes requested for consultation with the WTO were resolved autonomously between member states or by the adoption of the Dispute Settlement Body (DSB) report reveals the excellence of the WTO dispute settlement system.

Recently, however, the WTO dispute settlement system is facing a crisis. The members of the Appellate Body are composed of seven members with a four-year term, and a new member should be appointed before the expiration of the term of office of the members. The United States has refused to appoint an appellate member since 2017, and there now is no appellate member. As a result, the Appellate Body does not work.

In the process of resolving WTO disputes, the panel review is operating normally, but the function of the appellate body is suspended. Member States have the right to appeal to the Appellate Body if they are dissatisfied with panel decisions, and about 76% of the disputes adopted in panel reports are referred to the Appellate Body. If the losing country decides to appeal, the panel report is not adopted and the dispute is referred to the Appellate Body in a suspended state. In other words, an "appeal into the void" occurs and falls into a legal vacuum in which the dispute settlement process does not proceed further.

International efforts such as Walker's proposal, MPIA, and a reform of the Appellate Body are being made to restore the WTO dispute settlement system. None are easy to realize, and other alternatives are needed. Interest in the dispute settlement system of regional trade agreements is increasing in terms of introducing a dispute settlement system similar to the WTO and being compatible with the WTO.

Since the launch of the WTO in 1995, regional trade agreements have been increasing rapidly, and the number of regional trade agreements notified to the WTO and in effect is 356. With the increase in regional trade agreements, the number of regional trade agreements introducing dispute settlement systems is increasing, and the content of dispute settlement systems are becoming more sophisticated. However, despite the increasing number of regional trade agreements introducing a dispute settlement system, disputes are rarely resolved through it.

Considering the pace of the increase in disputes among regional trade agreement members and the trend of introducing a dispute settlement system in regional trade agreements, these results are unexpected. There are a number of factors behind this outcome. In other words, complex factors such as the institutional vulnerability of the dispute settlement system of the regional trade agreement, the excellence of the WTO dispute settlement system, and a lack of political will among members are at work.

Until now, regional trade agreements have played a role in supplementing the multilateral world trade system. In this respect, it is worth considering the dispute settlement system of the regional trade agreement as an alternative to the WTO dispute settlement system. In other words, it is necessary to consider the regional trade agreement dispute resolution system as a tentative alternative until the WTO dispute resolution system is restored, and as a complementary alternative after the WTO dispute resolution system is restored.

Due to the lack of information and statistical data, research on dispute settlement systems has been limited. Existing studies have focused on overlapping jurisdictions between the dispute settlement system of regional trade agreements and the WTO dispute settlement system (Hillman, 2009; Kwak, 2006). These studies legally analyze which forums should be prioritized in the international legal system, and most emphasize that the WTO dispute settlement system should be prioritized. Although it is a minority, new attempts are being made to categorize and classify dispute settlement procedures in regional trade agreements by item from an institutional perspective to propose institutional improvements.

Representative studies include Chase et al. (2013), Marceau and Wyatt (2010), and McDougall (2018), who analyzed the characteristics and types of regional trade agreement dispute settlement systems item by item.

However, studies conducted thus far have not analyzed how the dispute settlement system is operated in regional trade agreements, and whether it is useful as an alternative to the WTO dispute settlement system. In particular, there are few studies on the dispute settlement system of regional trade agreements that reflect changes in the international trade environment after the crisis of the Appellate Body.

This paper does not analyze the overlapping jurisdiction of regional trade agreements or the legal characteristics of the dispute settlement system. In terms of institutional and functional aspects, this paper examines the usefulness of regional trade agreements as an alternative to the WTO dispute settlement system, which has recently been in crisis, and analyzes the problems to be solved in order for regional trade agreement dispute settlement systems to be an efficient alternative.

II. The Crisis of the WTO Dispute Settlement System and Dispute Settlement Status

1. The Current Crisis

With the expiration of the terms of two members on December 10, 2019, the WTO Appellate Body was unable to fill the quorum of three for the hearing, and there now is no appellate member. The Appellate Body serves as an appellate court that specializes in examining legal issues for panel review or the legal interpretation of the panel. Since the establishment of the WTO in 1995, 187 (76%) of the 247 disputes adopted as panel reports have been appealed to the Appellate Body, and the Appellate Body system is actively used as an institutional device to secure member state rights in the WTO Dispute Settlement Mechanism (DSM).

The WTO dispute settlement system operated normally, even when multilateral trade negotiations were stalled, and played a central role in supporting the maintenance and development of the WTO system, as described as a "crown jewel" (Payosova et al., 2018). However, the WTO dispute settlement system is threatened in effect because the appeals body, which plays a key role, does not work. Of course, the panel stage is still valid, and if the panel's judgment is adopted by DSB, it can be effectively implemented. According to the WTO dispute settlement procedure, parties to the dispute have the right to appeal, and if the losing country decides to appeal, the panel report is not adopted and the agenda is referred to the suspended Appellate Body. Using this "appeal into the void", the losing country can effectively prevent the adoption of panel reports against the country by filing an appeal. As a result, if WTO members strategically abuse this, there will be a legal vacuum in which no dispute can be resolved through the WTO dispute settlement system.

The crisis of the WTO dispute settlement system is undermining the trust of member countries in the WTO-DSM, which is seen as a decrease in the member countries' requests for consultation. Even though the operation of the appeal body has been suspended, consultation requests and panel activities are still being made; however, the number of consultation requests and panel installations is decreasing. Since the establishment of the WTO, an average of 24.7 requests for consultation were made through 2019, but there were only five requests in 2020, nine requests in 2021, eight requests in 2022, and one request for consultation in 2023.

The direct reason for the suspension of the appellate body's function is the United States' refusal to appoint an appellate member. More fundamentally, the accumulation of complaints from the U.S. government about the WTO dispute settlement system is a key contributing factor. The U.S. government's complaints against the Appellate Body are described in a USTR (USTR)

report released in February 2020, as follows: (a) DSU's 90-day mandatory deadline, (b) the contents of the review after the expiration of the term of office of the appellate body members, (c) Appellate Body interpretations as binding precedent, (d) overstep in the authority of the Appellate Body, and so on (USTR, 2020).

The key points of the U.S. claims are summarized as the overreach and judicial activism of the appellate body. The United States is strongly dissatisfied that some member states regard the Appellate Body as an independent international court, and that it grants broad powers to the Appellate Body. The United States argues that the authority of the appellate body should be limited to what has been agreed upon by member states, and that the appellate body should not act as if it can make new laws on its own, or solve the problems of the WTO agreement.

2. International Resolution Effort

As the Appellate Body loses function, the WTO's dispute settlement system based on norms is in a crisis of inactivity. Although the WTO was in an unexpected crisis at the time of its establishment, WTO members are seeking various ways to restore the WTO dispute settlement system, such as MPIA, agreements between parties to abandon appeals, and a reform of the appeals body.

2.1. Walker Proposal

To resolve the crisis of the Appellate Body, WTO members have been discussing a reform of the dispute settlement system. At the end of 2019, the "Walker Proposal" was submitted by New Zealand Ambassador David Walker, which reflects the claims of the United States and consists of the following (WTO, 2019). First is the (a) 90-day deadline; the 90-day limit was restated, subject to an agreement by the parties to extend it. (b) hearing after the expiration of the term of office; limits were placed on the ability of Appellate Body members to hear cases after expiration of their terms. (c) location of domestic law: the 'meaning of domestic law' is a matter of fact and not subject to appeal. The Appellate Body cannot review or analyze the matter of fact anew. (d) recommended opinion; the Appellate Body should review the issues raised by the parties only to the extent necessary for dispute settlement. (e) precedent binding; in principle, precedents are not formed through WTO dispute settlement procedures. However, to the extent related to disputes, panel and appeals bodies may refer to past reports. (f) overreach; the recognition, recommendation, and ruling of the panel and appeals body, or the DSB's recommendation and ruling, reaffirm that the rights and obligations stipulated in the target agreement cannot be added or reduced, and the panel and appeal body must interpret the agreement in accordance with Article 17(6) of the anti-dumping agreement. Finally, (g) formal dialog between WTO members and the Appellate Body; this provides a forum for regular discussions between WTO members and the Appellate Body.

The above proposal in the Walker proposal acknowledges that the appellate body is not functioning as stipulated by the DSU, and reflects the U.S. claim to some extent. However, the United States argues that reaffirming existing rules alone cannot solve the problem, and that the underlying cause of why the appellate body has moved beyond its original authority to act should be discussed. Eventually, the Walker proposal fell through.

2.2. MPIA

Article 25 of the Understanding on Rules and Procedures Governing the Settlement of Dispute (DSU) explicitly stipulates arbitration as an alternative to dispute settlement. However, there were few cases of using the arbitration system as a means of dispute settlement until the function of the appeal body was lost. Recently, there has been a movement to use the arbitration system as a way to replace the function of the Appellate Body.

In May 2019, the EU proposed a Multi-Party Interim Appeal Arbitration Arrangement (MPIA) to temporarily replace the function of the appeal

body until the function of the appeal body is restored using Article 25 of the DSU. As of April 2023, 27 countries, including the EU, China, Japan, Australia, and Brazil, are participating in the MPIA. Currently, 13 cases have agreed to resolve disputes through MPIA procedures, of which two have already been resolved, three have been confirmed or withdrawn during the panel review stage, and eight are ongoing. Of these, there are actually eight disputes to be resolved through MPIA, except for those that have already been resolved (see Table 1).

Countries that do not participate in MPIA may also use arbitration as an alternative to the appeals body under Article 25 of the DSU, as long as there is an agreement between the parties. The first case of resolving a dispute using an arbitration system was a drug-related dispute between the EU and Turkey (DS583). On April 25, 2022, the EU and Turkey agreed to use the arbitration system in place of the Appellate Body under Article 25 of the DSU in connection with the drug dispute, and on July 25, 2022, the conclusion of the panel report[1] was found to be valid. This became the first case of using the arbitration system in the absence of the function of the Appellate Body.

The first outcomes in arbitration through MPIA were also made. In October 2022, a panel report adopted in the Anti-Dumping Tariff Dispute on Frozen Potatoes (DS591) between the EU and Colombia was referred to the arbitration system through the MPIA. The panel report ruled that Colombia's anti-dumping duties on EU frozen potatoes violate Articles 5, 6, 5, 2, 4, and 3 of the WTO Anti-Dumping Agreement. However, the arbitration ruling announced in December 2022 reversed the panel's decision on Article 5 (3), ruled that Colombia did not violate this regulation, and recognized the panel's decision on the remaining provisions (IELP Blog, 2023).

In the EU-Turkey drug dispute and the EU-Colombia anti-dumping dispute, some results have been made to replace the appeals body, such as dispute settlement using an arbitration system based on Article 25 of the DSU. However, MPIA has been proposed as a tentative alternative when the function of the Appellate Body has been suspended, but it is not a system that can fundamentally replace the appeals body. Moreover, questions are being raised about the role of the temporary alternative system due to U.S. opposition to MPIA, limitations of legal binding force, and repetition of another appellate body. Since there are currently 27 MPIA participating countries, the effect of MPIA will be very limited if more WTO members do not participate. This is well illustrated by the fact that there have been only two cases in which disputes have been resolved through arbitration, although they have agreed to resolve disputes through MPIA.

2.3. Agreement to Waive an Appeal

If the parties to the dispute accept the panel report and agree not to raise objections, the dispute will be terminated. This should be premised on a prior agreement between member states in which the panel report serves as a final review. In fact, since the function of the Appellate Body was lost, there have been cases in which disputes have been resolved without appeal through such agreements.

In March 2019, Indonesia and Vietnam agreed not to appeal in the dispute over Indonesia's safeguard measures against steel products (DS490, DS496), and the panel report was confirmed as a binding final ruling. South Korea and the United States also agreed not to appeal in the dispute over U.S. anti-dumping measures against Korean petroleum products (DS488).

These cases are cases wherein appeals have been waived through agreements between the parties since the panel report was adopted, and there was no agreement before the panel report was adopted. This is because, if an agreement is

1. A panel report organized in connection with the EU-Turkey Drug Dispute (DS583) concluded that Turkey's discrimination against imported medicines violated Article 20(b) of the GATT regarding the refund of drug purchase costs (IELP Blog, 2023).

Table 1. Disputes in which Parties Have Agreed to Use MPIA

DS Number	Title	Status
DS583	Turkey-Certain Measures concerning the Production, Importation and Marketing of Pharmaceutical Products	Finalized MPIA Disputes
DS591	Colombia-Anti-Dumping Duties on Frozen Fries from Belgium, Germany and the Netherlands	
DS589	China-Measures Concerning the Importation of Canola Seed from Canada	Ongoing Disputes
DS598	China-Anti-dumping and countervailing duty measures on barley from Australia	
DS601	China-Anti-Dumping Measures on Stainless Steel Products from Japan	
DS602	China-Anti-Dumping and Countervailing Duty Measures on Wine from Australia	
DS603	Australia-Anti-Dumping and Countervailing Duty Measures on Certain Products from China	
DS607	European Union-Measures Concerning the Importation of Certain Poultry Meat Preparations from Brazil	
DS610	China-Alleged Chinese restrictions on the import and export of goods, and the supply of services, to and from Lithuania	
DS611	China-Enforcement of intellectual property rights	
DS522	Canada-Measures Concerning Trade in Commercial Aircraft	Finalized without MPIA Appeal, Withdrawn or Settled Disputes
DS524	Costa Rica-Measures Concerning the Importation of Fresh Avocados from Mexico	
DS537	Canada-Measures Governing the Sale of Wine	

Source: Author's Compilation based on WTO Plurilaterals (2023).

not reached before the panel is formed or before the panel report is adopted and an agreement is pursued thereafter, it is very unlikely that the country that lost the dispute will give up its right to appeal on its own (Jayakumar, 2019).

2.4. Reform of the Appellate Body

The international response movements described above are not fundamental measures because they are temporary solutions to the problem of the suspension of the Appellate Body. Therefore, there is an international consensus that a reform of the dispute settlement system is necessary to fundamentally resolve the crisis of the WTO dispute settlement system. Discussions are taking place around the following three proposals regarding the direction of reform.

First is a proposal to introduce an independent one-stage arbitration panel procedure by simplifying the two-stage dispute settlement procedure consisting of the panel and appeal procedures. This proposal could resolve the current legal vacuum created by the Appellate Body. However, there is no means to resolve member states dissatisfaction with the panel ruling, and if panel rulings on similar cases differ, legal consistency will inevitably be undermined. In terms of legal stability and consistency, the proposal is practically unacceptable, and WTO members agree on this point.

The next possible resolution is based on the

Walker proposal as a proposal to develop the WTO dispute settlement system by improving the problems of the WTO-DSM. In the WTO Agreement, the establishment and interpretation of new rules is the right of member states, and the role and operation of the Appellate Body must follow this principle. Therefore, based on this principle, reform should be made in the direction of avoiding the overreach of the appellate body and judicial activism. Other member states, including the United States, agree on this point. In detail, measures to reform the appellate body are being discussed, focusing on technical and procedural issues such as the selection and expansion of appellate body members, the period of appellate body review, precedent binding, and factual hearing.

WTO member states, including the United States, do not deny the need for a binding independent dispute settlement system. However, in detail, the discussion on the reform of the appellate body currently taking place is only discussing partial reforms, and does not deal with fundamental reforms of the dispute settlement system. In this respect, as with Walker's proposal, there is a possibility that the United States will not accept the proposal.

Third, since the United States will not accept returning to the existing dispute settlement system through the reform of the Appellate Body, there is a plan to fundamentally reform the dispute settlement system within the framework of WTO reform. The U.S. recognizes that the current WTO system is advantageous for emerging countries such as China, which is competing with the United States. In particular, it is less likely to agree to reform the dispute settlement system unless improvements are made in areas of interest to the United States, such as non-market competition with China, national security measures, and trade remedy (Wolf, 2022). However, as shown by the deadlock in multilateral trade negotiations, this is a more difficult task in reality.[2] The revision of the WTO Agreement must be premised on the consent of all member states, and it is difficult to gather opinions on issues wherein the interests of member states are sharply opposed. In this regard, the issue is more difficult than a new multilateral trade negotiation, and it is unlikely to be realized in reality.

In conclusion, the first and third proposals are not realistic reform directions, and the second proposal is most likely to be realized. The problem with the second proposal is that the United States does not agree. WTO members believe that it is most desirable for disputes to be resolved through consultation before entering judicial procedures. Therefore, the WTO dispute settlement system should be based on the settlement of disputes through autonomous consultation between the parties to the dispute, and the panel procedure and appeal procedure should be reformed in a way that complements it. In particular, the appellate body should not be at the center of the dispute settlement system, and each dispute settlement stage should operate in harmony. This is America's demand, and the most realistic approach. The Biden administration has not announced its position on the issue, but a report by the U.S. Congressional Research Service argues for the reform of the appellate body that considers U.S. complaints on the premise of recognizing the value of an efficient WTO dispute settlement system (CRS, 2021).

3. Current Status of Dispute Settlement in the WTO

In the WTO, disputes are initiated through a formal request for consultation, and as of February 29, 2023, a total of 617 requests for consultations were circulated to the WTO. A total of 111 member countries participated in at least one dispute as a party or a third country (WTO, 2023a).

Many of the disputes requested for consultation are resolved before the panel is set. Of the 617

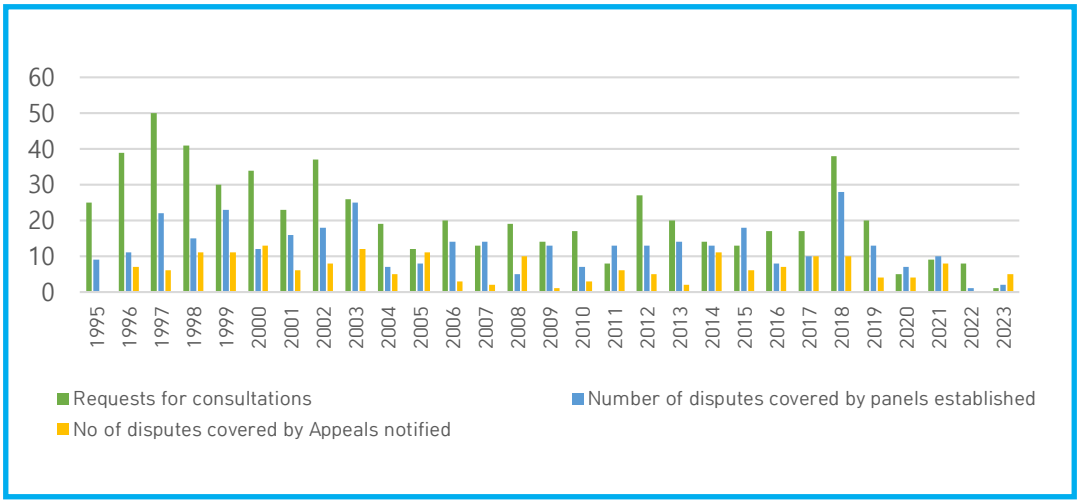
2. The WTO is facing an overall crisis due to the negative impact of COVID-19 on the multilateral trade system (Yoon and Ko, 2022), the failure of DDA negotiations, and the suspension of the function of the WTO Appellate Body.

disputes requested for consultation, 247[3] were resolved through consultation between parties without forming a panel, accounting for about 40% of the total of requests for consultation.

According to the WTO dispute settlement procedure, if mutual agreement cannot be reached through consultation, the parties may request the establishment of a panel, and both parties may appeal the panel's decision. As of February 2023, panels have been set up for 369 disputes, accounting for about 60% of all disputes. Of these disputes, 247 panel reports were adopted, of which about 76%, or 187 disputes, led to appeals. An appeal report was adopted in 166 disputes.

Even after the function of the appeal body was lost, consultation requests and panel activities are still being made, though the number of consultation requests and panel installation disputes are decreasing. Since the establishment of the WTO in 1995, an average of 24.7 disputes were requested for consultation through 2019, but there were only five requests in 2020, nine requests in 2021, eight requests 2022, and one request for consultation in 2023. In panel installation, panels have been installed in an average of 14.5 disputes since the establishment of the WTO through 2019, but panels were installed in seven disputes in 2020, 10 in 2021, one in 2022, and two as of February 29, 2023. Both the number of disputes requested for consultation and the number of panels disputes are significantly decreasing because member country trust in the WTO's dispute settlement system is faltering. However, despite the ineffectiveness of the appeal, the number of appeals disputes has been consistent, with four in 2020, eight in 2021, and five in 2023. As a result, there are currently 21 disputes in the "appeal into the void", where no further hearing can be conducted by the appellate body.

Fig. 1. WTO Dispute Settlement Statistics (1995 – February 2023)



Source: Author's Compilation and Update based on WTO (2023a).

3. In the case of disputes of a similar nature, the WTO-DSB forms a single panel to review these together, and deals with multiple disputes with different DS numbers in the same panel. This is why the number of panels and the number of disputes do not match in WTO dispute statistics. In order to accurately understand the status of disputes at each stage, statistics were prepared based on the number of disputes, not the number of panel installations or notifications of the appellate body.

III. Structure of RTA-DSM and Possibility of Alternative to the WTO-DSM

1. Structure and Characteristics of RTA-DSM

Since the dispute settlement system of regional trade agreements is designed based on the WTO-DSU, most have a structure similar to the WTO dispute settlement system. The dispute settlement process of regional trade agreements largely consists of three stages: the consultation stage, the arbitration stage, and the implementation stage, similar to the WTO dispute settlement process. However, RTA-DSM differs greatly from WTO-DSM in terms of specific procedures and provisions, and it is also differentiated between regional trade agreements. Overall, except for limited innovation cases, the level of institutionalization of RTA-DSM is lower than that of WTO-DSM.

