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

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## Abstract

Network-enabled enterprise systems called inter-organizational systems use (IOS) go beyond the walls of an organization, allowing partners in the supply chain to collaborate better by exchanging business information in real time. As a result, the study (Case Study: Sudan Food Industry) examined the Mediating Role of Supply Chain Management Capabilities on the Relationship between Inter-Organizational System Use on Firm Performance, with the purposeful participation of (450) participants, to whom the questionnaire was addressed. The information was then gathered from the supply chain and production management at the Sudanese food processing industry. The data was then coded using SPSS and AMOS 26. After ensuring normality, validity, and reliability, a descriptive analysis was conducted and variable correlation was examined. Path analysis was formerly 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.

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**Index terms**— inter-organizational systems, supply chain responsiveness, supply chain integration

## 1 Introduction

Network-enabled enterprise systems called interorganizational systems (IOS) go beyond the confines of an organization, allowing partners in the supply chain to interact more successfully and share business information in real time (Bakos, 1991; Chatterjee & Ravichandran, 2004; Hartono, Li, Na, & Simpson, 2010).

Businesses have implemented a variety of IOS uses, such as vendor managed inventory, electronic data interchange, and collaborative planning, forecasting, and replenishment, to enable supply chain partners to communicate in real time and make informed decisions. To gain a competitive edge, interorganizational systems enable efficient management of activities in a coordinated and integrated manner.

According to the resource-based view (RBV) hypothesis, a corporation acquires a competitive edge when it manages and successfully combines resources that are uncommon, valued, heterogeneous, and unique (Barney, 1991; Beneraf & Barney, 2003). Consequently, research in logistics and resource-based theory both Author ? : Ahfad University for Women. e-mail: ee.abou@auw.edu.sd demonstrate for the mutual advantage of the supply chain network's participants, inter-organizational systems enable an organization to supplement its internal resources and capabilities with external resources made available to the partners.

The entire supply chain greatly benefits from the usage of IOS (Asamoah, Agyei-Owusu, Andoh-Baidoo, & Ayaburi, 2019; Hartono et al., 2010). However, there are calls for deeper research into the methods by which IOS use improves firm performance and for the supply chain Blackbox to be opened. (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 Sudanese food processing industry.

The current study thus concentrates on 1) external IOS usage in SCC and 2) the impact of interorganizational system uses on firm performance. Management's comprehension of the operational dynamics of IOS in the organization is enriched by insights from the investigation of the interaction between IOS use and SCC in improving Firm performance. In this work, we investigate the complex interactions between SCC, Firm performance, and IOS usage.

The remaining sections of this essay are organized as follows. Introduction in Section 1, evaluation of pertinent literature in Section 2, and formulation of hypotheses in Section 3. Section 4 presents the research methodology, while Section 5 summarizes the findings. Finally, our analysis and conclusions in Section 6.

## 2 II.

### 3 Literature Review a) Inter-organizational information systems (IOS)

Network-enabled information systems known as inter-organizational information systems (IOS) enable enterprises to efficiently coordinate business operations and supply chain activities across many organizations (Asamoah et al. 2021). Additionally, nothing is known about how IOS-enabled business intelligence enhances company performance. This study closes these research gaps by analyzing the significance of information interchange, coordination, integration, and supply chain responsiveness abilities in explaining the outcomes of IOS-enabled business intelligence. Therefore, we conclude the following hypothesis H 1 inter-organizational system use IOS with subdimension (C-I) has positive impact on Firm performance SCP with sub-dimension (R.E.F).

H 2 inter-organizational system use IOS with subdimension (C-I) has positive impact on supply chain capabilities with sub-dimension (I.C.R)

### 4 b) Dynamic Supply Chain Capabilities (SCC)

Due to uncertainties and ongoing market and business environment changes, the idea of dynamic capabilities has evolved. Teece et al. (2017). created the dynamic capabilities hypothesis. In order to adapt to the quick changes in the business environment, firms must be able to develop, integrate, and reconfigure their internal and external resources and competencies.

According to Zahra and George (2002), dynamic capabilities allow businesses to update and reorganize their resource base in response to shifting consumer demands and rival strategies. The importance of using dynamic capabilities in the supply chain is rising (Witcher et al., 2008 & et al., 2018).

