Global Scientific JOURNALS

GSJ: Volume 11, Issue 2, February 2023, Online: ISSN 2320-9186
www.globalscientificjournal.com

IMPACT OF IT INFRASTRUCTURE FLEXIBILITY ON FIRM PERFORMANCE OF PAKISTAN'S SHIPPING COMPANIES: THE MEDIATING ROLE OF ABSORPTIVE CAPACITY

ABIDA ALI GOHAR, MBA IN SUPPLY CHAIN MANAGEMENT

KARACHI UNIVERSITY BUSINESS SCHOOL

UNIVERSITY OF KARACHI

p18108004.abida@gmail.com

DR. SARAH ANJUM, ASSISTANT PROFESSOR

KARACHI UNIVERSITY BUSINESS SCHOOL

UNIVERSITY OF KARACHI

anjum.sara@uok.edu.pk

© GSJ

Abstract. *The research is based on the need for a flexible information technology infrastructure in an organisation. As it is mandatory for a firm to develop a strategy to provide resilience.For this purpose, this research has worked on proposing a model to assist firms in adopting a long term strategy to cope with uncertainty. The model investigates IT infrastructure flexibility impact on performance of shipping companies in Pakistan. This direct and positive impact is mediated by a capability that is absorptive capacity. As shipping companies play a major role in the contribution to a country's GDP, therefore, the proposed model is tested on this particular industry.The key to gain competitive advantage is by working on its IT infrastructure,making it flexible as per the needs and market trends changing rapidly and also adapt absorptive capacity at the same time. Being technologically strong means a firm has the required and flexible technology (hardware, software, human). The management has a major role to play in increasing firm's overall performance by having an attitude of accepting, learning and implementing new ideas and knowledge.*

Keywords: *IT Infrastructure Flexibility, Absorptive Capacity and Firm Performance.*

Introduction. Background Of Study. Shipping industry is an asset to the world economy because it carries about 90% of all commodities throughout the world. Shipping companies are a source of importing and exporting almost all commodities from raw materials to finished products. Therefore, all companies involved in global trade depend upon shipping companies for their supply chain profitability. In 2019 the maritime trade slowed down, and in 2020 pressure increased. Conflicts over trade policy, a poor economy, civil unrest in some countries, and sanctions were the main causes of this. The COVID-19 pandemic made things worse by reducing demand and delaying the subsequent recovery. In CY21, it was anticipated that growth in global maritime trade will turn positive and increase by 4.8 %. (PACRAResearchShippingJune21.pdf)

Maritime transport is a significant part of the nation's overall economic trade. Strategic planning and management is the core element of this sector as it is highly complicated, competing, and highly invested because of the constantly advancing lift of technology and market competitiveness. Over 95% of Pakistan's imports and exports are transported by sea. (PACRAResearchShippingJune21.pdf) The profitability of the shipping sector is positively correlated with global economic activity. However, due to global economic slowdown due to COVID19, demand for all aspects of global transportation, such as freight, asset values, and demolition costs, remained weak and negatively impacted. (PACRAResearchShippingJune21.pdf)

Pakistan’s role as a worldwide logistic hub, it provides outstanding logistics services and enjoys many benefits to maintain this position and participate in the international commercial center on having the “right” logistics by eradicating wastage and making accessible the required product at its required time. (Haji-Esmaeili et al., 2017).

Problem Statement. To sustain its position in the market and to make sure that business operations are running seamlessly, companies in the shipping industry must be highly resilient. They must have a strategy which will help them to cope and overcome any external and internal environmental fluctuations which are unpredictable as there is no business without risk. In order to cope with any uncertainty internally or externally, firms in the shipping industry must have an efficient information technology system and exploit absorptive capacity at its optimum level. Together IT infrastructure and absorptive capacity is the key to the firm's increased performance. For this it has to make Information technology systems flexible and strong enough to achieve resilience.

Research Objectives. Analyzing the relationship between IT infrastructure flexibility on the performance of shipping firms in Pakistan is the main aim of this research. The need and the purpose of this research is to propose a model which will assist companies especially in the shipping sector to maintain their sustainability and improve their overall performance in this digital competitive environment. As all the activities from procuring the orders to delivering it globally requires an efficient and resilient supply chain, therefore shipping companies must have required capabilities and a strategy to implement. The proposed model is a strategy for such companies that if they work on their IT infrastructure flexibility i.e. its infrastructure should be such that it supports all other activities and is easily variable according to the changing environment. If firms adopt absorptive capacity with IT infrastructure flexibility, it is likely to sustain its position in the market and achieve desired results.

Much work has been done previously on information technology infrastructure in different industries, but this paper combines IT infrastructure flexibility and absorptive capacity within the shipping companies. This paper will throw light on the flexibility of IT infrastructure on shipping companies with absorptive capacity working as the mediator..

Information Technology is an important factor for any firm in any industry. No firm can survive without exploiting the latest technology within its organization. For Absorptive capacity to work in an organisation,ideas and acknowledgement is not enough. To implement the ideas, the latest technology is a necessity.Absorptive capacity and IT goes hand in hand as AC is incomplete without technology. Together it means that the firm can now implement and execute its new idea as plans according to its strategy having all required resources(IT infrastructure) to support its strategy.

It is very essential for a firm to see if its information technology is flexible or not. It must be flexible according to customer changing needs, competition in the market and externally environmentally changing environment. Firms must reconfigure and modify their supply chain strategies to satisfy their customers and provide quality services to them.IT is the backbone of any organization, therefore, firms must have a strong and flexible IT system to support its strategy which will ultimately help in providing best quality services to customers.

Shipping companies must ensure that their IT infrastructure supports their operations because 90% of all commodities are traded by sea. This will ensure that business operations continue without interruption. Facilities, data centers, servers, desktop computers, enterprise application software solutions, networking hardware, and IT personnel's adaptability make up the IT infrastructure.

The main objective of this paper is to acknowledge organizations that to achieve sustainability in today's competitive market, they need to adapt the proposed model which shows that if a firm has a flexible IT infrastructure and also incorporates absorptive capacity then it is in a better position to gain increased firm overall performance.

According to Martinez, 2018, today, in the fast-changing environment, firms constantly need to analyze and update their supply chain and technology either internally or by managing sufficiently the use of external knowledge. In this fast and ever changing information technology (IT) world, IT has a major role to play in assisting organizations in achieving desired optimum performance level regardless of its size. As the business needs will generally vary in passing time, an adaptable IT flexibility is an unquestionable necessity to-have with the goal that association could be more receptive to the difference in business requests.