1.1. Methods for Dispute Settlement

There are three ways to resolve disputes between countries; a political and diplomatic model that resolves autonomously through negotiations between related countries, a quasi-judicial arbitration model by neutral third-party mediation, and a judicial model that resolves using independent judicial bodies (Chase et al., 2013; McDougall, 2018). In the case of the WTO, parties go through a consultation stage before entering the arbitration process, but binding measures are taken through panel procedures and appeal procedures. In this regard, the WTO dispute settlement procedure can be classified as a quasi-judicial arbitration model. GATT, the predecessor to the WTO, is classified as a political and diplomatic model in that it presupposed diplomatic consultation and negotiation in principle.

Dispute settlement in regional trade agreements varies. First, the political and diplomatic model introduced at the beginning of the regional trade agreement is a method of resolving disputes through diplomatic consultations. This method forms a committee composed of government representatives, and resolves disputes through consultation. Regional trade agreements that adopt this method include the Bangkok Agreement, the SAARC, and the EC-Norway FTA.

The second type is the arbitration model mainly adopted in recent regional trade agreements. In the event of a dispute, a panel will be formed with a neutral third party at the request of the applicant country, and if the panel report is adopted after examination, it is accompanied by compulsory and binding implementation. A representative regional trade agreement is USMCA/NAFTA, and in Korea, most FTAs adopt this method. Recent regional trade agreements have adopted an almost arbitration model, but there are many differences in content and nature in specific dispute settlement procedures.

Third is a binding compulsory dispute settlement method through a permanent trial body. In the case of the arbitration-type model, a temporary panel is formed to resolve the dispute, but in the case of the judicial model, the dispute is resolved through an institutionalized permanent trial body. This method is the strongest dispute settlement method in that it has compulsory jurisdiction and effective mechanisms, but only a few regional trade agreements adopt it. The EU's European Union Court of Justice (CJEU) is representative, and the European Free Trade Agreement (EFTA) and the Andean Community adopt this method (McDougall, 2018).

1.2. Scope of Coverage

According to the WTO-DSU, all disputes arising in connection with the WTO Agreement are subject to WTO jurisdiction. Therefore, in the case of disputes within the scope of the WTO agreement, there is no limit to the subject of the dispute settlement system. However, regional trade agreements often limit the subject of dispute settlement. In particular, new trade issues, such as the environment, competition, labor, and certain

areas that are sensitive to Member States tend to be excluded from application.

For FTAs in Korea, in the case of disputes related to the interpretation and application of FTA agreements, there are basically no restrictions on the subject of application. However, some restrictions are imposed in FTAs with ASEAN and FTAs with individual ASEAN member states. For example, investment, economic cooperation, and annexes to economic cooperation are excluded in the Korea-ASEAN FTA, and sanitary and phytosanitary measures, competition, economic cooperation, and treatment for certain goods are excluded in the Korea-Vietnam FTA and the Korea-Cambodia FTA (Yes FTA, 2023).

1.3. Overlap of Jurisdiction and Choice of Forum

Since the WTO-DSM and RTA-DSM stipulate substantially similar rights and obligations, the same dispute may be requested to both WTO-DSM and RTA-DSM depending on the interests of the relevant parties. If this overlap of jurisdiction is not adjusted and forum shopping occurs by member states, the dispute settlement process will be confused (Furner, 2020). Recently, regional trade agreements that introduce provisions related to forum choice have been increasing to solve these overlapping jurisdiction problems.

There are three types of forum choices between RTA-DSM and WTO-DSM. First, there is a method of granting exclusive jurisdiction to regional trade agreements (EU-India FTA); secondly, a method of granting exclusive jurisdiction to the WTO (EC-Chile FTA); and finally, there is a type that allows the dispute applicant country to freely choose between RTA-DSM and WTO-DSM. Most recent regional trade agreements allow dispute-applicant countries to freely choose forums. In the case of FTAs in Korea, most stipulate that dispute-applicant countries can freely choose forums.

Provisions related to forum choice were introduced to solve the problem of overlapping jurisdiction, and concerns about forum shopping were significantly resolved. However, the issue of overlapping jurisdictions remains a challenge. This is because the WTO dispute settlement system is compulsory and automatic, so it cannot essentially limit the exercise of WTO jurisdiction,[4] and there are no clear international norms to prevent jurisdiction conflicts between the WTO and regional trade agreements (Furner, 2020). There is no absolute answer to whether regional trade agreements or the WTO is the best forum for dispute settlement. In general, RTA-DSM can be a suitable forum if disputes are local and have a limited impact on global trade, and WTO-DSM can be a suitable forum if disputes are institutional issues that affect multilateralism (Marceau, 2015).

1.4. Procedures for Dispute Settlement

The RTA-DSM has a dispute settlement procedure almost similar to that of the WTO-DSM in its framework. However, there are differences in panel referral, committee selection, dispute settlement deadline, and appeal procedures, and RTA-DSM are differentiated by reflecting the regional experience and situation of member countries.

First, in the case of the WTO, if the dispute requested for consultation is not agreed upon, the dispute is automatically referred to the panel, and one of the parties cannot unilaterally block the referral. In most regional trade agreements, panels are automatically organized. In the case of panel member selection, the WTO selects panel members for each dispute. However, in the case of regional trade agreements, there are bodies that select panel members for each dispute, such as the WTO, while there are regional trade agreements that select and manage panel candidates in advance and select panel members. In the latter case, USMCA and

4. Article 23 of the WTO DSU stipulates that Member States must comply with the rules and procedures of the DSU if they interfere with the achievement of the objectives of the WTO Agreement. Therefore, there is a general view that the WTO has exclusive jurisdiction over disputes arising from violations of the WTO Agreement (Steger, 2004).

CARICOM are applicable, and most regional trade agreements, including Korea, belong to the former. Overall, in the case of regional trade agreements, panel composition is automatic, but there is uncertainty that the panel procedure is virtually suspended because the selection of panel members is delayed, or member states may refuse.

Second, even if a binding decision is made by the dispute settlement system, the effectiveness of dispute settlement will be reduced if the final judgment takes a long time due to a delay in the dispute settlement procedure. In the case of the WTO, a limit is set for each dispute settlement process, such as up to one year for panel procedures, and up to one year and three months for appeal procedures, to promote rapid dispute settlement. In the case of regional trade agreements, most clearly set a deadline for processing, but some regional trade agreements signed long ago, such as CACM and CARICOM, do not clearly define this.

Third, a first trial system through panel procedures is desirable from the perspective of the rapid settlement of disputes, but a second trial system through appeal procedures is needed to resolve complaints from the losing country, and for legal stability and consistency. The WTO consists of a panel review in the first trial, and an appeal in the second trial. Most regional trade agreements operate on a one-judgment basis, centering on panel procedures, and there are few regional trade agreements that operate an appeal system. Some regional trade agreements, such as EU-Ukraine and EU-MERCOSUR RTA, do not introduce an appeal body, but some argue that it is actually a second trial in terms of operating a consultative panel corresponding to the first trial, and an arbitration panel corresponding to the second trial (Rudyuk, 2018).

Fourth, in order for dispute decisions to be effective, implementation and compensation for dispute judgments must be faithfully made by the parties. The WTO authorizes parties to take trade retaliation measures if they fail to implement the recommendations of the report adopted by the panel and Appellate Body, and forces them to comply. Like the WTO, most regional trade agreements have procedures and regulations that can guarantee implementation. Regarding the establishment of the implementation period, there is a regional trade agreement that clearly stipulates the deadline, while there is also a regional trade agreement that sets the implementation period through agreement between relevant parties. Overall, content that is not in the WTO, such as monetary compensation, is included, but they are insufficient in terms of remedies and retaliatory measures.

1.5. Openness and Transparency

The most insufficient area of the dispute settlement system of regional trade agreements is the lack of transparency and non-disclosure of dispute settlement procedures. The WTO-DSM systematically guarantees the participation of third countries in the dispute settlement process, thereby guaranteeing a wide range of international legitimacy, and furthermore, the power of collective dynamics that allows member countries to comply with WTO regulations is in operation (Vidigal, 2017). This also improves the predictability of dispute settlement by circulating panel reports and appeals reports to member countries, and transparently disclosing all dispute settlement processes.

Most RTA-DSMs do not allow third parties to participate in the dispute settlement process. However, in the case of multilateral regional trade agreements with a large number of member countries, third parties are allowed to participate in some scope. RECEP, in which Korea participates, stipulates that a party with a substantial interest has the rights and obligations of a third party if it notifies participation in a dispute (Yes FTA, 2023). Regarding securing transparency in dispute settlement procedures, most regional trade agreements have not disclosed the dispute settlement process, but recently, they have been moving toward disclosing all or part of the dispute settlement process.

2. Status and Paradox of Dispute Settlement in RTA-DSM

2.1. Status of Dispute Settlement in RTA-DSM

Along with the continuous increase in regional trade agreements, regional trade agreements that introduce a dispute settlement system are increasing. However, few cases of resolving disputes using RTA-DSM are found. Most use WTO-DSM to resolve disputes. This does not mean that there are fewer disputes between members of regional trade agreements. According to Vidigal (2017), about 20% of disputes in the WTO are disputes between members of regional trade agreements, which was also confirmed by the author's investigation.

As of the end of February 2023, 119[5] of the 616 disputes that requested consultation with the WTO were disputes between members of regional trade agreements, accounting for about 19.3% of total disputes. Since the establishment of the WTO, regional trade agreements have steadily increased, and 356 regional trade agreements are currently in effect (WTO, 2023b). Considering that all WTO members have joined one or more regional trade agreements, and that the trend of increasing regional trade agreements continues, disputes between regional trade agreement members will steadily increase. Despite the many trade disputes between members of regional trade agreements, it is difficult to find any disputes that have been formally raised in RTA-DSM. Most resolve disputes through informal diplomatic negotiations, or use the WTO dispute settlement system as an official judicial dispute settlement procedure.

Table 2. NAFTA/USMCA Disputes

	Title	DSM	Complaining party	Responding Party	Status	Date of Request
NAFTA	Tariffs Applied by Canada to Certain U.S. Origin Agricultural Products	Ch. 20	Canada	United States	Completed	1995. 07.17
	In the matter of the U.S. Safeguard Action Taken on Broomcorn Brooms from Mexico	Ch. 20	Mexico	United States	Completed	1997. 01.14
	In the matter of Cross-Border Trucking Services	Ch. 20	Mexico	United States	Completed	1998. 09.22
USMCA	Dairy TRQ Allocation Measures	Ch. 31	United States	Canada	Active	2021. 05.25
	Crystalline Silicon Photovoltaic Cells Safeguard Measure	Ch.31	Canada	United States	Active	2021. 06.18
	Automotive Rules of Origin	Ch. 31	Mexico and Canada	United States	Active	2022. 01.06
	Dairy TRQ Allocation Measures	Ch. 31	United States	Canada	Active	2023. 01.31

Source: Author's Compilation based on USMCA Secretariat (2023).

5. Based on the time of entry into force of regional trade agreements, the figure is aggregated for disputes that occurred between member countries since that time (WTO, 2023a).
6. As a measure to import a certain amount of goods at a low tariff rate, a high tariff rate is applied to imports exceeding the quota.

After the function of the WTO Appellate Body was suspended, there have been cases of using RTA-DSM. From its establishment in 1994 until it was replaced by the USMCA in 2020, there were only three disputes between member states dealt with in NAFTA. However, since the launch of the USMCA, four panels were formed in a short time. The dispute over Canada's tariff rate quotas (TRQ)[6] on U.S. dairy products has already been concluded in favor of in the U.S., but a second panel was formed when the U.S. requested a panel again due to Canada's lack of corrective action. Therefore, considering this, practically three disputes are being handled through USMCA-DSM (see Table 2). A dispute between Mexico, Canada, and the United States over automotive rules of origin was concluded in favor of Mexico and Canada. The U.S. acknowledges its defeat, but has yet to take concrete action. A dispute between the U.S. and Canada over safeguards for crystalline silicon photovoltaic cells was ruled in favor of Canada, but was resolved through an agreement between the two countries during the panel process.

In the case of FTAs promoted by the EU, more and more cases are actively using the dispute settlement system. Disputes related to Korea's trade union law in December 2018, wood exports to Ukraine in January 2019, and disputes with the South African Customs Union (SACU) related to frozen chicken safety standards in June 2019 were resolved through the dispute settlement system of regional trade agreements. It is difficult to count disputes handled in regional trade agreements due to non-disclosure and the absence of permanent secretariat. Considering this, it can be inferred that more disputes are actually being handled through RTA-DSM.

2.2. Paradox of Dispute Settlement

Regional trade agreements introducing dispute settlement mechanisms are increasing, and the content is developing, but the utilization is very low. What is the reason for this paradoxical result?

2.2.1. Incomplete Information

Due to incomplete information related to dispute settlement, the performance of regional trade agreements in dispute settlement is underestimated. Most regional trade agreements do not have institutional support organizations that register or aggregate disputes like the WTO, so disputes between member states are often not officially counted or announced. In particular, RTA-DSM often resolves disputes through diplomatic negotiations, such as consultation or arbitration, before entering the judicial dispute process. In the case of such disputes, since disputes are often resolved behind closed doors, it is not easy to grasp the results, and errors occur in the number of disputes. For example, in the case of the EU and Andean common market, the dispute settlement system has been used more than actually thought, but it is not statistically aggregated (McDougall, 2018).

As a result, it is difficult to grasp the current status of disputes in regional trade agreements due to incomplete information related to disputes, such as the absence of a support system, preference for diplomatic negotiations, and non-disclosure of negotiations. This is a factor that causes the performance of RTA-DSM to be underestimated.

2.2.2. Superiority of the WTO

WTO-DSM is preferred over RTA-DSM because of its superiority, such as efficient proven dispute settlement procedures, multilateralization of disputes through participation in third countries, the action of WTO collective dynamics, and institutional support from the WTO secretariat. The WTO dispute settlement procedure provides a high level of reliability verified from consultation, arbitration, and implementation, and increases the predictability of the dispute settlement process. However, in the case of RTA-DSM, parties can block or delay certain stages, and procedural regulations are generally insufficient, which does not give the member states a clear sense of trust.

Second, unlike regional trade agreements that block the participation of third countries, the WTO dispute settlement procedure can

multilateralize disputes through the participation of third countries and obtain broader international legitimacy. It also provides WTO members with a wide range of opportunities to express opinions through the participation of third countries, and secures the legitimacy of a democratic dispute settlement process (Junko, 2021).

Third, the usefulness of the WTO-DSM is due to the effectiveness of rulings from the collective dynamics of the WTO (Vidigal, 2017). For example, conflict-related parties feel more burdened by collective pressure from member states on compliance with WTO norms than fear of trade retaliation. Since these collective dynamics do not exist in RTA-DSM, which does not guarantee participation in third countries, the dispute settlement process does not have much effect. In addition, regional trade agreements are limited to a small number of member states in terms of the effect of the judgment. However, WTO rulings are primarily limited to parties to the dispute, but are circulated to all member states and cited as precedent in similar disputes, ultimately affecting all member states.

Fourth, in the case of the WTO, various administrative and legal support related to disputes is provided through the secretariat, and the cost of dispute settlement is shared by all member countries. On the other hand, regional trade agreements have difficulties in establishing a permanent secretariat due to their bilateral nature. Therefore, in the event of a dispute, it is difficult for member states to systematically receive legal and administrative support, and the cost of dispute settlement is also borne entirely by the parties. In particular, in the case of developing countries, these dispute settlement costs can be a great burden.

2.2.3. Institutional Weakness and Lack of Political Will

The institutional weakness of the dispute settlement system of regional trade agreements and the lack of political will of member countries are factors that hinder the use of RTA-DSM. The dispute settlement systems of regional trade agreements were designed based on the WTO's dispute settlement system, but the level is insufficient compared to the WTO. Of course, the latest RTA-DSM includes further details. However, compared to the WTO's proven and compulsory dispute settlement procedures, the dispute settlement procedures in regional trade agreements are still ineffective in that the discretion of the relevant parties is considerable, and the dispute progress is uncertain.

Above all, the lack of political will of member countries is an obstacle to the use of RTA-DSM. In general, regional trade agreement member countries recognize RTA-DSM as a preventive system to avoid disputes, not as a means of dispute settlement, and tend to think of it passively as an insurance means in preparation for the weakening of WTO-DSM (Froese, 2014). Despite the steady increase in regional trade agreements introducing RTA-DSM, the passive attitudes toward RTA-DSM are a factor that leads to a paradoxical situation that is low in utilization.

3. RTA-DSM as an Alternative to the WTO-DSM

3.1. Utility of RTA-DSM

The loss of the function of the appellate body is causing a continuous delay in the settlement of disputes in appeal cases. Various international efforts are being made to solve this crisis, but it is not easy to succeed in the current situation. The restoration of a fair and transparent WTO-DSM is the best solution, but it is necessary to find alternatives to replace WTO-DSM when it does not function. RTA-DSM cannot only be an alternative temporarily until the WTO dispute settlement system is restored, it can also play a role in supplementing it even after the recovery of WTO-DSM. The utility of RTA-DSM as an alternative means to replace WTO-DSM is as follows.

First, since RTA-DSM and WTO-DSM are legally compatible dispute settlement systems, RTA-DSM can most efficiently replace the legal vacuum of WTO-DSM. Since the WTO allows the establishment of regional trade agreements

under Articles 24 of GATT and 5 of GATS under strict conditions, it recognizes the right of member countries under regional trade agreements. Therefore, RTA-DSM is a legally recognized dispute settlement system within the framework of WTO rules. In addition, given that most of RTA-DSM is designed based on the WTO-DSU, there is no legal problem in supplementing the WTO-DSM through RTA-DSM.

Second, the significant increase in disputes between WTO members is another cause of the WTO Appellate Body crisis. As shown in Figure 1, an average of 24.7 disputes occurred every year before the function of the appeal body was suspended, increasing the burden on the WTO-DSM. This overload on WTO-DSM causes a delay in the dispute settlement process, and as a result, it increases the dissatisfaction of member countries (Azeveâdo, 2015). Considering changes in the global trade environment, disputes between countries are likely to increase further in the future. In particular, trade disputes between regional trade agreement members account for about 20% of total disputes, but considering the increase and development of regional trade agreements, the proportion will increase further.

The problem of overlapping jurisdiction may arise, but the burden on WTO-DSM may be eased if appropriate role sharing is created between WTO-DSM and RTA-DSM. Although there are no clear criteria for role sharing, RTA-DSM may be considered for bilateral disputes that have limited impact on global trade, and WTO-DSM may be considered for multilateral disputes that have an extensive impact on global trade. In the case of regional trade agreements, agreements have already been promoted based on close economic relations between related countries, so if disputes between member countries have a bilateral nature, disputes can be efficiently resolved based on this. On the other hand, if disputes between regional trade agreement members are multilateral, it is more efficient to resolve the dispute through WTO-DSM, which can secure a wide range of international legitimacy and reliability through participation in third countries. The coordination of the roles of the WTO-DSM and the RTA-DSM must be premised on the consent of the member states, and in this regard, the political will of member states to realize this is very important.

Third, regional trade agreements have been increasing rapidly since 2000, and in terms of content and nature, they show structural changes that are distinct from existing regional trade agreements. In other words, as the international division of labor changes from traditional trade for final goods to GVC trade for parts and intermediate goods, the role of the WTO in establishing rules related to international trade is reduced, and regional trade agreements are replacing it (Cheong, 2023).

In the case of regional trade agreements, deep integration is being promoted by introducing new WTO-X provisions such as competition, investment, labor, and environment to establish an efficient global supply chain and promote GVC trade. In this deep integration, WTO exclusive jurisdiction may be claimed in the case of disputes similar to WTO agreements, but in the case of disputes related to WTO+ or WTO-X provisions, these disputes cannot be dealt with as WTO-DSM. In particular, in the case of disputes related to WTO-X provisions, RTA-DSM can be the only alternative because the exclusive jurisdiction of the WTO does not apply. In terms of providing norms for new trade agendas not covered by the WTO Agreement, regional trade agreements play a role in supporting and supplementing the WTO system. From this point of view, the usefulness of RTA-DSM as a complementary alternative to WTO-DSM can be evaluated (Froese, 2016).

Fourth, the dispute settlement system of regional trade agreements has recently become more sophisticated and evolved. Although it is part of USMCA and the EU FTA, binding dispute settlement systems are being introduced, and disputes resolved through it are also gradually increasing. This is a factor that raises expectations for RTA-DSM as an alternative to WTO-DSM.

The USMCA mostly follows NAFTA's dispute settlement system, but improvements have been made in the method of panel selection and the

legal binding force of dispute rulings, which were problematic in NAFTA. In the case of NAFTA, member states were allowed to refuse to organize panels, but in USMCA, panel configurations are made automatically. In addition, in the case of panel member selection, unlike NAFTA, wherein member countries nominate members, the USMCA adopts a fair selection method that selects members among panel member candidates already selected. In terms of the legal binding force of panel decisions, unlike NAFTA, wherein member states can reject panel reports, panel decisions are final binding in the USMCA.

In FTAs promoted by the EU, relatively advanced dispute settlement provisions are being introduced. Since the FTA with Mexico, the EU has introduced a quasi-judicial arbitration model in all FTAs. In particular, the EU-Ukraine FTA introduces a double arbitration panel procedure, and in fact, it is operated on a two-judgment system. In a situation wherein the function of the WTO Appellate Body has been lost, the development of RTA-DSM in USMCA and EU FTAs is resulting in some changes in the dispute settlement process. In the future, if the development of RTA-DSM and the crisis situation of WTO-DSM work together, there will be a stronger tendency to resolve disputes using RTA-DSM.

Finally, if dispute settlement through consultation is most ideal, the dispute settlement system of regional trade agreements is an attractive alternative. Due to the nature of dispute settlement, disputes are often resolved at the consultation stage before entering the formal arbitration process. In the WTO, about 40% of all disputes requested for consultation were resolved through consultation between parties before the panel procedure. In regional trade agreements, only a small number of disputes are officially resolved through the dispute settlement system, but it is inferred that there will be more disputes resolved that are not shown in the statistics. When resolving disputes through consultation, the trust and faith between parties concerned are very important. In this respect, regional trade agreements are advantageous in resolving disputes, as these trust and ties have already been formed among member states through regional trade agreements.

