

Exploring the Link between Supply Chain Capability and Inter-Organizational Compatibility: Do Inter-Organizational Information Systems (IOIS) Integration Matter?

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Abstract--- The prime objective of the current study is to the link between Supply chain capability and inter-organizational compatibility. In addition to that, the mediating role of the inter-organizational information systems (IOIS) integration in the relationship between the Supply chain capability and inter-organizational compatibility is examined. Using surveys-based methodology the data is collected with the aid of a questionnaire adopted from the previous studies. The SEM-PLS is used to analyses the data. Overall the findings of the study have provided support with the hypothesized results. The findings of the study confirm the view that the increasing role of globalization and growing environmental uncertainties have increased the managerial challenges in providing diversifying product and services to their values customer. The findings of the study also confirmed the argument broached in the study that the Integration of information systems across partnering organizations has become the backbone of supply chain management. **Introduction.** The study which is among very few studies on the issue will provide guidelines to policymakers, researchers and practitioners across the globe.

Keyword--- Inter-organizational Compatibility, Inter-organizational information systems, PLS-SEM

1. Background

Increased globalization, environmental uncertainty, and market dynamism have considerably gave rise to various challenges for managers to deliver right kind of product or service, in adequate quantity and quality, at the right time and at lowest possible cost [38]. Under dynamic environments, managers are needed to develop new value proposals which consider customer agreements driven by relationships [33] as well as manage business-oriented relationships. Business-to-business relationships can be managed using critical tools of computer and information technology and information integration across channel partners. Such information integration system acts as a backbone of SCM, since it helps in the process of information sharing, therefore improving responsiveness and flexibility of an organization [22] while reducing inventory costs and risks [3].

Inter-organizational information systems (IOIS) consists of value-added networks and boundary spanning innovations, linking organizational buyers

and suppliers [42, 31]. It can also account for internet-based EDI, network-based value-added electronic data interchange, electronic exchange under SCM, extranets, and supports systems for decision-making, which utilizes similar kind of technology [27]. Hence, an inter-organizational information system is capable of incorporating two or more independent organizations which exchange information as well as communication technology, based on common or shared IT capabilities, thus helping to generate, store, transform, and communicate information across the boundaries of a firm.

Although, naturally IOIS are complex due to their properties of boundary-spanning, since it comprises of various partners having diverse culture, strategic intentions, and interests, therefore, their application seems to be problematic, because it calls for considerable efforts for extending and redefining organizational boundaries of the participating firms [21]. Thus, [6, 35] proposed that inter-organizational compatibility acts as a basic ingredient for IOIS integration. Effective integration, within boundary-spanning system demands highly embedded technical, strategic, and operational business partners. Previous researches on industrial marketing and business-to-business marketing highlights the need for congruency and inter-organizational compatibility [5] among partnering firms, for assuring effective physical and financial flow of information throughout the supply chain. Literature shows the positive influence of inter-organizational information systems on supply chain and individual organizations. Such as, information sharing with the help of IOIS allows communication and identification of consumer demands [25, 40] thus improving the product delivery and responsiveness, thereby, facilitating in satisfying specified buyer and customer arrangements. Moreover, effective IOIS integration across SC help firms to timely access and determine accuracy of necessary information needed for forecasting, collaborative planning, order synchronizations, production, and scheduling [2]. Hence, IOIS integration is essential for managing uncertainty and risk and allow firms to sustain information integrity within the SC [7].

The present study aims to develop understanding that how managers implement and sustain IOIS integration effectively, for improving supply chain capabilities and organizational performance. Based on the congruence and dynamic capability theory and resource-based perspective, this study creates and tests a framework for explaining the mechanism of inter-organizational compatibility dimensions helping to achieve supply chain capabilities and IOIS integration. The rest of the paper is arranged as follows: second section involves the theoretical overview and literature regarding IOIS integration, supply chain capabilities and performance, and inter-organizational compatibility. Subsequently, next section includes research methodology and analysis of data, and the final section presents the conclusion through discussing the results and presenting future implications and further research areas.

