



# Impact of Exchange and Communications Technology on Firm Performance: The Mediation effect of Supply Chain Capabilities

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**Abstract:** Inter-organizational systems use (IOS), network-enabled enterprise systems, extend beyond the borders of an organization, enabling external entities such as supply chain partners to share business information in real time and to collaborate more effectively. So, the study investigated the Mediation Role of Supply Chain Management Capabilities on the Relationship between Inter-Organizational System use on Firm performance (Case Study: Sudan food industry), where (42) participants were purposely, and to whom the questionnaire was directed, Afterward, the data collected from the managers of production and supply chain officers at Sudanese food processing Industry. After that, the data coded against SPSS and AMOS 26. Then after checking normality, validity and reliability, descriptive analysis carried out, and correlation among variables checked. While, path analysis used to test hypotheses. The findings of the study reveal IOS have a positive and significant impact on SCM capabilities. also, SCM capabilities mediating the relationship between IOS and Performance.

**Keywords:** Inter-organizational systems , Supply chain responsiveness , Supply chain integration.

## 1. INTRODUCTION

Inter-organizational systems (IOS), network-enabled enterprise systems, extend beyond the borders of an organization, enabling external entities such as supply chain partners to share business information in real time and to

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collaborate more effectively (Bakos, 1991; Chatterjee & Ravichandran, 2004; Hartono, Li, Na, & Simpson, 2010).

Firms have deployed diverse IOS use including electronic data interchange, vendor managed inventory, and collaborative planning, forecasting and replenishment for real time communication and intelligent decision making with supply chain partners. Inter-organizational systems facilitate effective management of activities in a coordinated and integrated fashion to achieve competitive advantage.

The resource-based view (RBV) theory postulates that a firm gains competitive advantage when it controls and effectively combines resources that are rare, valuable, heterogeneous and inimitable (Barney, 1991; Peteraf & Barney, 2003). so, both resource-based theory and logistics research show Inter-organizational systems enable an organization to augment its internal resources and capabilities with external resources available to the partners for the mutual benefits of the members of the supply chain network.

The use of IOS results in significant benefits to the entire supply chain (Asamoah, Agyei-Owusu, Andoh-Baidoo, & Ayaburi, 2019; Hartono *et al.*, 2010). However, there are calls for opening the supply chain Blackbox and further investigating the mechanisms through which IOS use enhances Firm performance (Agbenyo, Asamoah, & Agyei-Owusu, 2018; Aydiner, Tatoglu, Bayraktar, & Zaim, 2019; Yu, Chavez, Jacobs, & Feng, 2018). Therefore, Through the following research gaps, the study attempts to cover the food industry in Sudan in order to get the benefit of IOS and SCC in Dall Group.

Accordingly, the current study focuses on 1) external utilization of IOS in SCC and 2) Inter-Organizational System use on firm Performance. Insights from the examination of the interplay between IOS use and SCC in enhancing Firm performance enriches management's understanding of operational dynamics of IOS in the organization. In this study, we explore the intricate interplay between IOS use, SCC and Firm performance.

The remainder of this paper is arranged as follows. Section 1 Introduction, Section 2 reviews the relevant literature and Section 3 proposes the hypotheses. We show the research methodology in Section 4 and present the results in Section 5. Finally, the paper ends with our discussion and conclusions in Section 6.

## **2. LITERATURE REVIEW**

### **2.1. Inter-organizational information systems (IOS)**

Inter-organizational information systems (IOS) are network-enabled information systems that allow organizations to effectively manage business

operations and supply chain activities across several organizations (Asamoah *et al.* 2021).

IOS use and adoption have increased over the past few decades and have spread to numerous industries. According to research, there are three possible goals that can be accomplished by adopting and using IOS: facilitating communication, facilitating integration, and facilitating business intelligence (Zhang and Cao 2018; Subramani 2004).

In the current big data era, where significant amounts of corporate data are generated every day, deploying IOS for business intelligence is more important. Exploring and comprehending business data can give businesses fresh perspectives on their operations, clients, and markets, which can lay the groundwork for improved performance. How well IOS is used to support learning and business intelligence is referred to as IOS-enabled business intelligence. International Federation for Information Processing (IFIP) 2021 Knowledge sharing within a supply chain network by A. Kumi *et al.* published by Springer Nature Switzerland AG 2021 (Zhang and Cao 2018).

Applications for IOS-enabled corporate intelligence include collaborative knowledge acquisition, shared database and decision support systems, and artificial intelligence (Mandal and Dubey 2021).

According to earlier research, implementing IOS improves a variety of outcomes, including firm performance (Hartono *et al.* 2010, Rajaguru and Matanda 2013, and Firm performance (Cho *et al.* 2017; Asamoah *et al.* 2021a).

The existing literature on IOS outcomes, however, frequently combines many IOS use aspects, focusing mostly on IOS use at the second order level and failing to explore how certain IOS use dimensions may improve firm performance. So, there is still a knowledge gap about whether and how IOS-enabled business information improves firm performance. Researchers have urged numerous times to investigate the impact of various IOS use factors on performance (Asamoah *et al.* 2021a; Agbenyo *et al.* 2018).

The methods by which IOS-enabled business intelligence improves firm performance are also little understood. By evaluating the importance of information exchange, coordination, integration, and supply chain responsiveness skills in explaining the results of IOS-enabled business intelligence, this study fills these research gaps.