3.2. Tasks for RTA-DSM to Improve

RTA-DSM cannot completely replace the WTO-DSM. However, RTA-DSM is worth using not only as a temporary alternative in the event of an appellate body crisis but also as a supplementary means when the appellate body's function is restored. In order for RTA-DSM to be an efficient alternative, there are many tasks to be improved, such as the lack of effectiveness of the dispute settlement system, the lack of political will of member countries, and the absence of a permanent secretariat.

3.2.1. Improvement of Dispute Settlement System

When promoting new regional trade agreements or improving existing regional trade agreements, the institutional problems of RTA-DSM should be supplemented. In particular, compared to WTO-DSM, problems are prominent in the panel and implementation stages, which have hindered the use of RTA-DSM. Therefore, institutional improvement of dispute settlement procedures is needed so that RTA-DSM can become a predictable dispute settlement system as an alternative to WTO-DSM.

Dispute settlement procedures for regional trade agreements consist of consultation, arbitration, and implementation. This is mostly similar to the WTO dispute settlement procedure. However, overall, it is insufficient compared to the WTO dispute settlement procedure, and it is necessary to improve the dispute settlement procedure to a level similar to the WTO. First, it is necessary to automatically organize the panel and select fair and reliable panel members. In recent regional trade agreements, panel composition is automatic, but the panel process can be virtually suspended because the parties to the dispute may delay or refuse to select panel members. Therefore, if candidates for panel members are designated in advance, and panel members are selected from

among them, or if they are not made within a given period, the system should be improved in the direction of forcibly selecting panel members.

Second, another problem with RTA-DSM is uncertainty about the implementation of panel rulings. Most regional trade agreements have related procedures and regulations so that disputes can be corrected and compensated. However, since there is no clear standard on whether the concession requested by the applicant is appropriate, or the respondent's corrective action is appropriate, correction and compensation may be delayed due to conflicts between parties during the implementation stage. Therefore, regulations related to the implementation procedure should be clearly specified in detail, and the effectiveness of implementation should be secured by setting a minimum deadline for each implementation stage.

Third, regional trade agreements are diverse and complex in nature, with the current number reaching 356. Therefore, not all regional trade agreements can access trade disputes in the same way. In consideration of the characteristics of regions and member countries, differentiated dispute settlement systems should be designed for each regional trade agreement, and a more flexible dispute settlement system should be introduced.

3.2.2. Establishment of Practical Secretariat and Dispute-Related Statistical Systems

In order to improve the institutional problems of RTA-DSM, an accurate analysis of problems in the actual operation process must be made. However, in disputes in regional trade agreements, accurate information is insufficient due to the non-disclosure of the dispute settlement process and difficulty in statistical aggregation. As a result, our analysis shows that disputes resolved through RTA-DSM are officially very rare, and the dispute settlement effect of regional trade agreements is underestimated more than it actually is. The reason why there are few analyses and studies on the dispute settlement system of regional trade agreements is also related to these factors.

In order to accurately analyze the problems of RTA-DSM, it is necessary to establish an institutional system that can obtain information related to the regional trade agreement's dispute settlement system and systematically manage dispute statistics.. Above all, a professional organization to support it is needed. In this sense, Porges (2018) emphasized the importance of the secretariat, which plays an important support role in the dispute settlement process.

The WTO provides various administrative and legal supports related to disputes through the secretariat, and systematically manages dispute-related statistics. In other words, it serves as legal and administrative support for panels and appellate bodies, monitoring the implementation of adjudication and recommendations, receiving and managing all dispute-related documents, and managing dispute-related statistics.

The most ideal path is to open a permanent secretariat, such as the WTO, but it is difficult to establish a permanent secretariat, except for some multilateral regional trade agreements. Therefore, it is desirable to establish a practical secretariat organization in consideration of the bilateral nature of regional trade agreements. Since regional trade agreements have fewer disputes than the WTO, it can also be an alternative to managing disputes through the establishment of joint committees between member countries, or through external specialized institutions, rather than regular secretariat. In the case of the EU-Japan Economic Partnership Agreement, an office in charge of managing dispute settlement procedures can be entrusted to external institutions through agreement between member countries, thereby receiving administrative and legal support from external specialized institutions (MFAJ, 2019).

Even if disputes in each regional trade agreements are managed through a dedicated organization, the problem remains that information related to individual disputes in regional trade agreements must be managed globally. The most realistic alternative to this issue is for the WTO, which manages regional trade agreements, to comprehensively manage dispute-related data and information with the cooperation of each regional trade agreement. For example, just as the World

Bank provides related data through a handbook related to deep regional trade agreements (RTA), the WTO can comprehensively organize data related to the dispute settlement of regional trade agreements through the RTA-DSM Handbook. If a systematic analysis of problems in each dispute settlement stage is made, it can be used as a reference for designing a dispute settlement system for a new regional trade agreement or improving the existing RTA-DSM.

3.2.3. Strong Political Will

In order to overcome the paradox of dispute settlement and increase the utilization of RTA-DSM, institutional improvements must be made, such as improving problems in dispute settlement procedures and establishing a support organization. Most importantly, however, member states must have a strong political will to use the dispute settlement systems of regional trade agreements.

Members of regional trade agreements tend to think of RTA-DSM as a preventive system to avoid dispute, not as a means of dispute settlement. However, there is now a situation in which it must be actively used. In other words, a legal vacuum continues due to the loss of function of the appellate body, and international efforts to solve this problem cannot guarantee results. In this situation, there is a growing demand that RTA-DSM be used as a temporary alternative until the WTO dispute settlement system is restored, as well as an institutional device to supplement it even after the WTO-DSM is restored. If member state political wills toward RTA-DSM are confirmed along with the institutional improvement of RTA-DSM, the dispute settlement systems of regional trade agreements can be a useful means to replace and supplement the WTO dispute settlement system.

IV. Conclusion

In proportion to the increase in regional trade agreements, regional trade agreements that introduce dispute settlement systems are increasing, and in recent years, the content is becoming more sophisticated. Paradoxically, however, regional trade agreement members prefer to resolve disputes through WTO-DSM rather than RTA-DSM to resolve disputes. This is also confirmed in official dispute-related statistics. The low use of regional trade agreement dispute settlement systems is attributed to factors such as the underestimation of RTA-DSM performance due to a lack of information and statistics, the excellence of WTO-DSM, and the lack of political will of member countries.

However, a basic environment is being created in which RTA-DSM can serve as an alternative to WTO-DSM in terms of increases of and structural changes in regional trade agreements, qualitative development of dispute settlement systems, and legal stability. Considering the increase in regional trade agreements, the proportion of trade disputes between member countries will continue to increase. For the WTO, which is facing difficulties such as delaying the dispute settlement process due to the increase in trade disputes, the burden of overload can be eased through RTA-DSM. Structural changes in regional trade agreements are also acting as an environment in which RTA-DSM can serve as a complementary alternative to WTO-DSM. Recent regional trade agreements are pushing for deep integration, introducing new WTO-X provisions to build efficient supply chains and promote GVC trade. In the case of WTO-X provisions, the WTO cannot exercise exclusive jurisdiction because it is not in the WTO agreement, and RTA-DSM is the only alternative. Regional trade agreements play a role in supporting and supplementing the WTO in that disputes that cannot be resolved through the WTO-DSM can be resolved through RTA-DSM.

On the legal front, WTO-DSM and RTA-DSM are complementary dispute settlement systems. The WTO recognizes regional trade agreements as an exception to the principle of non-discrimination. RTA-DSM is therefore a legally recognized dispute settlement system within the framework of the WTO rules, and is the most

reasonable means against other alternatives in terms of legal stability.

Changes in regional trade agreements are improving the usefulness of dispute settlement systems, and serve as the basis for becoming an alternative to the WTO-DSM. In addition, the crisis of the WTO dispute settlement system due to the suspension of the function of the Appellate Body serves as a catalyst for this possibility to become a reality.

Regional trade agreements are leading trade liberalization on behalf of the WTO at a time when the WTO's multilateral trade negotiations (DDA negotiations) are deadlocked, and are introducing rules on new trade agendas. In other words, regional trade agreements still play a role in supporting and supplementing the WTO multilateral world trade system. From this point of view, the answer to whether RTA-DSM can be a tentative and complementary alternative to WTO-DSM becomes clearer. Now, the introduction of dispute settlement systems in regional trade agreements is an irreversible trend, and considering the usefulness, the number of cases of dispute settlement using RTA-DSM will increase rapidly in the future.

This paper analyzes the structure and characteristics of RTA-DSM as an alternative to the WTO dispute settlement system in crisis, and examines the possibility of RTA-DSM as an alternative to WTO-DSM. However, in this paper, there are also limitations. This study examines the basic structure and characteristics of RTA-DSM at the institutional and functional levels, and the possibility as an alternative to WTO-DSM. However, this study presents institutional justification, but has not been able to make a specific legal analysis of whether RTA-DSM can be an alternative to WTO-DSM in the international legal system. Through legal analysis, measures can be prepared to solve the overlapping problem of RTA-DSM and WTO-DSM and the legal weakness of RTA-DSM; further analysis is needed in this regard.

In this paper, the dispute settlement process of regional trade agreements has not been empirically analyzed due to a lack of information and dispute-related data. If we can analyze related data on how the dispute settlement systems of regional trade agreements actually operate, and how they perform, we can prove regional trade agreement dispute settlement systems are undervalued and are sufficiently valuable as an alternative to WTO-DSM. In the case of disputes resolved before the formal arbitration procedure, it is difficult to obtain relevant data due to non-disclosure. However, in recent years, as seen in the USMCA and EU trade agreements, regional trade agreements that have introduced an evolved dispute settlement system tend to disclose the dispute settlement process, so further investigation and analysis of these regional trade agreements will be possible.

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An Empirical Study on the Effect of a High Performance Work System on the Human Resource Performance of Accounting Experts in Korean Companies: Focusing on the Mediated Effect of Informal Learning

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ABSTRACT

Purpose – The purpose of this study is to verify the effect of a high-performance work system on human resource performance and the mediating effect of informal learning in this causal relationship.
Design/Methodology/Approach – The research method of this study is a quantitative approach, and the data was aggregated to the 1st Human Capital Corporate Panel Survey II (HCCPS) by the Korea Research Institute for Vocational Education & Training (KRIVET) due to its focus on the experience of accounting experts in Korean companies. A total of 1,024 participants were included in this study.
Findings – The study found that high-involvement work organization and high-commitment HRM had a positive effect on organizational commitment and job competence in Korean companies, and that informal learning had a partial mediating effect in the causal relationship between a high-involvement work organization and organizational commitment and job competence.
Research Implications – From a theoretical perspective, this research highlights the importance of informal learning in linking high-performance work system with human resource performance. In addition, this study also demonstrates the relational impact of high-commitment HRM and high-involvement work organization in Korean companies, further expanding the literature on workplace performance. From a practical perspective, this study suggests that companies need to incorporate effective high performance work systems, and build an environment to enable active informal learning opportunities. In addition, institutions should promote learning initiatives to maximize human resource effectiveness, ultimately improving organizational performance.

Keywords: high-commitment HRM, high-involvement work organization, high-performance work system, human resource performance, informal learning
JEL Classifications: L20, M10, M41

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I. Introduction

The main task of accounting experts is to prepare and analyze corporate financial, non-financial, and tax information, and to support the long-term management strategies as well as basic operations management in corporate management. Therefore, accounting experts must have the ability to calculate accounting information suitable for the needs of various stakeholders (investors, governments, unions, civil society organizations, etc.) in a timely manner, and have a strict work ethic that requires objective and fair accounting in any situation. Accounting experts must fully understand stakeholders in advance in providing various expertise, including accounting data, and there is a growing need to develop accounting, finance, and tax-related expertise in a timely manner to respond to the rapidly changing corporate environment.

In these changes to the business environment, accounting experts, with the main role of producing financial information, must additionally serve professional functions to establish long-term management strategies and support them, as well as provide basic operational management to utilize the information. How is the financial, strategic, and operational knowledge of accounting experts learned in the workplace? To answer this question, it is important to understand that the knowledge of accounting experts develops not only in institutionalized educational institutions but also in the workplace (Billett, 2004; Fuller & Unwin, 2003; Marsick & Watkins, 1990).

As often as possible, accounting expert knowledge that produces financial information can be developed in institutionalized educational institutions, but knowledge and capabilities for establishing operational management and management strategies is developed by case analysis in the workplace. In other words, most of the vocational skills of accounting experts is developed through workplace learning. In this context, workplace learning in which work and learning are performed simultaneously, such as informal learning and non-formal learning, has been developed by pointing out the many problems of formal learning (Bae, 2007; Clarke, 2005; Eraut, 2004). However, in the field of accounting in Korea, attention has been focused only on curriculum in institutionalized educational institutions (commercial high schools, university accounting departments, etc.), while only a small number of studies have been conducted on the workplace learning of accounting experts in companies (Han & Jung, 2010; Ju et al., 2008).

This study purposes a verification of the effect of a high-performance work system on human resource performance for accounting experts. This study will find whether the informal learning of accounting experts in the workplace has a mediating effect between high-performance work system and human resource performance. Through this analysis, the efficiency of informal learning for accounting experts is examined.

The data were used by selecting 1,024 accounting expert responses collected from the 1st Human Capital Corporate Panel Survey II (HCCPS) by the Korea Research Institute for Vocational Education & Training (KRIVET). This study is divided as follows. The second section outlines the theoretical background, explaining the relationship between high-performance work system, informal learning, and human resource performance and, infers research hypotheses. The third section details the methodology and results. The final section is devoted to the conclusions and limitations.

II. Literature Review

1. High-Performance Work System and Performance

Workplace innovation, which was attempted in the rapidly change of business environment, was formulated by Appelbaum (2000) with the concept of the high-performance work system, and since then, this concept has spread not only to manufacturing but also to offices and service industries, and the various practices for workplace

innovation have been sought by companies (Batt, 2002; Boxall, 2003).

A high-performance work system is a system of the best work practices that creates high performance for a company. This concept consists of sub-components such as 'high performance', 'best work practice', and 'system'. In order to identify the sub-components of a high-performance work system, it is necessary to understand the best work practices, and the systematicity of each best work practice having a great effect on corporate performance (Boxall & Macky, 2009). Next, we will look at the relationship between the high-performance work system and performance focusing on the three theoretical perspectives that Delery and Doty (1996) distinguished from previous studies: universalist perspective, contingency perspective, and constructivist perspective.

First, universalist studies mainly explored the best work practices that affected corporate performance (Delery & Doty, 1996; Lawler, 1986; Pfeffer, 1997; Walton, 1985). For example, Delery and Doty (1996) selected seven best work practices from a universalist perspective: internal promotion, formal education and training, personnel evaluation based on results, compensation linked to performance, job security, grievance, and job enlargement. In Pfeffer's (1997) case study, seven best work practices were derived: employment security, strict selection, information sharing, decentralized autonomous work team, performance-based high wage, various education and training, and reducing discrimination among workers. However, in the universalist perspective, theoretical and methodological confusion occurred, with different researchers presenting different best work practices and defining different concepts.

Second, contingency studies based on open system theory paid attention to the external fit between the high-performance work system and contingency factors (Arthur, 1992; Miles & Snow, 1978; Youndt et al., 1996). The universalist studies discussed above had the problem of not being able to grasp various contingency factors that promoted or hindered the causal relationship between high-performance work system and performance. Therefore, studies of the contingency perspective argued that a high-performance work system interacted with contingency factors (management strategy, government support, market competition, organizational size, technology system, etc.) to affect corporate performance. Arthur (1992) focused on management strategy as contingency factor, and divided it into the low-cost management strategy and differentiation management strategy. He divided the high-performance work system into a bundle of cost-saving human resource management and a bundle of immersive human resource management. As a result of the analysis, it was found that the company's differentiation strategy had a positive (+) effect on the bundle of immersive human resource management. In a study by Youndt et al. (1996), management strategy, as contingency factor, was divided into cost strategy, quality strategy, flexibility strategy, and high-performance work system in the bundle of administrative human resource systems and the bundle of human capital-enhancing human resource systems. The moderating effect of management strategy was analyzed in the causal relationship between the bundle of human resource systems and corporate performance (customer satisfaction, labor productivity, and facility efficiency). As a result, the quality strategy showed a significant moderating effect in the relationship between the bundle of human capital-enhancing human resource system and corporate performance, while the cost strategy only had a positive (+) moderating effect on the relationship between the bundle of administrative human resource system and facility efficiency.

Third, constructivist studies focused on the complementarity of best work practices and the relationship between these best work practices in a high performance work system (Appelbaum, 2000; Boxall & Macky, 2009; Godard, 2004; MacDuffie, 1995). Constructivist studies focused on the synergy between best work practices to overcome the problem of universalism discussed above, demonstrating that bundles of best work

practices with internal fit have a greater effect on corporate performance than individual best work practices. For example, Appelbaum (2000) defined the alternative methods of management that US companies had tried since the 1980s, such as the high-performance work system, and analyzed the process in which a high-performance work system affected performance through worker abilities, motivations, and participation opportunities. He divided high-performance work system into the work organization category related to the principle of worker participation opportunity and employment management category related to the principle of worker ability/motivation, and included each best work practice in the two subcategories above. Godard (2004) also divided the high-performance work system into two categories: alternative work practices and high-commitment employment practices. The category of alternative work organization practices included each best work practice, such as alternative job design (job-enrichment and autonomous work teams) and formal participation (QC, problem-solving groups), and the category of high-commitment employment practices included careful selection, behavior evaluation and promotion, system of single status, and knowledge-based compensation. A study by Ashton and Sung (2002) focused on trust between labor and management as a prerequisite for the successful implementation of a high-performance work system. Within the employment relationship of reciprocal interest, consultation between labor and management functioned as a kind of governance to correct trial and error, problems arising from the process of workplace innovation, and to promote communication between labor and management to supplement a high-performance work system (Guest & Pecci, 2001). In this sense, Kim (2008) also suggested labor-management cooperation as the main factor of a high-performance work system along with open management, motivation, and knowledge accumulation, and Roh and Kim (2002) pointed out the characteristics of labor-management relations as a major factor affecting the introduction of a high-performance work system.

In this study, a high-performance work system will be defined as a system of work practices that promote worker ability, motivation, participation opportunities, and discretionary effort behavior, unlike existing Taylorist work methods and employment practices. The components of a high-performance work system in this study will be divided into two categories: 'high-involvement work organization' for worker participation and autonomy in workplace, and 'high-commitment Human Resource Management (HRM)' for worker abilities and motivation in workplace. Through the following research hypotheses, this study aims to analyze the relationship between the components of a high-performance work system and human resource performance.

H1: A high performance work system will have a significant effect on human resource performance.
H1a: A high involvement work organization will have a positive (+) effect on organizational commitment.
H1b: High commitment HRM will have a positive (+) effect on organizational commitment.
H1c: A high involvement work organization will have a positive (+) effect on job competence.
H1d: High commitment HRM will have a positive (+) effect on job competence

2. Antecedents and Outcomes of Informal Learning

In the rapid changes in the business environment, researchers in human resource development academia began to think about learning and work in an integrated manner. Of course, these attempts already had begun with Dewey's experiential learning theory in the 1930s (Dewey, 1938). According to his study, adults constructed practical knowledge from the reflection of their experience, and developed their own thoughts and actions. In the early 1990s, a study by Marsick and Watkins (1990) highlighted a new issue about workplace

learning in human resource development academia. The concept of workplace learning was initially proposed by Marsick and Watkins (1990), who suggested that workplace learning consisted of three components: formal learning, informal learning, and incidental learning. First, formal learning is structured learning in which an educator shares codified knowledge with institutional support. Second, informal learning is unstructured learning arising in everyday work and life. Third, incidental learning is unintended learning as a by-product derived from other activities (experience, human relations). They explained that the context of workplace learning triggered a worker's learning process study. Learners develop worker constructed learning strategies in order to interpret experiences from context and seek solutions. After, a learner reflects on the intended or unintended outcomes of learning, and repeats reconstructing their personal cognitive framework about the learning context (Marsick & Watkins, 2001).

A pioneering study by Marsick and Watkins (1990) has been largely accepted as explaining informal learning in most follow-up studies. The definition and characteristics of informal learning have evolved and improved over consecutive studies. Marsick and Vople (1999) focused on the unintended characteristics of informal learning, and described informal learning such as unstructured, empirical, and non-institutional learning. Enos et al. (2003) pointed out the social interaction of informal learning, and defined informal learning as learning achieved by interaction with others performing interconnected tasks. Lohman (2005) paid attention to the place of informal learning, and defined informal learning as learning to develop professional knowledge and skills for work processes through experiences in the workplace.

With regard to learning processes in the workplace, workers start informal learning with individual experiences and effort. Many problems are solved by collaboration and social interaction with others in the workplace. In particular, the tacit knowledge of difficult tasks and hidden organizational contexts are acquired by the informal learning of social interactions with bosses and colleague. Workers reflect upon their own work experiences and interactions with others. They not only quantitatively accumulate memories of work experiences but also develop a new cognitive framework in a new situation. This process of informal learning develops job knowledge and skills. Therefore, many of authors agree that the concepts of informal learning are comprised of three dimensions: 'work experience', 'interaction with others' and 'reflection on experience and interaction' (Bae, 2007; Manuti 2015; Skule, 2004). Informal learning can be defined as learning in which workers acquire the knowledge necessary for work via their experiences at work, interactions with others in workplace, and reflection on their experiences and interactions (Marsick & Watkins 2001; Moon, 2010).

During the last decades, many researchers have explored the antecedents and outcomes of informal learning (Manuti, 2015). The previous empirical studies can be divided into two groups. One group set informal learning as a dependent variable and explored the facilitating factors of informal learning. The other set informal learning as an independent variable and performed empirical research on the relationship between informal learning and learning outcomes.

First, we will look at the relationship between learning facilitators and informal learning. According to Engeström (1999), cognitive subjects are motivated by external stimuli to engage in purposeful activities and obtain desired outcomes. In this learning process, it is the unique feature of human being that they influence external objects through physical tools such as machines, and mental tools like symbols. Further, they improve 'expansive learning' in this process. In his study, 'expansive learning' can be facilitated by three factors; the 'task factor' as a starting point and learning curriculum, the 'relational factor' as cooperation with others, and the 'motivation factor' as subject's intention and fair distribution system in a community.

