



Research article

Trust and commitment in supply chain during digital transformation: A case in Korea

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Abstract: Purpose - The purpose of this paper is to test the hypothesis that the fundamentals of the supply chain relationships have not changed during the digital transformation period in Korea between 2006 and 2018. Design/methodology/approach - The data for this study were collected through a questionnaire-based survey during two different time periods in Korea, 2006 and 2018. Findings - This study reveals that supply chain professionals in 2006 regarded trust building process as the most important construct for the successful supply chain operations while in the 2018 survey, trust-based commitment became the most important construct. This paper concludes that supply chain sustainability will be enhanced based on strong supply chain relationship framework. Originality/value - This study reaffirmed that a supply chain relationship built on a trust-based commitment is still the pathway to successful supply chain implementation. As far as we know, no studies have been published in examining supply chain relationships during the digital transformation in two time periods.

Keywords: supply chain foundation; trust-based relationship; trust-based commitment; Wilcoxon rank order test; exploratory factor analysis; principle components; digital transformation in supply chain; supply chain on sand; curriculum changes

1. Introduction

Never before has supply chain management been in the forefront of main newspapers around the world during the Covid-19 pandemic. A few samples include; “U.S. Food Supply Chain Is Strained as Virus Spreads” [1], “World Economy Shudders as Coronavirus Threatens Global Supply Chains” [2], “Covid-19 crisis has laid bare weaknesses in supply chains” [3], “People are hoarding toilet paper. The truth about the supply chain” [4]. The public were under the impression that supply chain is outdated and is the main source of such disruption of daily life. The words “supply chain” became almost a daily buzzword in the news media, politics, financial circles and the general public. During this supply chain “enlightenment” period, it has been blamed for almost everything from misplacing items on shelves to the shortage of toilet paper to protective gear for medical workers. Supply chain is now considered as a matter of national security.

Supply chain is oversubscribed to the point that supply chain is the panacea for solving every issue we face today. The truth is that supply chain execution is not that simple. It is a complex process even under normal circumstances. The Covid-19 pandemic is certainly not considered as a normal event. Whenever an extraordinary event along the supply chain occurs, then we tend to dissect the outcomes only and avoid the fundamentals of the supply chain process. If the fundamentals of the supply chain process are neglected or overlooked, such disruption will continuously occur somewhere in the world that cascades to other parts of the world. Therefore, it is about time for us to review and revisit whether the supply chain relationship among and between players which has played an important role in supply chain optimization has changed since the information technology (IT) evolution that altered the landscape of the supply chain world. Ever since IT played a significant role in supply chain, there has been debates ranging from “The death of supply chain management [5] to the “need for a stress test for critical supply chain” [6]. Has supply chain management been really dead and needed resuscitation to deliver values to society?

The purpose of this paper is to test the hypothesis that the fundamentals of the supply chain foundation (trust-based commitment) has not changed during the digital transformation between 2006 and 2018. In this paper, we define digital transformation as the integration of digital technology into all areas of a business resulting in fundamental changes to how businesses operate and how they deliver value to customers. Digital transformation in this paper includes but not limits to AI, machine learning, blockchain, IoT, Rfid, etc [7,8]. Korea is used as a sample space in this study. Korea experienced a tremendous economic growth powered by IT adoption in supply chain since 2006. Per capita income increased from \$21,743 in 2006 to \$33,424 in 2018, a 53.7% increase during the study periods [9]. Household internet access in Korea increased from 94% in 2006 to 99.5% in 2018, the highest in the world [10]. Samsung Electronics, LG, Hyundai are some of few of the companies in Korea that took advantages of information technologies to have become global players in supply chain operations. Recently during the 68th board meeting of the U.N. Conference on Trade and Development (UNCTAD), South Korea was designated as a developed economy. South Korea was the first nation to become a donor country from being a recipient of U.N. aid in half a century, a transformation that has inspired many developing nations to follow.

This paper is organized as follows. A short literature review on the supply chain foundation and relationship building process will be presented in Section 2. The roles of digital transformation in

supply chain operations also discussed in Section 2. Research hypothesis will be developed at the end of Section 2. Research methodology including measurement units and data sources will be described in Section 3 which is followed by statistical findings on the supply chain relationships between two periods (2006 and 2018). Discussions will be presented in Section 5. Conclusion, implications and limitation of study will be outlined in Section 6.