## **2.2. Dynamic Supply Chain Capabilities (SCC)**

The concept of dynamic capabilities has emerged due to uncertainty and continual changes in the business environment and market. The dynamic capabilities

theory was developed by Teece *et al.* (2017). They define dynamic capabilities as a firm's ability to build, integrate and reconfigure its internal and external resources and competences to cope with the rapid changes in the business environment. Zahra & George, (2002) argue that dynamic capabilities enable firms to renew and reconfigure their resource base to meet evolving customer demands and competitor strategies. The use of dynamic capabilities in the supply chain is becoming increasingly important (Witcher *et al.*, 2008 & Allred *et al.*, 2018).

The emergence of dynamic capabilities in the supply chain are due to the changes in the long and short-term supply and demand, market structure and customer requirements (Ju *et al.*, 2016). Therefore, firms must have dynamic supply chain capabilities to address these changes. Through dynamic supply chain capabilities, firms can create a collaborative relationship with other organizations, customers and suppliers and precisely predict market demands, in turn, enhancing the supply chain responsiveness to meet customer and supplier needs (Sanders, 2014). Several researchers have investigated the dynamic capabilities from a supply chain perspective.

Mathivathanan *et al.* (2017) argue that the development of dynamic capabilities through the supply chain has an important role to deal with future needs. Oh *et al.* (2019) describe dynamic supply chain capabilities as a firm's ability to sense and exploit internal and external resources in order to enhance supply chain practices efficiently and effectively.

They also state that dynamic supply chain capabilities include sharing information, coordination, integration, and supply chain responsiveness. Ju *et al.* (2016) argue that dynamic supply chain capabilities are processes of information exchange, supply chain alignment, and information technology in order to meet customer needs and maintain competitiveness in a dynamic environment. Aslam *et al.* (2018) suggest that supply chain agility and adaptability are coherent components of dynamic supply chain capabilities which should be integrated to support supply chain ambidexterity.

Supply chain agility capability enables a firm to effectively match the internal and external resources to market changes. This capability helps a firm's efforts to take advantage of opportunities or counteract threats from turbulent environments (Van Hoek *et al.*, 2001), which may lead to the achievement or maintenance of a competitive position (Eisenhardt and Martin 2000). Many studies state that the continuous improvement in supply chain agility capability, that is, improving the responsiveness to changes at small costs, has a positive impact on firm performance and competitiveness (Blome *et al.*, 2013; Chakravarty *et al.*, 2013; Oh ., 2018).

**2.2.1 Supply chain responsiveness:** is a firm's ability to respond quickly to changes in consumer needs, production and delivery quantities and, product mix, volume, and delivery in response to shifts in demand and supply. These changes are most likely to lead to enhancing performance outcomes such as a lower production cost, greater customer satisfaction, and faster delivery (Yu *et al.*, 2016). Moreover, (Prajogo and Olhager, 2016; Mandal *et al.*, 2016) show that supply chain responsiveness positively impacts on operational performance.

**2.2.2 Collaboration capability:** refers to a firm's ability to build a long-term partnership in terms of supply chain activities and exchange of information, resources, and risk to achieve common objectives (Bowersox *et al.*, 2002). Cao and Zhang (2011) argue that supply chain collaboration capability is an organization's capability to share information, knowledge and resource, goal consistency. Yunus (2018) discusses that customer collaboration, supplier collaboration, and internal collaboration are important elements to constitute the collaboration supply chain. Integration capability indicates the firm's capacity to build strategic relationships and collaborate with its supply chain partners (Flynn *et al.*, 2010).

**2.2.3 Supply chain integration:** emphasizes the availability of the right products, to the right consumers, at the right time at a competitive price (Angeles, 2009). Rajaguru and Matanda (2019) argue that supply chain integration consists of information flow integration, physical flow integration, and financial flow integration. Agility capability refers to the firm's ability to respond speedily to the changes and turbulence in the market in order to enhance its suppliers and customers (Aslam *et al.*, 2018).

Moreover, supply chain agility is a dynamically process to adjust or reconfigure the current business process to address the shifts in the market and other uncertainty. Li *et al.*, (2009) suggest that supply chain agility consists of important elements are strategic readiness and response capability, operational readiness and response capability, and episodic readiness and response capability. Responsiveness capability is defined as the ability of supply chain partners to respond to changes and shifts in the environment (Williams *et al.*, 2013). Singh and Sharma (2015) allude that supply chain responsiveness emphasizes a reduction in lead time, improves service quality, quick response to a customer's requirements, and transportation optimization. Shekarian *et al.*, (2020) argue that responsiveness in supply chain has three key elements: first, agility to respond to customer needs; second, flexibility to ensues a new product development and entering new markets and third, reduce the risk of supply chain bottlenecks and disruptions.

### 2.3. Firm Performance

Operational performance in a dynamic environment, firms strive to obtain competitive advantages and achieve excellent organizational performance (Rajaguru and Matanda, 2019).

Related to the firm's internal operations efficiency, which may enable the firm to enhance its competitiveness and profitability in the market (Hong *et al.*, 2019). Operational performance is a multidimensional construct that includes the effective transformation of operational capabilities into competitive advantages of organizations. It can be assessed by productivity, quality, cost, delivery, flexibility, and customer satisfaction (Gambi, 2018).