The establishment of dynamic supply chain capabilities is a result of shifting long-and short-term supply and demand, market dynamics, and consumer demands (Ju et al., 2016). In order to handle these changes, businesses need dynamic supply chain capabilities. Dynamic supply chain skills enable businesses to foresee market demands precisely, forge collaborative relationships with consumers and suppliers, and improve the supply chain's response to those needs (Sanders, 2014). From a supply chain perspective, the dynamic capabilities have been studied by numerous academics.

According to Supply chain integration emphasizes the availability of the appropriate items to the appropriate consumers at the appropriate time and at a reasonable cost (Angeles, 2009). According to Rajaguru and Matanda (2019), supply chain integration entails integrating financial, physical, and informational flows. The ability of a business to adapt quickly to market changes and turbulence in order to better serve its suppliers and consumers is referred to as agility capability (Aslam et al., 2018).

Additionally, supply chain agility is a dynamic process that modifies or reconfigures the current business process to deal with market hiccups and other uncertainties. According to Li et al. (2009), strategic readiness and reaction capability, operational readiness and response capability, and episodic readiness and response capability are key components of supply chain agility. The ability of supply chain partners to react to changes and alterations in the environment is referred to as responsiveness capability (Williams et al., 2013). According to Singh and Sharma (2015), supply chain responsiveness places an emphasis on cutting down on lead times, enhancing service quality, responding quickly to client needs, and optimizing transportation. Shekarian and others, (2020) contend that there are three essential components to supply chain responsiveness: agility to respond to customer requests, flexibility to facilitate the development of new products and entry into new markets, and a reduction in the likelihood of supply chain bottlenecks and interruptions. So, we conclude the following hypothesis H3 supply chain management capabilities SCMC with sub-dimension (I.S.R) has positive impact on Firm performance SCP with sub-dimension (R.E.F)

### 5 c) Firm Performance

Firm performance in a changing environment, with businesses aiming for superior organizational performance and competitive advantages (Rajaguru and Matanda, 2019). pertaining to the effectiveness of the company's internal operations, which may allow the company to increase its profitability and competitiveness in the market (Hong et al., 2019). Operational performance is a multifaceted concept that encompasses the successful conversion of operational capabilities into organizational competitive advantages. Productivity, quality, cost, delivery, flexibility, and customer happiness can all be used to evaluate it (Gambi, 2018). Businesses aim to gain competitive advantages and achieve good organizational performance in a dynamic environment (Rajaguru and Matanda, 2019).

Firm performance is related to the effectiveness of the company's internal operations, which may allow the company to increase its profitability and competitiveness in the market (Hong., 2019). Firm performance is a multifaceted concept that encompasses the successful conversion of operational capabilities into organizational

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competitive advantages. Productivity, quality, cost, delivery, flexibility, and customer happiness can all be used to evaluate it (Saleh, 2018). Therefore, after reviewing previous studies that confirmed the existence of a relationship between them, we can conclude the following hypothesis H4 supply chain management capabilities SCMC multidimension mediated the positive impact of interorganizational system use IOS use with multi-dimension on SCP .

## 6 III.

## 7 Research Methods

### 8 a) Sampling and data collection

The current study is categorized as both a cause-and-effect and descriptive study. Its goal to testing (ISO, FP, SCCM). The approach begins with a review of the literature in order to compile a profile for assessing supply chain management capabilities SCMC multi-dimension mediated the positive impact of interorganizational system use IOS use with multi-dimension on SCP. Following that, the information gathered used non-probability sample (Convenience) The data was then coded using SPSS, SMART PLS. After ensuring normality, validity, and reliability, a descriptive analysis and variable correlation checks were conducted.

### 9 c) Empirical strategy

In this work, the proposed model was examined using SPSS and AMOS. The theoretical framework was examined using SEM in order to examine the suggested model. Additionally, it provides accurate estimations of the pathways between constructions by simultaneously analyzing the structural and size models (Chin, 1998). Sarstedt, Ringle, and Hair (2017) argue that SEM is a suitable method for testing mediation and moderation outcomes and examining complex relationships as a result. Last but not least, CB-SEM is often utilized in fields involving number lookups (e.g., Ferraris, Devalle, Ciampi, and Couturier, 2019; Rezvani, Dong, and Khosravi, 2017).

