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A Study on the Relationship between Transaction Fairness, Social Capital, Supply Chain Integration and Sustainability: Focusing on Manufacturing Companies of South Korea

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***Abstract*—**The purpose of this study is to analyze the relationship between transaction fairness, social capital, supply chain integration and sustainability. Based on the previous studies, measurement items were determined by using SPSS 22 and exploratory factor analysis was performed, and again, using AMOS 21 for confirmatory factor analysis and path analysis was performed by using study items that satisfy reliability, validity, and appropriateness of measurement model. It has shown that transaction fairness has a (+) significant effect on social capital, social capital on supply chain integration, supply chain integration on economic sustainability and social sustainability, and has a (+), but not significant effect on environmental sustainability. It has shown that supply chain integration has been proven to play a role as a parameter between social capital and economic and social sustainability, but not as a parameter between environmental sustainability. Through this study, it is suggested that clearly examining the relationship between fairness of trade, social capital, supply chain integration and sustainability, maintaining fairness of the transaction make formation of social capital, and further integration of supply chain, and achieve sustainability of entire supply chain.

***Keywords*—**Transaction fairness, social capital, supply chain integration, sustainability.

I. Introduction

IN transactions, it is very important that all trading partners satisfy the transaction. According to the statistics of the Fair Trade Commission [1], the number of cases of unfair trade practices in Korea is estimated to be 692 in 2011, 750 in 2012, 439 in 2013, 470 in 2014, and 361 in 2015, showing continuous decreasing since 2012, as in Table I.

Table I summarizes the types of cases received by the Fair Trade Commission according to types of fair trade violations, and it is very desirable to reduce the number of cases received, but, if actual number of cases not reported to the Fair Trade Commission is included, it can be predicted that there might have been more unfair trade acts.

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Transaction fairness is a concept of trading procedures and trading practices ensuring that firms with superior market power do not disturb fair market order by doing opportunistic actions. In general, purchasing companies mostly have a superior position or power over supply companies. Thus, if there is a force imbalance, the purchasing firm can weigh influence on the supply companies in various ways. Oppressive practices that do not listen to what suppliers want, such as reducing transaction volume or clearing business relationships without justifiable reasoning, or forcing unwanted works, can cause unfair trade [2], [3]. It is because, in general, fairness in business-to-business transactions is a factor that establishes the friendship and trust relationship with trading partners, and if the result or process of the transaction is perceived as fair, they want to maintain continuous transaction relationship, but, in the opposite case the intent is to make a transaction relationship looking for a new trade company. Therefore, the fairness of the transaction will serve as a leading factor in shaping individual companies' social capital and further achieving supply chain integration.

The effects of social capital on a firm's financial and operating performance can be found in the studies of [4], [5]. However, studies that suggest social capital formed according to transaction fairness can achieve supply chain integration and that companies can cooperate with each other and further develop into sustainable companies and supply chain, are relatively limited. Also, social capital refers to the structural/relative/cognitive level of social capital, such as trust building, observance of norms among social members, and continuance of individual companies and supply chain will be under chance for maintaining depending on building of a mutual relationship of purchaser and supplier [5]–[7], while the results of studies also suggest that if social capital is overemphasized, negative influence, rather than positive influence, becomes more pronounced [7]. Therefore, it is also necessary to clarify this. Therefore, in this study, the formation of social capital based on transactional fairness can be regarded as providing an ecological, cultural, and economic basis for individual companies to continue to operate, and the main purpose of the study is to examine the mechanisms that lead to the sustainability of transaction fairness, social capital, supply chain integration, and the supply chain.

The composition of this study is as follows. Section I presents the necessity and purpose of the research as an

introduction. Section II explores previous studies on the research and measurement items of this study as a literature review and theoretical background, and explores operational definition and detailed measurement items. Section III presents the research hypotheses and research models to be tested in this study based on the research items presented in the previous section. Section IV presents empirical studies on the reliability and validity of the sample design and research methodology and research items, and presents the results of the path analysis, and Section V summarizes the results of the research and suggests the limitations of the research, as well as the direction of future research.

TABLE I
STATUS OF INCIDENTS ACCEPTED BY TYPE OF VIOLATION IN RECENT 5 YEARS (FAIR TRADE COMMISSION, 2017)

Year	Abuse of market dominant position	Business Combination Restriction	Suppression of Economic Power concentration	Unfair corporate action	Business group prohibition	**Unfair trade practice**	**Total**
2011	17	25	57	127	151	**692**	**1,069**
2012	10	39	34	76	141	**750**	**1,050**
2013	16	30	81	90	140	**439**	**796**
2014	15	30	35	207	100	**470**	**857**
2015	17	25	106	237	98	**361.**	**844.**

- Statistics of Consumer Protection Act, Subcontracting Act, Affiliate Business Act, Large-scale distribution Business Act are excluded.