2. Literature Review

2.1 Inter-organizational information systems integration (IOIS)

IOIS is considered to be a key factor for inter-organizational relationships according to the literature of organizational behavior, supply chain management, marketing and information systems, and logistics management [10, 39]. IOIS integration is defined as the system creates a linkage with the information technologies of channel partners which helps in sharing of information. A networking theory states that supply chain associations have the ability to motivate resource co-creation, when the partnering firms integrate, combine, and redesign mutual resources. Hence, partnering firms involved in IOIS integration are required to establish relationships which could help in exchanging valuable technology, market, and information, whereas, effective integration develops unique capabilities using exchange of available organizational resources and timely communication [12]. Previous studies on supply chain particularly focuses upon the need for IOIS integration and significance of the information exchange for improving superior SC performance [14].

2.2 Inter-organizational compatibility

Based on congruency theory, the study proposes that inter-organizational compatibility is required for the effective and efficient IOIS integration. Where, inter-organizational compatibility is the exchange of values, common experiences, business strategies, and principles among the partners of supply chain. The participating member firms having comparable services, products and similar cultures and objectives can attain successful inter-organizational integration and business-to-business partnership more easily [34]. However, compatibility arises as a result of values and work practices of SC partners, and make the business information sharing to be simpler across the partnering firms [30]. Inter-organizational compatibility develops coordination between channel partners [37]. Although, it is not necessary to achieve positive firm performance through complementary resources. Partnering firms need to share similar cultural compatibility, comparable objectives, and technological infrastructure to achieve compatibility within the organizations. Thus, it is a multi-faceted variable comprising of strategic, cultural and technical components.

Where technical compatibility arises from the common information systems of the channel partners and encompasses issues related to software, network commonality, point-of-sale terminals, technical and operational business processes, and business oriented technology [37]. Whereas, cultural compatibility covers subjective norms, shared business philosophies, values, and traditions of the partnering firms and such compatibility is essential as differences that arise from norms and values of these firms could result in lack of control and instability in business market and has the ability to negatively affect the data-based decision-making, information transfer, and inter-organizational management of information [16]. Compatible values, philosophies, and common identity encourage consultative behavior and knowledge sharing.

2.3 Inter-organizational Capabilities and Supply Chain Performance

A supply chain refers as a network of entities that causes the flow of information, money, and material among the suppliers, primary producers, retailers,

consumers, and manufacturers. Supply chain management is the strategic and systematic coordination of conventional business processes, in an organization as well as across other businesses involved throughout the supply chain [36], for the purpose of improving supply chain and long-term organizational performance. It involves inter and intra-organizational business processes, delivering services and products with minimal inconvenience and difficulty, at minimum possible prices. Furthermore, superior performance of supply chain is largely dependent upon effective information, finance, and material flows across the supply chain [32]. Supply chain management having information systems enabled in them, help to develop supply chain capabilities by allowing the product and information flow from primary producers to consumers and consumers to producers, respectively.

On the other hand, supply chain capability is the organizational ability of identifying, exploiting, and assimilating external and internal information and resources, in order to assist overall activities of the supply chain. Several previous studies classify it into efficacy and efficiency-related supply chain capabilities [4]. Where efficacy-related capabilities enable maintaining SC relationships among the channel partners and act in accordance with the customer demands [19], whereas efficiency-related capabilities are the organizational capabilities which allow firms to attain superior logistics performance at minimum possible cost. Moreover, supply chain capabilities are the customer service-based and logistics-based capabilities. Therefore, we conceptualize these capabilities to be second-order or higher-order capabilities which covers supply chain relationships, SC responsiveness, and logistics performance.

2.4 Inter-organizational compatibility and IOIS integration

An efficient and effective information sharing and product exchange must take place within supply chain partners [18, 20]. Hence, information systems integration is critical across business-to-business and supply chain partners for achieving higher performance. Although, differences or incongruence of the objectives, goals culture, and information technology among the channel partners may cause

obstruction in the process of integration. Meanwhile, congruency theory requires compatibility, similarity, as well as fit among the channel partners to achieve effective integration, as the compatible values, culture, and practices considered to be necessary platforms for the information system integration and its adoption [26]. Thus, inter-organizational compatibility involves information system application and e-commerce factors, within the channel partners. Firms face various cultural and technical challenges while performing information system integration and its adoption. Hence, strategic, cultural, and technical compatibility are the feasible inter-organizational compatibility components and the IOIS integration antecedent.