To provide a comprehensive picture about workplace learning, Eraut (2004) developed a theoretical model to explain how learning facilitators influence informal learning and the outcomes. He divided learning facilitator into two factors: individual factor and organizational factor. The learning facilitator at the individual level is defined as the 'learning factor', and the learning facilitator at the organizational level is defined as the 'context factor'. The 'learning factor' is comprised of three dimensions: 'challenging work', 'support and feedback', and 'confidence and commitment'. The most important learning facilitator at the individual level is 'confidence and commitment', which promotes informal learning in individual level interacting with 'challenging tasks' and 'support and feedback'. Meanwhile, the 'context factor' is comprised of three dimensions: 'structuring and allocating work', 'human relationships in the workplace', and 'expectations of organizational members for role-performance-development'. Also, the 'learning factor' at the individual level interacts with the 'context factor' at the organizational level. 'Confidence and commitment' at the individual level is promoted by 'expectations of organizational members for roles-performance-development' at the organizational level. 'Challenging tasks' at the individual level is deeply influenced by 'structuring and allocating work' at the organizational level, and 'support and feedback' at the individual level also interacts with 'human relationships in the workplace' at the organizational level.

On the basis of Eraut's comprehensive model, many empirical studies have explored the antecedents of informal learning. In a meta-analysis by Cerasoli et al. (2018), the facilitators of informal learning in previous empirical studies were significantly classified into personal and situational antecedents. The personal antecedents were divided into three sub-factors: personality/propensity factors, general learning-related motives, and demographics. Situational antecedents are classified into three sub-factors: job/task characteristics, support, and opportunities for learning. Previous studies on the six factors of personal and situational antecedents are as follows.

(a) Personality/Propensity Factors: Often, the process of informal learning is influenced by a learner's propensity factors formed in the past. In a study by Noe et al. (2013), learner propensities such as extraversion, openness to experience, and agreeableness were found to have significant relationships with informal learning.

(b) General Learning-Related Motives: Workers with learning-related motives would naturally be inclined to engage in informal learning processes. In a study by Choi and Jacobs (2011), informal learning was significantly influenced by learning goal orientation, motivation to learn, and self-efficacy. Sambrook's study (2005) indicated that the activation of informal learning was influenced by personal factors such as responsibility for learning, learning motivation, learner confidence. Moon (2010) demonstrated that learning motivation and learning strategy had a positive (+) effect on the knowledge acquisition of informal learning.

(c) Demographics: In studies by Billett (2004) and Fuller and Unwin (2003), the opportunities of learning in the workplace could be unequally distributed according to demographic attributes. In previous empirical studies, rarely were demographic factors treated as substantive predictors of informal learning (Cerasoli et al., 2018).

(d) Job/Task Characteristics: Within the workplace, job/task content corresponds to a kind of informal learning curriculum, and worker control over a job/task may create many learning opportunities. In a study by Gijbels et al. (2012), worker task autonomy was found to increase informal learning behavior. In a study by Shim (2018), task variety had positive effects on the activation of informal learning and human resource performance.

(e) Support: The support of informal learning may be derived from three sources in the workplace: personal support such as supervisors or coworkers, formal organizational support such as incentives, policies, and rules, and informal organizational support such as organizational learning climate and learning culture (Cerasoli et al., 2018). In a study by Rooney and Gottlieb

(2007), supervisor support had a positive effect on employee professional development. In studies by Rowden and Conine (2005) and Moon and Na (2009), it was found that compensation for informal learning promoted informal learning behavior. In studies by Berg and Chyung (2008) and Jeon and Kim (2012), an innovative culture of learning in the workplace had a positive relationship with informal learning.

(f) Opportunities for Learning: Workers are more likely to participate in informal learning when opportunities for learning exist (Billett, 2004; Noe et al., 2013). Worker opportunities for learning refer to the extent to which an organization affords potential for worker learning. Billett (2004) pointed out 'workplace affordance' in order to develop workplace pedagogy properly. In a study by Shim (2016), a high-performance work system promoting worker decision-making autonomy had a positive (+) moderating effect on the relationship between informal learning and productivity/innovative activity.

Table 1. Relevant Studies on the Antecedents of Informal Learning

Construct Level 1	Construct Level 2	Construct Level 3	Relevant studies
Personal Antecedents	Individual Predispositions	- Personality/propensity factors (conscientiousness, curiosity, adaptability)	- Noe, et al. (2013)
		- General learning-related motives (perceived need for informal learning, learning goal orientation)	- Sambrook (2005) - Moon (2010) - Choi and Jacobs (2011)
	Demographics	- Age, Education, Sex, Income, Rank/ Tenure, Experience, Marital Status	- Billett (2004) - Fuller and Unwin (2003)
Situational Antecedents	Job/Task Characteristics	- Demands. - Resources. - Control/autonomy	- Gijbels et al. (2012) - Shim (2018)
	Support	- People support (e.g., supervisors, peers, role models, partners) - Formal organizational support (e.g., rewards, processes, systems) - Informal organizational support (e.g., climate, social capital, culture, norms, perceived organizational support)	- Rowden and Conine (2005) - Sambrook (2005) - Rooney and Gottlieb (2007) - Berg and Chyung (2008) - Moon and Na (2009) - Moon (2010) - Jeon and Kim (2012)
	Opportunities for Learning	- Potential for new learning - Lower workload - Time	- Billett (2004) - Sambrook (2005) - Shim (2016)

Source: Cerasoli et al. (2018, 206).

Next are studies on the relationship between informal learning and outcomes. Kirkpatrick's (1983) educational evaluation model is often the most used prior research in research on the causal relationship between learning and outcomes. In this model, educational evaluation is divided into four stages. The first stage of educational evaluation is divided into the reaction outcomes of learner educational satisfaction, the second stage evaluation concerns the learning outcomes of acquired knowledge after education, the third stage evaluation focuses on job behavior outcomes,

and the four-stage evaluation emphasizes organizational outcomes. Unlike formal learning, most researchers used Kirkpatrick's educational evaluation model. However, because informal learning is practiced informally by workers, three-stage evaluation indicators (job satisfaction, organizational commitment, productivity, etc.) and four-stage evaluation indicators (Tharenou et al., 2007) were noted. In most previous studies, informal learning was supposed to have a positive (+) effect on learning outcomes. Estimates of the proportion of organizational learning that take place informally ranged from 80% (Koopmans et al., 2006) to 90% (Flynn et al., 2006).

With regard to previous studies about informal learning, Cerasoli et al. (2018) researched a meta-analysis, and classified the outcomes of informal learning into attitudes, knowledge/skill acquisition, and performance. The previous studies about the three outcomes of informal learning are as follows.

(a) Attitudes: Rowden and Ahmad (2000) showed that informal learning had a higher positive (+) relationship with job satisfaction than formal learning and incidental learning. In a study by Kim and Hong (2016), it was found that informal learning had a positive (+) effect on job satisfaction, and career stagnation was partially mediated in the relationship between informal learning and job satisfaction.

(b) Knowledge/Skill Acquisition: The core competencies of internal management resources are fostered through the tactic/procedural knowledge of workers rather than coded/descriptive knowledge, which can be strengthened through informal learning more than formal learning (Nonaka, 1994). In a case study, Clarke (2005) demonstrated that individual forms of informal learning were positively associated with worker procedural knowledge. In a study by Moon (2010), four dimensions of informal learning (dialogue/question, information search, trial and error, and personal reflection) were positively associated with acquiring knowledge and self-development. In a study by Shin (2012), it was found that all four dimensions of informal learning (exploring learning opportunities, learning with others, utilizing external resources, and reflection) had a positive (+) effect on descriptive/procedural knowledge.

(c) Performance: When workers are actively absorbed in a problem to find a solution, they perform self-directed learning, and as a result, perform better in the long run. In a study by Spreitzer et al. (1997), a positive correlation was found between international executive informal learning and job performance. Bae et al. (2011) examined the relationship between informal learning and learning transfer. Informal learning was comprised of three dimensions: learning with others, external exploration, and self-reflection. The study showed that informal learning, such as learning with others and external exploration, had a positive (+) effect on learning transfer, and self-reflection had no effect.

Table 2. Relevant Studies on the Outcomes of Informal Learning

Construct Level 1	Construct Level 2	Construct Level 3	Relevant studies
Outcomes	Attitudes	- positive general work attitudes [job satisfaction, organizational commitment]	- Rowden and Ahmad (2000) - Kim and Hong (2016)
	Knowledge/Skill Acquisition	- proficiency, - knowledge acquisition - core skills	- Clarke (2005) - Moon (2010) - Shin (2012)
	Performance	- effectiveness[productivity] - Learning transfer - Innovation Behavior	- Spreitzer et al. (1997) - Bae et al. (2011)

Source: Cerasoli et al. (2018, 206).

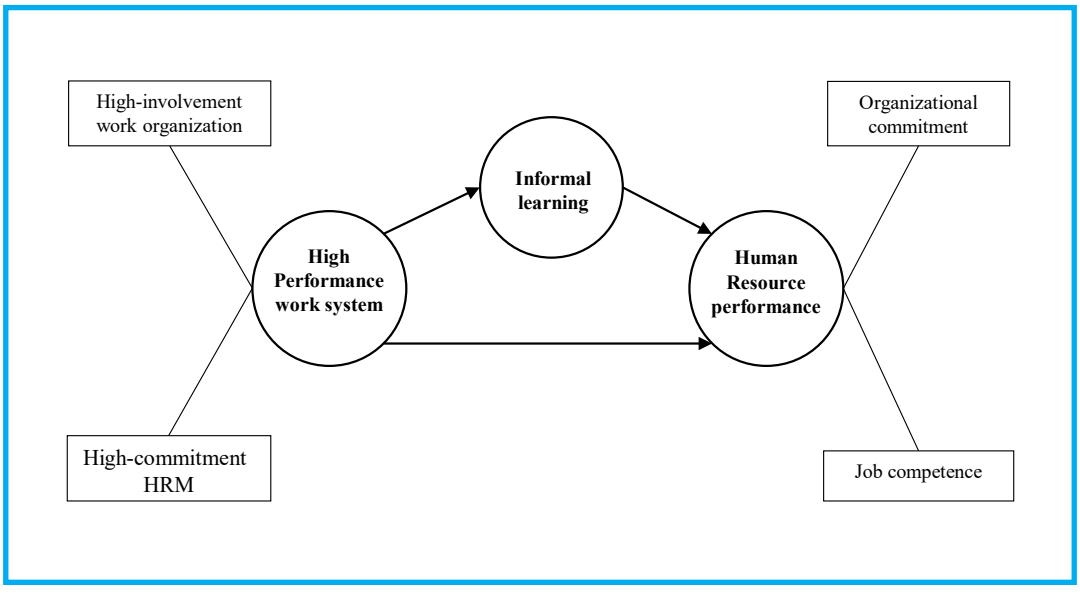
According to previous studies on informal learning, the core concepts of informal learning are 'work experience', 'interaction with others', and 'reflection' (Bae, 2007; Manuti, 2015; Moon, 2010, Marsick & Watkins, 2001). In this study, informal learning will be defined as learning in which workers acquire the knowledge necessary for work by experiences at work, interactions with others in the workplace, and reflection on experiences and interactions (Marsick & Watkins 2001; Moon , 2010). Based on previous studies, this study will examine the relationship of informal learning and human resource performance, and explores the mediating effect of informal learning on the causal relationship between a high-performance work system and human resource performance. Given this preceding discussion, the research hypotheses and model are inferred as follows.

H2: A high performance work system will have a significant effect on informal learning.
H2a: A high involvement work organization will have a positive (+) effect on informal learning.
H2b: High-commitment HRM will have a positive (+) effect on informal learning.

H3: Informal learning will have a significant effect on human resource performance.
H3a: Informal learning will have a positive (+) effect on organizational commitment.
H3b: Informal learning will have a positive (+) effect on job competence.

H4: Informal learning will mediate the causal relationship between a high performance work system and human resource performance.
H4a: Informal learning will mediate the causal relationship between a high involvement work organization and organizational commitment.
H4b: Informal learning will mediate the causal relationship between high commitment HRM and organizational commitment.
H4c: Informal learning will mediate the causal relationship between a high involvement work organization and job competence.
H4d: Informal learning will mediate the causal relationship between high commitment HRM and job competence.

Fig. 1. Research Model



III. Research and Results

1. Research Method

The analysis unit of this study is the perception of accounting experts of the high-performance work system, informal learning, and human resource performance in Korean companies. The data of this study were aggregated from the 1st Human Capital Corporate Panel Survey II (HCCPS) by the Korea Research Institute for Vocational Education & Training (KRIVET). HCCPS was officially approved by the Korea government (Statistical Office approval number: 389003) and was initiated in 2005 to understand the quantitative level of resources in Korean companies, as well as how and what kind of data companies accumulate with regard to human resources. Since then, this survey has been performed every other year as a mid- and long-term panel survey intended to track the same companies. Questionnaires of HCCPS II include a planned set of questions in order to analyze the human resource development of Korean companies and the status of workplace learning. In 2019, HCCPS II aggregated survey responses from 9,053 workers. This paper included data from the survey responses of 1,024 accounting experts in Korean companies for analysis. The demographic composition of the research sample in this study are as follows.

Table 3. Sample Composition

		Personnel	Ratio
Tenure	1-3 years	252	24.6
	4-6 years	258	25.2
	7-10 years	214	20.9
	11-20 years	215	21.0
	More than 21 years	85	8.3
Position	Employee	348	34.0
	Assistant Manager	375	36.6
	Chief Manager	147	14.4
	Deputy Director	91	8.9
	Department Head	50	4.9
	Executive	13	1.3
Education	High school graduate or lower	115	11.2
	Bachelor's Degree	886	86.5
	Master's Degree	22	2.1
	Doctorate	1	0.1
Gender	Male	537	52.4
	Female	487	47.6
Employment Pattern	Full-time Worker	995	97.2
	Part-time Worker	29	2.8
Union Membership	member	62	6.1
	Non-Member	962	93.9
Industry	manufacturing industry	753	73.5
	service industry	271	26.5
		1024	100

The variables of this study were measured as follows.

(a) Independent Variable: The high-performance work system, as an independent variable, was divided into two categories based on previous studies: high-involvement work organization and high-commitment HRM. A high involvement work organization was measured by averaging five items (decision-making participation, task diversity, autonomy, multifunctionality, and team collaboration) for the level of worker participation in decision-making in the work organization. High commitment HRM was measured by averaging five items (talent-oriented HRM, performance-oriented evaluation, diversity in education/training, rewards for innovative activities, fairness in personnel evaluation, and compensation) for the level of human resource management for which workers experienced for corporate purposes.

(b) Mediating Variable: Informal learning, as a mediating variable, was measured by averaging six items (OJT, coaching/mentoring by colleagues, coaching/mentoring by supervisors, knowledge sharing among workers, knowledge sharing through platforms, and job circulation) on the number of informal learning programs participated in by workers.

(c) Dependent Variable: On the basis of Kirkpatrick's educational evaluation model (1983), this study set three-stage evaluation indicators, such as human resource performance (job satisfaction, organizational commitment, productivity, etc.), as the dependent variable. Human resource perfor-mance consisted of organizational commitment and job competence. Organizational commitment was measured by averaging four items for organizational commitment recognized by workers, and job competence was measured by one item about the level of worker proficiency (worker of a simple job, apprentice, worker of a single job, skilled worker of a single job, worker of multiple jobs, skilled worker of multiple jobs, and expert).

(d) Control Variables: In studies by Billett (2004), Cerasoli et al. (2018), and Fuller and Unwin (2003), the development process of worker skill could be influenced by worker demographics such as educational background, position in the workplace, years of service, type of employment, union negotiation, and gender. Hence, control variables influencing skill in this study were measured by accounting expert demographic attributes such as tenure, position, education, male dummy (gender), full-time dummy (employment type), union dummy (union membership status), manufacture industry dummy (industry).

2. Results

First, looking at the results of descriptive statistics analysis, the mean of the high involvement work organization was 3.45 points, and the mean of high commitment HRM was 3.21 points. The high performance work system surrounding the accounting experts of Korean companies appeared to be slightly above the middle level of the total score of 5 points. The mean of accounting expert informal learning was 2.96 points. Accounting expert participation in informal learning in Korean companies appeared to be slightly below the middle level of the total score of 6 points. The mean of accounting expert organizational commitment and job competence in Korean companies were 3.09 points and 3.43 points, respectively.

Looking at the correlation of major variables, the correlation coefficients between a high involvement work organization and high-commitment HRM were all 0.53 ($p<0.01$), and were closely correlated with each other in the two subcategories of the high-performance work system. The correlation coefficient with informal learning and both independent variables was 0.25 ($p<0.01$). The correlation between a high involvement work organization and human resource performance (organizational commitment and job competence) was positive significantly. The correlation between high commitment HRM and organizational commitment was positive significantly. However, the correlation between high commitment HRM and job competence was irrelevant. The correlation coefficient for informal

Table 4. Measurement of Variables

		Measurement
Independence Variable	High Involvement Work Organization	The level of high involvement work organization recognized by workers (5 items, 5-point scale; 1 = not at all, 5 = very much) - Decision-making participation, task diversity, autonomy, multifunctionality, and team collaboration
	High Commitment HRM	The level of high commitment human resource management recognized by workers (5 items, 5-point scale: 1=not at all, 5=very much) - Talent-oriented HRM, performance-oriented evaluation, diversity in education/training, rewards for innovative activities, fairness in personnel evaluation and compensation
Mediating Variable	Informal Learning	Number of informal learning programs participated by workers (6 items, 2 points scale: 0 = Not participating, 1 = Participating) - OJT, Coaching/mentoring by colleagues, Coaching/mentoring by supervisors, Knowledge sharing among workers, Knowledge sharing through platforms, Job circulation
Dependent Variable	Organizational Commitment	Organizational commitment recognized by workers (4 items, 5-point scale)
	Job Competence	The level of workers' proficiency (1 item, 7-point scale: 1. worker of simple job, 2. apprentice, 3. worker of single job, 4. skilled worker of single job, 5. worker of multiple job, 6. skilled worker of multiple job, 7. expert)
Control Variable	Tenure	Length of service
	Position	The level of a worker's position (7-point seventh scale)
	Education	Educational background (8-point scale)
	Male Dummy	Gender (standard variable: female)
	Permanent Employee Dummy	Whether a worker is a regular/non-regular worker (standard variable: non-regular worker)
	Union Member Dummy	Whether a worker joins a union (standard variable: non-union)
	Manufacture Industry Dummy	The industry to which a worker belongs (standard variable: service industry)

learning and organizational commitment was 0.23 ($p<0.01$), and the correlation coefficient for informal learning and job competence was 0.08 ($p<0.01$). The descriptive statistics of the variables are as follows.

Table 5. Descriptive Statistics and Correlation Analysis

	Mean	Standard Deviation	1	2	3	4
High Involvement Work Organization	3.45	0.74				
High Commitment HRM	3.21	0.79	0.53***			
Informal Learning	2.96	1.78	0.25***	0.25***		
Organizational Commitment	3.09	0.75	0.38***	0.55***	0.23***	
Job Competence	3.43	1.51	0.05*	0.02	0.08***	0.21***

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

Hypothesis verification in this study was to analyze the relationship of the high-performance work system and human resource performance, and explored the mediating effect of informal learning on the relationship between a high-performance work system and human resource performance (organizational commitment and job competence). A hierarchical regression analysis for the mediating effect was analyzed according to the method of Baron and Kenny (1986). According to their study, in the first stage regression model, independent variables should have a significant effect on mediating variables. In the two-stage regression model, independent variable should have a significant effect on dependent variables. In the three-step regression model, independent variables and mediating variables should be put in the model at the same time, so that the mediating variables have a significant effect on dependent variables. At the same time, if the regression coefficient of the independent variable is close to '0' or is not statistically significant, it means that there is a complete mediating effect. However, if the regression coefficient of the independent variable is significant, but if it is smaller than the regression coefficient of the independent variable in Step 2, there is a partial mediating effect. Prior to the analysis, the variance expansion coefficient (VIF) of a high involvement work organization and high commitment HRM, which are independent variables, was 1.443 and 1.422, respectively, confirming that there was no problem with multi-colliniarity between the independent variables.

It was found in Model 1 that a high involvement work organization and high commitment HRM had positive (+) effects on informal learning (Hypothesis 2-1 supported, Hypothesis 2-2 supported).

In Model 2, a high involvement work organization and high commitment HRM had positive (+) effects on organizational commitment (Hypothesis 1-1 and 1-2 supported). When comparing the influence of independent variables on organizational commitment, high commitment HRM (β=0.471) had the greatest influence, and a high involvement work organization (β=0.142) appeared in order. In Model 4, a high involvement work organization had a positive (+) effect on job competence (Hypothesis 1-3 supported), but high commitment HRM had no effect on job competence (Hypothesis 1-4 rejected).

It was found in Models 3 and 5 that informal learning had a positive (+) effect on organizational commitment and job competence (Hypothesis 3-1 and3-2 supported).

The fourth step analyzed the mediating effect of informal learning in the causal relationship between a high performance work system and human resource performance. In Model 3, informal learning as a mediating variable was additionally put into Model 2. Comparing the standardized β of the independent variable on

organizational commitment in Model 3 to Model 2, the standardized β of a high involvement work organization decreased from 0.142 ($p<0.001$) in Model 2 to 0.133 ($p<0.001$) in Model 3, and the standardized β of high commitment HRM decreased from 0.471 ($p<0.001$) in Model 2 to 0.461 ($p<0.001$) in Model 3. These statistics show that informal learning has a partial mediating effect on the causal relationship between a high involvement work organization, and high commitment HRM led to organizational commitment (Hypothesis 4-1 and 4-2 supported)

In Model 5, informal learning as a mediating variable was additionally put into Model 4. Comparing the standardized β of independent variable on job competence in Model 5 to Model 4, the standardized β of high-involvement work organization decreased from 0.064 ($p<0.001$) in Model 4 to 0.057 ($p<0.001$) in Model 5, and high commitment HRM had no effect on job competence. These statistics show that informal learning has a partial mediating effect on the causal relationship between a high involvement work organization and job competence, but no mediating effect on the causal relationship between high commitment HRM and job competence (Hypothesis 4-3 supported, Hypothesis 4-4 rejected).