The actual purpose of the study is to provide a model to firms which are trying to sustain their position in a competitive market so that firms may be prepared for upcoming risks. They should have a well-designed and efficient supply chain model to be resilient and cope with all uncertainties. A proposed model has been developed which will assist firms in meeting its objective and gain competitive advantage. The model says that if firms IT infrastructure is aligned with its operations and exploits absorptive capacity at optimum level it will surely be resilient and boost performance.

© GSJ

Research Questions. The research paper will cover the following three questions based on the purpose of this research.

Q1) How does IT infrastructure flexibility impact firm performance?

Q2) What will be influence of absorptive capacity on IT infrastructure flexibility and firm performance?

Q3) What will be the result of firm overall performance if it incorporates absorptive capacity in its organization?

Significance Of The Study. Companies with the latest information technology does not guarantee its sustainability. Therefore this paper will be a source of guidance to all companies that a flexible information technology infrastructure is the key performance indicator not just in the shipping companies but all companies big or small. The significance of IT infrastructure can be seen today as without this dynamic capability the firm cannot survive. It must revive its IT with required changes in the environment.IT plays a crucial role in the success of any

organization. No firm can perform well if its IT infrastructure is not well designed or is outdated. It cannot sustain its position in the market.

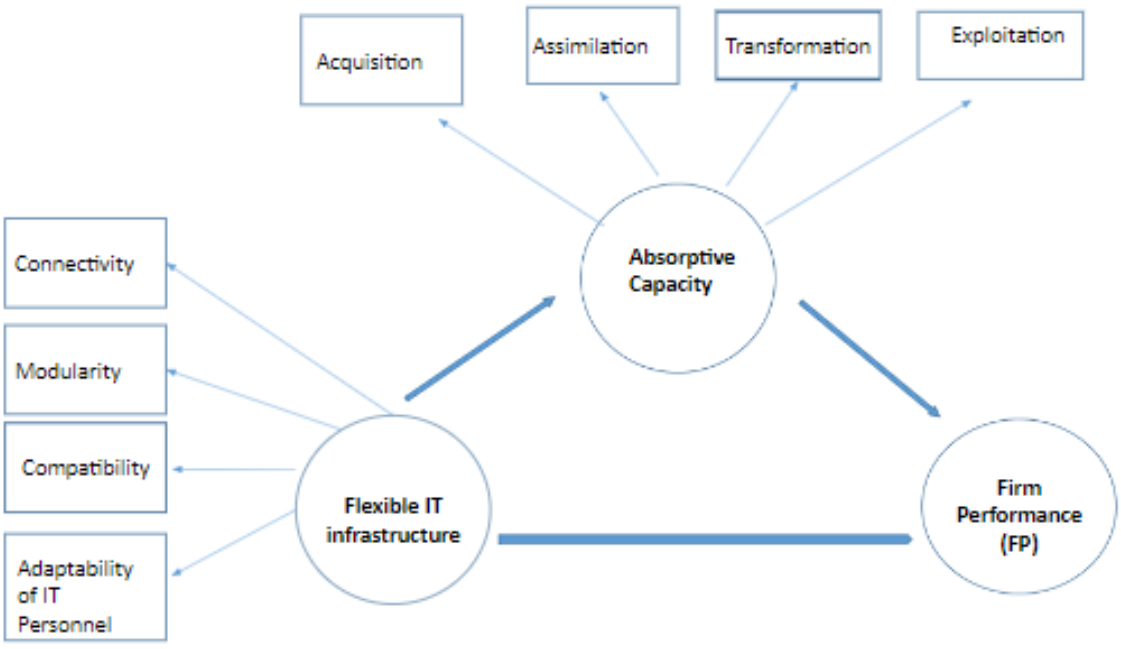
This research will help organizations as they will get acknowledged about how to sustain their position in this fast changing and competitive environment. For a firm to sustain its position it has to adapt or adopt absorptive capacity so that its flexible IT infrastructure and AC works together bringing a positive impact on firms' overall performance.

Scope Of The Study. For an effective and efficient supply chain, IT skills are vital for knowledge management and innovation. The ability of firms to incorporate absorptive capacity and information technology both within an organization are the sources of direct wellsprings of prevalent firm execution in the cutthroat market. Absorptive Capacity (AC) and Information Technology are two most crucial components in this fast-pacing competition to achieve competitive advantage.

The findings indicate that absorptive capacity influences positively on the positive relationship between IT infrastructure flexibility and firm performance.IT alone is not enough, firms should work on absorptive capacity and make its IT infrastructure flexible to achieve desired output.

© GSJ

Research Methodology. Theoretical Framework.



Hypothesis.

Three constructs make up the conceptual model for this study:

Firm performance is considered as the dependent variable, absorptive capacity is taken as the mediator, and IT infrastructure flexibility is taken as the independent variable. The four dimensions to the flexibility of IT infrastructure are: connectivity, modularity, compatibility,adaptability of IT personnel. The four dimensions to absorptive capacity taken are:assimilation, exploitation, transformation, and acquisition. The performance of a company is directly impacted favourably by the IT information infrastructure, and this link is mediated through absorptive capacity.

Connectivity and Firm Performance. The capacity of an IT component to integrate and interact with other components in a way that facilitates smooth coordination and information flow both internally and externally. As a result, if the organization's IT devices are connected both internally and externally, it will be able to perform at a higher level. It must have a well-designed IT infrastructure that allows for the free exchange of ideas and information, or smooth information flow. In order to provide IT services and solutions, the company's hardware, software, networking, operating system data storage, and other components must be designed to be interconnected.

H1: *IT infrastructure connectivity has a positive impact on firm performance.*

Modularity and Firm Performance. Modularity is the capacity of an organization to rapidly and securely change software, hardware, and data to meet business objectives. As a result, it immediately and favourably affects the company's entire success. Many firms redesign soft wares and purchase new hardware to meet high competition and provide quality and unmatchable services to its customers. As technology is ever changing, new soft wares are continuously designed to meet the needs and requirements of organizations, firms must modify and change its software according to changing technology. Likewise it must also ensure that all of its technical hardware components are running in perfect manner and should not compromise on delivering best outputs. If not then it should redesign its hardware and software.