### 10 d) Non-response bias and common method bias countermeasures

Countermeasures for non-response bias and common method bias inclination we compared 25% of replies from the first fourteen days of the review period with 25% of responses from the most recent two weeks, as recommended by Armstrong and Overton (1977), and performed a t-test to determine whether our review was free of the NRB problem. Additionally, it was confirmed that there were no disparities in the respondents' responses in the two states using the ANOVA analysis, which revealed that there were no significant differences. We conducted many tests to mitigate the negative effects of normal technique predisposition (CMB). In addition to the programming stacking test by Muthen and Muthen (2007), 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.

IV.

## 11 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. a) Factor analysis i. Exploratory factor analysis EFA used to be done in an organized order and was viewed as such. First, the significance of the issue evaluation, which was evaluated by looking at the correlation matrix of the accumulated statistics, was verified using the Bartlett sphericity test ??Hair et al., 2005). Kaiser-Meyer-Olkin (KMO) statistics were employed to calculate sample adequacy at the same time. Sphericity and the KMO value are considered in the Bartlett's grading. Maximum Likelihood Approach to Habits (EFA). The twelve elements that were originally utilized to gauge the dimensions Impact of exchange and communications technology on firm performance: the mediation effect of supply chain Capabilities underwent factor examination. 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, ??enny and McCoach, 2003). The results were found substantial, and hence the result of factor analysis was accepted ??Hair et al., 2005).

ii. Confirmatory factor analysis (CFA) Confirmatory factor analysis (CFA) was used to examine the validity and reliability of the records measuring tool, respectively. A multi-dimensional CFA model in (Figure 1) has been hypothesized and tested for its psychometric qualities in order to confirm the degree of correspondence between the apparent variables and latent aggregate of the trImpact of exchange and communications technology on firm performance.

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 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 After doing a statistical study on the hypothesis, it was determined that the findings were statistically significant (95% confidence interval, 5,000 bootstrapping). The key details about the potential relationship routes are presented in Table 5. Some hypotheses were supported when the P value for statistical significance was used (P value 0.05), which supports the corresponding hypothesis. The other pathways showed statistically insignificant impacts, therefore their predicted linkages were unsupported.

From the data in the above table, we can derive the following results Responsiveness is only significant for Female.

## 12 -

V.

## 13 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 became 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. 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;