II. LITERATURE STUDY AND THEORETICAL BACKGROUND

Transaction Fairness

The concept of fairness [8] is largely divided into three components: procedural fairness, interactional fairness, and distributional fairness [9], [10]. Procedural fairness means the fairness of the policy or process that results in the transaction, while interactivity fairness focuses on the human treatment of personal experience in the transaction process, and distributional fairness focus on the cognitive fairness of the results.

Transaction fairness in the supply chain can be divided into distribution fairness and procedural fairness [11]. Distribution fairness means the extent to which the benefits and rewards obtained through cooperation by supply chain participants are appropriately allocated through their contribution of each participant. Procedural fairness is related to transparency, which means that the opinions of all participants are appropriately reflected in decision-making processes and procedures, and that they are acceptable to the outcome determined by the process [12]. Therefore, fairness of trade means abstaining from market dominance to avoid unilateral and opportunistic transaction (exchange) and adhering to fair trading practices according to established procedures and standards. Therefore, in this study, measurement items were selected with reference to these previous studies.

Social Capital

Social capital is the sum of social resources to promote the institutional relationship of mutual understanding and cooperation between companies [13], and social capital is the total of practical/potential resources included in the network of relations owned by individuals and social units [14]. Also, if research on early social capital has been approached in terms of individual and social relations, recent research is being studied as a concept of cooperation among firms, and social capital is defined as available resources by individuals or social members in their social relative structure [15].

Social capital was distinguished from the structural dimension, which is the concept of network formation among social members, and the relational dimension, which is a concept of trust or shared norms between social members [16]. It is divided into three kinds of level of a trust that is constructed in the process of interaction, which is a concept that encompasses interrelationships among members of society, relative level in concept of amity respect and mutual benefits, and cognitive level in the concept of shared understanding among the members of society [14]. In this study, the measurement items of social capital were also constructed by referring to the contents of literature study [14]–[16].

Supply Chain Integration

Supply Chain Integration can be divided into inter-organizational process integration and integration between various organizational processes [17]. Therefore, supply chain integration can be divided into internal integration and external integration, but, this study focuses on the transaction fairness and social capital in business-to-business transactions, and thus examines the supply chain integration from the perspective of external integration.

The concept of expanding the scope of integration of a company to outside of the company is in the direction of suppliers and customers [18]. External integration means establishing strategy or procedure with key customer companies or supply companies in the supply chain as a cooperative relationship [19], [20], and the cooperation is defined as custom-made business relationship between companies based on sharing of mutual trust, openness, risk and reward to achieve common goals. Therefore, in this study, we tried to select and measure the measurement items based on the contents of previous studies [21].

Economic, Environmental and Social Sustainability in the Supply Chain

Sustainability is defined as achieving corporate social, environmental and economic goals in the systematic coordination of key inter-organizational processes to improve long-term economic performance within individual firms and their supply chains [22]. Sustainability is a concept that integrates economic, social and environmental performance in a broad sense [22], [23]. Therefore, sustainable SCM can be understood as an integrated concept of SCM and Sustainability,

and it focuses on environmental, social subjects in the supply chain. In addition, to maximizing the profit of the entire supply chain, as well as all activities to manage resources, knowledge, and information of supply chain in order to reduce the environmental burden and maximize social common goods [24], [25]. The Triple Bottom Line of Sustainability Management should be evaluated on three criteria: corporate profit, environmental sustainability, and social responsibility [26], [27]. In addition, as part of efforts to minimize the negative impacts on the environment within the supply chain, including economic sustainability which include purchases to help local economic recovery from local suppliers, the environment, Green SCM, and social Sustainable SCM was discussed as a meaning to integrate various concepts such as social problems in the supply chain [28].

The following three summaries are presented [29], first, economic enterprises should provide long-term benefits to shareholders and other financial institutions over the interests of the corporation within the framework of securing competitive return, promoting growth, increasing long-term value of profit form, and sustainability. Next, environmental is the influence of the enterprise on the environment, and the enterprise must do its best to protect the environment, at least not causing damage to the environment. It includes execution of careful management of natural resources consumption, reduction of waste, disposal of waste by safe and legitimate procedures, guarantee of harmfulness of waste, reduction of ecological trace, and production of environmental costs for the whole process from production, procurement, distribution, and disposal of raw materials. Finally, the term social refers to fair and informative business practices for the workforce, local communities, and communities in which they operate, and it is returning activities to contribute to the health and growth of local communities seeking the interests of employees, the local community and other entities, prohibiting the use of child labor, paying fair wages, offering reasonable working hours, and providing a safe working environment. Therefore, in this study, we tried to select and measure the measurement items based on the previous studies.

So far, this investigation examined previous studies on the main research items, and based on measurement items, the research items in this study and detailed measurement items; these previous studies and references are arranged in Table II.