H2: *IT infrastructure modularity has a positive impact on firm performance.*

Compatibility and Firm Performance. Compatibility is the ability of an organization to share information both internally and outside.IT skills are vital for an organization's supply chain to run its knowledge and chain management smoothly. Information sharing within and organization (within department and cross departmental) as well as externally to suppliers and customers should be smooth and easy. Supply chain is all based on three flows. Flow of product, money and information. Real time data plays a significant role in efficiency of a firm as firms need updated, accurate and timely information to run its operations at all levels and stages. Without information sharing a firm is unlikely to reform better and achieve desired outputs.

H3: *IT infrastructure compatibility has a positive impact on firm performance.*

Adaptability of IT Personnel and Firm Performance. The adaptability of IT staff is defined as their capacity to eliminate any inconsistency, modify IT systems in accordance with changes in corporate strategy, and work collaboratively across departments within the organization. Therefore trained and skilled IT personnel will be able to identify any IT discrepancy within the organization so that operations are run smoothly. Ever organization has IT department in which IT personnel and technicians are responsible for any IT issue arising and sort it smoothly and efficiently so that there is no disruption during the operation.IT personals should be skilled and have profound knowledge in all IT domain.IT personnel has a major role to play in the success of any organization.IT team should be efficient enough resolve all issues related to information technology within an organization.

H4: *IT personnel flexibility has a positive impact on firm performance.*

Absorptive Capacity as a mediator. If AC is adopted in an organization, it is likely to have improved overall performance since Absorptive capacity has a good impact on firm performance Information Technology with ACAP will definitely boost firm performance as together these will prove to be firms most key strengths and competitive factors to gain competitive advantage. Flexibility in IT infrastructure alone could not have that much of a direct influence on business performance. Absorptive capacity with Tit infrastructure will prove to be a success factor to boost performance and provide desired outcomes.

According to Pavlou and El Sawy (2006), the use of and production of information utilizing ACAP has been seen as fundamental to maintaining competitive advantage. According to the dynamic capability perspective, businesses have significant areas of strength for which they are likely to obtain fresh information remotely from suppliers, rivals, clients, or intermediaries.

H5: *Absorptive capacity mediates the relationship between IT infrastructure flexibility and firm performance.*

Absorptive Capacity and firm Performance. Absorptive capacity influences firm performance directly. A company's ability to recognize new knowledge, take it and use it alongside existing knowledge, and modify present practices by applying new knowledge is known as its absorptive capacity.

H6: Absorptive capacity positively influences firm performance.

Sample and Data Collection. The questionnaire for the survey is quantitative. There are numerous shipping companies operating in Pakistan .Pakistan's international trade operations heavily relies on these companies. It has a major role in contribution to GDP. However, the current study necessitates specific knowledge of supply chain management and information systems, making it challenging to collect data through a survey questionnaire .For this we communicated with employees of different shipping companies .Respondents were employees from different departments of various shipping companies with management level positions (top. middle, low).Survey was a designed questionnaire through google form and was distributed through online media (emails and LinkedIn). Total 80 questionnaires were emailed to respective respondents, out of which 50 responses were answered and completed. The study received a response rate of 62.5% approximately from 50 completed questionnaires. Sample size is taken 50.After sending out the questionnaires, we followed up with emails to non-respondents to encourage them to respond.

Demographic Profile. Descriptive analysis was performed on the 50 sample responses to obtain the appropriate demographic profiling of all respondents. The respondents were profiled based on the following factors: Factors like current position, work experience and department within the company.

The sample taken consisted of three different management levels within different shipping companies.12% respondents belonged to top level management, 60% respondents were from middle management which shows more employees were form middle management whereas 28% respondents were from low management. The department of the respondents were 10% purchasing and procurement, 10% respondents were from technical department, 4% belonged to accounting and finance department, 2% from sales department, 10% from import operations department, 52% belonged to export operations department which shows that the highest number of respondents were from export department.2% from custom clearance department,

6%from administration, 2/% from HR department and 10% from marketing department. Looking into the number of years they were employed it was concluded that less than one year respondents were 48%, one to three years employed respondents were 30%, four to seven years employed respondents were 10%, eight to ten years employed respondents were 4% and more than 10 years employed were 8% .This shows that more respondents were employed less than one year

The sample's demographics are presented in Table 1.

Descriptive statistics (N = 50).

	Demographics	Frequency	Percentage
Current Position	Top Management	6	12%
	Middle Management	30	60%
	Low Management	14	28%
No.of years	Less than 1 year	24	48%
	1 – 3 years	15	30%
	4 – 7 years	5	10%
	8 – 10 years	2	4%
	More than 10 years	4	8%
Department	Purchasing and Procurement	5	10%
	Technical Department	5	10%
	Accounting and Finance	2	4%
	Sales Department	1	2%
	Import Operations Department	5	10%
	Export Operation Department	26	52%
	Custom Clearance Department	1	2%
	Administration	3	6%
	Human Resources	1	2%
	Marketing	5	10%

Analysis. SMARTPLS 3.2.7 was used to conduct additional statistical analyses on 50 responses following the initial data screening process. The outer model measurement test was the first step, followed by hypothesis testing.

Measures. The three main components of this study's instrument are questions about the firm performance, absorptive capacity, and flexibility of the IT infrastructure. Respondents were asked to select one choice from a range of five options on a Likert scale, from strongly disagree to strongly agree. The appendix part contains the whole questionnaire.

Absorptive Capacity. The items of the absorptive capacity were adapted from (Flatten et al., 2011).Three acquisition related items, three assimilation related items, three transformation related items and three transformation related items. The goal of acquisition is to improve one's capacity for locating and acquiring fresh, pertinent knowledge, which is crucial to operations. Assimilation is the capacity to comprehend and absorb newly acquired information; the main goal of transformation is the capacity to blend previously acquired and recently gained knowledge. And the capacity to use the new information to accomplish a company's goals is referred to as exploitation.

IT infrastructure flexibility. The flexibility-related items for IT infrastructure were taken from Isal et al., (2016).It consists of three connectivity related items, three modularity related items, three compatibility related items and three adaptability of IT personnel related items. Each respondent was asked to rate the connectivity, compatibility, and modularity of the company's IT infrastructure using these measures. The use of IT applications in high-level management and operations, functional areas, business processes.

Firm Performance. The firm performance items were modified from Wang et al (2012). The five factors are the company's overall financial success, customer retention, sales growth, profitability, return on investment, and profitability.

Data Analysis. Introduction. The primary objective of this study is to evaluate the proposed framework, so data are compared to the tested hypothesis for this purpose. There are a variety of statistical data analysis methods that can be applied using SPSS and Smart PLS.SPSS was used to screen the data, and Smart PLS was used to determine the impact and significance level of each proposed hypothesis.