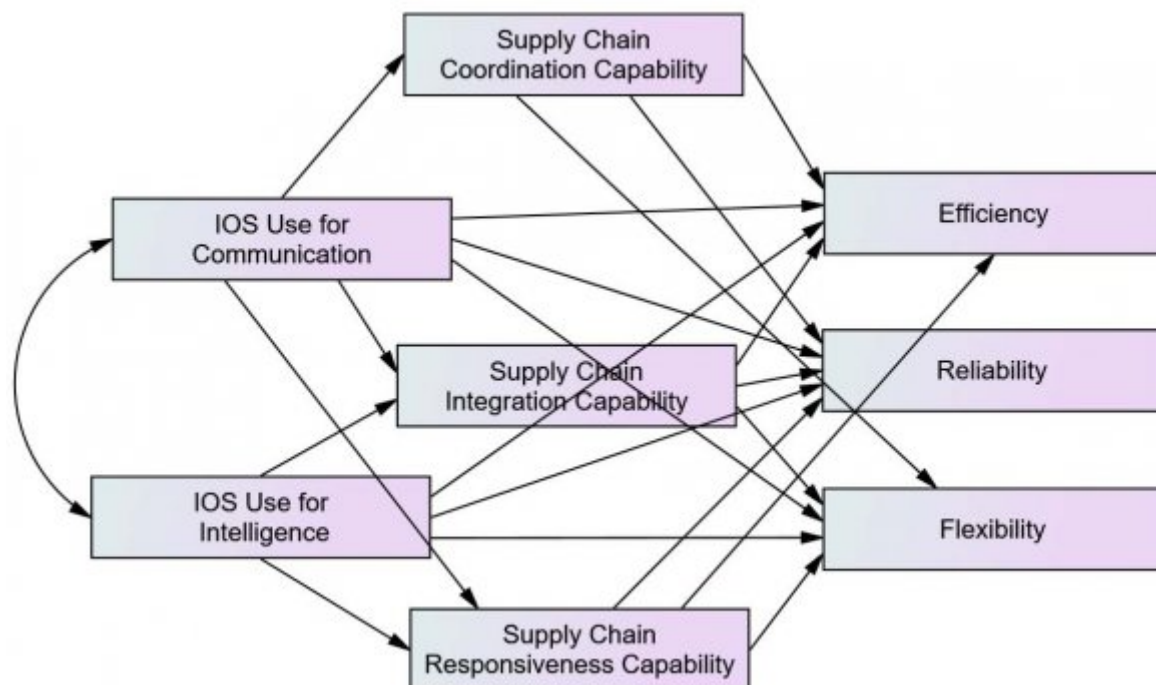


Figure 1: Fig. 1 :