TABLE II
DETAILED MEASURES AND REFERENCES OF PREVIOUS RESEARCH VARIABLES

Item	Number	Measurement contents	References
Transaction fairness	T1	Responsibility and compensation granted between transactions are fair	[8]
	T2	Disclose transaction process as possible	[9]
	T3	Maintain transaction procedures transparent and fair	[11]
	T4	Understand trading partners through communication	[10]
	T5	Make efforts to be a fair deal on the whole	[12]
Social capital	S1	Establish mutual relationship with other social members	
	S2	Build trust with other members of society	[13]
	S3	Build friendly relationship with other members of society	[14]
	S4	Build respect relationship with other members of society	[15]
	S5	Build mutual benefits relationship with other members of society	[16]
	S6	Build shared interests with other members of society	
Supply chain integration	I 1	Jointly respond to fluctuations in demand at trading companies and markets	
	I2	Jointly respond to the change of needs from trading companies and customer	[18]
	I3	Share risks and rewards with trading companies	[17]
	I4	Share revenue and loss with trading companies	[19]
	I5	Share indicators of business performance with trading companies	[20]
	I6	Actively respond and cooperate upon conflicts with trading companies	[21]
Economic sustainability	E1	Improve productivity (output/input)	
	E2	Improve product and service value	
	E3	Continuous quality improvement (improvement)	
	E4	Sustained cost reduction	
Environmental sustainability	En1	Resource usage continues to decline	[22]
	En2	Resource usage continues to increase	[23]
	En3	Resource recycling continues to increase	[24]
	En4	Reuse (recycling) of renewable resources continues to increase	[25]
	En5	Increased eco-efficiency	[26]
Social sustainability	S1	Corporate image (reputation) improved	[27]
	S2	Product and service brand image improved	[28]
	S3	Increased reliability	[29]
	S4	Reduced recruitment costs for new employees	
	S5	Achievement of win-win cooperation with stakeholders	

III. Research Hypotheses and Research Models

Research Hypothesis

1. Relationship between Fairness of Transaction and Social Capital

As relationship building between the individual companies in the supply chain is achieved through mutual transaction processes and results, fairness must be guaranteed in the transaction process and the result, in order to build a mutually beneficial relationship. A long-term oriented relationship based on fair transactions enhances the expectation of supply companies in the future, which leads to active long-term investment, and which in turn increases the trust between firms, leading to the formation of related. However, if the purchase company intends to forcibly control the supply company using superior negotiation power, and if the supply company recognizes that the purchase company's transaction act is unfair, the relative quality is reduced [30], [31]. But, when the purchasing company and the supplying company improve the performance through joint effort, the supplier is highly aware of the distribution fairness if the system of dividing is well implemented by the predetermined method [32]. Therefore, it is expected that social equity based on mutual trust and mutual benefit can be formed when fairness is highly recognized in inter-firm transactions, and the hypothesis is established and to be verified as follows.

Hypothesis 1. Trade fairness will have a positive (+) effect on social capital.

2. Relationship between Social Capital and Supply Chain Integration

In supply chain management, social capital has been studied as having a direct impact on supply chain management activities, and this is because SCM proceeds its process with continuous mutual activities between supplier and purchaser, forming social capital in these relationships [33]. And, when trust, which is a relational dimension suggested by social capital, becomes insufficient, mutual instability may increase, and the exchange of resources among suppliers may not occur [34]. And, since relational capital, including trust, is formed through consistent transaction practices over a long period of time, it can affect engagement with each other and efforts to improve joint performance increase [35]. Therefore, the formation of social capital was hypothesized to test this, assuming that individual firms would be able to influence supply chain integration, which would make individual companies gather and move like a single company.

Hypothesis 2. Social capital will have a positive (+) impact on supply chain integration.

3. Relationship between Supply Chain Integration and Economic Sustainability

Cooperation through the building of trust between companies has a positive effect on business-to-business tie-ups, and establishing trust among firms provides a basis for more efficient management by improving economic efficiency and cooperation by reducing transaction costs [7]. Firms should establish trust and long-term strategic relationships with suppliers to build efficient and successful SCMs, and need to engage suppliers and consumers in the initial period [36]. However, cooperation with suppliers does not directly affect on the economic performance of sustainable SCM outcomes [37]. Therefore, it is necessary to identify the results of these studies. In this study, it is predicted that economic sustainability can also be improved if supply chain constituent companies are integrated, and the hypothesis is established and to be verified as follows.

Hypothesis 3. Supply chain integration will have a positive (+) effect on economic sustainability.

4. Relationship between Supply Chain Integration and Environmental Sustainability

Direct collaboration with customers affects environmental performance [37]. In addition, green SCM based on cooperation positively affects the environmental performance improvement of suppliers as well as purchasing companies [38]. In this study, therefore, it is predicted that economic sustainability can also be improved if supply chain constituent companies are integrated, and the hypothesis is established and to be verified as follows.

Hypothesis 4. Supply chain integration will have a positive (+) impact on environmental sustainability.

5. Relationship between Supply Chain Integration and Social Sustainability

In this study, it is predicted that economic sustainability can also be improved if supply chain constituent companies are integrated, and the hypothesis is established and to be verified as follows.

Hypothesis 5. Supply chain integration will have a positive (+) impact on social sustainability.