Data screening. The finalized questionnaire was distributed to 80 relevant respondents via email and LinkedIn for the purpose of data collection. Out of the 80 questionnaires distributed, only 50 completed the survey successfully, resulting in a response rate of 62.5%.The 50 responses were subjected to a data screening process because it is absolutely necessary to do so before employing any statistical analysis methods on the collected data.

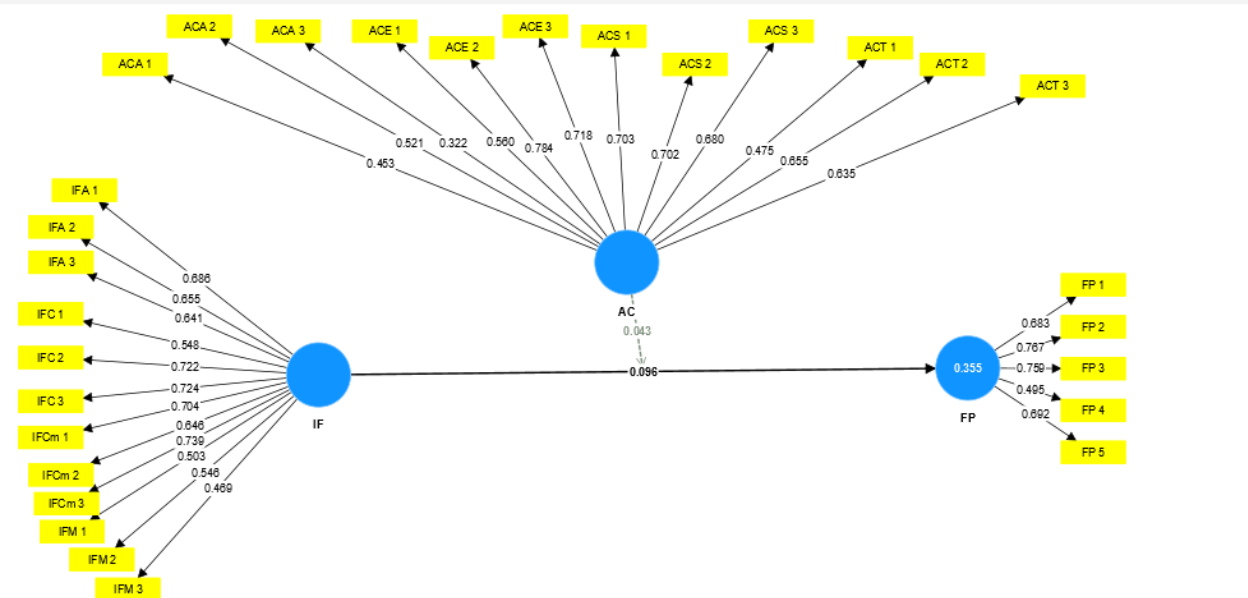
The screening and cleaning of the data was done with the SPSS software. Data were checked for missing values, multivariate and univariate outliers, and a few other mandatory checks using SPSS. The questionnaire was created using Google Forms, and no values were left out of the data that was collected because all of the questions were marked as required to proceed.

After all of the checks for data cleansing, the final sample size was 50, which was used for further statistical analysis.

Measurement Model. The model has been evaluated using a structural equation modelling (SEM) approach with SmartPLS 4.0. According to the work of (Henseler & Fassott, 2010), PLS is a component-based approach that relies on three primary types of interactions. For instance, the outer/measurement model describes how latent constructs are linked to observables; the inner/structural model illustrates how latent constructs are linked to one another; and weight relationships lay the groundwork for identifying latent variable case values. According to Gefen et al. (2000), With PLS, a good model fit is indicated by a sizable path coefficient, R-squared values that are within acceptable ranges, and internal consistency/construct reliability values of 0.70 or above. All the constructs' convergent validity analysis summaries were displayed in Table 3. For currently used scales, a Cronbach's alpha of 0.70 was regarded as sufficient, whereas a value of 0.60 was deemed adequate for freshly created scales. Existing Cronbach's alpha values ranged from 0.785 to 0.897, suggesting a strong confidence interval for the reliability estimate (Gefen et al., 2000). Composite reliability (CR) is often less cautious than the average variance extracted (AVE). Current study value varies from 0.488 to 708, while Fornell and Larcker (1981) suggested that AVE should be at least 0.50. According to Gefen et al. (2000), the AVE values for the various constructs are not equally weighted measures, therefore the number often represents a minimum estimate of reliability. In addition, an AVE value of 0.488 suggests that the hidden variable indicator accounts for around 50% of the total variance. Composite reliability was indicated by rho A values above the cutoff (ranging from 0.794 to 0.899), content reliability values above the cutoff (ranging from 0.850 to 0.924), and large factor loadings above the cutoff (indicating sufficient convergent validity). (Fornell and Larcker, 1981). The summarizing associations between the latent variables are presented in Table 3, with the square root of AVE serving as the header for each column. The correlation between latent variable scores and their corresponding rows and columns must be smaller than the square root of AVE in order to prove sufficient discriminant validity. Figure 2 displays the modelled measurement results.

© GSJ

			Composite Reliability	Average Variance Extracted(AVE)
IF	IFC 1	0.686	0.877	0.407
	IFC 2	0.655		
	IFC 3	0.641		
	IFM 1	0.548		
	IFM 2	0.722		
	IFM 3	0.724		
	IFCm 1	0.704		
	IFCm 2	0.646		
	IFCm 3	0.739		
	IFA 1	0.503		
	IFA 2	0.546		
	IFA 3	0.469		
AC	ACA 1	0.453	0.875	0.378
	ACA 2	0.521		
	ACA 3	0.322		
	ACS 1	0.56		
	ACS 2	0.781		
	ACS 3	0.718		
	ACT 1	0.703		
	ACT 2	0.702		
	ACT 3	0.68		
	ACE 1	0.475		
	ACE 2	0.655		
	ACE 3	0.635		
FP	FP 1	0.683	0.745	0.471
	FP 2	0.767		
	FP 3	0.759		
	FP 4	0.495		
	FP 5	0.692		



Discriminant validity. Discriminant validity, as defined by Hair Jr et al. (2014), is a method of gauging how significantly two constructs differ from one another. Discriminant validity is a crucial step in establishing the reliability of statistical tests and ensuring that each set of results is reliable and consistent, as it quantifies the degree in what ways one construct is distinct from another (Henseler et al., 2015). Fornell and Larcker Criterion, Heterotrait-Monotrait Ratio, and Item Crossing Loadings are the three criteria used to assess discriminant validity (Hair Jr et al., 2014; Henseler et al., 2015). According to the Fornell and Larcker criterion, a variable should exhibit greater variance within its own constructs than between other variables. The criteria set by Hair et al. suggests that the square root of AVE should be the highest of any inter-construct correlation, hence these values are displayed along the diagonal (2011). All the diagonal values are the highest in their corresponding columns and rows, hence the correlation matrix in Table 3 complies with the aforementioned norm.