3

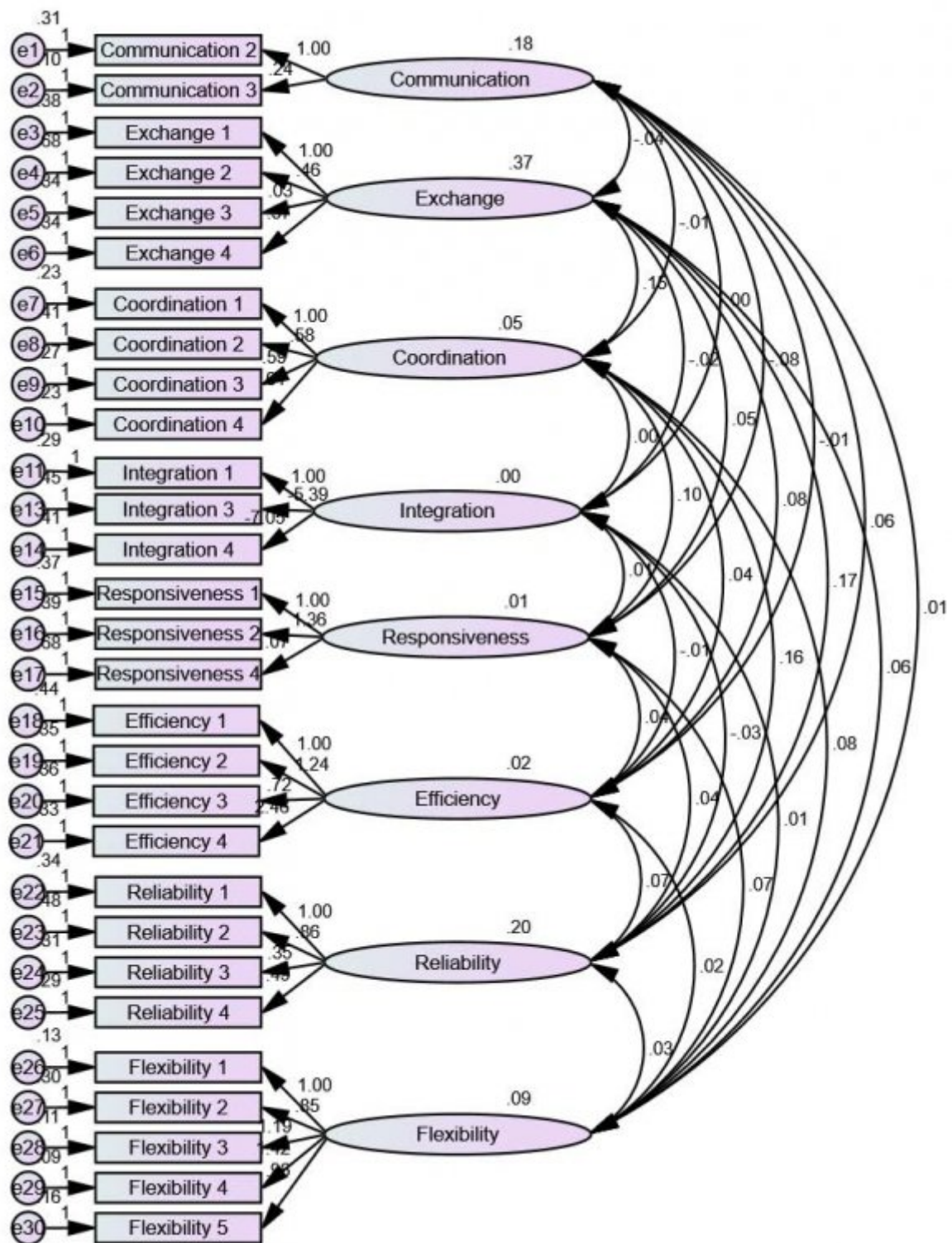


Figure 2: Figure 3 :



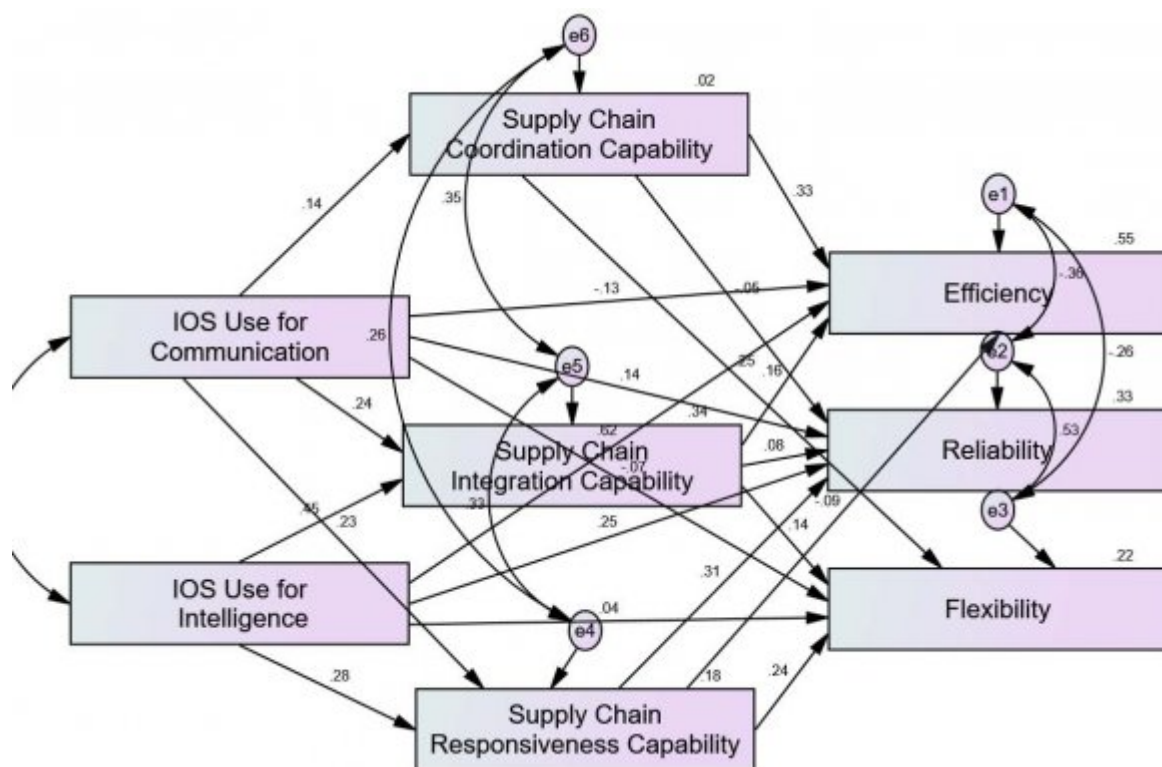


Figure 3:

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following three objectives: facilitate communication, facilitate integration, and facilitate business intelligence (Zhang and Cao 2018; Subramani 2004).

Deploying IOS for business intelligence is more crucial in the present big data era, where large amounts of corporate data are produced every day. Exploring and understanding corporate data can help organizations gain new insights into their processes, customers, and markets, which can pave the way for enhanced performance.