2. Digital transformation in supply chain management: literature review

Supply chain professionals realize that they have to shift their attention from cutting costs to creating new processes making corporations more agile and connected to create value across the enterprise. In the internet age, speed is crucial as the product life cycles are becoming shorter as productions and distributions are globally scattered. Digital technologies allow companies to generate a better understanding of customers' preferences and enable companies to enhance their relationship with customers, create real-time visibility on their operations and attain a more agile and flexible supply chain. This will result in increased efficiency and product availability, reduced costs and delivery times which enable them to enjoy sustainable growth [11]. Digital transformation is, therefore, the strategic decision that helps organizations to achieve better customer service, build stronger and sustainable relations with suppliers, increased sales and business development and hence increased competitive position [12]. In short, digitalization of supply chain has the potential to significantly achieve higher customer satisfaction, enhanced visibility, better collaboration among supply chain partners, lower delivery times, production cost and increased product availability [13].

According to one study, digitalizing supply chain has achieved a 97% reduction in manufacturing disruptions and an 82% improvement in delivery performance [14]. Sustainable supply chain management becomes better manageable as digital transformation places corrective action (rapid detection, response and recovery) in a timely manner to avoid or minimize major disruptions along the supply chain map. A recent survey on future technology investment, 79% of respondents consider investment in technology as a collaborative tool (it was 44% in 2021 survey), and not just as a processing tool [15]. It has been also reported that digital adoption helps in identifying root causes of disruption and reduce or eliminate recurring business process and product quality defects [14]. It appears that digital adoption reduces cost of business and business risk, and improves productivity and efficiency [16]. By making use of integrated digital systems, supply chains can unify their existing data and share it securely – using a forward-thinking approach to predict lead times, as well as managing demand planning and forecasting.

Literature, however, reveals a slow pace in adopting this technology until recently when we faced the pandemic where connectivity with supply chain partners were suddenly and unexpectedly lost. While digital transformation was rapidly adopted in healthcare and personal medicine due to the pandemic [17], it has been painfully slow in the supply chain area that precipitated supply chain into a “dark” period during the pandemic creating panic along the supply chain. Achieving digital maturity across supply chain operations is challenging as it spans several main supply chain components such as demand planning and management, supply planning, procurement, inventory management, warehousing and logistics, and supplier risk management [16]. A recent survey cites several obstacles in implementing digital transformation from different angles but equally important sectors in supply

chain [18] (CSCMP, 2021a); a skills deficit among their staff (41%), followed by data quality/lack of data (34%), COVID-related uncertainty (28%), an existing rigid technology structure (28%), and fear of change (28%) are cited as some of the roadblocks. These leading factors represent a shift from the 2019 survey. Two years ago, according to the same study, respondents listed fear of change, data quality/lack of data, risk aversion, skills deficits, and rigid technology structure as the top five obstacles they faced, in that order.

Technical aspects of digital transformation such as skill sets, data quality and workforces appear to be the main obstacle in implementing digital transformation in supply chain [19]. During the transition period, the fundamentals of supply chain management (relationship building process) has not been adequately addressed even though we are moving into the next generation of supply chain planning, with collaboration and relationships at the helm, powered by digital innovation. Supply chain professionals assume that new technologies will solve problems caused by unexpected events such as a pandemic. Unless the fundamentals of supply chain are adequately addressed, technologies would not solve issues and problems brought about by external events such as pandemic. The relationship building process among and between supply chain partners are the foundation of successful supply chain operations with or without technologies [20].

Of the three critical components in a supply chain management strategy (information flow, product flow and the relationship among and between supply chain partners), Handfield and Nichols [21] argued that the relationship management is perhaps the most fragile and tenuous. This is because of the high importance placed on trusting relationships where each party in the supply chain has mutual confidence in the other members' expectations, capabilities and commitments. Thus, developing the intended partner's trust is an important concern in managing the relationship [22]. Trust is considered the single most important variable influencing interpersonal and inter-organizational behaviour [23]. Maintaining a mutual relationship between partner companies based on trust contributes to enhanced supply chain management performance [24]. Loss of trust with suppliers, on the other hand, costs Chrysler \$24 billion in profit over the past 12 years [25]. It is also reported that trust-based collaboration among supply chain partners appears to improve inventory carrying cost [26] and profitability [27]. A close collaboration among partners during the Great Recession period solved many financial issues for suppliers [28].