Table 6. Mediating Effect of Informal Learning

		Mediating Variable	Dependent Variable			
		Informal Learning	Organizational Commitment		Job Competence	
		Model 1	Model 2	Model 3	Model 4	Model 5
Control Variable	Tenure	0.109***	0.091***	0.085***	-0.102***	-0.106***
	Position	-0.028	0.170***	0.172***	0.873***	0.874***
	Education	0.050	0.025	0.022	0.039*	0.037
	Male Dummy	0.043	0.046	0.044	-0.012	-0.013
	Regular Employee Dummy	-0.022	0.027	0.028	0.011	0.012
	Union Member Dummy	0.091**	0.049	0.044	-0.045*	-0.049
	Manufacturing Industry Dummy	-0.061*	0.029	0.032	0.009	0.011
Independent Variable	High Involvement Work Organization	0.159***	0.142***	0.133**	0.064**	0.057**
	High Commitment HRM	0.161***	0.471***	0.461***	-0.033	-0.040
Mediating Variable	Informal Learning			0.061*		0.043*
	R^2	0.109	0.387	0.391	0.681	0.682
	Adj.R^2	0.101	0.382	0.385	0.678	0.679
	F-value	13.757**	71.240**	64.938***	240.055***	217.486***
	N			1024		

Note: *$p<0.05$, **$p<0.01$, ***$p<0.001$.

IV. Conclusion

This study aimed to explore how a high-performance work system affected the human resource performance of accounting experts in Korean companies, and examined the mediating effect of informal learning in this causal relationship. As a result, a high involvement work organization and high commitment HRM in Korean companies appeared to be slightly above the middle level of the total score of 5 points. Accounting expert informal learning appeared to be slightly below the middle level of the total score of 6 points. According to hierarchical regression analysis, high commitment HRM showed a greater influence on organizational commitment than a high involvement work organization, and only a high involvement work organization showed a significant influence on job competence. Informal learning showed a significant influence on organizational commitment and job competence. Informal learning had a partial mediating effect on the causal relationship between a high involvement work organization and job competence, but no mediating effect on the causal relationship between high commitment HRM and job competence.

1. Implications

Previous studies have limitations in that they mainly only had a direct relationship between the high-performance work system and human resource performance. By focusing on the mediated effect of informal learning, this research may develop a more comprehensive approach on the 'black box' between the high-performance work system and human resource performance surrounding accounting experts in Korean companies. According to the constructivist perspective of workplace, this study verified the process of influence between a high-performance work system, informal learning, and the human resource performance of accounting experts in Korean companies

This study is of practical significance in that it presented prerequisites and directions for Korean companies to strengthen the capabilities of accounting experts by verifying the positive (+) impact of a high-performance work system for participation in informal learning in the workplace. Most previous studies have shown that companies that invest in and strive for workplace learning have produced high corporate performance (Marsick & Watkins, 1990, 2001; Nonaka, 1994; Skule, 2004). Therefore, in order for Korean companies to strengthen the capabilities of accounting experts in the future, interest and investment in workplace learning should be increased.

2. Limitations and Suggestions for Future Research

This study has the following limitations. First, in adopting a quantitative research method, this study was unable to explore the various context factors having an effect on the human resource performance of accounting experts in Korean companies. Many other variables may influence human resource performance. As a matter of fact, not only contextual factors but also individual beliefs, personal affinities, or personal circumstances (among others) might affect the subsequent outcomes. However, this study could not examine the effect of many variables having an effect on human resource performance. It is necessary to use in-depth case studies, which are qualitative research methods. Second, this study focused only on the causal relationship between a high performance work system and informal learning affecting the human resource performance of accounting experts in Korean companies, and failed to examine the effect of these variables on various human resource performances and organizational performance. In fact, a high-performance work system and informal learning has a positive effect on human capital, commitment, trust, partnership, and social capital, promoting innovation activities, resulting in a positive effect on the organizational performance of labor productivity, sales, and operating profit. Therefore, in future studies, it is necessary to develop a comprehensive research model that can examine this influence process more thoroughly, including additional mediating and moderating variables.

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Research on the Influence of Live e-Commerce Broadcasting on Consumer Purchase Intention Based on Content Marketing

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ABSTRACT

Purpose – In recent years, e-commerce live broadcasting has received attention from theoretical scholars and practical experts for its online interactive promotional capabilities. In the context of e-commerce live streaming, this article provides new ideas for exploring the logic of content marketing by exploring the paths of various dimensions of e-commerce live streaming content marketing on consumer purchase intention, and clarifying the interrelationships among the variables.

Design/Methodology/Approach – Based on SOR theory, this article takes content marketing as the entry point to explore the influence mechanism of e-commerce live content marketing on consumer purchase intention from the perspective of consumers. Empirical data were obtained through questionnaires; 393 valid samples were analyzed using SPSS26 and AMOS26 tools, and research hypotheses were verified using structural equation modeling.

Findings – The four dimensions of content marketing, functionality, entertainment, emotion, and interactivity can positively influence consumer purchase intention to varying degrees. Content marketing positively influences perceived value, perceived value positively influences purchase intention, and perceived value partially mediates the relationship between content marketing and purchase intention.

Research Implications – This study reveals the mechanism of the influence of e-commerce live content marketing on consumer purchase intention, provides guidance for live anchors and e-commerce sellers, and, at the same time, helps consumers understand themselves and make more rational consumption decisions.

Keywords: content marketing, e-commerce live streaming, perceived value, purchase intention, SOR
JEL Classifications: C10, C40, E10, G40

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I. Introduction

Since Taobao took the lead in launching an online live marketing platform for "consumer live streaming" in 2016, major online e-commerce platforms have launched live webcasting services, and live e-commerce has developed rapidly and become a remarkable new highlight of online consumption growth. In 2020, the superimposed effects of the COVID-19 epidemic and extra-long holidays led to a surge in live-streaming users and hours of use. According to Ai Media Consulting, the size of China's e-commerce market was estimated to reach $961 billion in 2020, an increase of 121.5% year-on-year. It suggested a higher growth rate of 1.2 trillion yuan in 2021, and the number will increase to $1,659.4 million in 2023. The penetration rate of live-streaming with goods will rise as high as 20%.

The e-commerce live streaming platform has built an interactive bridge between sellers and consumers, which not only eases the shrinking offline business caused by the epidemic but can even be said to have opened a new era of live streaming. The rise of live e-commerce brings new development opportunities for content marketing. On one hand, compared with text and pictures, live streaming can deliver richer and more vivid information; on the other hand, live e-commerce platforms such as Taobao have a huge user base and can provide traffic for marketing. However, as the cost of customer acquisition rises, conversion rate decreases, traffic dividend maximizes, and the live mode of e-commerce gradually appears as marketing content homogenization, low purchase conversion rate, and other problems arise. More content instead of attracting a wider target audience may even cause a negative impact.

Therefore, current merchants continue to increase investment in and attention to content marketing. Nearly 50% of advertisers had positive confidence in the content marketing market in 2021, and increased investment budgets, with content marketing ranking first in budget increase plans. In addition, major platforms have launched a "content subsidy" strategy, actively tilting content sources and algorithms toward "high-value" content to improve consumer "access" (Li & Du, 2021).

Currently, content marketing research is mainly focused on consumer behavior or corporate brand loyalty, and less research is based on the live-streaming context, which still needs to be studied in depth. Therefore, as one of the hottest areas of e-commerce live streaming, there is still much room for exploration. In the context of the Internet era, the content and medium of marketing are constantly changing and innovating. There is no clear research conclusion on how companies can sell products through e-commerce live streaming platforms, how the effect of different forms of content marketing differs, and how it effects consumer willingness to buy.

In this paper, we study content marketing in the context of e-commerce live streaming, introduce perceived value as a mediating variable, explore the role of content on purchase intention in each dimension of e-commerce live streaming, clarify the interrelationships between variables, and provide new ideas to explore the logic of content marketing, so as to make the theoretical research in this field deeper and more sound, and also provide a valuable reference for enterprises to use live streaming.

II. Literature Review and Research Hypotheses

1. Literature Review

1.1. S-O-R Theoretical Model

The S-O-R (Stimulus-Organism-Response) theory model is a widely applied model in the field of marketing, which suggests that various stimuli influence individual physiological and psychological states, thereby affecting consumer purchasing behavior. The model was initially proposed by Skinner based on research on stimuli and responses, establishing the S-R model by

linking the environment and responses. However, scholars have pointed out that the S-R model is not comprehensive (Shelby, 1986). Subsequently, Mehrabian and Russell supplemented the S-R model from the perspective of environmental psychology, presenting a complete S-O-R theory model that considers intrinsic consciousness and studies the impact of different elements in the environment on individual behavior. Twenty years later, the S-O-R theory model was first applied to shopping environments, and scholars confirmed through empirical research that shopping environments influence customer behavior (Donovan et al., 1994). Consequently, the model gained widespread application in marketing research.

In recent years, the S-O-R theory model has been extensively applied to research on online consumer behavior. Gong et al. (2019) applied the S-O-R model to examine the impact of atmospheric cues in live streaming scenarios on impulse purchase intentions. Zhang et al. (2017) utilized the S-O-R model to investigate the influence of technological features in the context of social commerce on purchase intention. Furthermore, Wang et al. (2019) used the S-O-R model to study the effect of consumer-generated online word-of-mouth (IWOM) in the realm of social commerce on purchase intention. The S-O-R theoretical model provides a solid theoretical foundation for this study with high applicability. Based on this model, this paper will investigate the impact of different content marketing approaches, which are external stimuli, on consumer perceptions of these stimuli and their cognitive emotions, and ultimately on purchase intention.

1.2. Live e-Commerce

Live e-commerce is a combination of e-commerce and webcasting, and is a product of the joint role of society, business, and technology. Live e-commerce can only better attract continuous consumer attention and enhance purchase intention by continuously outputting high-level, personalized, and high-quality content. For example, Zhang et al. (2021) believed that live e-commerce could make consumers willing to buy if it contained knowledge-based application content such as basic product information and functional information. Chen et al. (2022) found that e-commerce live broadcast content with entertainment induced consumers to produce purchase behavior. Wu (2022) proved that e-commerce live broadcasting could drive consumers to produce impulsive consumption behavior through interactive means such as pleasurable emotions and consumption arousal. In many studies, scholars mostly analyze the impact of live e-commerce on consumer consumption behavior from a single level of content. However, they have not explored in detail and comprehensively the different effects of content marketing on purchase intention in the context of live e-commerce.

1.3. Content Marketing

Pulizzi and Barrett (2009) first defined content marketing as a means for companies to attract and retain customers through the production and distribution of a diverse range of educational or entertaining content. Lorenz (2011) argued that content marketing is the art of communicating with customers in a smart way that is not pushy, but rather content-driven, with content that is valuable, relevant, and engaging to consumers. Instead of hard selling, content marketing is based on publishing valuable, relevant, and appealing content that is of interest to consumers, and builds a long-lasting group of followers, ultimately realizing the purpose of sales or communication. Zhou and Chen (2013) argued that content marketing emphasized more customer engagement and attracted consumers to participate by delivering content of interest to the consumer market through various channels. Li (2017) believed that the core of content marketing was to provide audiences with relevant and practical value content that could help consumers solve a practical problem. Zhang and Liu (2017) believed that content marketing was a kind of publicity and

promotional way for enterprises to achieve a final goal by conveying valuable content information to consumers and stimulating willingness to buy.

In the existing literature on content marketing, scholars have made a variety of ways of dividing its dimensions according to the purpose and perspective of the research. It was divided according to form: the three dimensions of dialog, storytelling, and customer interactive participation (Doorn et al., 2010; Zuk, 2009). The division was made according to the type of content, which was summarized into the following five dimensions: functional content, entertainment content, emotional content, interactive content, and self-actualization content (Gao, 2019; Lai, 2017; Yan, 2019, etc.).

By combing the literature and scholars on the dimensional division of content marketing, combined with the actual background of live e-commerce, this paper has four dimensions of content marketing: functional content, emotional content, entertainment content, and interactive content. Functional content refers to the effective and practical information content that consumers can obtain from short videos about the demanded products; entertainment content refers to information content that can make allow consumers to relax feel happy, and easily attract consumers; emotional content refers to content conveyed through product marketing that can move hearts and cause emotional resonance. Functional content realizes emotional appeal, interaction, and information exchange and sharing.

1.4. The Relationship between Content Marketing and Purchase Intention

Zhou and Chen (2013) argued that content marketing emphasized customer engagement, attracting consumers by delivering content that interests them to the consumer market through various channels. Negash concluded, through empirical analysis, that information with more interesting entertainment effects can bring stronger positive perceptions to consumers, and thus impact purchase intentions. He et al. (2016) suggested that content marketing, as a contemporary marketing strategy, was highly desirable in terms of fulfilling diverse consumer demands, including the need for informative, authentic, enjoyable, and emotionally appealing content. Therefore, the following hypotheses are proposed.

H1: Content marketing has a positive impact on influencing consumer purchase intentions.
H1a: Functional content in content marketing has a positive impact on consumer purchasing intention.
H1b: Entertaining content in content marketing has a positive influence on consumer purchasing intention.
H1c: Emotional content in content marketing has a positive impact on influencing consumer purchasing intention.
H1d: Interactive content in content marketing has a positive influence on consumer purchasing intention.

2. Research Hypotheses

2.1. The relationship between Content Marketing and Perceived Value

Kim and Niehm (2009) argued that websites with entertaining content could reduce the loss of information delivery while attracting consumers and improving pleasure in the shopping process. Simultaneously, it enhances the consumer sense of pleasure during the shopping process, making them more likely to form an overall evaluation of the product. Fatima and Lodhi (2015) showed that advertising methods that can stimulate emotions were more likely to influence perceived value. Li and Li (2013) found that advertisements that added interest and attractiveness were more likely to generate positive attitudes toward consumers than advertising content that lacked interest, so they concluded that consumer attention could be attracted by increasing the interest of advertising content to accelerate the perceived value of products and services. Zhang and Liu (2017) highlighted the significance of the scenario-based

and storytelling nature of content marketing as a distinguishing characteristic in comparison to traditional marketing methods. This approach immerses users in an interactive experience, which effectively stimulates customer development of perceived value. In summary, consumers engage in a cognitive process wherein they transform the content created by companies or advertisers, which is valuable, interesting, and emotionally stimulating. This transformation ultimately shapes perceived value. Therefore, the following hypotheses are proposed.

H2: Content marketing has a positive impact on influencing perceived value.
H2a: Functional content in content marketing has a positive impact on perceived value.
H2b: Entertainment content in content marketing has a positive impact on perceived value.
H2c: Emotional content in content marketing has a positive impact on perceived value.
H2d: Interactive content in content marketing has a positive impact on perceived value.

2.2. The Relationship between Perceived Value and Purchase Intention

Based on SOR theory, consumer perception is influenced by external stimuli, which subsequently affects purchase intention. The relationship between perceived value and purchase intention has been repeatedly confirmed by scholars. Wang et al. (2007) found that the greater the perceived benefit and the smaller the perceived risk of product information, the easier it was for consumers to meet their psychological expectations, and therefore were more likely to make corresponding purchase decisions. Liu et al. (2021), in a study on live e-commerce, demonstrated through empirical research that perceived value had a significant positive effect on purchase intention. In a study on travel app embeddedness, Geng and Li (2021) highlighted the perceptions of pleasure derived from app interface design that played a crucial role in facilitating purchase decision-making. Through empirical analysis, they established that perceived value had a significant positive impact on purchase intention, and demonstrated the mediating role of perceived value. In different consumption scenarios, consumers autonomously evaluate the usefulness, reliability, and risk associated with products and services based on their own perceptions, subsequently making corresponding purchase decisions. Therefore, the following hypothesis is proposed.

H3: Perceived value has a positive impact influencing purchase intention.

2.3. The Mediating Role of Perceived Value

Grewal argued that perceived value directly affected purchase intention. Yun (2011) argues that authentic and credible information and resources delivered to consumers will enhance their perception of value, which will make it easier to stimulate the behaviour of consumers to make consumption decisions, and confirms the mediating role of perceived value in his study. Zeithaml (1988) argued that the higher the perceived value of a product or service by consumers, the stronger the willingness to purchase that product or service. Cheng et al. (2020) concluded, from an empirical study, that content marketing with different dominant logic allows consumers to perceive higher usefulness and credibility of product information and lower risk of uncertainty. Consumers were more likely to have high perceived value and higher purchase intention. Liu et al. (2019) showed that the detailed and comprehensive delivery of product information in live streaming e-commerce has a more pronounced influence on purchase intention, especially when mediated by perceived value. Therefore, the following hypotheses are proposed.

H4: Perceived value mediates content marketing and purchase intentions.
H4a: Perceived value mediates functional content and purchase intention.
H4b: perceived value mediates entertainment-

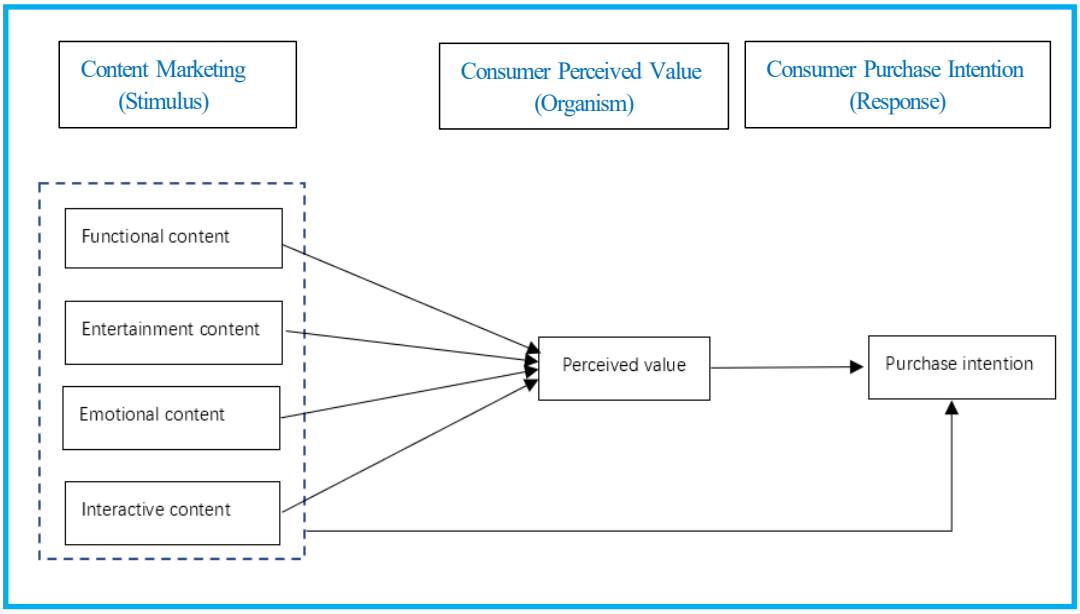
based content and willingness to purchase.

H4c: perceived value mediates emotion-based content and willingness to purchase.

H4d: Perceived value mediates interactive content and purchase intentions.

Theoretical analysis framework of live e-commerce content marketing-perceived value-purchase intention was established based on the above theoretical analysis (as shown in the figure below). This lays the foundation for the following empirical research.

Fig. 1. A Framework for the Mechanism of Content Marketing's Impact on Consumer Purchase Intention



III. Research Design

1. Questionnaire Design

To ensure the reliability and validity of the variables, the metrics of each hypothetical variable proposed were borrowed from the measurement items of latent variables commonly used in foreign literature studies as the theoretical basis, and then referred to the revised measurement items of the theoretical basis in domestic e-commerce related literature. Finally, they were modified and supplemented with the actual use of live e-commerce content marketing.

2. Data Collection and Descriptive Analysis

The data collection process was carried out through a professional questionnaire survey website. There were 427 questionnaires returned, 34 invalid questionnaires were excluded, 393 valid questionnaires were produced, and the sample data was 92.04% effective. For invalid questionnaires, the main method of elimination was to designate option questions, ask questions on the front and back, and delete questionnaires with too short a response time. By conducting ANOVA on the data, there was no sample bias in the demographic

Table 1. Variable Measurement Items

Latent Variables	Measurement Problem Items	Source
Functional Content (GN)	Ability to get information about the product or brand from the live room.	Wiertz and Ruyter (2007)
	I was able to get some practical information from the live broadcast.	
	I was able to get some valuable information about myself from the broadcast.	
	I was able to learn something I wanted to know by watching the live stream.	
Entertainment-Based Content (YL)	I can feel relaxed, fun, and interested while watching the live broadcast of the host.	Liu and Arnett (2000)
	The content of the host‘s live broadcast makes me curious and imaginative.	
	Live anchor broadcasts can be immersive.	
Emotional Content (QG)	The content of the live broadcast can give me emotional resonance.	Sun (2016), Grohmann (2003)
	I think the content of live e-commerce can make me empathize.	
	The content of the live broadcast is relatively easy to understand and realistic.	
	I think live e-commerce content hits the heart.	
Interactive Content (HD)	By following the live-streaming account, I found people with similarities.	David (2009), Mc Alexander et al. (2002)
	By following accounts, I can interact with people who have similarities.	
	By following live posting accounts, I have met interesting people	
Perceived Value (JZ)	By watching the live content, I can get the product information I need.	Korgonkar and Wonlin (1999)
	Watching live content helps in my purchase decision.	
	Watching live content can reduce my risk of blindly following a trend.	
	Watching live content can reduce the risk of buying back products that do not match my own needs.	
Purchase Intention (YA)	If necessary, I will consider buying products recommended by the live broadcast.	Dodds et al. (1991)
	The content of the products recommended by the live broadcast has a great influence on my purchase.	
	I would recommend products from the live stream to others.	
	I think the product recommended by the live broadcast is worth buying.	

characteristics of the valid sample and invalid book (p>0.05).