6. Mediating Effect of Supply Chain Integration

The relationship dimension, which is a kind of social capital, can mutually complement each other to maintain mutual resource accessibility, reducing mutual surveillance costs, and positively influence on cooperation promotion [7], [34]. And social capital is emerged as an important factor in the establishment of mutual relationships and win-win cooperation [5], [15], [39] and social capital in supply chain mostly have a significant effect on strategic, operational performance [6], [7], [40]. And, social capital is an influential variable for promoting the introduction of eco-friendly supply chains, and positive relationship with social capital and eco-friendly practices [41]. Thus, the formation of social capital in individual firms can have a positive (+) influence on the sustainability of individual firms, i.e. economic, environmental and social sustainability, but it can be predicted that the supply chain integration, which operates like a single firm, will have an impact on higher economic, environmental and social sustainability. Therefore, we tried to establish the following hypothesis and test it.

Hypothesis 6. Supply chain integration will play a mediating role between social capital and economic sustainability.

Hypothesis 7. Supply chain integration will play a mediating role between social capital and environmental sustainability.

Hypothesis 8. Supply chain integration will play a mediating role between social capital and social sustainability.

Research Model

The main purpose of this study is to identify mechanisms that lead to fairness of transactions, social capital, supply chain integration, and sustainability. The previous research hypotheses to be tested in this study were presented, and the model of this study in generalization is shown in Fig. 1.

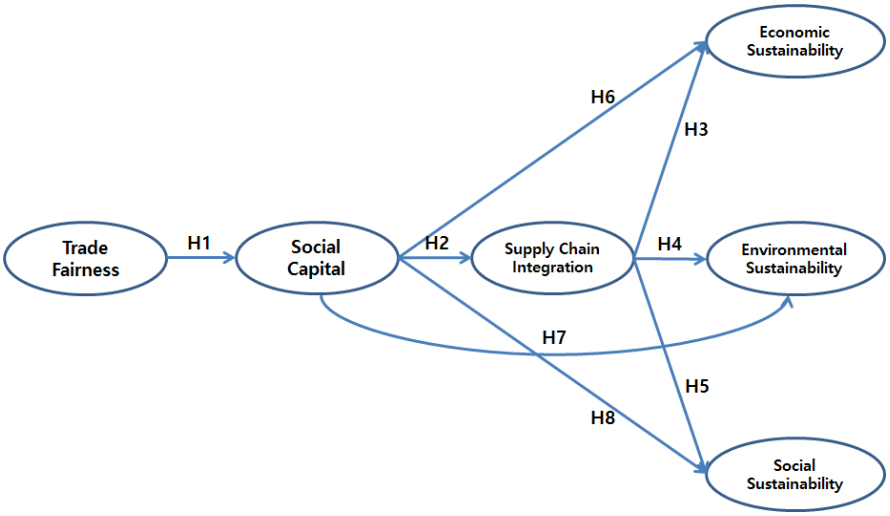

Fig. 1 Research Model

TABLE III
DEMOGRAPHIC CHARACTERISTICS OF SURVEY OBJECTS

Sales	**Less than 5 billion won**	**5 ~ 10 billion won**	**10 ~ 50 billion won**	**50 ~ 100 billion won**	**100 ~ 500 billion won**	**Over 500 billion won**
	12(9.3)	18(14.0)	13(10.1)	13(10.1)	17(13.2)	56(43.4)
Number of employees	**Less than 50**	**50 ~ 100**	**100 ~ 500**	**500 ~ 1000**	**1000 ~ 5000**	**Over 5000**
	24(18.6)	14(10.9)	20(15.5)	11(8.5)	5(3.9)	55(42.6)
Business kind	**Chemicals & Petroleum**	**Metal material**	**Assembled metal**	**Electronic and communication**		**Electricity, equipment**
	4(3.1)	5(3.9)	2(1.6)	78(60.5)		10(7.8)
	Vehicles, Parts	**Shipbuilding & Parts**	**Medical Precision**		**Others**	
	15(11.6)	6(4.7)	2(1.6)		7(5.4)	
Position	**Assistant Manager**	**Section chief/assistant manager/manager**			**Officers**	
	85(65.9)	38(29.5)			6(4.7)	
Business power	**Less than 5 years**	**5 ~ 10 years**	**10-15 years**	**15-20 years**	**20-30 years**	**Over 30 years**
	15(11.6)	39(30.2)	17(13.2)	12(9.3)	21(16.3)	25(19.4)

IV. EMPIRICAL STUDY

Design and Data Collection of Samples, Research Methodology

In order to test the hypotheses presented in this study, the contents of the questionnaire are as follows: fair fairness 5, social capital 6, supply chain integration 6, economic sustainability 4, environmental sustainability 5, and social sustainability, and the total score was 31 items, excluding demographic items, and the Likert scale was 7 points.

The questionnaire was conducted from September to November, 2016, and the list of companies located in Gyeongbuk Province area was surveyed and questionnaires were sent to them. A total of 129 questionnaires were collected from companies that responded to the questionnaire and were used in the current research. One copy of the questionnaire is to be provided to each company, and when the business division is clearly divided and deals with other trading companies, the survey is conducted for each business division. The demographic characteristics of the respondents are summarized in Table III.