Nevertheless, a lack of uniform definition and interpretation of relationship-based trust in supply chain has hampered us to dive deeper into the operational aspect of trust in supply chain [22]. Trust itself neither creates value nor provides any framework for sustainable business relationships. The underlying tenet of trust is a sense of commitment by both partners to execute the spirit of understandings/agreements in the most efficient and effective manners so as to deliver the value for both parties. Research is abundant that the ultimate goals in supply chain is commitment by trading partners to fulfil their understanding so as to create value for everyone in the chain. The path from trust to commitment is highly significant in inter-organizational relationships [29–34]. Built on Morgan and Hunt's [35] trust and commitment framework, Kwon and Suh [36] tested the "trust leading to commitment" hypothesis. They concluded that "the results from a path model appear to support a relationship between trust leading to commitment" (p. 31).

Supply chain practitioners have been so pre-occupied with only financial returns through technologies that the fundamentals of the supply chain foundation (trust- led- commitment) have been

routinely either ignored, or neglected or both. We have been building the supply chain infrastructure based on a false assumption (dubbed as “supply chain on sand”) that supply chain itself solves many issues and problems. The result from such a false supply chain framework has been a disappointment with outcomes that we are experiencing during the Covid-19 pandemic. We often consider supply chain as a “tool” to create financial rewards and not as a process of creating value. The lean supply chain concept is a by-product from such misconceptions of supply chain [6]. When unexpected external events occur such as the Covid-19 pandemic or any other disasters, the supply chain process either collapsed (Covid-19 pandemic) or becomes very inefficient and ineffective (price is determined not by supply and demand but rather artificial speculation/intervention/emotion). We had been warned as far back as 2015 that the most pressing area to understand supply chain is the foundational knowledge of core supply chain functions [37].

Sustainable supply chain operation should be built on a strong foundation, upon which various technology-based supply chain tools including digital supply chain can be applied in order to generate a steady value stream. Supply chain cannot be resilient without a strong foundation. As we are moving into the next generation of supply chain planning with collaboration and relationships at the helm, decision makers need to know whether continuous investment in technologies achieve the intended goals. The purpose of this paper, therefore, is to study whether supply chain relationships (trust-based commitment) has changed since the introduction of technology-based supply chain (digital transformation).

From the above literature survey, the following hypotheses will be tested:

H1: The level of trust in supply chain operations has not changed.

H2: The level of commitment has not changed

H3: Trust-based commitment in supply chain has not changed since digital transformation.

This study uses the framework developed by Kwon and Suh (2004) shown in Figure 1.

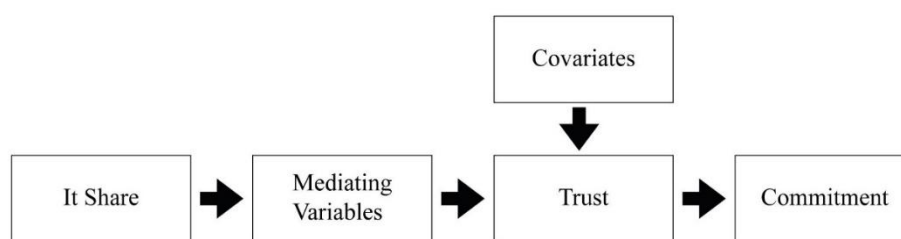


Figure 1. Study Design. (Source: Kwon and Suh [38], Trust, Commitment and relationship in Supply Chain Management: A Path Analysis.)

3. Study Design

3.1. Sampling place and data sources

The data for this study were collected through a questionnaire-based survey in two different time periods in Korea, 2006 and 2018. The Korean economy is a highly developed mixed economy ranked the 4th, largest GDP in Asia and the 10th in the world. South Korea is known for its spectacular rise

from one of the poorest countries in the world to a developed, high-income country in just a few generations. This economic growth has been described as the Miracle on the Han River, which has brought South Korea to the ranks of elite countries in the OECD and the G-20. Korea's rigorous education system and the establishment of a highly motivated and educated populace is largely responsible for spurring the country's high technology boom and rapid economic development. Korea ranks No. 1 in the International Innovation Index (Innovation Index, 2018). A highly adaptive culture also plays an important role in implementing technology-based supply chain as an economic growth engine. Global products such as Samsung's Galaxy, LG appliances, TV screens and Hyundai automobiles are by-products of a technology-based economy for the last decade. Park et al [24] noted that without technology-based supply chain implementation, the Korean economic growth might have been limited. Therefore, Korea is an ideal sample space to test the hypotheses whether digital transformation has changed the trust-based commitment in supply chain optimization process between two time periods 2006 and 2018.