Organizations involving coordination and collaboration among partnering firms having diverse technological and technical systems usually find it difficult to achieve effective integration and maintaining relationships [15]. Therefore, establishing technical compatibility is essential for IOIS integration and business-to-business partnering. Limiting application transactions to minimum i.e. shipping invoices or orders and developing inter-organizational association with one firm are somehow easy. Although, increasing connectivity with various channel partners include, various software, hardware, business practices, and networking protocols making information system integration to be a more complex phenomena [1, 28]. In spite of the information technology advancements, still technical challenges impede the IOIS integration and successful inter-organizational networks. In addition, incompatible network systems, software, and hardware cause retards and incongruent IOIS integration between the partners of supply chains. Thus, following hypothesis is proposed:

H1. The IOIS integration is positively affected by inter-organizational technical compatibility.

The prior studies about innovation adoption, business-to-business relationships, and outsourcing highlighted the need for fit and congruency between the objectives and goals of the partnering firms, to achieve superior business-to-business relationships. Furthermore, congruency theory suggests that greater goal congruency implies greater alliance and advanced inter-organizational exchange of

information [11, 23]. Following this theory, positive relationship is found among alliance success and strategic compatibility. Firms who fail to establish any coordination and exchange sensitive information among the supply chain partners may hinder the integration process and in turn affect the organizational performance. Successful compatibility of objectives and goals between partnering firms promotes the exchange of strategic information, demand, and sales, thus helping firms in planning and collaborative forecasting throughout the SC. Hence, integrating information system is expected to be more susceptible in case of compatible objectives, goals, strategies, and business practices of the SC partners. Therefore, we hypothesize as follows:

H2. The IOIS integration is positively affected by inter-organizational strategic compatibility.

Although, willingness of channel partners to exchange strategic information and strategic compatibility do not ensure successful IOIS integration and business-to-business organizational associations. Incongruent business values, culture, and norms of SC partners can negatively influence the integration and inter-organizational associations [44, 41] Prior studies highlight that organizational culture plays a significant role in resource integration and in the business processes. This paper, views cultural compatibility to be an essential factor for successful integration of information systems, and propose the following hypothesis:

H3. The IOIS integration is positively affected by inter-organizational cultural compatibility.

2.5 IOIS integration and supply chain capabilities

With evolving information systems, supply chains have become increasingly converted into supply networks, where various suppliers, producers, customer, and intermediaries are practically connected globally and are satisfying the changing requirements of their customers. Therefore, IOIS is a breakthrough in the field of SCM, since it allows SC partners to satisfy customer demands efficiently and effectively, through ensuring rapid information and product transferring across the SC. A successful IOIS integration requires coordination in data exchange,

data management, and information systems technology among the SC partners [8]. According to RBV perspective, developing competitive advantage is represented by organizational performance. Furthermore, by developing information-sharing capabilities, integrating information systems ensure quick response to market challenges and improve firms' competitive advantage [17]. Therefore, this integration improves logistics performance and supply chain coordination, thus, affirming just-in-time delivery, reduced inventory, and product availability. Therefore, we propose the following hypothesis:

H4. Supply chain capabilities are positively associated with IOIS integration.

2.6 Linkage between supply chain capabilities and inter-organizational compatibility

Instead of particular business processes optimization, enhancing overall supply chain performance is the prime objective of supply chain management. Applying congruency theory on the effectiveness of inter-organizations, calls for the fitness of needs, goals, partnering systems, and structure. Networking systems, hardware, and software of information system for the partnering firms must be compatible for achieving higher SC capabilities, since incompatible processes and incongruence may impede the achievement of interactive-business and successful SC capabilities development. Thus, [23] suggested that compatible or similar legacy systems, are needed for the IOIS integration for helping firms to access and keep the sensitive information.

Congruency and compatibility of SC partners' objectives and goals play a significant role in organizational performance and inter-organizational relationships. Such as, Baxter Healthcare Corporation and Xerox has minimized their inventory and production costs and improves their market share as well as revenue, through sharing common goals among the partners of supply chain. In a similar manner, compatible norms, beliefs, and values create feasible relationships between the channel partners and affect their post-integration performance. An effective IOIS applications require top managers to coordinate and support organizational-level participation for assuring the alignment of long-term strategic goals of partnering firms. Moreover, support

of top management is critical to understand particular IOIS integration benefits, shared vision, and reducing interest divergence throughout the channel partners. Failing to establish shared vision as well as culture may cause hindrance in the successful SC integration and inter-organizational associations.