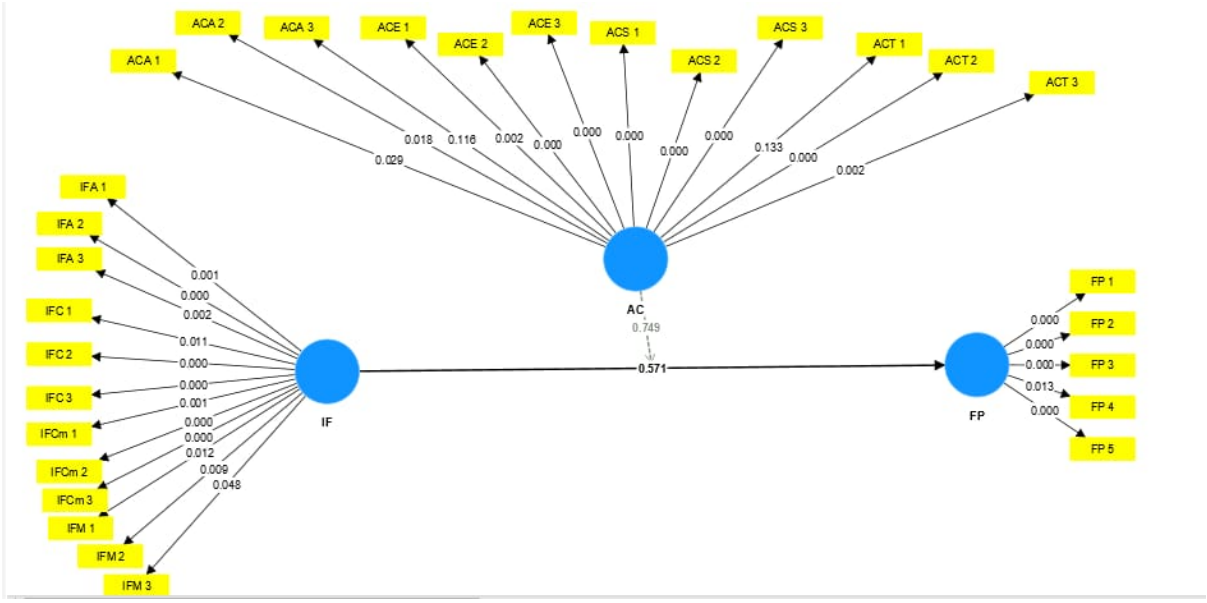
	AC	FP	IF	AC x IF
AC				
FP	0.622			
IF	0.876	0.522		
AC x IF	0.672	0.358	0.648	

Correlations of Discriminant Validity. To ensure the data is discriminant, one might apply a statistical method called item cross-loading analysis. Each item's cross loading within its own construct should be higher than that of any other item (Hair et al., 2011; Hair Jr et al., 2014). The recommended minimum for the difference between the item's cross loading on its target build and the loadings on all other constructions is 0.1. Table 4 displays the inter-correlations between all of the variables.

	AC	FP	IF
IFC 1	0.339	0.141	0.548
IFC 2	0.487	0.385	0.722
IFC 3	0.504	0.363	0.641
IFM 1	0.372	0.217	0.503
IFM 2	0.566	0.272	0.546
IFM 3	0.443	0.063	0.469
IFCm 1	0.577	0.276	0.704
IFCm 2	0.484	0.275	0.646
IFCm 3	0.541	0.331	0.739
IFA 1	0.426	0.233	0.686
IFA 2	0.428	0.296	0.655
IFA 3	0.38	0.337	0.641
ACA 1	0.453	0.307	0.534
ACA 2	0.521	0.193	0.372
ACA 3	0.322	0.048	0.342
ACS 1	0.703	0.202	0.51
ACS 2	0.702	0.218	0.491
ACS 3	0.68	0.441	0.597
ACT 1	0.475	0.09	0.472
ACT 2	0.655	0.411	0.431
ACT 3	0.635	0.267	0.446
ACE 1	0.56	0.048	0.404
ACE 2	0.784	0.359	0.522
ACE 3	0.718	0.521	0.361
FP 1	0.429	0.683	0.349
FP 2	0.396	0.767	0.298
FP 3	0.509	0.759	0.389
FP 4	0.197	0.495	0.195
FP 5	0.4	0.692	0.271

Inner Model Measurement And Hypothesis Testing. Analyses for internal model measurement follow those for external model measurement. Hypothesis testing is another common application of the SMART PLS program. Bootstrapping is a statistical method for evaluating hypotheses in Partial Least Square (PLS), as described by Haenlein and Kaplan (2004). It uses a resampling method, which entails selecting a sizable subsample (often 5000) from the full dataset. The results of bootstrapping are displayed in Fig.

		Loadings	Standard Deviation(STDEV)	T Statistics(|O/STDEV|)	P Values
IF	IFC 1	0.686	0.216	2.536	0.011
	IFC 2	0.655	0.195	3.7	0
	IFC 3	0.641	0.205	3.537	0
	IFM 1	0.548	0.199	3.415	0.012
	IFM 2	0.722	0.21	3.732	0.009
	IFM 3	0.724	0.237	4.544	0.048
	IFCm 1	0.704	0.206	3.415	0.001
	IFCm 2	0.646	0.173	3.732	0
	IFCm 3	0.739	0.163	4.544	0
	IFA 1	0.503	0.204	3.357	0.001
	IFA 2	0.546	0.179	3.652	0
	IFA 3	0.469	0.207	3.099	0.002
AC	ACA 1	0.453	0.208	2.185	0.029
	ACA 2	0.521	0.22	2.364	0.018
	ACA 3	0.322	0.205	1.574	0.116
	ACS 1	0.56	0.188	3.746	0
	ACS 2	0.781	0.189	3.709	0
	ACS 3	0.718	0.166	4.094	0
	ACT 1	0.703	0.316	1.503	0.133
	ACT 2	0.702	0.158	4.144	0
	ACT 3	0.68	0.21	3.155	0.002
	ACE 1	0.475	0.18	3.109	0.002
	ACE 2	0.655	0.133	5.893	0
	ACE 3	0.635	0.127	5.636	0
FP	FP 1	0.683	0.133	5.151	0
	FP 2	0.767	0.135	5.681	0
	FP 3	0.759	0.126	6	0
	FP 4	0.495	0.198	2.497	0.013
	FP 5	0.692	0.123	5.643	0