The sample period for this study includes 2006 (before the Great Recession) and 2018 (before Covid-19 pandemic and heavy investment in technology in various sectors of the economy). These two sample periods, therefore, excluded potential opinion bias stemming from extraordinary events that might influence the respondents' perception of supply chain performance. The 2006 survey results were reported by Hong, Kwon and Kim [39] indicating that the level of trust is strongly related to the level of commitment. An identical survey was repeated in 2018 in Korea to test whether perception toward supply chain relationships has changed due to technology implementation (for survey instrument, see Appendix in table 2).

All constructs in the survey instrument were measured on a 7-point Likert scale (1=strongly disagree to 7=strongly agree). A similar survey instrument was originally used in 2004 and 2005 studies by Kwon and Suh [36,38] in the United States. The original instrument was translated into Korean by two professional linguistic translators to ensure consistent wording, and then a pilot test was performed by eight experts from the automotive, electronics, finance, and pharmaceutical industries. The same experts were asked to comment on the suitability of the constructs and their corresponding sub-factors. Based on feedback from the experts, ambiguous items were modified. The questionnaire, then, was translated back to English to check for a semantic discrepancy. A pilot study was conducted with 50 supply chain experts to solicit feedback regarding the constructs and to ascertain the content validity and functionality of the questionnaire [40]. The constructs in the survey were randomly arranged in order to avoid response bias.

The respondents in both surveys were supply chain managers, vice-presidents, and CEOs in supply chain and related areas across Korea. The questionnaires were sent to the respondents via e-mail in the 2006 survey while a web-based questionnaire was employed in the 2018 survey. Of those who responded in the 2006 survey, a face-to-face interview format was used with manufacturers and service providers in Incheon in Gyeonggi Province in Korea from May 9 to June 8, 2006. Out of 430 contacts, seventy-five (75) organizations (17.4%) actually participated.

For the 2018 survey, the initial data was provided by a nationwide marketing organization whose membership includes the largest panel of Korean professionals. In the first step, a cross-sectional list of more than 1592 professionals with over three years' experience in partnership management was created. A filtering process was used in the second step to remove those without sufficient knowledge

of the supply chain processes (understanding of product and service flow), or the ability to distinguish between buyer–supplier relationships (understanding of respondent’s firm and partner’s transaction positioning), and those who were not involved in business transaction activities (no direct experience in collaborating with a partner firm). In the third step, a sample of 472 respondents (29.6% response rate) completed an online survey.

The constructs of interest were adopted from the existing literature. This study adopted a five-item scale to measure supply chain collaboration [41]; a four-item scale to measure trust [36]; a three-item scale to measure commitment [36]; a four-item scale to measure each of information sharing and information quality constructs [42]; and a three-item scale to measure financial performance [43].

Since the main objective of this study is to investigate whether the trust-commitment relationship has changed during the two sample periods (2006 and 2018) when a massive investment was made in technologies by major companies in Korea, a multivariate discriminant principle component was used to extract weight of constructs for two periods. The weights of constructs, then, are used as inputs to test the rank order for two periods. A statistically significant rank order test results may indicate a change in perceptions by the respondents toward supply chain relationships during these two periods. Finally, an exploratory factor analysis is used for both periods to exam whether factor loadings on trust-commitment constructs between the two periods are statistically different. A significant rank order shift between two study periods may imply a change of priority in building supply chain relationship.

4. Results

Reviewing the respondents’ characteristics (not shown here but provided upon request), less than 20% of the respondents in the 2006 survey were decision-makers (vice-president, directors or managers) whereas in the 2018 survey, over 70% of the respondents were in such decision-making positions in their organizations. More high-level decision makers appear to engage in supply chain operations in 2018 than in 2006 reflecting a trend of elevation of senior level supply chain to C-Suite. As to industry identification, a little over 12% of respondents were working for manufacturing companies in the 2006 survey whereas the corresponding information in the 2018 survey shows almost 55%; a significant change between these two time periods; from small scale manufacturing industry to power-house manufacturing industries in Korea primarily led by Samsung, LG, and Hyundai Auto Industry. Our study seems to indicate that not many supply chain professionals were working in supply chain related areas in 2006. However, supply chain professionals made a significant inroad into Korean major industries in early 2018.