According to the results of the questionnaire, in terms of gender, 35.4% of the respondents were male and 64.6% were female, which is consistent with the fact that most of our consumption behaviors are made by women. In terms of age, 77.51% were under 30 years old, mainly students, which is consistent with the distribution characteristics of Internet users in China. In terms of disposable monthly income, the highest percentage at 65% was 3000 RMB and below, which is easier to verify when combined with age and occupation. Furthermore, it is easy to verify by combining age and occupation.

IV. Research Results and Analysis

1. Reliability Test

This paper uses SPSS26 to test the reliability of the questionnaire data. The Cronbach's α value of each dimension was greater than the standard value of 0.7, which indicates that the internal consistency of the measurement questions within a single dimension is good. The values of combined reliability (CR) and average variance extracted (AVE) were greater than the standard value of 0.7 and 0.5 respectively, which indicates that the convergent validity of the model is good.

Table 2. Reliability and Convergent Validity Analysis of the Measurement Model

Potential Variables	Measured Variables	Factor Loadings	Cronbach'α	CR	AVE
Functional Content (GN)	GN1	0.879	0.934	0.934	0.780
	GN2	0.889			
	GN3	0.890			
	GN4	0.875			
Entertainment Content (YL)	YL1	0.885	0.900	0.900	0.751
	YL2	0.860			
	YL3	0.854			
Emotion-based Content (QG)	QG1	0.894	0.924	0.924	0.754
	QG2	0.834			
	QG3	0.863			
	QG4	0.881			
Interactive Content (HD)	HD1	0.879	0.887	0.888	0.726
	HD2	0.796			
	HD3	0.879			
Perceived Value (JZ)	JZ1	0.841	0.914	0.914	0.727
	JZ2	0.839			
	JZ3	0.873			
	JZ4	0.856			
Willingness to Buy (YY)	YY1	0.768	0.844	0.845	0.577
	YY2	0.741			
	YY3	0.788			
	YY4	0.740			

2. Discriminant Validity Test

The variables were subjected to a two-tailed test for discriminant validity using SPSS 26, as shown in the table. The values on the diagonal represent the square roots of the Average Variance Extracted (AVE), and the calculated square root values for each construct exceed the correlation coefficients between the factors and other factors. Consequently, the square root values of the AVE for each construct were greater than the correlation coefficients with the other constructs, indicating favorable discriminant validity among the constructs.

Table 3. Differential Validity Test

Dimensionality	1	2	3	4	5	6
Functional Content	0.883					
Entertainment Content	0.388	0.867				
Emotional Content	0.478	0.496	0.868			
Interactive Content	0.342	0.408	0.462	0.852		
Perceptual Value	0.490	0.544	0.580	0.510	0.852	
Willingness to Buy	0.521	0.554	0.608	0.552	0.658	0.760

Note: ** represents $p<0.01$, and the diagonal line is the square root of AVE.

3. Model Testing and Path Analysis

3.1. Model Fit Test

The actual measured values of the fit indicators of the structural equation model in this study and their standard values are organized as shown in the following table, which indicates that all the fit indicators of the structural equation model meet the fit criteria, and the model fits well. It can be seen that the setting of the present theoretical model is acceptable.

Table 4. The Goodness-of-Fit Index of the Structural Equation Model

Fit Index	Reference Value	Test Value
$\chi 2$ / df	<3. 0	1.399
GFI	> 0. 9	0.942
AGFI	> 0. 8	0.925
RMSEA	<0. 08	0.032
NFI	> 0. 9	0.960
TLI	> 0. 9	0.986
CFI	> 0. 9	0.988

3.2. Direct Effect Test

The structural relationships between the latent variables, the estimated values of standardized path coefficients, and the results of hypothesis testing are shown in the table below. With a P-value < 0.05, the hypothesis is valid.

Table 5. Path Fit Test

Path Relationship	Standardized Path Coefficients	S.E.	C.R.	P	Hypothetical Results
Perceived Value ← Functional Content	0.191	0.047	3.946	***	Support
Perceived Value ← Entertainment-Based Content	0.272	0.052	5.22	***	Support
Perceived Value ←Emotion-Based Content	0.265	0.053	4.75	***	Support
Perceived Value ←Interactive Content	0.232	0.049	4.615	***	Support
Purchase Intention ← Functional Content	0.166	0.04	3.548	***	Support
Willingness to Buy← Entertainment-Based Content	0.173	0.044	3.357	***	Support
Purchase Intention ← Emotional Content	0.207	0.045	3.786	***	Support
Willingness to Buy ← Interactive Content	0.231	0.043	4.654	***	Support
Purchase Intention ← Perceived Value	0.293	0.054	4.752	***	Support

3.3. Mediating Effect Test

According to the recommendations of Preacher and Hayes, this paper uses AMOS26 to test the mediating effect using the bootstrap method. Compared to other methods, the bootstrap method does not require assumptions such as normal distribution, which makes up for the weakness of the stepwise test method that cannot test the significance of the mediating effect, and it has a better statistical effect. The model fitting method used in this study is the maximum likelihood method, and by bias-corrected nonparametric percentage bootstrap while utilizing the bias-corrected test method, with 5,000 repetitive samples under the condition of a 95% confidence interval. According to the mediation effect judgment criteria proposed by Wen Zhonglin et al., if the interval of the values of the variables in the 95% confidence interval does not include 0, it indicates that the mediation effect is significant. This study analyzes the mediation effect of structural equation modeling, and the specific results are shown in the following table.

The total mediated effect values of functional content, entertainment content, emotional content, and interactive content acting on purchase intention through perceived value are 0.056, 0.080, 0.078, and 0.068, respectively, with confidence intervals of indirect effects not containing 0 and p-values less than 0.05, indicating that the total mediated effect of these four paths is significant.

Table 6. Bootstrap Mediating Effect Test

Parameter	Estimate	Lower	Upper	P
Functional Content - Perceived Value - Purchase Intention (indirect effect)	0.056	0.019	0.113	0.001
Functional Content - Intention to Buy (direct effect)	0.166	0.060	0.280	0.003
Functional Content - Intention to Purchase (total effect)	0.222	0.109	0.328	0.001
Entertainment-Based Content - Perceived Value - Purchase Intention (indirect effect)	0.080	0.032	0.163	0.000
Entertainment-Based Content - Purchase Intention (direct effect)	0.173	0.049	0.302	0.007
Entertainment-Based Content - Intention to Purchase (total effect)	0.253	0.132	0.381	0.001
Emotional Content - Perceived Value -Intention to Buy (indirect effect)	0.078	0.029	0.160	0.000
Emotional Content - Intention to Buy (direct effect)	0.207	0.078	0.343	0.001
Emotional Content - Intention to Buy (total effect)	0.285	0.154	0.419	0.001
Interactive Content -Perceived Value - Intention to Buy (indirect effect)	0.068	0.031	0.127	0.000
Interactive Content -Intention to Buy (direct effect)	0.232	0.095	0.372	0.001
Interactive Content - Intention to Buy (total effect)	0.300	0.162	0.435	0.001

V. Conclusion

Based on the literature review, this paper establishes an e-commerce live streaming content marketing model based on the SOR model and rational behavior theory. Taking consumers with experience watching live webcasts as the research sample, structural equation modeling was used to examine the relationship between content marketing and purchase intention, and at the same time, the mediating role of perceived value was verified in the process. The empirical results led to the following conclusions. The (1) four dimensions of content marketing positively affect consumer willingness to buy; (2) content marketing positively affects perceived value; (3) perceived value positively affects willingness to buy; and (4) perceived value partially mediates the relationship between content marketing and willingness to buy. The findings of this paper contribute to both theoretical and practical applications related to the factors influencing consumer purchase behavior in the live e-commerce environment.

1. Theoretical Contributions

First, most existing research on content marketing focuses on brand loyalty and perceived attitudes, and there are relatively few articles exploring the effect of content marketing on purchase intention. Based on the S-O-R theoretical model, selecting content marketing as the independent variable and referring to relevant literature, this study explores the four dimensions of functional content, entertainment content, emotional content, and interactive content to explore the role of content marketing on purchase intention, which enriches the theoretical research on content marketing based on the current situation of China, to a certain extent, and reveals the deeper logic and meaning of content marketing. This reveals the deep logic and meaning of content marketing.

Secondly, we introduced perception as an intermediary variable, and started from the internal factors of consumers to explore the mechanism of perceived value between content marketing and purchase intention, which improves the path of the influence of live e-commerce content marketing on purchase intention, and enriches and expands the relevant theories in the field of marketing.

2. Management Insights

2.1. Enterprises should prioritize content marketing as a powerful tool

Future competition is ultimately about content, not just traffic. Research shows that content marketing improves consumer trust and stimulates buying intent, making it a critical part of marketing. Utilizing e-commerce live broadcasting as a new channel, enterprises can craft meticulous marketing content that integrates brand and product features. By deeply understanding consumer needs and forging closer connections, enterprises can provide additional value and establish long-term relationships. This approach elevates market quality, transforms content into brand value, and leads new consumer trends, promoting the growth of e-commerce live content marketing.

2.2. Content marketing should prioritize the functionality, entertainment, emotionality, and interactivity of live content

The process should provide informative content on product function, appearance, and operation, reducing consumer risk perception and information asymmetry. Exploring interactive entertainment expressions and innovating live broadcast modes can enhance the audience‘s e-commerce live broadcast experience, achieving greater dissemination and promotional effects. Emotional content enhances consumer well-being and fosters empathy, leading to a preference for a good and transferring emotions to the product or brand, thereby driving purchasing intent. Attention should be given to the seamless combination of informational, emotional, and entertainment content, using effective marketing skills and expression forms. For instance, demonstrating product usage in various scenarios and fostering positive interactions with consumers enhances consumer presence, increases purchase intent, and ultimately drives sales.

2.3. Focus on perceived transformation

Perceived value acts as a mediator between content marketing and purchase intention. High-quality content satisfies consumer product information needs. Attractive highlights create consumer addiction, while emotional marketing content evokes resonance. However, marketers should control the degree of publicity to stimulate perceived value discreetly, building consumer trust and reducing online shopping risks. By establishing product trust and minimizing perceived risk, the transformation of perceived value in consumer psychology enhances the likelihood of stimulating the desire to buy recommended products. It is crucial for marketing content to align with an enterprise’s products,

avoiding over-exaggeration and false claims that can negatively impact consumer perceptions.

3. Research Limitations and Future Perspectives

This study validates the theoretical model through actual data, which is of some research significance in theory and practice, but limited to the research capacity, there are still some limitations. (1) This study did not conduct an in-depth analysis of the demographic characteristics of the sample for different characteristics of the population, such as gender, age, and so on, so the conclusions obtained may be different, and in the future, we can consider an in-depth empirical analysis of this aspect of the factors. (2) The data collection method in this study adopts the traditional questionnaire research, and the data collection method is limited. Therefore, a combination of multiple data collection methods can be adopted in future research to make the data more convincing. (3) There are different conversion mechanisms between content marketing and purchase intention. In future research, we can study the moderating role of product involvement in different dimensions of content marketing and perceived value, or we can also enrich the research model by exploring other moderating variables, such as product type, information source, and consumer attitudes.

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Impact of International Trade on the Share Prices of the Industrial Bank of Korea Using Stochastic Prediction Modeling*

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ABSTRACT

Purpose – The share price of any financial institution fluctuates due to various hidden and visible factors. Predicting share price behavior in the economy and financial marketing theory is crucial but complex. The Industrial Bank of Korea's (IBK) share prices are also affected by hidden factors, including Korean international trade flow. The study aims to forecast hidden impacts on IBK share prices resulting from the international trade flow in Korea.

Design/Methodology/Approach – Two Hidden Markov Model (HMM) approaches are employed, one based on exports, and the other on imports, to identify trends and fluctuations in the hidden states influencing visible states.

Findings – The findings reveal a significant positive correlation between IBK share prices and both exports and imports. Notably, increasing exports indicate a 50% probability of IBK share prices rising, while falling imports indicate a 56% chance of IBK share prices increasing. These results demonstrate how changes in exports and imports impact IBK's share price in the Korean stock market.

Research Implications – The research implications are valuable for short- and long-term investors in IBK shares and the Korean stock exchange. This research can help decision-makers identify the relationships between and within the visible/observed states that influence the stock price of IBK.

Keywords: forecasting, portfolio management, stochastic modelling
JEL Classifications: C02, C53, C58, F17, F31

I. Introduction

The stock market functions as a dynamic and efficient global network that enables crucial economic activities, determining stock value through market stability. The global stock market is a marketplace that reflects the world's economic activities. It serves as a platform where people

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purchase and trade company ownership in the form of equity shares, facilitated by stockbrokers. The stock market accommodates both investors and traders that pursue both short-term and long-term gains from investment endeavors. Traders strive for quick profits by closely monitoring and capitalizing on minor fluctuations in share prices. On the other hand, investors adopt a long-term outlook, aiming to gain from the growth in capital value over time.

The dynamic forces in the market lead to daily fluctuations in stock values. A stock exchange is an authorized platform where equity transactions take place. The Korean Stock Exchange (KRX) handles the majority of South Korean stock transactions. In terms of market capitalization, KRX ranked 14th in the world, and is a globalized market.

The Industrial Bank of Korea (IBK) is a commercial banking institution founded in 1961. The primary objectives of this institution are to support small and medium-sized enterprises (SMEs) by offering development finance and related banking services. The business of this independent institution is divided into five segments: credit cards, loans, foreign exchange, trusts, and deposits.

Until 1994, the Korean government held the entire issued share capital of IBK. However, since 1994, the government's shareholding has gradually decreased through the issuance of additional shares to the public and growth in employee stock ownership. As of 2015, the percentage of shares owned by the Korean government was approximately 50.6%. According to the IBK Act, the Korean government has complete control over the management, strategies, and activities of IBK.

To provide Korean SMEs access to services wherever they conduct business, IBK has expanded its global operations to include all six continents. It has been particularly focused on expanding its reach across Asia, where Korean SMEs are most prevalent. For instance, IBK China Ltd., a subsidiary bank formed under Chinese law, had eight branches and eight sub-branches throughout China as of the end of 2015. In addition, IBK currently operates three representative offices and 24 foreign branches spread across 11 nations. The value of IBK shares depends on various factors, and the volume of Korean international trade is one significant factor.

The potential for significant profit opportunities by predicting stock values serves as a key motivator for research and exploration in this field. Various elements within the stock market can exert influence on stock prices, encompassing political factors, the state of the economy, company performance, industry dynamics, international trade (import and export volumes), corporate indicators, overall national economic health, and investor psychological behavior, among others.

The utilization of Markov chain models and Hidden Markov Models (HMM) can prove highly beneficial in analyzing and forecasting future stock price patterns within the financial market. Within an HMM, the factors that impact stock prices are termed "hidden states". These states are not directly observable and adhere to the Markov property, while states dependent upon them are visible and observable. An HMM is based on the assumption that a hidden Markov process determines the probability distribution of visible factors.

This study aims to predict the share price of the Industrial Bank of Korea (IBK), which is influenced by different factors, such as exports and imports. These factors, which remain hidden, are considered the hidden states of the models. In this paper, we employ two different models to forecast the impact of the volume of international trade on the share price of IBK.

The first model incorporates three hidden states: decrease (D), constant (C), and increase (I) in the amount of exports. The three visible states of the model are the corresponding changes in the share price of IBK: loss (L), no change (N), and gain (G). Similarly, the second HMM consists of three hidden states: fall (F), same state (S), and rise (R) in the volume of imports. The three visible states are loss (L), no change (N), and gain (G) in the stock price of IBK.

Using these models, we identify the trend and extent of fluctuations in hidden data sets, such as exports and imports in South Korea, which

influence the stock prices of IBK. Furthermore, we examine the relationship between exports and imports with the share prices of IBK through probability measures.

This paper provides a clear overview for analyzing and estimating the impact of South Korea's international trade on the share price of IBK using stochastic modeling. The first section offers a critical overview of HMMs and their applications. The second section presents a concise literature review on Korean international trade and its forecasting. Section 3 provides a brief methodology of HMM with diagram representations. Section 4 illustrates the parameter estimation, forecasting, and statistical analysis with a brief discussion of the results. The findings and conclusion of this research are reported in the final section.

II. Literature Review

Over the past few years, a substantial volume of research has emerged with the aim of discovering an optimal (or nearly optimal) model for analyzing and predicting stock market behavior. In this quest, various statistical time series analysis methods, such as linear regression, ARMA, and multiple regression models, have played a significant role in forecasting research (Kimoto et al., 1990). Traditional statistical prediction models are typically built upon linear time series data. However, Hidden Markov Models (HMMs) offer a versatile solution for dealing with time series data, whether linear or nonlinear, when evaluating market situations and transitions between different states. HMMs can be described as statistical Markov chain models, assuming the system being modeled is a Markov process with hidden or unobservable states. The concept of Markov chains was initially introduced by the Russian mathematician Andrei Andreevic Markov (1856–1922). Subsequently, in the late 1960s and early 1970s, Mor et al (2021) and Rabiner (1989) conducted a series of studies on hidden Markov models and the applications.

An illustrative example of the utilization of Markov models in decision-making was demonstrated by Landeta et al. (2014), who employed a Markov model to determine the best strategy for managing an orange farm. Compared to linear programming, policy iteration, a technique based on Markov models, requires fewer calculations to arrive at the optimal solution, making it more efficient.

In the context of Markov chains, the transition of states from one to another, in discrete time, is referred to as "state transitions". According to Alghamdi et al. (2016), Markov chains exhibit a memory-less property, also known as the Markov property, which means that the probability of moving the system from one state to another depends solely on the current state of the process and is independent of its previous history.

There exists significant literature supporting a strong link between the international trade and banking system of a country. Dia and VanHoose (2017) stated that the international trade of a country is an important factor for the overall capital intensity of the national banking system. Caballero et al. (2018) employed a gravity approach to model trade among 66 countries over a span of 24 years, incorporating fixed effects. The study revealed that new banking has a substantial impact on a country's international trade. The underlying theoretical model explored the significance of financial intermediaries in facilitating large-scale, high-return projects, leading to a comparative advantage in manufacturing industries for economies with well-developed financial sectors (Beck, 2002).

Hur et al. (2006) utilized industry-level data for 27 industries in 42 countries, focusing on firm reliance on external finance and asset tangibility. They found that economies with higher levels of financial development tend to have greater export shares and more favorable trade balances, particularly in industries with intangible assets.

Furthermore, Chaudhary et al. (2016) discovered a long-run relationship between exchange rates and exports in over half of the sample countries, but this relationship was only evident in one sample country when analyzing imports.

In contrast, Niepmann and Schmidt-Eisenlohr (2017) observed that the significant short-run relationship between variables was not prevalent in the majority of sample countries. Additionally, it is worth noting that international trade plays a crucial role in the functions and value of banking shares.

Numerous researchers have employed Hidden Markov Models (HMMs) to analyze and predict share prices in the stock market. For instance, Hassan and Nath (2005) utilized an HMM to predict share prices in interconnected markets, using four states of observations: close, open, high, and low share prices, to forecast future closing share prices for various airline stocks. In a different context, Guidolin and Timmermann (2006) applied an HMM with four states and multiple observations to examine asset allocation decisions based on state-switching in market returns. Similarly, Kritzman et al. (2012) utilized a two-state HMM to forecast the inflation rate, market volatility, and industrial production index.

To analyze time series data, Gupta and Dhingra (2012) proposed a posterior hidden Markov prediction model. They employed share prices observed on one day, such as the high and low values of shares, to forecast the share price for the next day.

Xing et al. (2013) presented a strategy utilizing a Hidden Markov Model to predict trends in stock prices and uncover the hidden relationships between stock prices and their correlations with the HMM. Nguyen (2017) conducted an analysis and implementation of the Hidden Markov Model for predicting technology stock prices. They used historical data from companies like Apple, Google, and Facebook to forecast daily stock prices.

In another study, Nguyen and Nguyen (2015) applied the HMM to forecast the hidden state of market data, enabling them to select stocks based on the projected state. Holzmann and Schwaiger (2016) explored states and state space in an HMM, and discovered the state with the highest volatility during the financial crisis. Liu and Wang (2017) employed a three-state HMM to describe the time-changing distribution of Chinese stock market returns. Furthermore, Nguyen (2018) discussed the application of HMMs in stock trading, focusing on stock price predictions.

The role of order imbalance in predicting the price movement of various companies was investigated using the Thai and Korean stock exchanges, each characterized by distinct liquidity levels. The model with lower liquidity demonstrated the ability to generate signals with an average hit ratio of 0.83, successfully predicting positive price movements in risky assets at a 5-minute frequency (Huang et al., 2019).

Huang et al. (2019) explored non-homogeneous HMMs and proposed an improved EM approach to detect bull and bear market movements. Similarly, Suda and Spiteri (2019) made comparisons using the S&P 500, a widely studied stock index in finance research, to study market movements. Liu (2019) proposed an HMM to model transitions in the states of an economy, and examined option pricing as the pricing system shifted risks. Ryou et al. (2020) suggested a momentum investment approach using an HMM to identify stocks in an increasing state. They created an HMM momentum portfolio with 890 Korean stocks and analyzed the performance from 2000 to 2018. Ryou et al. (2020) also utilized an HMM for investment selection in growing equities. They developed an HMM momentum strategy with 890 Korean stocks and assessed their performance from January 2000 to December 2018. Their findings suggested the effectiveness of the HMM-based momentum investment approach in predicting the Korean stock market. Additionally, Dar et al. (2020) presented a time series approach for visualizing and forecasting South Korea's international trade profile. Moreover, the impact of international trade on the efficiency of central banks was studied in a seperate work by Dar et al. (2021).