IOS-enabled business intelligence refers to how effectively IOS is used to support learning and business intelligence. IFIP 2021, International Federation for Information Processing A. Kumi et al., "Knowledge Sharing in a Supply Chain Network," Springer Nature Switzerland AG, 2021 (Zhang and Cao 2018).

Cooperative knowledge acquisition, shared databases and decision support systems, and artificial intelligence are examples of applications for IOS-enabled business intelligence (Mandal and Dubey 2021).

Implementing IOS enhances a number of outcomes, including firm performance, according to past studies (

).

Over the past few decades, IOS use and adoption have grown and have moved across numerous industries, implementing and utilizing IOS may help achieve the

According to studies,

Figure 4:

to Mathivathanan et al. (2017), the supply chain's ability to build dynamic capabilities is crucial for meeting future demands. Dynamic supply chain capabilities are defined by Oh et al. (2019) as a firm's capacity to recognize and utilize internal and external resources in order to improve supply chain processes effectively and efficiently. They add that information exchange, coordination, integration, and supply chain responsiveness are examples of dynamic supply chain capabilities. According to Ju et al. (2016), in order to meet customer expectations and keep competitiveness in a dynamic environment, dynamic supply chain capabilities are procedures of information sharing, supply chain alignment, and information technology. According to Aslam et al. (2018), dynamic supply chain capabilities include cohesive elements of supply chain agility and flexibility which should be integrated to support supply chain ambidexterity. A company's capacity to adapt its internal and external resources to market changes depends on its supply chain agility. This skill aids an organization's efforts to seize opportunities or fend off dangers posed by unstable environments (

*[Note: ? Supply chain responsiveness is a company's capacity to react swiftly to fluctuations in consumer demands, production and delivery volumes, and product mix, volume, and delivery. Most likely, these modifications will result in improved performance results, such as lower manufacturing costs, higher customer satisfaction, and quicker delivery (Yu et al., 2016). Additionally, studies by Prago and Olhager (2016) and Mandal et al. (2016) demonstrate that supply chain responsiveness has a favorable effect on operational performance. ?]*

Figure 5:

1

Frequency

Percent

Figure 6: Table 1 :



2

	Component							
	1	2	3	4	5	6	7	8
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

Figure 7: Table 2 :

3

Exchange	Communication	Coordination	Integration	Responsiveness	Efficiency	Reliability	Flexibility
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	-	2.423		0.347
				1.449			
0.642*		0.316	1.634**	-	0.787		0.962
				1.137			0.453
0.331		0.105	1.216**	0.388	2.141*		0.460
The							0.251
fit statistics: $\chi^2(59) = 112.329$ , reliability of all constructs. As proven in Table 2, the model fit is good. The RMSEA=0.067, NFI=0.90, CFI=0.95, IFI=0.95, values of CR (ranging from 0.695 to 0.814) are all greater than 0.7, suggesting sufficient reliability (For Larcker, 1981)							
GFI=0.92, and SRMR=0.052. We used composite reliability (CR) and Cronbach's alpha to determine the							

Figure 8: Table 3 :

4

	CR	AVE	MSV	MaxR(H)
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

[Note: iii. Structural models and hypotheses test results]

Figure 9: Table 4 :

5

Estimate	S.E.	C.R.	P	Result
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Figure 10: Table 5 :

6

	Exchange	Result	Communication	Result
Coordination	...		...	
Flexibility	.250	No mediation	.356	No mediation
Reliability	.770	No mediation	.608	No mediation
Efficiency	.015	Full mediation	.551	No mediation

Figure 11: Table 6 :

7

	Exchange	Result	Communication	Result
Integration	...		...	
Flexibility	.032	Full mediation	.048	Full mediation
Reliability	.264	No mediation	.213	No mediation
Efficiency	.052	No mediation	.100	No mediation

Figure 12: Table 7 :

8

	Exchange	Result	Communication	Result
Responsiveness	...		...	
Flexibility	.024	Full mediation	.087	No mediation
Reliability	.020	Full mediation	.087	No mediation
Efficiency	.878	No mediation	.753	No mediation

-

Figure 13: Table 8 :