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## 3. RESEARCH METHODS

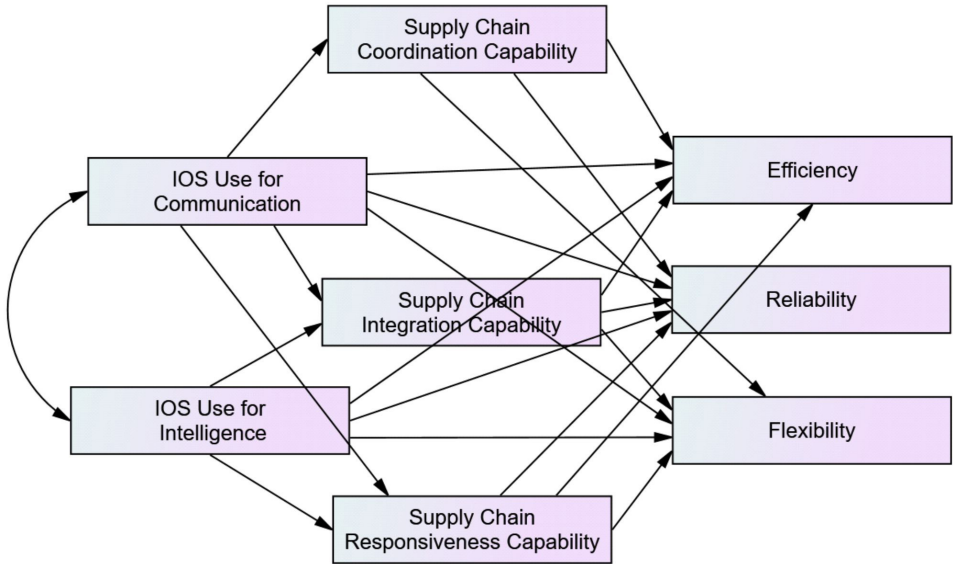
### 3.1. Sampling and data collection

The current study is considered as a descriptive and cause-effect study. It aims of studying the impact of Supply Chain Control food processing Industry (Dal group of companies ). It starts with literature review to collect profile for measuring the impact of inter organizational Supply Chain impact as an example for Sundanese food processing Industry. i.e. questionnaire. Afterward, the data collected from the managers of production and supply chain officers at Sundanese food processing Industry.. After that, the data coded against SPSS 26 and AMOS.

Then after checking normality, validity and reliability, descriptive analysis carried out, and correlation among variables checker

H<sub>1</sub> inter-organizational system use IOS with sub-dimension (C-I) has positive impact on Firm performance SCP with sub-dimension (R.E.F)

H<sub>2</sub> supply chain management capabilities SCMC with sub-dimension (I.S.R) has positive impact on Firm performance SCP with sub-dimension (R.E.F)



**Figure 1: Conceptual framework**

$H_3$  inter-organizational system use IOS with sub-dimension (C-I) has positive impact on supply chain capabilities with sub-dimension (I.C.R)

$H_4$  supply chain management capabilities SCMC multi-dimension mediated the positive impact of inter-organizational system use IOS use with multi-dimension on SCP.

### 3.2. Measurement

Measurement instruments for the constructs were obtained from previous studies and adapted to suit the context of this study. IOS Use was adopted from Zhang and Cao (2018), Supply Chain Capabilities was adopted from Wu *et al.* (2006), and Firm performance was adopted from Kocoglu *et al.* (2011) and Lee *et al.* (2007).

### 3.4. Empirical strategy

In this study, SPSS and AMOS had been used to take a look at the proposed model. SEM used to be used to look into the theoretical framework in order to take a look at the proposed model. In addition, it gives correct estimates of the paths between constructs by way of inspecting the structural and size fashions concurrently (Chin, 1998). As a consequence, Sarstedt, Ringle, and Hair (2017) contend that SEM is a proper approach of trying out mediation



and moderation outcomes and inspecting complicated relationships. Last however no longer least, CB-SEM is broadly used in a number lookup fields (e.g., Ferraris, Devalle, Ciampi, and Couturier, 2019; Rezvani, Dong, and Khosravi, 2017).

### 3.5. Non-response bias and common method bias countermeasures

Non-response bias and common method bias inclination counter measures Following Armstrong and Overton's (1977) idea for Non-response bias (NRB) evaluation, we looked at 25% of responses from the initial fourteen days of the review time frame with 25% of reactions from the most recent two weeks and played out a t-test that uncovered our review was liberated from the NRB issue. Furthermore, it was checked that there was no distinction between the answers of the respondents in the two states utilizing the ANOVA examination, which uncovered that there were no fundamental differences. To alleviate the adverse consequences of normal technique predisposition (CMB), we performed different tests. We utilized Muthen and Muthen's (2007) M-in addition to programming stacking check, Harman's single element test (Gomez-Conde *et al.*, 2019), and Podsakoff et al's. (2003) NRB test. These tests showed that our review was liberated from CMB. Besides, we directed pre-testing for the questionnaire to guarantee the understandability of the assertions introduced in that.

## 4. DATA ANALYSIS AND RESULTS

We used SPSS and AMOS v 26 to assess the measurement model and structural model, and a bootstrapping estimation procedure was adopted to investigate the significance of mediation effects.