Predictive relevance of the model According to Hair Jr. et al., the quality of an internal model is measured by how well it can predict the endogenous construct (2014). The coefficient of determination (R2) and cross-validated redundancy are the basic metrics for assessing the reliability of an internal model (Q2). Cross-validated redundancy, also known as Q2, provides information about the predictive relevance of the internal model and is a measure of how well the outer model performs (Hair Jr et al., 2014). R2 measures the extent to which one exogenous (independent) variable affects another endogenous (dependent) variable (Hair Jr et al., 2014). According to Sanchez (2013), R2 can be classified as high, moderate, or low, with values above 0.6 indicating high, 0.3 to 0.6 indicating moderate, and below 0.3 indicating low. Table 6 displays R2 values, which are a measure of how well the model fits the data. Q2, also known as Cross-Validated Redundancy through the predict relevance, is another method for assessing the model's precision. Q square is calculated using the blindfold technique, and the result of Q2 must be greater than zero. Table 4 6 Q2 values, all of which are greater than zero, verify that the model is well-fit.

Constructs	R -Square	Q-Square
IF	0.656	0.639
AC	0.765	0.758
FP	0.825	0.5

HYPOTHESIS TESTING. The Structural Equation Modeling (SEM) method was utilized to examine five hypotheses posed in this investigation. Table 7 displays the results of the hypothesis tests, including the hypothesis loadings, probabilities, standard deviations, and T-statistics.

		Loadings	Standard Deviation(STDEV)	T Statistics	P Values	Results
H1	AC -> FP	0.588	0.161	3.652	0	ACCEPTED
H2	IFC -> FP	0.774	0.094	8.273	0	ACCEPTED
H3	IFM -> FP	0.874	0.036	23.971	0	ACCEPTED
H4	IFCm -> FP	0.401	0.152	2.628	0.004	ACCEPTED
H5	IFA -> FP	0.371	0.206	1.793	0.036	ACCEPTED
H6	AC x IF -> FP	-0.252	0.153	1.164	0.05	REJECTED

Structural Model. As the structural equation model is adequate, the predictions can be tested on it. Positive and statistically significant relationships were found between AC and FP (b = 0.588, t = 3.652, p0.000), IFC and FP (b = 0.774, t = 8.273, p0.00), IFM and FP (b = 0.874, t = 23.971, p0.000), IFCm and FP(b = 0.401, t = 0.152 p0.00), IFA and FP (b =0.371, t = 1.793, p0.00) and AC x IF->FP(b = -0.252, t = 1.164, p0.05. Therefore, all HI, H2, H3, H4, H5 and H6 can be accepted as true. No statistically significant relationship between IT infrastructure flexibility and firm performance was discovered in our study (b = -0.252, t = 1.641, po 0.050). These results show that IT infrastructure flexibility is inversely related to firm performance.

Conclusion. Three key hypothetical commitments are made in this study. It first includes distinct studies on the adaptability of IT infrastructure, absorptive capability, and business performance. It exactly tests their connections in the supply chain context. The discovery assists with resolving the dubious issue of the worth of IT capacities. That's what the outcomes show, despite the fact that IT abilities don't straightforwardly affect firm performance, they in all actuality do have a roundabout impact through absorptive capacity. First the relationship between IT infrastructure flexibility and firm performance (connectivity, modularity, compatibility, adaptability of IT personnel).This relationship needs a dynamic capability to influence positively on overall performance of a firm.

The practical implementation of this study can be very advantageous to managers to help improve company performance, particularly in supply chain management, businesses have invested millions of dollars in IT. These investments might not, however, perform to their full potential if firms do not use their IT capabilities to obtain. Therefore, managers must use IT capabilities to enhance higher-order organizational capabilities like absorptive capacity in

order to improve business performance.The results review gives the essential direction and information. Managers need to understand that citing the direct impacts of IT capabilities on business performance as justification for IT spending is inappropriate. Instead, they should be aware of how IT capabilities, absorptive ability, and firm performance are related. According to the findings, absorptive capacity acts as a mediator between IT infrastructure flexibility and firm performance. As a result, rather than focusing on directly improving firm performance, managers ought to concentrate on the effects of IT capabilities on improving the efficiency and effectiveness of information- and knowledge-intensive supply chain processes. The different ways that IT skills affect absorptive ability should be known to managers. The business should deploy IT resources to boost absorptive capacity first, which could lead to better performance.

Discussions. This study aims to explore the impact of IT infrastructure flexibility on supply chain performance. The findings of the research have brought to light the increasing significance of IT capabilities in the formation of absorptive capacity. The current study also demonstrates that the impact of flexible IT infrastructure on business performance can be fully mitigated by absorptive capacities. The findings have underlined the crucial importance of resources and capabilities and ability to operate capability in achieving firm performance, which is aligned with the dynamic resource - based view. The results strongly support the claim that a firm's flexible IT infrastructure can help the firm improve its absorptive capacity. This finding is consistent with previous studies that proposed the idea that IT infrastructure flexibility can help the company develop dynamic capabilities, which is consistent with the dynamic capabilities perspective. The current study responds to academics' calls for empirical research on the relationship between absorptive capacity and IT capability (IT infrastructure flexibility).

For a firm to increase its performance the flexibility of its IT infrastructure is not enough. Likewise the adoption or adaptation of absorptive capacity is not enough to increase its performance. The capability of top management in incorporating AC by welcoming new ideas and exploiting them within the organization depends upon the latest IT infrastructure.

Limitations. Despite this, it is vital to evaluate the contributions of this work in light of its constraints. First, there may be additional IT or organizational capabilities that have the potential to influence company performance, such as IT assimilation. Manufacturing, marketing, and managerial abilities may all play a role in determining a company's performance, which could be examined in subsequent studies to expand the scope of this one.

Future study can examine how IT capabilities can aid in the creation of new types of contracts, which would improve the efficiency of capacity investment, allocation decisions, and contracting.

Second, this study measures each key dimension because respondents' perceptions are by their very nature subjective. Even if the findings of our analysis do not show that the typical method bias is a significant problem, we advise future investigations to use objective data or collect information from numerous sources.