Incompatible value systems and cultural differences are the key factors of integration failures and mergers. Such as, differences between the BMW and Volkswagen's corporate cultures gave rise to integration failures and merger. Therefore, cultural compatibility is a key feature and a prerequisite to distinguish the business-to-business partnering of longer time with the short-term partnering and to achieve successful business-to-business association. As cultural compatibility encourages knowledge exchange and effective communication, thus stimulating shared objectives. While, Heil & Bornemann, [13] stated that partnering firms require operating systems and compatible cultures for achieving sustained competitive advantage. Hence, cultural, technical, and strategic compatibilities are considered as the key supply chain performance determinants therefore, we hypothesize as follows:

H5. Supply chain capabilities are positively affected by technical compatibility.

H6. Supply chain capabilities are positively affected by strategic compatibility.

H7. Supply chain capabilities are positively affected by cultural compatibility.

2.7 Association among supply chain capabilities, inter-organizational compatibility and IOIS integration

Literature shows that IOIS alone does not exhibit performance, since several organizations who have largely invested in IOIS have not experienced the expected outcomes and benefits. Therefore, it is argued that supply chain capabilities are only influenced by IOIS integration if the partnering firms achieve strategic, cultural, and technical compatibility [24]. A study found a direct association among supply chain activities and inter-organizational compatibility. However, other researchers have reported an indirect relation among SC communication systems i.e. IOIS and compatibility [28], firm performance and

compatibility. Compatible and congruent system of information ensures smooth functioning and flow of knowledge among partners of SC, through information system thereby, improving supply chain capabilities. Present study incorporates IOIS integration to be a mediator, linking technical, cultural and strategic compatibility effects with the supply chain capabilities. Therefore, we hypothesize as follows:

H8. IOIS integrations acts as a mediator in the relation among supply chain capabilities and technical compatibility.

H9. IOIS integrations acts as a mediator in the relation among supply chain capabilities and strategic compatibility.

H10. IOIS integration acts as a mediator in the relation among supply chain capabilities and cultural compatibility.

3. Methodology

The present study aims to examine the relation among inter-organizational compatibility, IOIS integration, and supply chain capabilities. Quantitative approach is used in this study, which employs survey methodology for the collection of data. The quantitative approach is employed as it includes a detailed examination of large sample size and allows to make inferences from these responses. It also provides a summary of the collected responses. The quantitative method has used questionnaire as an instrument of data collection, which then quantifies the responses of the survey. Questionnaire helps to determine the relationship among the dependent, intervening, and independent variables. It was formulated considering the problem, objectives and hypotheses proposed, for assessing the relative significance of components that can influence the performance of employees working in the manufacturing firms of Indonesia.

The measurement of inter-organizational compatibilities is adapted from the studies of

Rajaguru and Matanda, [33] of interorganizational information systems (IOIS) is adapted from [29], and of supply chain capabilities from Yenyurt et al. [43]. The data which was gathered through questionnaires were then coded into the statistical software i.e. Smart-PLS, SPSS, Microsoft Excel, and IBM. Likert scale was employed for scaling responses from the survey. Questionnaire is formulated on the basis of the literature. This PLS-SEM was used in this study for the significance of the path coefficients was assessed using the standard bootstrapping procedure, which included 5000 bootstrap samples and 266 cases as recommended.

4. Research Analysis and Discussion

PLS-SEM method is employed as a statistical tool for achieving the research objectives of the study. It is an extended form of structural equation modelling and a powerful technique which integrates multiple set of models into a well-structured equation. Results of the structural model exhibits the relationship among intervening and direct variables. SEM-PLS technique is better than the conventional multiple regression, as it has the capacity to deal with unfamiliarised conceptual models or to further assess some existing phenomena [9]. In addition, it can simultaneously handle multiple set of equations contrary to the multiple regression which performs this task in steps.