4.1. Descriptive information

Table 1 describes some of the respondents’ characteristic information in 2006 and 2018 surveys. There was no significant change in years in business with their supply chain partners between the two sample periods (8.2 years in 2006 vs.7.0 years in 2018, $P > 0.10$). However, there is statistically significant change in face-to face working days; from 175 days in 2006 to 36 days in the 2018 survey ($P < 0.01$). Advanced communication technologies in parts might have attributed to such a drastic reduction in this area between these two study periods. A significant increase in revenue is expected

between these two periods reflecting impressive economic growth and trade that Korea has accomplished since 2010 ($P < 0.01$). It appears that supply chain practitioners stay longer in their positions in 2018 compared with that in 2006 (11.8 years in 2018 vs. 8.1 years in 2006, $P < 0.01$) reflecting a recent trend that supply chain management attracts many talents [44]. Asset investment in partners' firms did not change much during the sample periods (10.2% vs. 10.8%, $P > 0.1$). However, business renewal with their partners increased from 49.7% in 2006 to 78.2% in 2018 ($P < 0.05$). Perhaps, supply chain practitioners began to understand potential value of supply chain and started to practice the value of the supplier relationship management (SRM) [45].

Table 1. Descriptive Statistics (2006 and 2018).

Attributes	2006			2018			t-value
	N	Mean (median)	SD	N	Mean (median)	SD	
Years in business with partners	72	8.2(6.5)	5.7	477	7.0(6.0)	5.8	1.694
Face to face working (days)	68	175.1(120)	127.5	477	36.3(15)	57.0	8.856**
Business renewal (%)	9	49.7(35)	38.8	471	78.2(80)	23.3	2.199*
Stock Owned by Your Firm (%)	64	10.2(5)	19.9	477	10.8(0)	19.3	0.227
Annual Sales Revenue(\$million)	76	9.4(13.5)	34.9	477	44.8(20.0)	12.1	5.136**
SCM Practice Experience(years)	68	8.1(5.5)	7.1	477	11.8(10)	8.9	3.987**

Notes: Values in parenthesis indicates median; ** $P < 0.01$; * $P < 0.05$.

4.2. Rank-order-test

Since the main objective of this study is to investigate whether major constructs (trust led commitment) have changed between these two time periods with digital transformation, it would be interesting to see whether the rank order measured by weight of each construct has changed since the 2006 survey. The weight was estimated through multivariate discriminant principle and extracted their components. Our study produced 5 components in order of importance (weight). We used only the first weighted component in this study and rank them for two periods.

The Wilcoxon rank-order test would be an appropriate statistical method to test whether a significant shift on trust-commitment constructs has occurred since the 2006 study. If there is a significant shift, the rank order test on constructs between these two periods would be statistically significant. Our study shows the Wilcoxon rank Z-statistics of -0.252 ($P = 0.801$) indicating that the rank order on trust-commitment pathway has not substantially changed between these two sample periods.

4.3. Exploratory factor analysis

Although the rank order test reveals no statistically significant change in trust led commitment, it is interesting to investigate whether size (weight) of components in each construct (trust and

commitment) has changed within the constructs between the study periods. Exploratory factor analysis was employed to investigate the components of constructs in the two study periods. This study focuses only on the first factor loading to study the components of constructs.

The Kaiser-Meyer-Olkin (KMO) test is used to measure sampling adequacy for each variable in the model. The KMO statistic is a measure of the proportion of variance among variables that might be a common variance [46]. The KMO Z-values for the 2006 survey show 0.898 ($P < 0.01$) and for the 2018 survey as 0.952 ($P < 0.01$) respectively indicating acceptable sampling adequacy for factor analysis for both sets of data. Almost 64% of information was extracted in the first loadings in 2006 while the corresponding information for the 2018 survey is almost 38%.

For the 2006 survey, nine (9) constructs were extracted in the 1st loadings. Among the 9 constructs, “trust” constructs dominate (4 out of 9, 44.4%) reflecting the importance of the trust building process in supply chain management. Partner and respondent’s asset specificity also played important roles in building the trust process. Asset specificity refers to investments in physical or human assets that are dedicated to a particular business partner and whose redeployment entails considerable switching costs [47]. In addition, a partner’s specific asset investments are positively related to expectation of business continuity [48]. Asset specificity has been considered an important long-run commitment by both sides [38]. It appears, therefore, Hypothesis 1 (The level of trust in supply chain operations has not changed) supported.