Looking at the detailed status of the respondents, 86 companies with sales exceeding 50 billion won accounted for 66.7%, while 55% of the companies have more than 500 employees, and 60.5% or 78 companies in electronics/telecommunication in many local companies. For the most part, 114 companies with over-5 years of business power account for 88.4% of firms surveyed. Therefore, it can be said that SMEs and large corporations are appropriately surveyed.

Statistical analysis of this study was performed using SPSS 22 and Amos 21. First, we conducted the exploratory factor analysis using SPSS 22 for the measurement data of the questionnaire items, and through the analysis, the validity of the measurement items was first analyzed, and the confirmatory factor analysis was performed again using the Amos 21, analyzing the validity of the discrimination validity and the measurement model of measurement items. Finally, a path

analysis was conducted on the research hypotheses using the research items satisfying the appropriateness of the measurement model.

Reliability and Feasibility Analysis

The results of the first exploratory factor analysis on the measurement items are summarized in Table IV. Exploratory factor analysis of measurement items were executed with factor analysis by Varimax right angle rotation type assuming independence between Principle Component Analysis, and KMO measure value as an index for appropriateness of factor analysis of entire relation lines was over 0.50, Bartlett's test of sphericity value for overall significance should be less than 0.05 in significance probability [42].

A result of measuring KMO measure value is 0.950, and significance probability was 0.000, meaning overall significance, and factor loading value of measurement items were all 0.540 (the 6th measurement item of supply chain integration), and finally accumulated explanatory power satisfies base value as 82.518. Therefore, as a result of the exploratory factor analysis, the research items of this study were divided into six categories.

Based on the results of exploratory factor analysis, confirmatory factor analysis was performed for the 2nd time on the items using Amos 21. The results of the confirmatory factor analysis are summarized in Table V.

In the confirmatory factor analysis, Cronbach's α value should be 0.7 or more to confirm the reliability of the six constructs composed of multiple items, the potential factor reliability factor Composite Reliability (Composite Reliability: C.R.) should be 0.7 or higher, and the Average Variance Extracted (AVE) should be 0.5 or higher. The results of the measurement are shown to satisfy the criterion as shown in Table IV. In addition, we attempted to improve the appropriateness of the measurement model by eliminating items with a factor load of less than 0.7 or with a value of Squared Multiple Correlations (SMC) that is considered to be relatively low. The measurement items removed here were T2 in transaction fairness, E1 in economic sustainability, En1, En2 in environmental sustainability, and S4 in social sustainability.

The validity of discrimination is generally analyzed by comparing the square root of AVE with the correlation coefficient values of other constructs [43]. As shown in Table VI, the square root of AVE is 0.7 or more, which was judged to have validity of discrimination as it is higher than the correlation coefficient of other constructs.

Table VII summarizes the appropriateness of measurement and research models. Although some items (AGFI, GFI, NFI, RMSEA, and SRMR) do not meet the criteria, other items meet the criteria; thus, path analysis of the research hypothesis was conducted judging that they have the reliability, validity, and fitness needed to test the research hypothesis among the research items.

TABLE IV
EXPLORATORY FACTOR ANALYSIS RESULTS

Item	Component					
	1	2	3	4	5	6
Transaction fairness	0.318	0.267	0.169	**0.649**	0.246	0.239
	0.153	0.350	0.273	**0.711**	0.078	0.061
	0.256	0.338	0.148	**0.719**	0.185	0.275
	0.325	0.261	0.126	**0.752**	0.167	0.235
	0.386	0.239	0.081	**0.725**	0.208	0.260
Social capital	**0.737**	0.256	0.291	0.201	0.242	0.336
	0.792	0.256	0.284	0.200	0.138	0.251
	0.768	0.286	0.182	0.254	0.223	0.311
	0.777	0.231	0.162	0.314	0.208	0.238
	0.804	0.245	0.175	0.297	0.178	0.206
	0.777	0.293	0.255	0.288	0.204	0.173
Supply chain integration	0.422	**0.747**	0.081	0.219	0.167	0.178
	0.353	**0.657**	0.108	0.291	0.237	0.262
	0.153	**0.832**	0.132	0.234	0.207	0.223
	0.186	**0.820**	0.214	0.277	0.148	0.111
	0.355	**0.709**	0.174	0.306	0.287	0.058
	0.271	**0.540**	0.158	0.408	0.342	0.272
Economic sustainability	0.354	0.183	0.312	0.105	0.146	**0.704**
	0.271	0.217	0.155	0.235	0.327	**0.748**
	0.254	0.202	0.146	0.180	0.228	**0.807**
	0.201	0.121	0.106	0.272	0.143	**0.793**
Environmental sustainability	0.037	0.110	**0.798**	0.087	0.233	0.122
	0.131	0.110	**0.838**	0.014	0.142	0.149
	0.190	0.120	**0.839**	0.188	0.177	0.189
	0.324	0.135	**0.816**	0.153	0.166	0.139
	0.249	0.113	**0.778**	0.229	0.213	0.014
Social sustainability	0.319	0.200	0.204	0.203	**0.717**	0.245
	0.293	0.188	0.249	0.226	**0.753**	0.252
	0.272	0.188	0.261	0.236	**0.778**	0.173
	-0.021	0.252	0.324	0.004	**0.660**	0.119
	0.327	0.279	0.273	0.318	**0.589**	0.272
Eigen value	5.511	4.449	4.423	4.014	3.613	3.571
Dispersion %	17.778	14.351	14.268	12.948	11.655	11.518