According to Hair et al. PLS-SEM consists of two-steps and is considered as an advanced structure of multiple regression analysis. It involves the assessment of two models i.e. inner and outer models. First step involves checking the reliability and validity of the constructed model. Assessing the results for structural model is necessary for the testing of hypothesis, which is done using five steps procedure i.e. i) carefully analysing the structural model for collinearity; ii) checking the significance level of path coefficients, iii) analysing R^2 values; iv) assessing the effect size of f^2 , and v) the predictive relevance for Q^2 and effect size q^2 . The measurement model of the study is shown in the figure 2

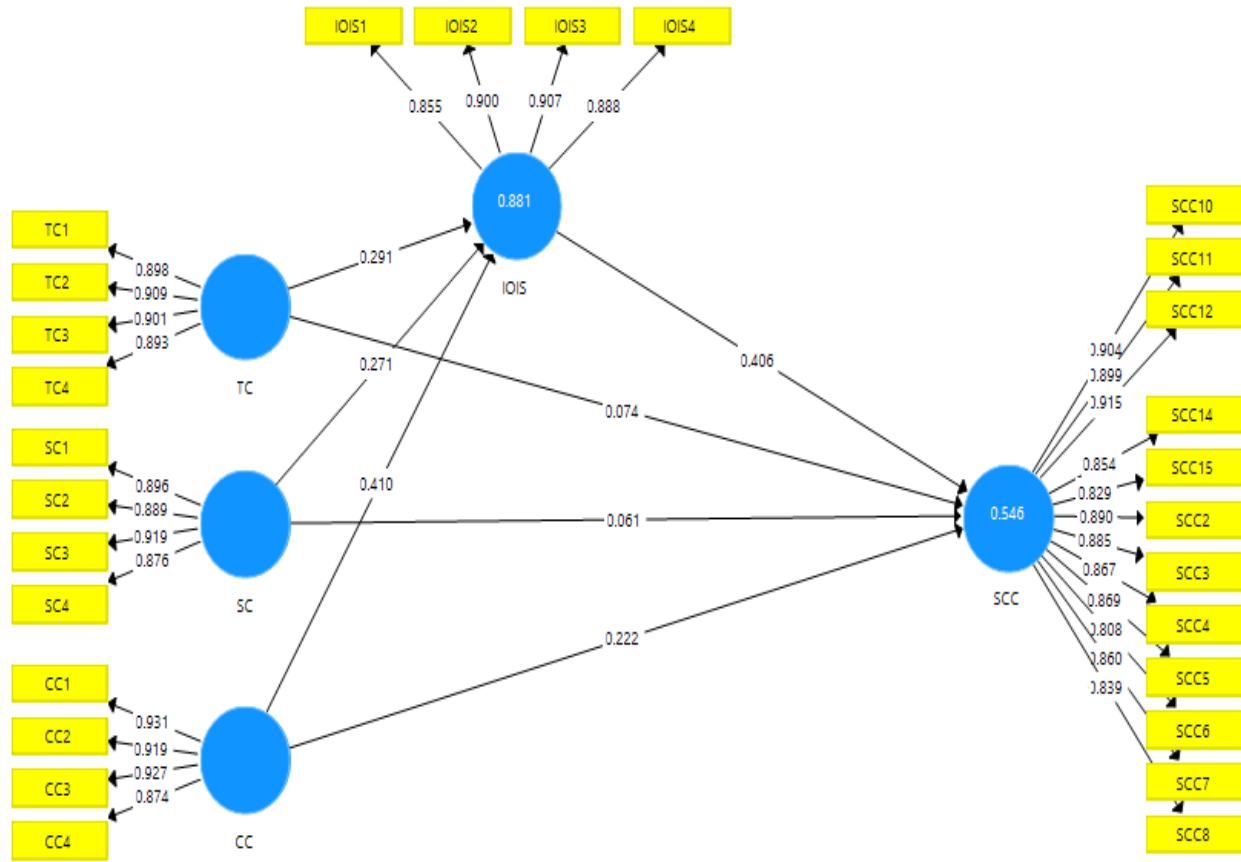


Figure 2. The measurement model

The outer loading is shown in the table 1. The items with loading less than 0.50 are deleted from the final measurement model.