**Table 1: Company profile**

		<i>Frequency</i>	<i>Percent</i>
<b>Gender</b>	Male	26	59.1
	Female	17	38.6
	Total	44	100.0
<b>Age</b>	18 to 24	18	40.9
	25 to 30	21	47.7
	31 to 35	3	6.8
	More than 36	1	2.3
	Total	43	97.7



		<i>Frequency</i>	<i>Percent</i>
<b>Academic qualification</b>	B.sc	1	2.3
	M.sc	38	86.4
	PhD	4	9.1
	Total	43	97.7
<b>Specialization</b>	Business	15	34.1
	Management (MIS)	7	15.9
	Supply chain Management	18	40.9
	IT	2	4.5
	Others	1	2.3
	Total	43	97.7
<b>Income</b>	Less than 100000	3	6.8
	In range 100000 to 500000	38	86.4
	Above 500000	1	2.3
	Total	42	95.5
Missing	System	2	4.5
Total		44	100.0

Source: prepared by researcher from data (2022)

## 4.1. Factor analysis

### 4.1.1 Exploratory factor analysis

EFA was once carried out thru structured order, had been viewed for EFA. First, the Bartlett take a look at of sphericity used to be used to verify the relevance of issue evaluation which used to be evaluated by means of inspecting the correlation matrix of the accrued statistics (Hair *et al.*, 2005). At the identical time, sampling adequacy used to be calculated with the aid of Kaiser-Meyer-Olkin (KMO) statistics. The rating of the Bartlett takes a look at of sphericity and the KMO value. Using Maximum Likelihood to habits (EFA). Factor evaluation was once performed on the twelve items, which used to be used to measure dimensions of the transaction attributes on logistics performance. Table 5.6 confirmed the precis of consequences all the gadgets it is above then 0.5. So, the KMO and Bartlett's take a look at equal 0.869 which is full-size (0.00). This end result indicates that the pattern dimension is ample for structural equation modelling (Gaskin, 2012, Kenny and McCoach, 2003).

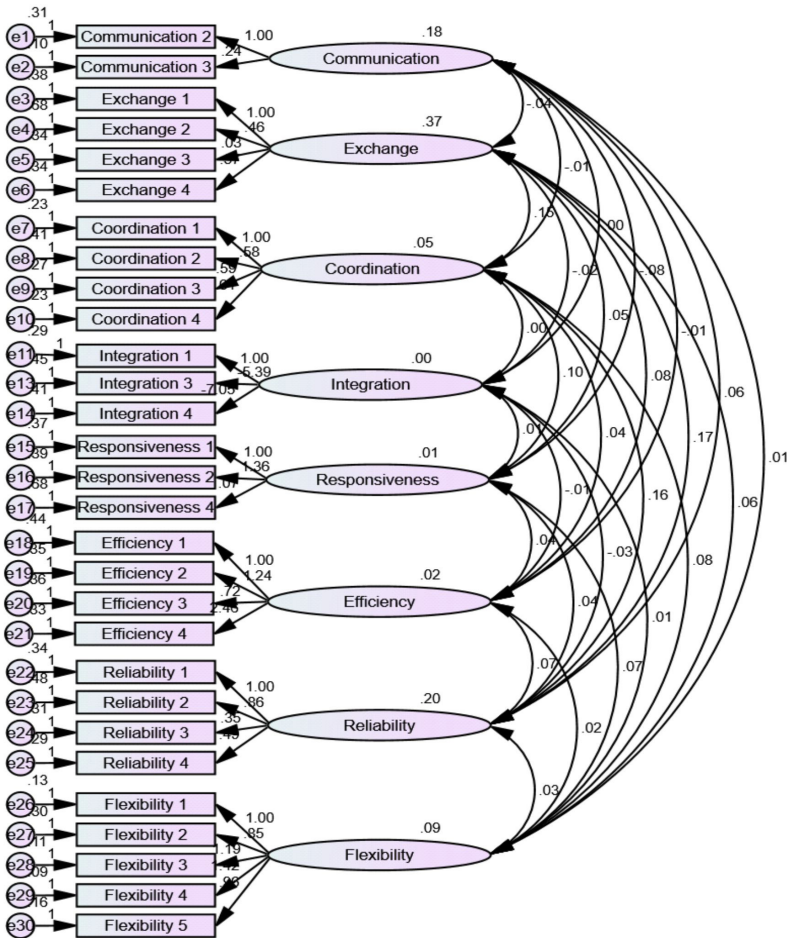
**Table 2: Pattern Matrix<sup>a</sup>****The pattern matrix to establish convergent and discriminant validity.**

	<i>Component</i>							
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>
Communication 1	-.028	.385	-.388	.019	.456	.082	.083	.150
Communication 3	-.060	.285	-.087		-.315	-.034	.260	.947
Exchange 1	.068	.850	.176	-.119	.210	-.104	-.196	.144
Exchange 2	-.271	.125	-.085	.478	.182	.295	.222	.322
Exchange 3	.158	.011	-.124	.047	.348	.645	.161	-.215
Exchange 4	-.182	.077	.733	-.105	.221	-.025	.237	-.244
Coordination 1	-.164	.074	.838	.072	-.093	.155	-.152	.047
Coordination 2	.571	-.173	.375	.102	.312	.286	-.094	.028
Coordination 3	-.256	.161		.071	.736	-.306	-.253	-.212
Coordination 4	.523	.553	-.151	-.514	-.067	-.018	.110	.221
Integration 1	-.027	-.006	-.025	.198	-.122	-.181	.848	.250
Integration 3	-.056	.232	.139	.745	-.330	.243	-.135	.087
Integration 4	.490	.162	.138	.065	.175	.264	-.256	.277
Responsiveness 1	.141	-.100	-.049	-.183	.887	.142	.040	-.209
Responsiveness 2	-.543	.646	.206	.184	.104	.080	.257	.037
Responsiveness 4	.604	-.072	-.450	.103	.076	.052	-.122	.235
Efficiency 1	.171	-.133	.473	.116	.267	-.352	-.045	.300
Efficiency 2	.081	.688	-.043	.014	-.044	.095	.114	.173
Efficiency 3	.145	-.066	.619	-.265	-.027	-.133	.683	.214
Efficiency 4	-.101	.386	.261	-.080	.713	.021	-.074	-.116
Reliability 1	.157	-.010	.130	-.076	-.166	.922	-.219	.064
Reliability 2	.291	.262	.089	.115	-.037	.207	.595	-.045
Reliability 3	.431	.385	-.130	.167	.197	-.420	.063	.101
Reliability 4	.326	-.025	.035	.892	-.122	-.359	.137	-.124
Flexibility 1	.256	-.279	-.098	.755	.151	.029	.251	-.012
Flexibility 2	.412	.079	.616	.265	-.183	.094	.060	-.099
Flexibility 3	.861	-.029	-.088	.051	-.030	.086	.092	-.073
Flexibility 4	.388	.573	-.067	.086	.076	-.086	-.100	-.598
Flexibility 5	.875	.172	.091	.039	-.192	.159	-.084	-.174