Thirdly, the respondents' demographics may limit the generalizability of our findings. In particular, it is restricted to the scope of the study to Pakistan. Informants were selected who had received training from the same establishment. Even though doing so may have improved the study's internal validity, it has limited the work's external validity. As a result, we caution academics and practitioners against extrapolating our findings to businesses operating in diverse economic, political, and cultural contexts.

Future Research Recommendations. Companies outside of the shipping sector will benefit from this research. Even though the research was done on a specific industry, it can be applied to all businesses. An infrastructure that is adaptable, effective, and able to change in response to changes in the environment is essential for all businesses. By recognizing, integrating, and rearranging their internal and external competencies, businesses can incorporate AC to deal with rapidly shifting environments. For a firm to be a benchmark within industry and outside it must have strong information technology infrastructure which will have a positive influence on performance of the firm. But this influence is incomplete without dynamic capability i.e. absorptive capacity.

© GSJ

Bibliography:

Amoako-Gyampah, K., Boakye, K. G., Famiyeh, S., & Adaku, E. (2020). Supplier integration, operational capability and firm performance: An investigation in an emerging economy environment. *Production Planning & Control*, *31*(13), 1128–1148. https://doi.org/10.1080/09537287.2019.1700570

Atnafu, D., & Hussen, S. O. (2017). THE EFFECT OF SUPPLY CHAIN INTEGRATION ON OPERATIONAL PERFORMANCE: A STUDY ON CHEMICAL AND CHEMICAL PRODUCT MANUFACTURING FIRMS IN ETHIOPIA. *Purchasing and Supply Chain Management*, 9.

Azim, M., Ahmed, H., & KHAN, A. T. M. (2015). OPERATIONAL PERFORMANCE AND PROFITABILITY: AN EMPIRICAL STUDY ON THE BANGLADESHI CERAMIC COMPANIES. *International Journal of Entrepreneurship and Development Studies*, *3*, 63–73.

Baihaqi, I., & Sohal, A. S. (2013). The impact of information sharing in supply chains on organisational performance: An empirical study. *Production Planning & Control*, *24*(8–9), 743–758. https://doi.org/10.1080/09537287.2012.666865

Bayraktar, E., Demirbag, M., Koh, S. C. L., Tatoglu, E., & Zaim, H. (2009). A causal analysis of the impact of information systems and supply chain management practices on operational performance: Evidence from manufacturing SMEs in Turkey. *International Journal of Production Economics*, *122*(1), 133–149. https://doi.org/10.1016/j.ijpe.2009.05.011

Bowersox, D. J., Closs, D. J., & Stank, T. P. (1999). *21ST CENTURY LOGISTICS: MAKING SUPPLY CHAIN INTEGRATION A REALITY*. https://trid.trb.org/view.aspx?id=672144

Cao, Z., Huo, B., Li, Y., & Zhao, X. (2015). The impact of organizational culture on supply chain integration: A contingency and configuration approach. *Supply Chain Management: An International Journal*, *20*(1), 24–41. https://doi.org/10.1108/SCM-11-2013-0426

Chae, B., Yen, H. R., & Sheu, C. (2005). Information Technology and Supply Chain Collaboration: Moderating Effects of Existing Relationships Between Partners. *IEEE Transactions on Engineering Management*, *52*(4), 440–448. https://doi.org/10.1109/TEM.2005.856570

Dehgani, R., & Jafari Navimipour, N. (2019). The impact of information technology and communication systems on the agility of supply chain management systems. *Kybernetes*, *48*(10), 2217–2236. https://doi.org/10.1108/K-10-2018-0532

Devaraj, S., Krajewski, L., & Wei, J. C. (2007). Impact of eBusiness technologies on operational performance: The role of production information integration in the supply chain. *Journal of Operations Management*, *25*(6), 1199–1216. https://doi.org/10.1016/j.jom.2007.01.002

Duhaylongsod, J. B., & De Giovanni, P. (2019). The impact of innovation strategies on the relationship between supplier integration and operational performance. *International Journal of Physical Distribution & Logistics Management*, *49*(2), 156–177. https://doi.org/10.1108/IJPDLM-09-2017-0269

El-Khalil, R., & Mezher, M. A. (2020). The mediating impact of sustainability on the relationship between agility and operational performance. *Operations Research Perspectives*, *7*, 100171. https://doi.org/10.1016/j.orp.2020.100171

Feng, M., Yu, W., Chavez, R., Mangan, J., & Zhang, X. (2017). Guanxi and operational performance: The mediating role of supply chain integration. *Industrial Management & Data Systems*, *117*(8), 1650–1668. https://doi.org/10.1108/IMDS-06-2016-0198

Flynn, B. B., Huo, B., & Zhao, X. (2010). The impact of supply chain integration on performance: A contingency and configuration approach. *Journal of Operations Management*, *28*(1), 58–71. https://doi.org/10.1016/j.jom.2009.06.001

Ganbold, O., Matsui, Y., & Rotaru, K. (2021). Effect of information technology-enabled supply chain integration on a firm's operational performance. *Journal of Enterprise Information Management*, *34*(3), 948–989. https://doi.org/10.1108/JEIM-10-2019-0332

Group, P. I., & Varma, D. T. N. (n.d.). *Information Technology in Supply Chain Management*. Retrieved November 15, 2021, from https://www.academia.edu/32455619/Information_Technology_in_Supply_Chain_Management

Gunasekaran, A., & Ngai, E. W. T. (2004). Information systems in supply chain integration and management. *European Journal of Operational Research*, *159*(2), 269–295. https://doi.org/10.1016/j.ejor.2003.08.016

He, Y., Keung Lai, K., Sun, H., & Chen, Y. (2014). The impact of supplier integration on customer integration and new product performance: The mediating role of manufacturing flexibility under trust theory. *International Journal of Production Economics*, *147*, 260–270. https://doi.org/10.1016/j.ijpe.2013.04.044

Hendijani, R., & Saeidi Saei, R. (2020). Supply chain integration and firm performance: The moderating role of demand uncertainty. *Cogent Business & Management*, *7*(1), 1760477. https://doi.org/10.1080/23311975.2020.1760477

Henseler, J., & Fassott, G. (2010). Testing Moderating Effects in PLS Path Models: An Illustration of Available Procedures. In V. Esposito Vinzi, W. W. Chin, J. Henseler, & H. Wang (Eds.), *Handbook of Partial Least Squares: Concepts, Methods and Applications* (pp. 713–735). Springer. https://doi.org/10.1007/978-3-540-32827-8_31