The dominant construct in the 2018 survey, on the other hand, include commitment constructs (top 3) followed by trust constructs. Out of a total of 9 constructs in the 2018 survey, 7 of them are on commitment and trust (77.8%). If commitment is defined as “an exchange partner believing that an ongoing relationship with another is so important as to warrant maximum efforts at maintaining it; that is, the committed party believes the relationship endures indefinitely” [35], then commitment is central to all the relational exchanges between the firm and its various partners [36]. Accordingly, Hypothesis 2 (the level of commitment has not changed) has been confirmed.

Information in Table 2 appears to indicate that the fundamental of supply chain management (trust leading commitment) has not changed. Supply chain professionals regard trust and commitment as the two most important constructs in supply chain management. However, an interesting and significant change in perception have occurred between 2006 to 2018. This study reveals that supply chain professionals in 2006 regarded trust building as the most important construct for successful supply chain operations while in the 2018 survey, commitment became the most important construct. Commitment, built on trust, became the “Holy Grail” for a successful supply chain execution This leads us to conclude that our Hypothesis No. 3 (trust-based commitment in supply chain has not changed since digital transformation) is supported.

In summary,

H1: The level of trust in supply chain operation has not changed. Confirmed

H2: The level of commitment has not changed. Confirmed

H3: Trust-based commitment in supply chain has not changed since digital transformation.

Confirmed

Table 2. First Factor Loadings (2006 and 2018).

Factor Loadings (2006)		
Constructs (1st factor loadings)	Question No (Appendix)	Contents
Trust: Benevolence	15	“Though circumstances change, we believe that the partner will be ready and willing to offer us assistance and support”.
Trust: Keep promise	12	“The partner usually keeps the promises that it makes to our firm”.
Trust: Best judgement	13	“Whenever the partner gives us advice on our business operations, we know that it is sharing its best judgment”.
Trust: Truth	10	“Even when the partner gives us a rather unlikely explanation, we are confident that it is telling the truth”.
Information Sharing	24	“Information sharing on important issues has become a critical element to maintain a strong partnership”.
Potential Opportunism	9	“It would be difficult for the partner to replace the sales and profits generated from the business with us”.
Partners Asset Specificity	1	“This partner firm has made significant investments in resources dedicated to their relationship with us”.
Commitment: Willingness to Invest	4	“We have made significant investments in resources dedicated to our relationship with this partner firm”.
Respondents Asset Specificity	5	“Our operating process has been tailored to meet the requirements of dealing with this partner”.
KMO = 0.898 ($P < 0.01$). Extraction Sums of Squared 1st Loadings = 63.9%		
Factor Loadings (2018)		
Constructs (1st factor loadings)	Question No (Appendix)	Contents
Commitment1 : Willingness to Invest	4	“We have made significant investment in resources dedicated to our relationship with this partner firm”
Commitment2 : Remain as a partner	29	“We want to remain a member of the partner's network because we genuinely enjoy our relationship with it”.
Commitment3 : Association	28	“Even if we could, we would not drop the partner because we like being associated with it”.
Trust 1: Keep promise	12	“The partner usually keeps the promises that it makes to our firm”.
Trust 2: Benevolence	19	“When it comes to things that are important to us, we can depend on the partner's support”.
Trust 3: Welfare	16	“When making important decisions, the partner is concerned about our welfare”.
Commitment 4: Willingness to Invest	4	“We have made significant investments in resources dedicated to our relationship with this partner firm”.
Respondents Asset Specificity	5	“Our operating process has been tailored to meet the requirements of dealing with this partner”.
Satisfaction	34	“Generally, we are very satisfied with its overall relationship with this partner”.
Partner's Reputation	27	“This firm has a good reputation in the market”
Conflict	25	“A high degree of conflict exists between the partner and our firm”.
KMO = 0.952 ($P < 0.01$). Extraction Sums of Squared 1st Loadings = 37.8%		

Notes: Wilcoxon Rank Z-statistics = -0.252 ($5 P = 0.801$).