Hypothesis Testing

1. Test Results between Hypotheses H1-H5

The results of the hypotheses 1 ~ 5 tests on the three items of transaction fairness, social capital, supply chain integration, and sustainability presented in this study are summarized in Fig. 2 and Table VIII.

Detailed results of the hypothesis test are as follows. First, Hypothesis 1 shows that transaction fairness has a positive (+) effect on social capital (β = 0.998, p = 0.000), and social capital as a result of testing hypothesis 2 has significant (+) effect on supply chain integration (B = 0.682, p = 0.000), and as a result of hypothesis 3, supply chain integration had a significant (+) positive effect on economic sustainability (β = 0.201, p = 0.044), and the results of hypothesis 5 show that supply chain integration has a positive (+) effect on social sustainability (β = 0.330, p = 0.000) (B = 0.095, p = 0.431), but the result of hypothesis 4 testing shows positive (+) but not significant (β = 0.095, p = 0.431) effect on environmental sustainability.

TABLE V
CONFIRMATORY FACTOR ANALYSIS RESULTS

Item	Number	Standard factor load	p-value	Cronbach's α	C. R.	AVE
Transaction fairness	T1	0.830	***	0.930	0.896	0.684
	T2	-	-			
	T3	0.869	***			
	T4	0.902	***			
	T5	0.912	***			
Social capital	S1	0.933	***	0.977	0.959	0.795
	S2	0.926	***			
	S3	0.955	***			
	S4	0.923	***			
	S5	0.933	***			
	S6	0.943	***			
Supply chain integration	I 1	0.895	***	0.949	0.916	0.646
	I2	0.870	***			
	I3	0.878	***			
	I4	0.865	***			
	I5	0.885	***			
	I6	0.824	***			
Economic sustainability	E1	-	-	0.910	0.898	0.746
	E2	0.928	***			
	E3	0.906	***			
	E4	0.799	***			
Environmental sustainability	En1	-	-	0.933	0.893	0.737
	En2	-	-			
	En3	0.906	***			
	En4	0.965	0.011			
	En5	0.851	***			
Social sustainability	S1	0.868	***	0.938	0.916	0.732
	S2	0.943	***			
	S3	0.928	***			
	S4	-	-			
	S5	0.829	***			

where ***, p <0.001

TABLE VI
RESULTS OF DISCRIMINATORY VALIDITY ANALYSIS OF RESEARCH ITEMS

Item	1	2	3	4	5	6
1. Transaction fairness	**0.827**					
2. Social capital	0.777	**0.891**				
3. Supply chain integration	0.781	0.755	**0.804**			
4. Economic sustainability	0.721	0.720	0.628	**0.864**		
5. Environmental sustainability	0.503	0.606	0.518	0.521	**0.858**	
6. Social sustainability	0.740	0.748	0.736	0.735	0.660	**0.856**

where, the diagonal bold character is the square root of AVE.

2. Test Results between Hypotheses H6-H8

This study intended to analyze the direct effects of economic, environmental, and social sustainability factors and analyze the mediating effects of supply chain integration because they can indirectly affect economic, environmental, and social sustainability through supply chain integration. the mediating effects of supply chain integration were tested in the following way.

First, we evaluate the fitness of the independent variable (X1) → dependent variable (X3) model as the first step. As the second step, the fitness of the independent variable (X1) → the parameter (X2) → the dependent variable (X3) is evaluated. Here, the path coefficients of independent variable (X1) → dependent variable (X3), independent variable (X1) → parameter (X2), parameter (X2) → dependent variable (X3) should all be significant in the predicted direction. As the third step and in order to verify the mediating effects, the two independent variables (X1), the parameters (X2), and the dependent variables (X3) are evaluated under the following two conditions. The two conditions are: ① the second step model condition in which the independent variable (X1) → dependent variable (X3) path is constrained to zero; and ② the independent variable (X1) → dependent variable (X3) without constraint on path. After that, examining whether the fitness of (2) ② improves significantly compared to ①, we can examine if this is that $\chi 2$ difference test between the two conditions is less than 3.84 at $\alpha = 0.05$ level and appears as non-significant in the condition that independent variable (X1) → dependent variable (X3) path as parameter variable (x2) is considered, it is complete mediation, and if $\chi 2$ difference value is more than 3. 84 in $\alpha = 0.05$ level, it is partial mediation. The results of analyzing the mediating effects of supply chain integration are shown in Table IX.