	CC	IOIS	SC	SCC	TC
CC1	0.931				
CC2	0.919				
CC3	0.927				
CC4	0.874				
IOIS1		0.855			
IOIS2		0.900			
IOIS3		0.907			
IOIS4		0.888			
SC1			0.896		
SC2			0.889		
SC3			0.919		
SC4			0.876		
SCC10				0.904	
SCC11				0.899	

SCC12				0.915	
SCC14				0.854	
SCC15				0.829	
SCC2				0.890	
SCC3				0.885	
SCC4				0.867	
SCC5				0.869	
SCC6				0.808	
SCC7				0.860	
SCC8				0.839	
TC1					0.898
TC2					0.909
TC3					0.901
TC4					0.893

Data reliability and validity are determined using composite reliability and Cronbach alpha measures. The acceptable value for both Cronbach's alpha and composite reliability is 0.70. Average variance extracted as well as factor loadings are observed, to observe the convergent validity and consistency of the internal model. The value for both the measures is higher than 0.50 which is considered to be acceptable. External consistency of the model is determined by undertaking the test for discriminant validity, where discriminant validity analyses

variables which are not supposed to be related are actually not related to each other. Principally, it shows that variables that are not linked are actually found to be linked in the study. It is a powerful technique by Fornell-Larcker. The values for both cross and outer loadings turned out to be the same, whereas the difference lies in the fact that cross loadings compare the correlation or association between the constructs. The results are exhibited in table 2.

Table 2. Construct Reliability and Validity

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
CC	0.933	0.934	0.952	0.834
IOIS	0.910	0.911	0.937	0.788
SC	0.917	0.921	0.942	0.801
SCC	0.970	0.971	0.974	0.755
TC	0.922	0.922	0.945	0.810

The discriminant validity is shown in the table 3. The results confirm that there model is valid.

Table 3: Discriminant Validity

	CC	IOIS	SC	SCC	TC
CC	0.933				
IOIS	0.910	0.938			
SC	0.902	0.918	0.895		
SCC	0.710	0.729	0.775	0.869	
TC	0.860	0.893	0.724	0.683	0.900

After the confirmation of the validity and reliability the next step is to develop the structural model. The

structural model of current study is shown in the figure 3.