5. Discussion

Efficiency and efficacy of supply chain management has been the subject of public discussions by many sectors in society especially since the Covid-19 pandemic. The vulnerability of global supply chain has been exposed by the pandemic that we are unprepared. Supply chain professionals still believe that fundamentals of supply chain play a significant role in sustainable operations. Therefore, this study affirmed our hypothesis that trust-based commitment in supply chain has not changed since digital transformation.

This paper traced back the origin of supply chain genesis, the relationships of supply chain. We have been so busy focusing on the end result, profit maximization through supply chain management, and have neglected the basic tenet of supply chain. Relationships once considered the most important asset in building trust [38] between and among supply chain partners has been replaced by technologies depriving the relationship building process in dealing with daily transactions and long-term strategic discussions. As a result, transaction cost increased [49] and relationships, built on trust and understanding of human psychology, was replaced by machines. Machines tell us what to make, how to make, and when to make the essential goods and services. But technology is unable to tell us when the unplanned external events would occur.

This study affirms that the basic constructs in supply chain has not changed between 2006 and 2018 refuting a study by Brown, Crosno and Tong [50] that "...while trust enhances commitment, commitment can also erode trust." (p. 155). As a matter of fact, this study reaffirms that the supply chain foundation built on "trust led commitment" is stronger in 2018 than in 2006. This study also raises an interesting research area in that digital transformation enhances collaboration among supply chain partners, confirming Gupta's study.

Research is abundant that trust-commitment matters most in successful supply chain execution since early the 2000s [29–34,36,38]. This study seems to reaffirm that the fundamentals of the supply chain foundation is still intact in spite of the on-set avalanche of technology deployment in supply chain operations. More supply chain practitioners believe now than before that a partner's commitment, built on trust, is the key for successful and sustainable supply chain operations. Technology deployment in supply chain actually enhances relationship building. This study seems to refute the argument that "supply chain is dead" [5]. Rather this study suggests that supply chain may need a "stress test" [6], not in technology but rather in our understanding of fundamentals of the supply chain relationships. Once we understand this foundation, supply chain becomes a bit more resilient and sustainable adverse impacts caused by unexpected external events would be minimized.

6. Conclusions, Implications and study limitations

This study reaffirmed that a supply chain relationship built on the trust-based commitment is still the pathway to successful supply chain implementation. Digital transformation has not changed trust-based commitment in supply chain. In addition, this study reveals that supply chain professionals have matured during the twenty years of practice from just a trust-building process to a trust-led commitment for successful supply chain implementation. We argue that on-going communications among and between supply chain partners based on relationships will minimize unforeseen disruptions.

and improve sustainable supply chain operations. We are encouraged by this study that the future outlook of sustainable supply chain operations is promising only if we stay with the fundamentals of the supply chain foundation.

Two broad implications can be derived from this study. For practitioners, technology has not replaced the fundamentals of supply chain operations. Before committing to no-ending expensive technology implementations, the relationship building process should be in place. It is not an easy task to build trust with supply chain partners especially under the global setting. Yet, investment in expensive technologies does not solve fundamentals of supply chain. It is the human side that matters the most in order to sustain a profitable supply chain.

For the future workforces, curriculum changes in the supply chain program are inevitable [51]. Granting that technology will continuously play a significant role in shaping the supply chain landscape, skill sets in leadership, communication, and understanding of different cultures are some of the areas that supply chain curriculums should address. If not addressed properly, our future supply chain leaders may limit their vision and talents to technical aspects of supply chain only and expose themselves unprepared to disruptions brought about by weak links along the supply chain.

This study has limitations in applying our findings to countries with a different stage of economic development and different social constructs. Korea is one of the few countries in the world that has experienced a rapid economic growth engineered by technology. The market structure in Korea is more or less homogenous yet dynamic that allowed them to adapt and implement new supply chain ideas and technologies quickly without creating serious disruptions. Accordingly, the generalization of findings from this study maybe limited for other countries with different backgrounds. In addition, the sampling methods and sample size are different between the two study periods. Results may be biased. Finally, adoption of digital technologies in supply chain is not an easy task. There are many obstacles as pointed out by [18]. Among the many, skill set is the most challenging area in successful adoption of technologies. Technology has been advancing at a faster rate than we feel comfortable in using on a daily basis. As long as the skill sets fall behind, investment in and adoption of technologies may create a technology waste.

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Conflict of interest

No potential conflict of interest was reported by the authors.

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