Hence, it is evident that Hidden Markov Models (HMMs) find extensive application in analyzing stock market data. This paper presents a comprehensive analysis of the impact of international trade on the share price of IBK in South Korea, along with its forecasting, utilizing stochastic modeling, specifically HMMs. The first section critically reviews HMMs, their

applications, and briefly discusses relevant literature. In Section 2, a concise methodology of the HMM is outlined, accompanied by a diagrammatic representation. Section 3 covers parameter estimation, forecasting, statistical analysis, and a brief discussion of the results. Finally, the paper concludes with the findings and conclusions drawn from the empirical study.

III. Research Methodology

Currently, various forecasting techniques are employed by different analysts and researchers in this field. In this section, we develop the methodology for forecasting stock prices using the HMM.

1. Markov Chain Model (MC-Model)

The Markov chain model is a stochastic model that characterizes a sequence of potential events, wherein the probability of each current event depends solely on its immediate preceding event, disregarding any prior events. Thus, in a Markov chain, given X_t (current state), the state $X_{(t+1)}$ (the future state) depends only upon X_t, not on $X_{(t-1)}, \ldots, X_2, X_1, X_0$. Because of its Markovian characteristics, the Markov chain exhibits a lack of interest in analyzing information and predicting behavior with respect to past states and preferences. Mathematically, in the Markov property, if $X_n; n=0,1,2,\ldots, t, t+1$ is a random process with a discrete state space S, then for $t=1,2,3 \ldots$

$$P\left(\frac{X_{t+1}=x_{t+1}}{X_t=x_t, X_{t-1}=x_{t-1}, \ldots, X_1=x_1, X_0=x_0}\right) = P\left(\frac{X_{t+1}=x_{t+1}}{X_t=x_t}\right) \quad (1)$$

The state-space, denoted as the countable set S,, contains all possible values. Over time, the condition of any state in the system may undergo changes. The transition probability, represented by a_{im}, indicates the likelihood of the process moving from one state i in the n^{th} step to another state j in $(n+1)^{th}$ step. Therefore,

$$a_{ij} = P\left(\frac{X_{n+1}=j}{X_n=i}\right) \forall i,j \in S and n \geq 0, 1 \leq i,j \leq n \quad (2)$$

2. Hidden Markov Model (HMM)

The HMM represents a statistical Markov model in which the system under consideration, labeled X, constitutes a Markov process characterized by hidden or unobservable states. Additionally, there exists another process, Y, whose movements are influenced by hidden process X. Suppose $\{X_n\}$ *and*$\{Yn\}$ to be two stochastic processes such that $n \geq 1$, then the pair $\{X_n, Yn\}$ is an HMM, given that the first process $\boldsymbol{X_n}$ follows the Markov property with an invisible trend behavior, and the equation is given as:

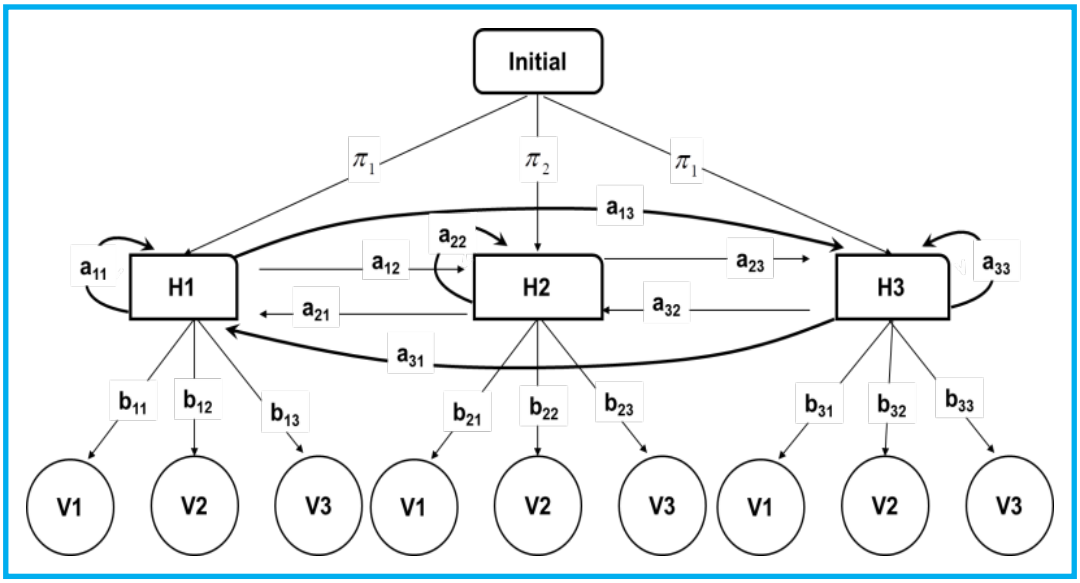
$$P\left(\frac{Y_t=y_t}{X_1=x_1, X_2=x_2, \ldots, X_t=x_t}\right) = P\left(\frac{Y_t=y_t}{X_t=x_t}\right) \forall n \geq 1 \quad (3)$$

In probabilistic models, HMM enables the examination of both observable and unobservable events, which are considered causal factors. Therefore, HMM is a stochastic model wherein the hidden states follow the Markov Property, and it surpasses other models in terms of accuracy (Frydenberg, 1990). In this study, the HMM contains two sets of states: namely, hidden states and visible states. It has the following three probability sets: the initial state probability vector (IPV), state transition probability matrix (TPM), and observation probability matrix (OPM). The parameters or elements of an HMM (λ) are indicated by A, B, and π, and are determined using the supplied or given input values. The complete HMM is written as follows. λ) are indicated by $\lambda = (A, B, \pi)$, where A is a square matrix of dimension 'N', referred to as the transition matrix or (TPM), B is an $N \times M$ rectangular matrix of observation probabilities known as the observed probability matrix (OPM), and the 'N' dimensional vector π contains the probability of hidden states, known as the initial probability vector (IPV).

The fundamental concept behind an HMM is that an unobservable Markov process governs the probability distribution of observable data. Thus, the specification of an HMM involves the transition density of the underlying Markov chain and the probability laws that govern the observable states of the chain. Once such a model is established, we proceed to estimate all the parameters it contains.

The parameters of the HMM are visually represented through a diagram known as a schematic diagram or state transition diagram. In Fig. 1, the schematic diagram illustrates the transitions between hidden states and visible states, with arrows depicting the connectivity within and between states.

Fig. 1. Trellis Diagram of a Three by Three HMM



Wherein H_1, H_2, H_3 and V_1, V_2, V_3 are the three hidden and visible states, respectively.

3. Model Parameters

Because the movement of hidden or influencing factors has been separated into three states, the transition probability matrices will also include these three states, resulting in a 3×3 TPM. The

transition probability matrix (TPM) is a matrix that denotes the probabilities of transitioning between states. The elements of the TPMs are all positive with the row's total unity. The TPM for the HMM is denoted by Matrix A with the elements $A=\{a_{ij}; i, j = 1,2,3\}$, and the transition probabilities among th ehidden states from i^{th}toj^{th} are written as:

$$a_{ij} = P\left(\frac{X_n=j}{X_{n-1}=i}\right) \geq 0; \frac{s}{t}\sum_{j=1}^{3} a_{ij} = 1, i = 1,2,3. \quad (4)$$

Therefore, the 3×3 TPMs are in the form $A = [a_{ij}]_{3\times3}$

The observed probability matrix (OPM) comprises emission probabilities from hidden states to visible states. Each element in the OPM is non-negative, and the sum of each row is equal to one. The elements of OPM are denoted as $b_{ij} \geq 0$, $\forall i,j$=1,2.3, and the probabilities from the i^{th} hidden state to the j^{th} visible state, or the transition between the states, are written as:

$$b_{ij} = P\left(\frac{y_m=j}{X_m=i}\right) \geq 0; \frac{s}{t}\sum_{j=1}^{3} b_{ij} = 1; \forall i = 1,2,3. \quad (5)$$

Therefore, the 3×3 OPM are of the form $B = [b_{ij}]_{3\times3}$

Finally, the IPV is a vector that contains the probabilities of all hidden states. Mathematically, the elements of IPV are written as:

$$\pi_i = P(X_0 = i); \frac{s}{t}\sum_{i=1}^{3} \pi_i = 1 \forall \pi_i \geq 0; i = 1,2,3. \quad (6)$$

Therefore, the 1 × 3 observed probability matrices are in the form $\pi = [\pi_{ij}]_{1\times3}$.

IV. Empirical Data Modelling Analysis, Results, and Discussion

In this paper, we use monthly data on the amount of exports and imports of South Korea as the two hidden data sets that influence the closing share price of IBK, which represents the visible data set. The objective of our study is to measure the impact of changes in South Korea's exports and imports on the share price of IBK.

The monthly data sets for South Korea's exports and imports, as well as the closing share price of IBK, were collected from various sources, including Bloomberg, World Bank Group (https://data.worldbank.org/), Yahoo Finance (www.yahoofinance.com), and national and international economic magazines. The data was compiled using Excel, SPSS, and Stata software.

In this study, we utilize international trade variables, namely imports and exports (in 1000 USD), as the hidden states. The share price of IBK is considered the visible state. Accordingly, our aim is to estimate and forecast the influence of international trade on the share price of IBK. The

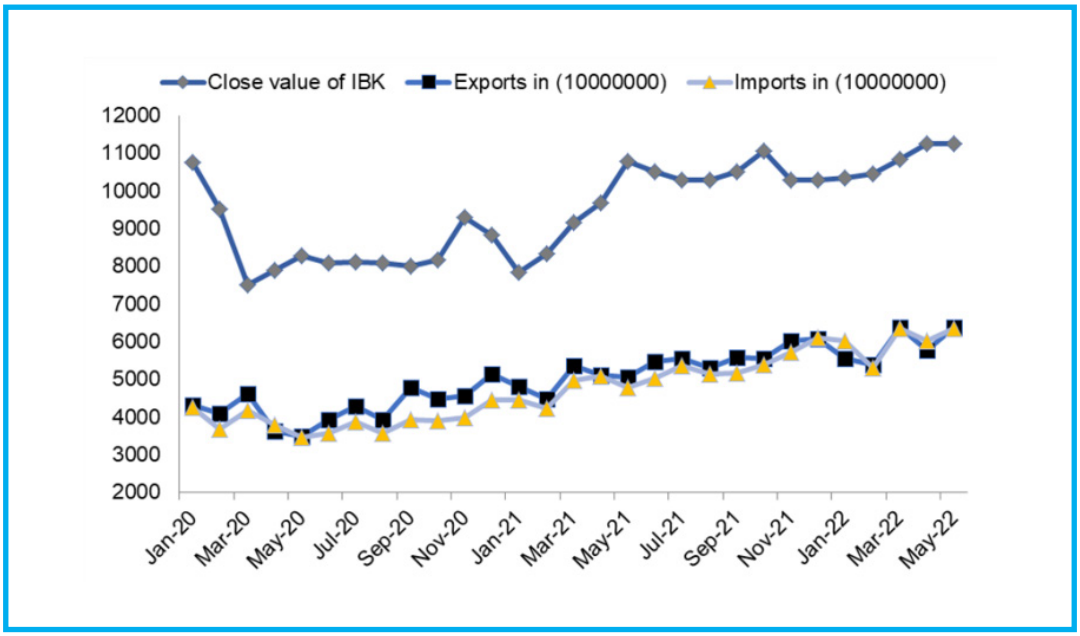
summary of the collected data sets for IBK share prices, as well as the exports and imports of South Korea, are presented in Table 1.

Table 1. Statistical Summary of Variables

Variable	Mean	SD	CV	Range	ρ
Share Price of IBK	9508.6206	1211.2197	12.738	3750	1.00
Exports	50060889.5000	7834882.2000	15.650	28938678	0.75
Imports	47707527.9300	8909430.6000	18.675	28919074	0.80

In the table above, the correlation between IBK and exports is calculated as 0.753, while the correlation between IBK and imports is 0.804. These values indicate a significant correlation between the share prices of IBK and the country's exports and imports. Therefore, it can be observed that the share price of IBK is highly influenced by the international trade of South Korea, as depicted in Fig. 2 below.

Fig. 2. Fluctuation of Share Prices of IBK Relative to Trade



In this paper, a comparative study is carried out using two different HMMs. The first HMM is based on exports and the share price of IBK, where changes in exports serve as the hidden states, and

the corresponding changes in the share price of IBK are the visible states. In the second HMM, changes in imports act as the hidden states, and the corresponding changes in the share price of IBK are the visible states. We compare the outcomes of both models using the elements of the observed probability matrices. Consequently, we can predict how exports and imports influence the share price of IBK.

1. Model I: Influence of Exports on Stock Price

The hidden states of the first HMM indicate the change in the amount of exports: namely, decrease (D), constant (C), and increase (I). The corresponding visible states are loss (L), no change (N), and gain (G) in the share prices of IBK. These three hidden and three visible states in the first HMM are defined as follows.

1.1. Hidden States of Model I.

The hidden states of Model I are defined on the basis of the difference between the next month and the previous month's export amount. Symbolically, we define these three states as follows.

$H_1 = D$: When $D_1 < -1000000$, there is a decrease in exports.
$H_2 = C$: When $-100000 \leq D_1 \geq 1000000$, exports are constant.
$H_3 = I$: When $D_1 > 1000000$, there is an increase in exports.

Where, $D_1 = (x_t - x_{t-1})$; x_t is the current month, and x_{t-1} is the previous month's amount of Korean exports.

1.2. Visible States of Model I

Similarly, the three visible states are assumed on the difference between the next month's and the previous month's closing share prices of IBK. Symbolically, we define these three states as follows.

$V_1 = L$: When $d_1 < -100$, the IBK share price is in the state of loss.
$V_2 = N$: When $-100 \leq d_1 \leq 100$, the IBK share price has no change.
$V_3 = G$: When $d_1 > 100$, the IBK is in the state of gain.

Where, $d_1 = (y_t - y_{t-1})$: y_t is the current month, and y_{t-1} is the previous month's closing share price of IBK.

In this section, the aim was to observe the effect of exports on the share prices of IBK. The data sets of exports and closing share price of IBK are converted in to states in MS excel using the IF function.

2. Parameters of Model I

In Model I, the parameters include the initial probability vector, transition probability matrix (A_1), and observed probability matrix (B_1). Therefore, Model 1 is denoted $\lambda_1 = (A_1, B_1, \pi_1)$. The estimated values of the model parameters are discussed in the following subsection.

2.1. Initial Probability Vector of Model I

To compute the IPV, we first need to obtain the initial frequency table. The initial frequency vector represents the frequency of invisible states, as presented in Table 2.

Table 2. Initial Frequency Table for Exports

States	Decrease (D)	Constant (C)	Increase (I)	Total
Frequency	11	5	12	28

The IPV indicates the probabilities of the hidden states. From the initial frequency table

given above, the required IPV denoted by π_1 are given by:

$$\begin{matrix} \boldsymbol{D} & \boldsymbol{C} & \boldsymbol{I} \end{matrix}$$
$$\boldsymbol{\pi_1} = [0.2928 \quad 0.1786 \quad 0.4286]$$

This vector reveals that, for the change in the amount of exports from South Korea, there is a 39% chance of decreasing, 18% chance of the exports remaining the same, and a 43% chance of increasing.

2.2. Transition Probability Matrix of Model I

The TPM of an HMM represents the probabilities of the system transitioning from one state to another within a single time unit. The TPM is the matrix of transition probabilities of shifting to hidden state *j* from hidden state *i*. The elements of TPM are denoted by a_{ij} and defined as $a_{ij} = P\left(\frac{X_{t+1} = j}{X_t = i}\right)$. To calculate the TPM, we need to obtain the transition frequency table. The transition frequency matrix of the real time data are presented in Table 3 below.

Table 3. Transition Frequency within States

	Decrease (D)	Constant (C)	Increase (I)	Total
Decrease (D)	1	3	6	10
Constant (C)	3	0	2	5
Increase (I)	7	2	3	12

From the above given transition frequency table, we obtain the transition probability matrix for shifting states. The TPM for this model is denoted by A_1, and it is obtained as follows:

$$\begin{matrix} & \boldsymbol{D} & \boldsymbol{C} & \boldsymbol{I} \\ D & & & \\ C & & & \\ I & & & \end{matrix}$$
$$A_1 = \begin{bmatrix} 0.10 & 0.30 & 0.60 \\ 0.60 & 0.00 & 0.40 \\ 0.58 & 0.17 & 0.25 \end{bmatrix}$$

The first row of the transition matrix represents a scenario when exports from South Korea are decreasing in the current month. There is a 10% chance that the exports will decrease further, a 30% chance that the exports will remain the same, and a 60% chance that the exports will increase in the next month.

The second row of Matrix A_1 indicates that if the exports remain in the same state as the current month, there is a 60% likelihood of exports decreasing, a 0% probability of the exports staying the same, and a 40% likelihood of exports increasing.

The third row of the matrix above represents that when exports from South Korea are increasing, the probability of shifting to the decreasing state is 0.58, the probability of remaining the same is 0.17, and the probability of increasing further is 0.25.

2.3. Observed Probability Matrix of Model I

The OPM is the matrix of observed or emission probabilities from hidden states to visible states. The elements of the OPM represent the conditional probabilities of observed states, given the hidden states. In this model, the changes in exports from South Korea are considered the hidden states: namely, decrease (*D*), remain constant (*C*), and increase (*I*). These hidden states influence the visible states, which represent the changes in

the share prices of IBK, categorized as loss (L), no change (N), and gain (G). The elements of OPM are denoted by b_{ij}, and are defined as $b_{ij} = P\left(\frac{Y_t=j}{X_t=i}\right)$. The observed frequencies shifting from the invisible states to visible states are obtained from the real-time data set, and are described in Table 4.

Table 4. Observed Frequency of Shifting Parameters

	Loss (L)	No Change (N)	Gain (G)	Total
Decrease (D)	5	3	3	11
RemainSame (S)	1	1	3	5
Increase (I)	2	4	6	12

The OPM of the parameters shifting from hidden states to visible states was calculated using MS Excel. The probabilities of a parameter shifting from the states of exports to the states of share prices of IBK are shown in Matrix B_1. This matrix illustrates the influence of hidden states over the visible states, thus revealing how the share price of IBK changes based on changes in exports, which is the main purpose of this study. The OPM for Model I is denoted by B_1, and is defined as follows:

$$B_1 = \begin{array}{c} \\ D \\ C \\ I \end{array} \begin{array}{c} \begin{array}{ccc} L & N & G \end{array} \\ \begin{bmatrix} 0.46 & 0.27 & 0.27 \\ 0.20 & 0.20 & 0.60 \\ 0.17 & 0.33 & 0.50 \end{bmatrix} \end{array}$$

This matrix reveals the influence and extent of the change in hidden states on the visible states. The first row in Matrix B_1 reveals that when exports are in a decreasing state, the probability of experiencing a loss, no change, or gain in the share prices of IBK is 0.45, 0.27, and 0.27, respectively. The second row reveals that if the amount of exports remains in the same state, there is a 20% likelihood of a loss, 20% likelihood of no change, and 60% chance of a gain in the share prices of IBK. Finally, when the exports are in an increasing state, the probability of a loss is 16%, no change is 33%, and a gain is 50%. In the above matrix, it is observed that when exports are increasing, the share prices of IBK will be in the state of gain, with maximum probability. In this study, the HMM was used to predict the share prices of IBK by identifying the trend movement of exports from South Korea using the transition and observed probability matrices. The corresponding schematic diagram of this model is presented in Fig. 3. The numbers on the respective arrows represent the probabilities of the parameters shifting states.

3. Movement of Exports and Share Price of IBK

Monthly data regarding exports from South Korea were collected for 29 months, specifically from January 2020 to May 2022. The monthly movements in exports are presented in Fig. 4, along with future predicted movement. The dotted line in Fig. 4 represents the future trend of exports from South Korea, covering the period of June 2022 to January 2023.

Similarly, the monthly trend movement in the share prices of IBK is presented in Fig. 5 for the same period. It has been observed that there is an increasing movement in the share price of IBK for the coming months.

Fig. 3. State Transition Diagram of the HMM from Exports to IBK.