Huang, M.-C., Yen, G.-F., & Liu, T.-C. (2014). Reexamining supply chain integration and the supplier's performance relationships under uncertainty. *Supply Chain Management: An International Journal*, *19*(1), 64–78. https://doi.org/10.1108/SCM-04-2013-0114

Huang, S. H., Uppal, M., & Shi, J. (2002). A product driven approach to manufacturing supply chain selection. *Supply Chain Management: An International Journal*, *7*(4), 189–199. https://doi.org/10.1108/13598540210438935

Huo, B. (2012). The impact of supply chain integration on company performance: An organizational capability perspective. *Supply Chain Management: An International Journal*, *17*(6), 596–610. https://doi.org/10.1108/13598541211269210

Jin, B. (2006). Performance implications of information technology implementation in an apparel supply chain. *Supply Chain Management: An International Journal*, *11*(4), 309–316. https://doi.org/10.1108/13598540610671752

Koufteros, X., Vonderembse, M., & Jayaram, J. (2005). Internal and External Integration for Product Development: The Contingency Effects of Uncertainty, Equivocality, and Platform Strategy. *Decision Sciences*, *36*(1), 97–133. https://doi.org/10.1111/j.1540-5915.2005.00067.x

Li, G., Yang, H., Sun, L., & Sohal, A. S. (2009). The impact of IT implementation on supply chain integration and performance. *International Journal of Production Economics*, *120*(1), 125–138. https://doi.org/10.1016/j.ijpe.2008.07.017

Liu, A., Liu, H., & Gu, J. (2021). Linking business model design and operational performance: The mediating role of supply chain integration. *Industrial Marketing Management*, *96*, 60–70. https://doi.org/10.1016/j.indmarman.2021.04.009

Lu, D., Ding, Y., Asian, S., & Paul, S. K. (2018). From Supply Chain Integration to Operational Performance: The Moderating Effect of Market Uncertainty. *Global Journal of Flexible Systems Management*, *19*(S1), 3–20. https://doi.org/10.1007/s40171-017-0161-9

Prajogo, D., & Olhager, J. (2012). Supply chain integration and performance: The effects of long-term relationships, information technology and sharing, and logistics integration. *International Journal of Production Economics*, *135*(1), 514–522. https://doi.org/10.1016/j.ijpe.2011.09.001

Roldán, J., & Sánchez-Franco, M. J. (2012). Variance-Based Structural Equation Modeling: Guidelines for Using Partial Least Squares in Information Systems Research. In *Research Methodologies, Innovations and Philosophies in Software Systems Engineering and Information Systems* (pp. 193–221). https://doi.org/10.4018/978-1-4666-0179-6.ch010

Shou, Y., Li, Y., Park, Y., & Kang, M. (2018). Supply chain integration and operational performance: The contingency effects of production systems. *Journal of Purchasing and Supply Management*, *24*(4), 352–360. https://doi.org/10.1016/j.pursup.2017.11.004

Shukor, A. A. A., Newaz, Md. S., Rahman, M. K., & Taha, A. Z. (2021). Supply chain integration and its impact on supply chain agility and organizational flexibility in manufacturing firms. *International Journal of Emerging Markets*, *16*(8), 1721–1744. https://doi.org/10.1108/IJOEM-04-2020-0418

Stevens, G. C. (1989). Integrating the Supply Chain. *International Journal of Physical Distribution & Materials Management*, *19*(8), 3–8. https://doi.org/10.1108/EUM0000000000329

Tarafdar, M., & Qrunfleh, S. (2017). Agile supply chain strategy and supply chain performance: Complementary roles of supply chain practices and information systems capability for agility. *International Journal of Production Research*, *55*(4), 925–938. https://doi.org/10.1080/00207543.2016.1203079

Vafaei-Zadeh, A., Ramayah, T., Hanifah, H., Kurnia, S., & Mahmud, I. (2020). Supply chain information integration and its impact on the operational performance of manufacturing firms in Malaysia. *Information & Management*, *57*(8), 103386. https://doi.org/10.1016/j.im.2020.103386

Wong, C. Y., Boon-itt, S., & Wong, C. W. Y. (2011). The contingency effects of environmental uncertainty on the relationship between supply chain integration and operational performance. *Journal of Operations Management*, *29*(6), 604–615. https://doi.org/10.1016/j.jom.2011.01.003

Wu, F., Yeniyurt, S., Kim, D., & Cavusgil, S. T. (2006). The impact of information technology on supply chain capabilities and firm performance: A resource-based view. *Industrial Marketing Management*, *35*(4), 493–504. https://doi.org/10.1016/j.indmarman.2005.05.003

Ye, F., & Wang, Z. (2013). Effects of information technology alignment and information sharing on supply chain operational performance. *Computers & Industrial Engineering*, *65*(3), 370–377. https://doi.org/10.1016/j.cie.2013.03.012

Yu, W. (2015). The effect of IT-enabled supply chain integration on performance. *Production Planning & Control*, *26*(12), 945–957. https://doi.org/10.1080/09537287.2014.1002021

Yu, Y., Huo, B., & Zhang, Z. (Justin). (2021). Impact of information technology on supply chain integration and company performance: Evidence from cross-border e-commerce companies in China. *Journal of Enterprise Information Management*, *34*(1), 460–489. https://doi.org/10.1108/JEIM-03-2020-0101

Yuen, K. F., & Thai, V. V. (2016). The Relationship between Supply Chain Integration and Operational Performances: A Study of Priorities and Synergies. *Transportation Journal*, *55*(1), 31–50. https://doi.org/10.5325/transportationj.55.1.0031

Zailani, S., & Rajagopal, P. (2005). Supply chain integration and performance: US versus East Asian companies. *Supply Chain Management: An International Journal*, *10*(5), 379–393. https://doi.org/10.1108/13598540510624205

Zhang, Z., Lee, M. K. O., Huang, P., Zhang, L., & Huang, X. (2005). A framework of ERP systems implementation success in China: An empirical study. *International Journal of Production Economics*, *98*(1), 56–80. https://doi.org/10.1016/j.ijpe.2004.09.004

Zhao, X., Huo, B., Selen, W., & Yeung, J. H. Y. (2011). The impact of internal integration and relationship commitment on external integration⋆. *Journal of Operations Management*, *29*(1–2), 17–32. https://doi.org/10.1016/j.jom.2010.04.004