The results were found substantial, and hence the result of factor analysis was accepted (Hair *et al.*, 2005).

**4.1.2. Confirmatory factor analysis (CFA)**

Confirmatory factor analysis (CFA) had been carried out to take a look at the reliability and validity of records measuring instrument, respectively. In order to verify the diploma of correspondence between the appear variables and latent assemble of the transaction attributes on logistics overall performance a multi-dimensional CFA mannequin in (Figure 1) has been conceptualized and examined for its psychometric properties.



Following Fornell and Larcker (1981), we performed a confirmatory component evaluation (CFA) to determine the constructs in phrases of convergent validity, discriminant validity, and reliability. The effects of the CFA confirmed pretty desirable

<i>Exchange</i>	<i>Communi- cation</i>	<i>Coordina- tion</i>	<i>Integra- tion</i>	<i>Respon- siveness</i>	<i>Efficien- cy</i>	<i>Reli- ability</i>	<i>Flexi- bility</i>
0.426							
-0.162	0.485						
1.157*	-0.115	0.288					
-0.649	-0.15	0.152	0.374				
0.83	-1.718†	4.360*	1.048	0.158			
0.875	-0.194	1.113	-1.449	2.423	0.347		
0.642*	0.316	1.634**	-1.137	0.787	0.962	0.453	
0.331	0.105	1.216**	0.388	2.141*	0.46	0.251	0.651

The fit statistics:  $\chi^2(59) = 112.329$ , RMSEA=0.067, NFI=0.90, CFI=0.95, IFI=0.95, GFI=0.92, and SRMR=0.052. We used composite reliability (CR) and Cronbach's alpha to determine the reliability of all constructs. As proven in Table 3, all values of CR (ranging from 0.695 to 0.814) are greater than 0.7, suggesting sufficient reliability (Fornell and Larcker, 1981).

**Table 3: Reliability and validity**

	<i>CR</i>	<i>AVE</i>	<i>MSV</i>	<i>MaxR(H)</i>
Exchange	0.780	0.181	1.34	0.551
Communication	0.757	0.235	2.951	0.413
Coordination	0.651	0.083	19.012	0.274
Integration	0.699	0.14	2.099	0.349
Responsiveness	0.685	0.025	19.012	0.073
Efficiency	0.713	0.12	5.872	0.385
Reliability	0.688	0.205	2.67	0.532
Flexibility	0.779	0.423	4.584	0.818

#### **4.1.3. Structural models and hypotheses test results**

In the current study, the hypotheses have been tested through constructing structural model using SEM. Structural model provides a direct effect on the output file as unstandardised and standardised

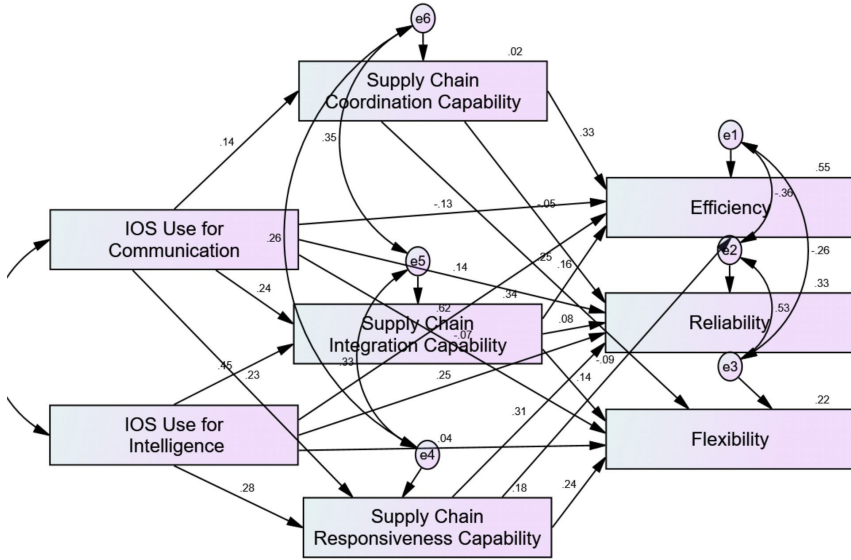


Figure 3

Figure 3 shows the estimation results of the structural model. The goodness of fit indices were  $\chi^2=(2.277)$ ,  $DF=2$ ,  $CMIN/DF= 1.138$  with  $RMSEA=0.026$ ,  $NFI=0.92$ ,  $CFI=0.96$ ,  $IFI=0.96$ ,  $GFI=0.94$ , and  $SRMR=0.041$ , suggesting an acceptable fit.