TABLE VII
RESULTS OF APPROPRIATENESS ANALYSIS OF THE MEASUREMENT MODEL AND THE RESEARCH MODEL

Item	χ^2/df	χ^2	AGFI	GFI	NFI	IFI	CFI	PGFI	PNFI	RMSEA	SRMR
Standard	Less than 3	p<0.05	Over 0.9	Over 0.9	Over 0.9	Over 0.9	Over 0.9	Over 0.6	Over 0.6	Less than 0.05	Less than 0.08
Measurement model	1.679	0.000	0.736	0.787	0.889	0.952	0.952	0.636	0.777	0.073	0.050
Research model	1.822	0.000	0.717	0.765	0.877	0.940	0.940	0.635	0.785	0.080	0.081

TABLE VIII
TEST RESULTS FOR HYPOTHESES 1 ~ 5 OF RESEARCH ITEMS

Hypothesis	Path			Path coefficient	S. E.	t value	p value	Adopted/Rejected
H1	Transaction fairness	→	Social capital	0.998	0.103	9.681	***	Adopted
H2	Social capital	→	Supply chain integration	0.682	0.066	10.383	***	Adopted
H3	Supply chain integration	→	Economic sustainability	0.201	0.100	2.013	0.044	Adopted
H4	Supply chain integration	→	Environmental sustainability	0.095	0.121	0.787	0.431	Rejected
H5	Supply chain integration	→	Social sustainability	0.330	0.097	3.414	***	Adopted

where ***, p <0.001

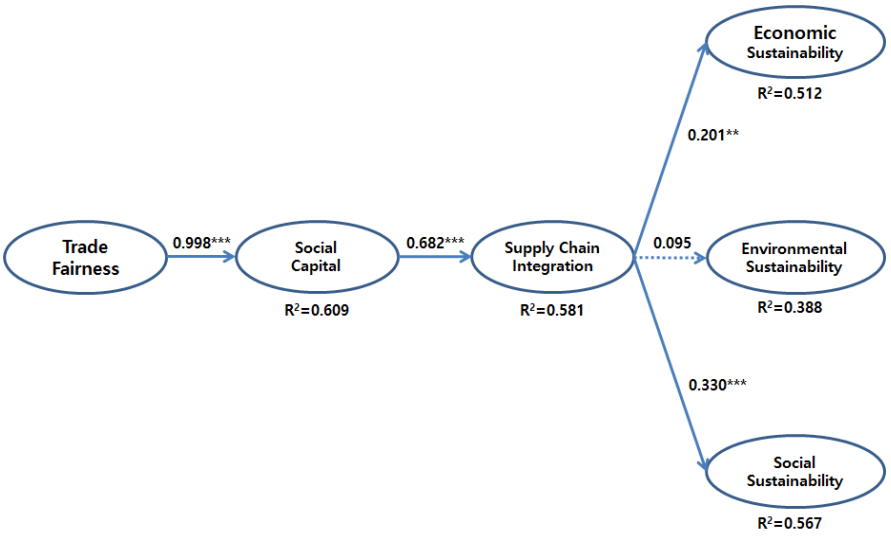

Fig. 2 Research Model

As a result of testing the mediating effects of supply chain integration between economic, environmental and social sustainability, which are 3 factors of social capital and sustainability, there was no mediating effect only on environmental sustainability, but has partial mediating effect between economic and social sustainability.

V. CONCLUSION AND FUTURE RESEARCH DIRECTIONS

Research Summary and Conclusion

The purpose of this study is to clarify the relationship between fairness of business transactions, social capital, supply chain integration, economic environmental and social sustainability in the supply chain, and in order to test them, this study established research hypotheses and executed tests.

The results of the hypothesis test can be summarized as follows.

First, Hypothesis 1 shows that transaction fairness has a positive (+) effect on social capital. And, hypothesis 2 shows that social capital has a positive effect on supply chain integration, and hypothesis 3 tests shows positive (+) effect on economic sustainability. Hypothesis 4 test shows that supply chain integration has no significant positive (+) effect on environmental sustainability, and hypothesis 5 tests shows that supply chain integration has a positive (+) influence on social sustainability.

Hypotheses 6 ~ 8 tests show that supply chain integration, between social capital and sustainability, play a partial mediating role only in economic and social sustainability, as well as environmental sustainability were not found to play a role as parameters. Based on these findings, the academic and practical implications of this study are summarized as follows:

First, increasing the level of fairness of transactions is the most basic factor that can raise the level of social capital formation and supply chain integration. Therefore, it is the most important factor to ensure fairness in the transactions among the individual companies constituting the supply chain. It is because, through this, individual firms can form social capital and further achieve supply chain integration. These results can be found through the test of hypothesis 1, hypothesis 2.