9

	X <sup>2</sup>	DF
Unconstrained	15.089	2
Constrained	53.396	22
Difference	38.307	20
P-Value	0.008	
Interpretation:		

Figure 14: Table 9 :

10

Path Name	Male Beta	Female Beta	Difference in Betas	P-Value for Dif- ference	Interpretation
Communication ? Co- ordination.	0.218	0.096	0.123	0.841	NO

Figure 15: Table 10 :



Dee 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

## 1 a) Implications

We have proposed and confirmed the construction by relying on structural equation modeling. Building the model consists of eight dimensions, and we found a positive relationship between interorganizational system use (ISO) on the firm performance through the mediation of the supply chains capabilities. Therefore, company managers need to rely on such models because they have a positive impact on the performance of companies, and also the need to rely on the capabilities of supply chains because they positively affect performance. Finally, since SCMC mediates the relationship between ISO and firm performance, company managers must pay attention to these capabilities and for the purpose of learning about the value of ISO implementation.

## 2 b) Limitations and future research

There were some limitations to the work. IOS use, SCC, onfirm 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 naduS in Africa, specifically Dall group future research may explore the phenomenon examined over multiple contexts.

[Blome et al. ()] ‘Antecedents and enablers of supply chain agility and its effect on performance: a dynamic capabilities perspective’. Constantin Blome , Tobias Schoenherr , Daniel Rexhausen . *International Journal of Production Research* 2013.

[Defee and Fugate ()] ‘Changing perspective of capabilities in the dynamic supply chain era’. C , Clifford Defee , Brian S Fugate . *The International Journal of Logistics Management* 2010.

[Ali and Abou ()] ‘Determinants of entrepreneurial intention among Sudanese university students’. M & Ali , E Abou . *Management Science Letters* 2020. 10 (12) p. .

[Aslam et al. ()] ‘Dynamic supplychain capabilities’. Haris Aslam , Constantin Blome , Samuel Roscoe , M Tashfeen , Azhar . *International Journal of Operations & Production Management* 2018.

[Zhu et al. ()] ‘Impact of information and communications technology alignment on supply chain performance in the Industry 4.0 era: mediation effect of supply chain integration’. Chunyan Zhu , Xu Guo , Shaohui Zou . *Journal of Industrial and Production Engineering* 2022.

[Asamoah et al. ()] ‘Inter-organizational systems use and Firm performance: Mediating role of supply chain management capabilities’. D Asamoah , B Agyei-Owusu , F K Andoh-Baidoo , E &ayaburi . *International journal of information management* 2021. 58 p. 102195.

[Han and Tan ()] ‘Investors’ Reactions to Management Earnings Guidance: The Joint Effect of Investment Position, News Valence, and Guidance Form’. Jun Han , Hun-Tong Tan . *Journal of Accounting Research* 2010. 2013. Springer Science and Business Media LLC. 11. (Supply Chain Collaboration)

[Ali and Abou ()] ‘The effects of internal and external resource management on logistics performance’. M & Ali , E Abou . *Uncertain Supply Chain Management* 2021. 9 (4) p. .

[Muhammad Fawad Afraz et al. ()] ‘The impact of supply chain innovation on competitive advantage in the construction industry: Evidence from a moderated multimediation model’. Sabeen Hussain Muhammad Fawad Afraz , Alberto Bhatti , Jerome Ferraris , Couturier . *Technological Forecasting and Social Change* 2021.

[Ali et al. ()] ‘The mediating role of technology perception in the relationship between customer experience and the adoption of e-payment cards during the COVID-19 pandemic’. M Ali , A Ibrahim , Rejal , E Abou . *Uncertain Supply Chain Management* 2021. 9 (4) p. .

[Paul Blaise Issockissock et al. ()] *Trying to recycle domestic waste and feelings of guilt: a moderated mediation model applied to South African*, Mercy Paul Blaise Issockissock , Mornay Mpinganjira , Roberts-Lombard . 2021.

[Changchit and Klaus ()] ‘Using Customer Review Systems to Support Purchase Decisions’. Chuleeporn Changchit , Timothy Klaus . *Journal of Global Information Management* 2021. (Alicha Treerotchananon.)