Table 5: Direct Hypotheses Testing

			Estimate	S.E.	C.R.	P	Result
Coordination	<---	Communication	0.128	0.135	0.947	0.344	Not Supported
Integration	<---	Communication	0.222	0.128	1.735	0.083	Not Supported
Responsiveness	<---	Communication	0.18	0.118	1.529	0.126	Not Supported
Integration	<---	Exchange	0.484	0.154	3.149	0.002	<b>Supported</b>
Responsiveness	<---	Exchange	0.245	0.146	1.681	0.093	Not Supported
Efficiency	<---	Communication	-0.126	0.114	-1.103	0.27	Not Supported
Reliability	<---	Communication	0.13	0.134	0.965	0.334	Not Supported
Flexibility	<---	Communication	-0.084	0.175	-0.481	0.631	Not Supported
Efficiency	<---	Exchange	0.7	0.16	4.389	***	<b>Supported</b>
Reliability	<---	Exchange	0.272	0.188	1.452	0.146	Not Supported
Flexibility	<---	Exchange	0.053	0.244	0.217	0.828	Not Supported
Efficiency	<---	Coordination	0.362	0.139	2.61	0.009	<b>Supported</b>
Reliability	<---	Coordination	-0.054	0.163	-0.332	0.74	Not Supported
Flexibility	<---	Coordination	0.316	0.212	1.494	0.135	Not Supported

Efficiency	<---	Integration	0.162	0.148	1.097	0.273	Not Supported
Reliability	<---	Integration	0.078	0.174	0.448	0.654	Not Supported
Flexibility	<---	Integration	0.175	0.226	0.775	0.439	Not Supported
Efficiency	<---	Responsiveness	-0.12	0.156	-0.769	0.442	Not Supported
Reliability	<---	Responsiveness	0.377	0.184	2.05	0.04	<b>Supported</b>
Flexibility	<---	Responsiveness	0.352	0.239	1.471	0.141	Not Supported

\*\*\* Significant at .001 level \*\* Significant at .01 level NS Not Significant

The hypothesis was subjected to statistical analysis and the results were found to be statistically significant (95% confidence interval, 5,000 bootstrapping). Table 5 shows the main information on the hypothesized relationship paths. Under the P value for statistical significance, some hypotheses were supported (P value < 0.05), which supports the respective hypothesis. Statistically insignificant influences were observed in the other pathways; therefore, their hypothesized relationships were not supported.

From the data in the above table, we can derive the following results

- Communication do not have a positive influence on Coordination
- Communication do not have a positive influence on Integration
- Responsiveness do not have a positive influence on Communication
- Exchange has a positive influence on Responsiveness
- Exchange has a positive influence on Integration
- Communication does not have a positive influence on Efficiency
- Communication does not have a positive influence on Reliability
- Communication does not have a positive influence on Flexibility
- Exchange has a positive influence on Efficiency
- Exchange does not have a positive influence on Reliability
- Exchange does not have a positive influence on Flexibility
- Coordination has a positive influence on Efficiency
- Coordination does not have a positive influence on Reliability
- Coordination does not have a positive influence on Flexibility
- Integration does not have a positive influence on Efficiency
- Integration does not have a positive influence on Reliability
- Integration does not have a positive influence on Flexibility
- Responsiveness does not have a positive influence on Efficiency

- Responsiveness does not have a positive influence on Reliability
- Responsiveness does not have a positive influence on Flexibility

#### 4.1.4. The mediation tests: indirect effects using the bootstrap approach

The indirect effects using the bootstrap approach (Bollen and Stine, 1990, Preacher and Hayes, 2004, Shrout and Bolger, 2002) it's different from Baron-Kenny (1986) approach. the evidence are shows in the next Table.

**Table The Regression Path Coefficient for Indirect Effects**

	<i>Exchange</i>	<i>Result</i>	<i>Communication</i>	<i>Result</i>
Coordination	...		...	
Flexibility	.250	<b>No mediation</b>	.356	<b>No mediation</b>
Reliability	.770	<b>No mediation</b>	.608	<b>No mediation</b>
Efficiency	.015	<b>Full mediation</b>	.551	No mediation

**Indirect Effects - Two Tailed Significance (BC) (Group number 1 - Default model)**

	<i>Exchange</i>	<i>Result</i>	<i>Communication</i>	<i>Result</i>
Integration	...		...	
Flexibility	.032	<b>Full mediation</b>	.048	<b>Full mediation</b>
Reliability	.264	<b>No mediation</b>	.213	<b>No mediation</b>
Efficiency	.052	<b>No mediation</b>	.100	No mediation

**Indirect Effects - Two Tailed Significance (BC) (Group number 1 - Default model)**

	<i>Exchange</i>	<i>Result</i>	<i>Communication</i>	<i>Result</i>
Responsiveness	...		...	
Flexibility	.024	<b>Full mediation</b>	.087	<b>No mediation</b>
Reliability	.020	<b>Full mediation</b>	.087	<b>No mediation</b>
Efficiency	.878	<b>No mediation</b>	.753	No mediation