Second, supply chain integration has a positive effect on economic and social sustainability among the three sustainability factors, and it is preferable to achieve supply chain integration in order to construct a sustainable supply

chain. This can be found through the test of hypothesis 3 and hypothesis 5. While, hypothesis 6 and hypothesis 8 tests show the role of supply chain integration as a parameter between social capital and economic and social sustainability.

TABLE IX
TEST RESULTS FOR HYPOTHESES 6 ~ 8 OF RESEARCH ITEMS

Hypothesis	Step	Path			$\Delta\chi^2$	Path coefficient	S. E.	t value	p value	Mediating effect
H6	1	Social capital	→	Economic sustainability	57.616	0.549	0.062	8.907	***	
	2	Social capital	→	Supply chain integration	201.958	0.693	0.066	10.502	***	
		Supply chain integration	→	Economic sustainability		0.568	0.073	7.799	***	
	3	Social capital	→	Supply chain integration	181.880	0.680	0.066	10.251	***	
		Supply chain integration	→	Economic sustainability		0.206	0.099	2.087	0.037	
		Social capital	→	Economic sustainability	Δ20.078	0.411	0.089	4.600	***	Partial mediation
H7	1	Social capital	→	Environmental sustainability	51.338	0.555	0.073	7.639	***	
	2	Social capital	→	Supply chain integration	191.851	0.687	0.066	10.378	***	
		Supply chain integration	→	Environmental sustainability		0.532	0.087	6.134	***	
	3	Social capital	→	Supply chain integration	172.120	0.680	0.066	10.244	***	
		Supply chain integration	→	Environmental sustainability		0.093	0.118	0.786	0.432	
		Social capital	→	Environmental sustainability	Δ19.731	0.492	0.109	4.533	***	No effect
H8	1	Social capital	→	Social sustainability	89.263	0.576	0.064	8.935	***	
	2	Social capital	→	Supply chain integration	247.832	0.691	0.066	10.495	***	
		Supply chain integration	→	Social sustainability		0.644	0.074	8.654	***	
	3	Social capital	→	Supply chain integration	232.022	0.679	0.066	10.226	***	
		Supply chain integration	→	Social sustainability		0.340	0.096	3.541	***	
		Social capital	→	Social sustainability	Δ15.810	0.346	0.086	4.038	***	Partial mediation

where ***, $p < 0.001$

Third, it is the importance of social capital held by individual companies. As a result of the hypothesis 2 test, social capital is a leading factor in achieving supply chain integration and further is a factor for constructing a sustainable supply chain. It is because hypothesis 6, hypothesis 7, and hypothesis 8 show that social capital has a direct positive (+) effect on all three sustainability (Economic sustainability $\beta = 0.549$, $p = 0.000$, environmental sustainability $\beta = 0.555$, $p = 0.000$, social sustainability: $\beta = 0.576$, $p = 0.000$). Therefore, it is necessary to form the social capital held by individual companies in order for social capital to achieve supply chain integration and further secure sustainability in the supply chain. On the contrary, if the level of social capital is low or does not exist, the supply chain integration cannot be achieved, and sustainability in the supply chain cannot be secured.

Finally, through this study, we clarified the mechanism between transaction fairness, social capital, supply chain integration, economic, environmental and social sustainability among trading companies in the supply chain. Therefore, it is suggested that securing fairness in business transactions can form social capital, achieve supply chain integration, and further achieve sustainability in the supply chain. Therefore, if we cannot secure the fairness of transactions in inter-firm transactions, it is impossible to construct such a mechanism, and so once again, it is important to emphasize the importance of fairness of transactions.

Limitations of Research and Future Research Directions

Limitations of this study and directions for future research are summarized as follows:

First, it is the lack of a number of survey and questionnaire data to use. More than 200 data were needed to secure the stability of the data used in the Amos test [44]. However, the number of data used in this study is 129, as shown in Table II, which are not as many as the number of data recommended [44]. This may be a limiting factor in the generalization of this study, and there is a need to acquire more data and research again in the future.

Second, as a test of hypothesis 4, it has shown that supply chain integration has a positive, but not significant, effect on environmental sustainability. This is the test of hypothesis 8, which is the same in the analysis of the mediating effect on environmental sustainability of supply chain integration. There are some previous studies [37], [36] that require supply chain integration to implement eco-friendly supply chain management, which is contrary to previous studies, and it is necessary to check this again.

Third, research on the negative effects of social capital is insufficient. For example, social capital can hinder the creative innovation capabilities of its members, making it difficult to transit to better trading partners [45], and the supply chain can be operated in a closed way causing inefficiencies [7]. It is also necessary to set up stipulated rules or standards because of the natural outflow of technology or the transfer of technology, which can result in the corruption of one's core competencies when opportunities are used opportunistically by other trading firms [46]. Therefore, these parts should be studied further.

Finally, as shown in Table II, the number of companies that can be classified as SMEs and large corporations appears with an appropriate number, and it will also be necessary to classify each company according to the sales amount and the number of employees. This is because there may be differences in the

perception and importance of SMEs and large corporations regarding fairness of transactions, social capital, supply chain integration, and sustainability in inter-company transactions.

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