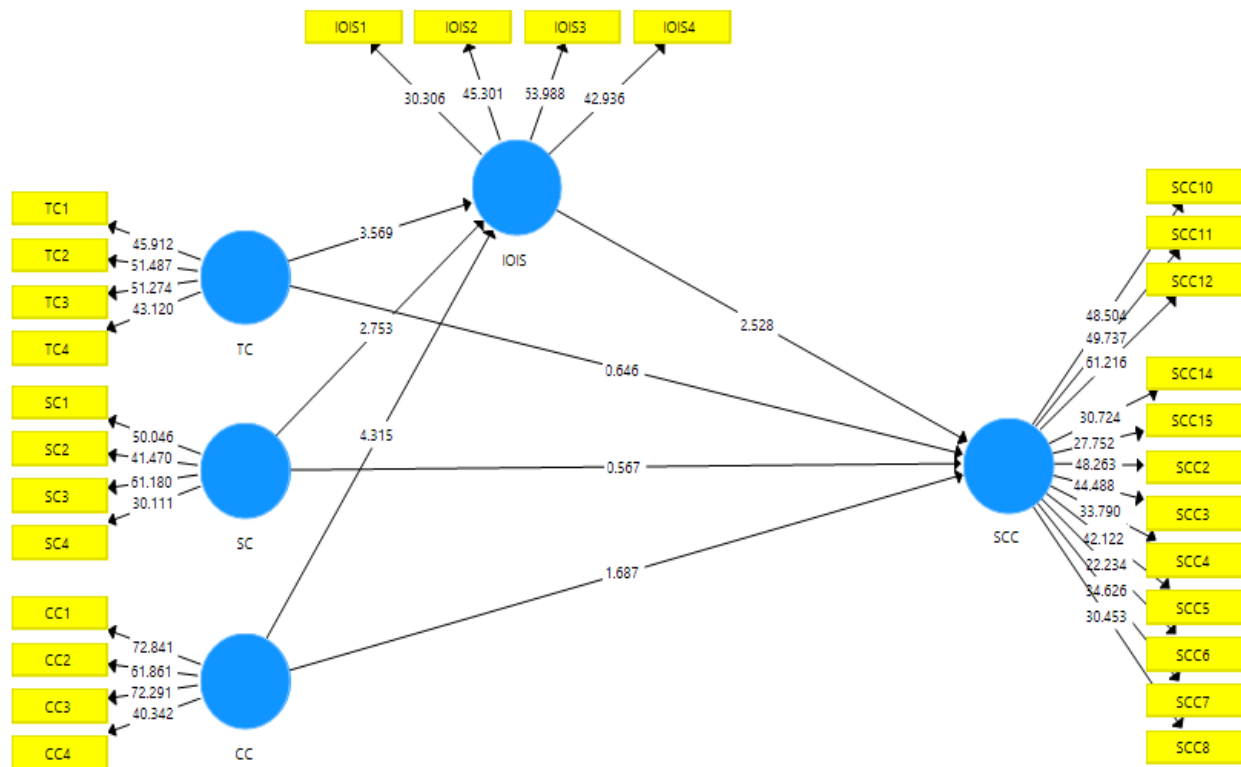


Figure 3. Structural Model

The last step in data analysis is the hypothesis testing of the models. For this purpose, PLS bootstrapping is used setting $t > 2.64$ and $p < 0.05$ as threshold. The values for five out of seven direct hypotheses have

fulfill the conditions for the acceptance of hypotheses. The hypothesis concerning the direct relationship between SC and SCC, and between TC and SCC are rejected because of $p > 0.05$.

Table 4. Direct Results

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
CC -> IOIS	0.410	0.404	0.095	4.315	0.000
CC -> SCC	0.388	0.387	0.105	3.681	0.000
IOIS -> SCC	0.406	0.403	0.161	2.528	0.012
SC -> IOIS	0.271	0.277	0.099	2.753	0.006
SC -> SCC	0.171	0.177	0.125	1.363	0.173
TC -> IOIS	0.291	0.290	0.081	3.569	0.000
TC -> SCC	0.192	0.187	0.112	1.715	0.086

The results of hypothesis explaining the indirect relationships or mediation are shown in table 5. The findings of the study revealed the fact except one

hypothesis all hypothesis concerning the indirect relationships are accepted significantly.

Table 5. Indirect Results

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
CC -> IOIS -> SCC	0.166	0.166	0.082	2.030	0.042
SC -> IOIS -> SCC	0.110	0.111	0.061	1.796	0.073
TC -> IOIS -> SCC	0.118	0.115	0.054	2.188	0.029

In the study of multivariate data analysis, R square of the endogenous variable is explained by the predictor variables. Therefore, the R square's magnitude for the endogenous variables were considered to be an

indicator of predictive power of the model. The R-square value in our case are above the threshold values.

Table 6. R-Square

	R Square
IOIS	0.881
SCC	0.546

5. Conclusion

The paper aims to provide theoretical foundation and empirical findings that how inter-organizational compatibility factors help in the supply chain capabilities and in the process of IOIS integration. The study is undertaken to explore the link between Supply chain capability, inter-organizational

compatibility, inter-organizational information systems (IOIS). In addition to that, the mediating role of the inter-organizational information systems (IOIS) integration in the relationship between the Supply chain capability and inter-organizational compatibility is examined. Since most firms possess the ability of dealing with inter-organizational barriers, while inter-organizational factors are

somehow difficult to resolve because of the involvement of multiple organizations in the process of firm's decision-making. Therefore, there is need to undertake empirical researches to assess what roles inter-organizational factors play in the IOIS integration. The study has defined the inter-organizational compatibility as a capability that involves information system application and e-commerce factors, within the channel partners. Firms face various cultural and technical challenges while performing information system integration and its adoption. Hence, strategic, cultural, and technical compatibility are the feasible inter-organizational compatibility components and the IOIS integration antecedent. Using surveys-based methodology the data is collected with the aid of a questionnaire adopted from the previous studies. The SEM-PLS is used to analyse the data. Overall the findings of the study have provided support with the hypothesized results. The findings of the study confirm the view that the increasing role of globalization and growing environmental uncertainties have increased the managerial challenges in providing diversifying product and services to their values customer. The findings of the study also confirmed the argument broached in the study that the Integration of information systems across partnering organizations has become the backbone of supply chain management. Introduction. The study which is among very few studies on the issue will provide guidelines to policymakers, researchers and practitioners across the globe.

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