- Coordination did not mediate the relationship between Exchange on Flexibility
- Coordination did not mediate the relationship between Communication on Flexibility
- Coordination did not mediate the relationship between Exchange on Reliability
- Coordination did not mediate the relationship between Communication on Reliability
- Coordination mediates the relationship between Exchange on Efficiency



- Coordination did not mediate the relationship between Communication on Efficiency
- Integration mediates the relationship between Exchange on Flexibility
- Integration mediates the relationship between Communication on Flexibility
- Integration did not mediate the relationship between Exchange on Reliability
- Integration did not mediate the relationship between Communication on Reliability
- Integration did not mediate the relationship between Exchange on Efficiency
- Integration did not mediate the relationship between Communication on Efficiency
- Responsiveness mediates the relationship between Exchange on Flexibility
- Responsiveness did not mediate the relationship between Communication on Flexibility
- Responsiveness mediates the relationship between Exchange on Reliability
- Responsiveness did not mediate the relationship between Communication on Reliability
- Responsiveness did not mediate the relationship between Exchange on Efficiency
- Responsiveness did not mediate the relationship between Communication on Efficiency

#### 4.1.5. Global Test

	$X^2$	$DF$
Unconstrained	15.089	2
Constrained	53.396	22
Difference	38.307	20
P-Value	0.008	

**Interpretation:** The p-value of the chi-square difference test is significant; the model differs across groups.

## Local Tests

<i>Path Name</i>	<i>Male Beta</i>	<i>Female Beta</i>	<i>Difference in Betas</i>	<i>P-Value for Difference</i>	<i>Interpretation</i>
Communication → Coordination.	0.218	0.096	0.123	0.841	There is no difference
Communication → Integration.	0.159	0.301	-0.142	0.558	There is no difference
Communication → Responsiveness.	0.091	0.415*	-0.323	0.193	The positive relationship between Responsiveness and Communication is only significant for Female.
Exchange → Integration.	0.431†	0.493**	-0.062	1.000	There is no difference.
Exchange → Responsiveness.	0.101	0.380*	-0.279	0.365	The positive relationship between Responsiveness and Exchange is only significant for Female.
Communication → Efficiency.	-0.147	-0.085	-0.062	1.000	There is no difference
Communication → Reliability.	0.054	0.118	-0.064	0.764	There is no difference
Communication → Flexibility.	-0.370*	0.188	-0.558	0.112	The negative relationship between Flexibility and Communication is only significant for Male.
Exchange → Efficiency.	0.748***	0.553**	0.195	0.913	There is no difference.
Exchange → Reliability.	0.241	0.100	0.141	0.760	There is no difference
Exchange → Flexibility.	-0.296	0.115	-0.410	0.286	There is no difference

<i>Path Name</i>	<i>Male Beta</i>	<i>Female Beta</i>	<i>Difference in Betas</i>	<i>P-Value for Difference</i>	<i>Interpretation</i>
Coordination → Efficiency.	0.258	0.294†	-0.036	0.722	The positive relationship between Efficiency and Coordination is only significant for Female.
Coordination → Reliability.	0.239	-0.226	0.466	0.192	There is no difference
Coordination → Flexibility.	0.441*	0.187	0.254	0.453	The positive relationship between Flexibility and Coordination is only significant for Male.
Integration → Efficiency.	-0.161	0.592**	-0.753	0.010	The positive relationship between Efficiency and Integration is stronger for Female.
Integration → Reliability.	0.037	0.106	-0.069	0.825	There is no difference
Integration → Flexibility.	0.116	0.185	-0.070	0.786	There is no difference
Responsiveness → Efficiency.	0.045	-0.418†	0.464	0.073	The negative relationship between Efficiency and Responsiveness is stronger for Female.
Responsiveness → Reliability.	0.047	0.532†	-0.485	0.166	The positive relationship between Reliability and Responsiveness is only significant for Female.
Responsiveness → Flexibility.	0.171	0.172	-0.001	0.956	There is no difference

- The positive relationship between Responsiveness and Communication is only significant for Female.
- The positive relationship between Responsiveness and Exchange is only significant for Female.
- The negative relationship between Flexibility and Communication is only significant for Male.
- The positive relationship between Efficiency and Coordination is only significant for Female.
- The positive relationship between Flexibility and Coordination is only significant for Male.
- The positive relationship between Efficiency and Integration is stronger for Female.
- The negative relationship between Efficiency and Responsiveness is stronger for Female.
- The positive relationship between Reliability and Responsiveness is only significant for Female.

## 5. DISCUSSION

The results of the study provide initial verification of the effectiveness of the IT artefact in explaining the level of Firm performance of firms.

First: the relationship between IOS Use for Intelligence (exchange) has positively and significant influence on firm Performance (Efficiency, Reliability and Flexibility) so, the rationale is to allow company to obtain information and then use it and exchange to get the benefit from the coordination and integration capabilities as it is supposed. In addition, companies are working to enhance the capabilities of information that helps business to become strong in their performance, which is directly reflected in the supply chain of companies. Therefore, this result is consistent with the results of previous studies that noted that the use of IOS in general enhances the ISO of supply chain management in general (Agbenyo *et al.* 2018; Asamoah *et al.* 2019; Asamoah *et al.* 2021a).

On the contrary, we find that IOS Use for Communication has not positively and significant influence on firm Performance (Efficiency, Reliability and Flexibility). consequently, this indicates that refer to Dal Foods industry is not leading to a staggering improvement in supply chain management capabilities specifically in IOS Use for (Communication). However, Communication were not correlated with higher supply chain response.