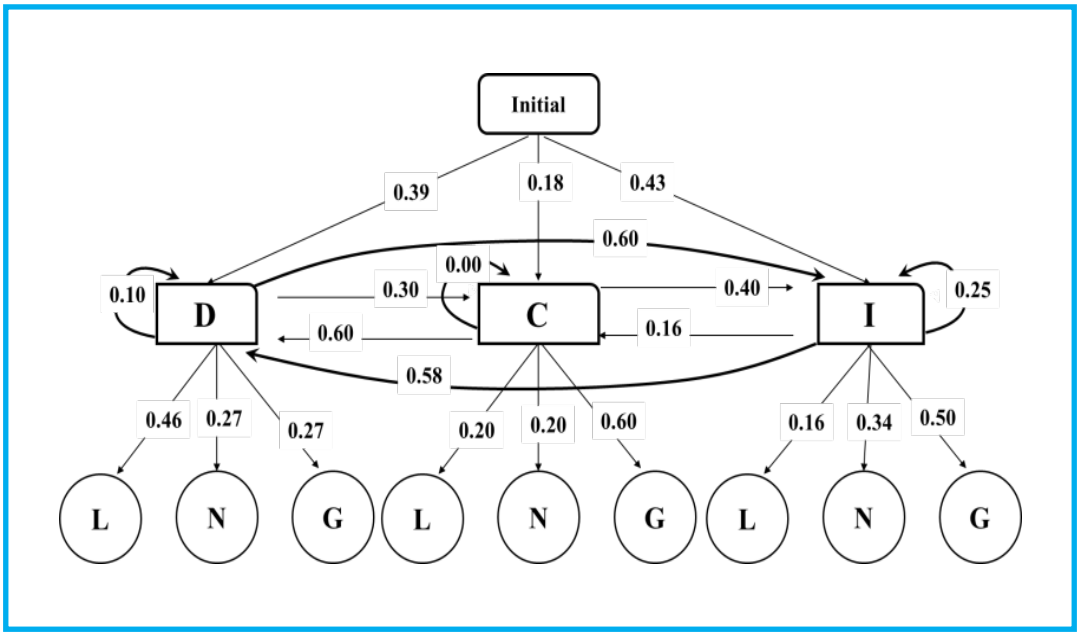


Fig. 4. Trend of Exports from South Korea

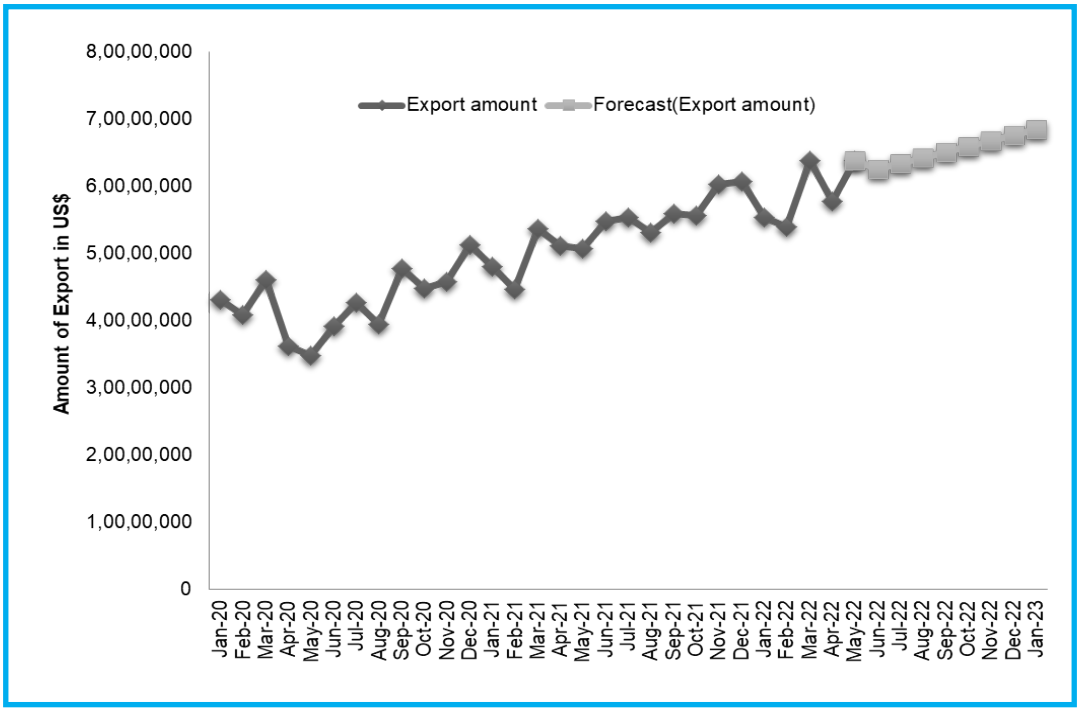
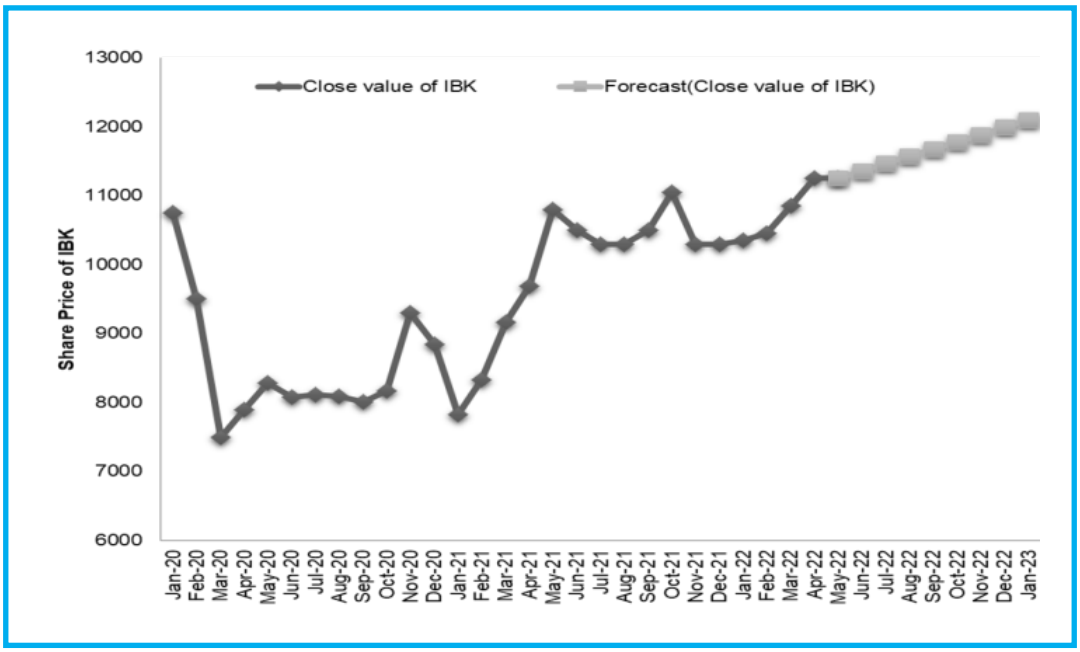


Fig.5. Stock Market Trend of IBK



4. Influence of Imports on the Stock Price of IBK

The hidden states of the second HMM are fall (F), same state (S), and rise (R) in the amount of imports in South Korea, while the corresponding visible states are the same as defined in Model I: loss (L), no change (N), and gain (G) in the share prices of IBK. These invisible and three visible states are discussed in the following subsection.

4.1. Hidden States of Model II

The hidden states of Model II are determined based on the difference between the amount of imports in South Korea for the next month and the previous month. Symbolically, these three states are defined as follows.

$H_1 = F$: When $D_2 < -1000000$, there is a fall in imports.
$H_2 = S$: When $-1000000 \leq D_2 \leq 1000000$, imports are in same state.
$H_3 = R$: When $D_2 > 1000000$, there is a rise in imports.

Where, $D_2 = (x_t - x_{t-1})$; x_t is the current month, and x_{t-1} is the previous month's volume of imports in South Korea.

4.2. Visible States of Model II

The three visible states for Model II are same as in Model I.

$V_1 = L$: When $d_1 < -100$, the IBK share price is in the state of loss.
$V_2 = N$: When $-100 \leq d_1 \leq 100$, the IBK share price has no change.
$V_3 = G$: When $d_1 > 100$, the IBK is in the state of gain.

Where, $d_1 = (y_t - y_{t-1})$: y_t is the current month, and y_{t-1} is the previous month's closing share price of IBK.

In this section, we analyze the impact of imports on the share values of IBK using the parameters of Model II. The two data sets related to imports and the closing share price of IBK are transformed into states, just like in Model I, using MS Excel. The hidden states represent the changes in the amount of imports in South Korea, and are denoted by *F*, *S*, and *R*. The visible states for the three-state visible states are denoted by *L*, *N*, and *G*, as in Model I.

5. Parameters of Model II

The parameters of Model II include the IPV (π_2), TPM (A_2) and the OPM (B_2). Therefore, the second model is denoted $\lambda_2 = (A_2, B_2, \pi_2)$. These parameters are explained in the following subsections.

5.1. Initial Probability Vector of Model II

To calculate the IPV, we derive the initial frequency table. The frequencies of the invisible states are depicted in Table 5.

Table 5. Initial Frequency for Imports

States	Fall (F)	Same State (S)	Rise (R)	Total
Frequency	9	5	14	28

The IPV indicates the probabilities of the hidden states *F*, *S*, and *R* in imports. In the above given initial frequency table, we have obtained the required IPV, denoted by π_2, and given by

$$\boldsymbol{\pi_2} = \begin{matrix}\boldsymbol{F} & \boldsymbol{S} & \boldsymbol{R}\\ [0.32 & 0.18 & 0.50]\end{matrix}$$

This vector reveals that, in terms of the amount of imports to South Korea, there is a 32% chance of falling, an 18% chance of the quantity of imports remaining the same, and a 50% chance of increasing.

5.2. Transition Probability Matrix of Model II

Similar to Model I, we calculate the TPM table and matrix for Model II. Using the real-time data sets, the transition frequency table in Model II is obtained and presented in Table 6.

In the above calculated transition frequency table, we have obtained the TPM within the states of imports. The TPM for this model is denoted by A_2, and is obtained as follows:

Table 6. Transition Frequency from Imports to Import States

	Fall (F)	Same State (S)	Rise (R)	Total
Fall (F)	1	1	7	9
Same State (S)	2	1	2	5
Rise (R)	5	3	5	13

$$A_2 = \begin{array}{c} \\ F \\ S \\ R \end{array} \begin{array}{c} \begin{array}{ccc} \boldsymbol{F} & \boldsymbol{S} & \boldsymbol{R} \end{array} \\ \begin{bmatrix} 0.11 & 0.11 & 0.78 \\ 0.40 & 0.20 & 0.40 \\ 0.38 & 0.24 & 0.38 \end{bmatrix} \end{array}$$

The first row of the above matrix reveals that if the amount of imports to South Korea is falling in the current month, there is an 11% likelihood of the imports falling further, an 11% likelihood of the imports staying the same, and a 77% likelihood of imports increasing in the upcoming month.

The second row reveals that if imports are in the same state in this month, the probabilities of falling, remaining the same, or rising in the next month are 40%, 23%, and 38%, respectively.

The third row reveals that when imports in South Korea are in the rising state in the current month, there is a 38% chance that they will fall, a 23% chance that they will remain the same, and a 38% chance that they will rise in the coming month.

5.3. Observed Probability Matrix of Model II

The hidden states in model II are influenced by the visible states, which are loss (*L*), no change (*N*), and gain (*G*) in the share prices of IBK. The observed frequencies of the invisible states (*F*, *S*, and *R*) shifting to the visible states (*L*, *N*, and *G*) are obtained using the real-time data sets of imports and share prices of IBK, which are presented in Table 7.

Table 7. Observed Frequency from Imports to Share Prices

	Loss (L)	No Change (N)	Gain (G)	Total
Fall (F)	1	3	5	9
Same State (S)	1	1	3	5
Rise (R)	6	4	4	14

Therefore, the required OPM of the invisible states of imports shifting to the visible states of IBK share prices is given as follows:

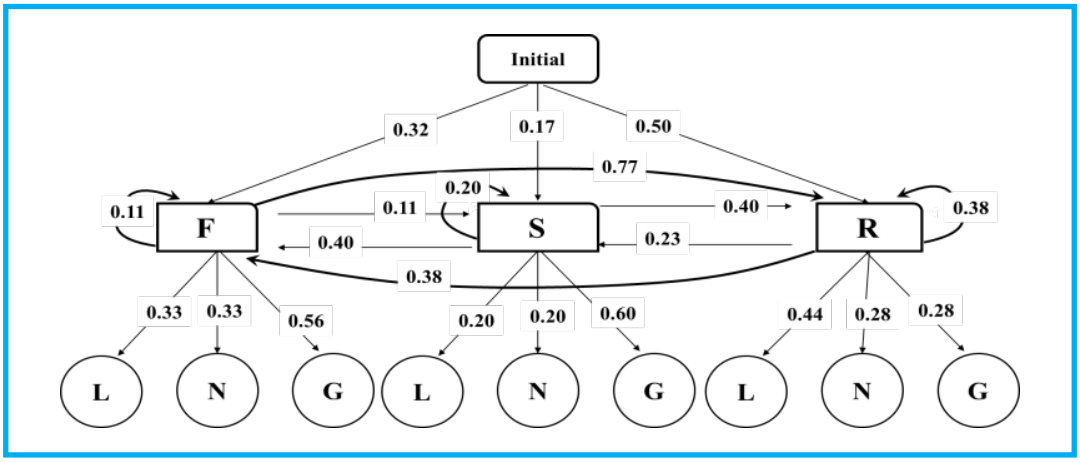
$$B_2 = \begin{array}{c} \\ F \\ S \\ R \end{array} \begin{array}{c} \begin{array}{ccc} L & N & G \end{array} \\ \begin{bmatrix} 0.11 & 0.33 & 0.56 \\ 0.20 & 0.20 & 0.60 \\ 0.43 & 0.28 & 0.29 \end{bmatrix} \end{array}$$

Similar to Matrix B_1 in Model I, this matrix also represents the impact of the change in the amount of imports to South Korea on IBK's share price. The visible states in Model II are the same as Model I. Matrix B_2 above reveals the influence of hidden states, such as fall (*F*), same state (*S*), and rise (*R*) in the amount of imports to South Korea, on the share prices of IBK. The first row of Matrix B_2 reveals that when there is a fall in imports to South Korea in the current month, there is an 11% probability of a loss, a 33% probability of no change, and a 56% probability of a gain in the next month's share prices of IBK. Similarly, when imports to South Korea are in the same state, the likelihood of experiencing a loss is 20%, a 20% likelihood of no change, and a 60% likelihood of a gain in the share prices of IBK. Finally, if imports in South Korea are rising at present, then the probability of the share price of IBK experiencing a loss, no change, or gain in the future are 42%, 28%, and 28%, respectively. In Matrix B_2 above, it was observed that when imports to South Korea are falling, there is a high probability of 56% of the

share price of IBK rising in the next month.

The probability values of the parameters of Model II (A_2, B_2, π_2) are presented through the schematic diagram in Fig. 6. This schematic diagram shows the influence of change in the amount of imports to South Korea on the share prices of IBK.

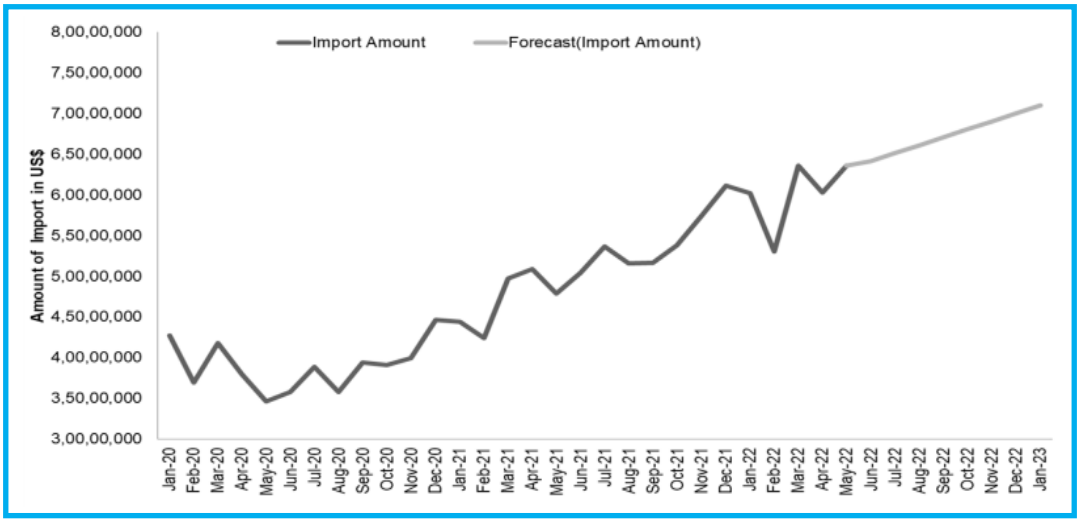
Fig. 6. State Transitions of HMM from Imports to IBK Share Values



6. Movement of Imports in South Korea

The monthly trend movements of imports are presented in Fig. 7, along with the future prediction trend. The dotted line shows the forecasted future trend in the amount of imports to South Korea.

Fig. 7. Trend of Korean Exports



Because the visible data set (share prices of IBK in the Korean Stock Exchange) is the same for both models, the trend behavior is presented in Fig. 7.

6.1. Comparison between Model I and Model II

In Models I and II, it is evident that there are influencing hidden states that drive the stock prices in the market. To identify these hidden states, HMM was used to predict probability measures for the states of share prices of IBK. This was achieved by examining the change in the states of exports and imports of South Korea, thus identifying the hidden states through observed probability matrices. The OPMs for both models are as follows:

$$B_1 = \begin{array}{c} \\ D \\ C \\ I \end{array} \begin{array}{c} \begin{array}{ccc} L & N & G \end{array} \\ \begin{bmatrix} 0.46 & 0.27 & 0.27 \\ 0.20 & 0.20 & 0.60 \\ 0.17 & 0.33 & 0.50 \end{bmatrix} \end{array} \qquad B_2 = \begin{array}{c} \\ F \\ S \\ R \end{array} \begin{array}{c} \begin{array}{ccc} L & N & G \end{array} \\ \begin{bmatrix} 0.11 & 0.33 & 0.56 \\ 0.20 & 0.20 & 0.60 \\ 0.43 & 0.28 & 0.29 \end{bmatrix} \end{array}$$

In Matrix B_1, it is observed that when the exports are decreasing, the probability of a loss in the share price of IBK is 45%. However, when the exports are increasing, the probability of a gain in the share price of IBK is at its peak at 50%. Therefore, we can say that an increasing state of exports leads to a gain in the share prices of IBK. Matrix B_2 reveals that when the imports are falling, the probability of a gain in the share price is at maximum at 56%; however, if the state of imports in South Korea is rising, there is a maximum likelihood of a loss in the share price of IBK at 42%. Thus, decreases in imports to South Korea lead to a gain in the share prices of IBK. Therefore, the invisible states, such as an increase in exports or fall in imports, affect the probability of gakins and losses in the share price of IBK.

The invisible states, such as exports remaining the same (S) and imports remaining in the same state (St), also influence the share prices of IBK. If the exports and imports remain in the same state as the previous month, the probability of experiencing a gain in the share prices of IBK is 60%. This likelihood is at its highest if exports and imports in South Korea stay constant.

7. Stationary Probability Distributions

In this section, we have obtained the stationarity observed probability matrices of both developed Hidden Markov Models. The observed probability matrices of Model I and Model II, calculated from the real time data sets in sections 4.2.3 and 4.5.3, respectively, are presented in Matrices B_1 and B_2.

$$B_1 = \begin{array}{c} \\ D \\ C \\ I \end{array} \begin{array}{c} \begin{array}{ccc} L & N & G \end{array} \\ \begin{bmatrix} 0.46 & 0.27 & 0.27 \\ 0.20 & 0.20 & 0.60 \\ 0.17 & 0.33 & 0.50 \end{bmatrix} \end{array} \qquad B_2 = \begin{array}{c} \\ F \\ S \\ R \end{array} \begin{array}{c} \begin{array}{ccc} L & N & G \end{array} \\ \begin{bmatrix} 0.11 & 0.33 & 0.56 \\ 0.20 & 0.20 & 0.60 \\ 0.43 & 0.28 & 0.29 \end{bmatrix} \end{array}$$

A stationary distribution is a probability distribution that remains unchanged in the chain as time progresses, and represents the probability at and beyond the n^{th} trading day. Stationarity conditions are reached by multiplying the matrix a number of times to get a matrix with identical elements in a column. The stationary conditions for both Matrices B_1 and B_2, respectively calculated from the historical data sets, are as follows.

$$B_1^{(14)} = \begin{array}{c} \\ D \\ C \\ I \end{array} \begin{array}{c} \begin{array}{ccc} L & N & G \end{array} \\ \begin{bmatrix} 0.247190 & 0.280897 & 0.471908 \\ 0.247190 & 0.280897 & 0.471908 \\ 0.247190 & 0.280897 & 0.471908 \end{bmatrix} \end{array}$$

$$B_2^{(14)} = \begin{array}{c} \\ D \\ C \\ I \end{array} \begin{array}{c} \begin{array}{ccc} L & N & G \end{array} \\ \begin{bmatrix} 0.277531 & 0.2753286 & 0.447134 \\ 0.277531 & 0.2753286 & 0.447134 \\ 0.277531 & 0.2758236 & 0.447134 \end{bmatrix} \end{array}$$

It is observed that for both the models, the stationary condition is reached on the 14th trading day. Matrix $B_1^{(14)}$ reveals that irrespective of the change in exports in South Korea, the probability of experiencing a loss, no change, and gain in the share price of IBK are respectively 0.25, 0.28, and 0.47 on and after the 14th trading day since May 2022. In the same way, Matrix $B_2^{(14)}$ demonstrates that no matter the state of imports in South Korea, there will be a loss in the share price of IBK with a probability of 28%, the share price of IBK will be in the state of no change with a likelihood of 27%, and the likelihood of a gain in the share price of IBK on and after the 14th trading is 45%, regardless of whether imports in South Korea fall, remain the same, or rise.

V. Conclusion

According to the existing literature, HMMs are applied to forecast stock market trends, and the calculations are based on HMM parameters (e.g., *A, B,* π). Stock movement prediction is challenging due to its randomness and volatility. However, HMM can be used to predict stock market values by finding hidden patterns and identifying the hidden states. In this research, we applied a new approach using HMM to forecast the change in the next month's closing price of financial time series data. We collected monthly data on the share prices of IBK and the exports and imports of South Korea for more than two financial years, from January 2020 to May 2022.

The results revealed a significant correlation of 0.75 between exports and IBK share prices, and 0.81 between imports and IBK share prices. The coefficient of variation (*CV*) for exports, imports, and the closing prices of IBK were found to be 15.65, 18.67, and 12.73, respectively, indicating consistency in exports, imports, and the share prices of IBK.

The initial state probability distributions for the states of exports revealed that the probability of exports from South Korea decreasing, remaining the same, and increasing were 39%, 18%, and 43%, respectively, for the studied months. The initial state probability distribution for imports showed that the likelihood of imports falling, remaining the same, and rising were 32%, 18%, and 50%, respectively, for the studied period.

It was also observed that when exports were in an increasing state, there was a 50% probability of the share prices of IBK increasing, and when imports were falling, there was a 56% chance of the share price of IBK increasing. This illustrates how influencing factors, such as changes in exports and imports, affect the share price of IBK.

Furthermore, from the stationary probability distributions, it is evident that the chance of a gain in the share price of IBK, irrespective of the change in the international trade (amounts of exports and imports) of South Korea, on the 14th trading day was at a maximum compared to other states. Therefore, investing in IBK's stock could be a good choice for investors to make capital gains.

These results will be helpful for both short-term and long-term investors in IBK shares and the Korean stock exchange, as they can closely follow the movement of international trade in South Korea.

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