The results provide empirical support for prior studies on the IOS (exchange) in predicting the level of Firm performance of firms (Asamoah *et al.*, 2019; Hartono *et al.*, 2010; Lee *et al.*, 2014). The findings of the study revealed that the effect of IOS use on SCM performance was partially positive and significant. Accordingly, we find that the availability of integrated supply chain management systems for the company works to take advantage of opportunities to obtain insights from inside and outside the organization.

Second: the relationship between SCC (Responsiveness, Integration and Coordination) have not positively and significant influence on firm Performance (Efficiency, Reliability and Flexibility)

Where confirmed (Williamson, Harrison, & Jordan, 2004). higher SCC can be leveraged to propel attainment of higher levels of Firm performance. on the complex interrelationship of IOS use and SCM capabilities in driving Firm performance, it is important for managers and business practitioners to aim at concurrently managing and deploying their IOS implementations and SCM capabilities, as this should create highest possible benefits in terms of Firm performance.

This result is confirmed by the results of the analysis of the mediator variable. Supply Chain Capabilities mediate the Inter-Organizational System use on firm Performance

### 5.1. Limitations and Future Research

There were some limitations to the work. IOS use, SCC, on firm performance. The complementary effect may not be linear and further examination of a potential non-linear relationship would provide additional insights. Also, as the study utilized data from only one context Sudan in Africa, specifically Dall group future research may explore the phenomenon examined over multiple contexts.

### References

- Ali, M & Abou, E. (2020). Determinants of entrepreneurial intention among Sudanese university students. *Management Science Letters*, 10(12), 2849-2860.
- Ali, M & Abou, E. (2021). The effects of internal and external resource management on logistics performance. *Uncertain Supply Chain Management*, 9(4), 905-916.
- Ali, M., Ibrahim, A., Rejal, A & Abou, E. (2021). The mediating role of technology perception in the relationship between customer experience and the adoption of e-payment cards during the COVID-19 pandemic. *Uncertain Supply Chain Management*, 9(4), 1047-1060.

- Asamoah, D., Agyei-Owusu, B., Andoh-Baidoo, F. K., & Ayaburi, E. (2021). Inter-organizational systems use and Firm performance: Mediating role of supply chain management capabilities. *International journal of information management*, 58, 102195.
- C. Clifford Defee, Brian S. Fugate. (2010). "Changing perspective of capabilities in the dynamic supply chain era", *The International Journal of Logistics Management*.
- Chuleeporn Changchit, Timothy Klaus, Alichia Treerotchananon. (2021) "Using Customer Review Systems to Support Purchase Decisions", *Journal of Global Information Management*.
- Chunyan Zhu, Xu Guo, Shaohui Zou. (2022). "Impact of information and communications technology alignment on supply chain performance in the Industry 4.0 era: mediation effect of supply chain integration", *Journal of Industrial and Production Engineering*.
- Constantin Blome, Tobias Schoenherr, Daniel Rexhausen. (2013). "Antecedents and enablers of supply chain agility and its effect on performance: a dynamic capabilities perspective", *International Journal of Production Research*.
- Haris Aslam, Constantin Blome, Samuel Roscoe, Tashfeen M. Azhar. (2018). "Dynamic supply chain capabilities", *International Journal of Operations & Production Management*.
- JUN HAN, HUN-TONG TAN (2010). "Investors' Reactions to Management Earnings Guidance: The Joint Effect of Investment Position, News Valence, and Guidance Form", *Journal of Accounting Research*,
- Mei Cao, Qingyu Zhang. "Supply Chain Collaboration", Springer Science and Business Media LLC, 2013.
- Muhammad Fawad Afraz, Sabeen Hussain Bhatti, Alberto Ferraris, Jerome Couturier. (2021). "The impact of supply chain innovation on competitive advantage in the construction industry: Evidence from a moderated multimediation model", *Technological Forecasting and Social Change*,
- Paul Blaise Isock Isock, Mercy Mpinganjira, Mornay Roberts-Lombard. (2021). "Trying to recycle domestic waste and feelings of guilt: a moderated mediation model applied to South African households", *Sustainable Production and Consumption*.
- Rahul S. Mor, Arvind Bhardwaj, Sarbjit Singh, Vinkel Kumar Arora. (2020). "Exploring the factors affecting supply chain performance in dairy industry using exploratory factor analysis technique", *International Journal of Industrial and Systems Engineering*.
- Responsible AI and Analytics for an Ethical and Inclusive Digitized Society", Springer Science and Business Media LLC, 2021.

Supply Chain Management: An International Journal, Volume 18, Issue 6 (2013-10-19).

Teng Teng, Christos Tsinopoulos. (2021). "Understanding the link between IS capabilities and cost performance in services: the mediating role of supplier integration", *Journal of Enterprise Information Management*.

Wantao Yu, Roberto Chavez, Mark A. Jacobs, Mengying Feng. (2018). "Data driven supply chain capabilities and performance: A resourcebased view", *Transportation Research Part E: Logistics and Transportation Review*.

Yang Shuhui, Yu Zhang, Muhammad Umar, Adeel Shah. (2021). "Empirical Investigation to assess the impact of ICT deployment in Supply Chain Management", *Journal of Advanced Manufacturing Systems*.

Yang Yuan, Zhaofang Chu, Fujun Lai, Hao Wu. (2020). "The impact of transaction attributes on logistics outsourcing success: A moderated mediation model", *International Journal of Production Economics*.