Positive Impact of Enabling Supply Chain Integration Using Information Technology. Case of UAE's Manufacturing Sector

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ABSTRACT

The purpose of this study is to investigate the factors that influence the financial and operational performance of manufacturing enterprises in the United Arab Emirates after they have integrated their supply chains. For the purpose of collecting primary data for the study, a survey questionnaire was distributed to supply chain experts working for the companies that were highlighted. After distributing the surveys and collecting the findings, we validated the instrument using exploratory factor analysis. In order to examine the study hypotheses, CFA analysis was utilized. These hypotheses were then put to the test using the SEM methodology. It has been demonstrated through statistical analysis that companies that integrate different aspects of their supply chains are able to enhance their operational efficiency, which in turn leads to improved financial performance.

Keywords: Supply chain, Manufacturing sector, Virtual supply chain, CFA, Financial performance

1. Introduction

Every corporation's primary goal is to increase the wealth of its owners, most of whom are shareholders. Consistently increasing sales revenue while minimizing expenses is critical for the company to achieve this goal. The majority see this as the marketing function, as it facilitates the acquisition of new customers and the retention of existing ones, assuring the company's profitability, longevity, and increased shareholder value. The majority of people are already aware of this. The supply chain meets this responsibility by ensuring the timely delivery of products and services to manufacturers and customers, resulting in client expansion and retention [1]. Historically, the success of this position was dependent on the efficient use of tangible assets in all aspects of planning and communication. The term "virtual supply chain management" refers to the profession's shift to a virtual format as a result of technological advancements. Scholars have expressed a strong interest in this function, which continues to grow. The primary reason for this interest is because virtual supply chains enable more effective use of limited resources. This role increases the resources needed for supply chain management while also enhancing the overall performance of numerous activities, such as marketing, finance, and human resource management [2]. While virtual supply chain management

presents considerable obstacles, it also provides several opportunities for the firm to improve its performance. In some cases, transitioning from analog to digital supply chain management might be challenging. Scholars have found various variables that contribute to these issues, including ineffective responses to change from management and personnel, a general lack of understanding, and, most importantly, a failure to recognize hazards. Additional potential hurdles include data privacy restrictions that affect consumers and businesses, the two main participants in the digital supply chain [3].

To increase earnings while decreasing expenses. Streamlined supply chain procedures, made possible by developments in information and communication technology (ICT), have drastically decreased commissioning times. As a result, supply chains may be more efficient if they deliver precise market demand data. Firms' competitive focus has switched from old supply chains to new alternatives as ICT-supported supply chains demonstrate more adaptability to changing market needs. The outcome was the establishment of research activities aimed at redesigning supply chain systems through the use of information technology [4].

Several factors, including a rise in both suppliers and customers, influenced the development of the VSC [5].In contrast to information and communication technologies, VSCs focus on the development of effective management systems that are always developing. VSCs make it easier to distribute customer and market information quickly, as well as provide new solutions [6]. Two other important proposals include the development of criteria for assessing the effectiveness and suitability of ICTs in S.C.s, as well as a regulatory framework for their use [7]. Industrial giants could improve their use of VSCs by reevaluating their annual production strategies. Nonetheless, this may result in fewer technical changes, a faster completion of production, and improved time efficiency throughout the planning phase [8]. The industrial sector, notably in the UAE, has considerable challenges as a result of the aforementioned elements; in order to adapt to the dynamic market and growing competition, many companies are quickly transitioning from a traditional to a virtual supply chain. Given that firms and clients work together in virtual supply chains, the transmission of real-time data on sales predictions and actual statistics is critical. Once implemented, supply chain integration benefits all stakeholders involved [7].

The industrial sector is critical to economic development because it provides a foundation for growth and facilitates trade and commerce through the export of domestically produced commodities. The UAE is working hard to diversify its economy, with the industrial sector acknowledged as a critical component of its goals. In March 2021, the country launched Operation 300 Billion, a decade-long plan with lofty goals targeted at increasing the economic contributions of the industrial sector. By 2031, the policy expects the industrial sector to contribute an additional AED 300 billion to GDP, with contributions from light and heavy manufacturing sectors having doubled. The industry can achieve long-term success by utilizing readily available energy resources, robust transportation and logistics networks, and capital investment, all of which provide economic benefits. A substantial portion of the United Arab Emirates' (UAE) economic framework has continually focused on manufacturing, which was critical in the country's first diversification attempts. The UAE capitals,

Dubai and Abu Dhabi, have built strong industrial networks in the metals and high-value processing sectors of the supply chain, thanks to companies like EGA and DUCAB. There is a thriving global market for construction materials produced in the northern emirates, particularly Ras Al Khaimah. The United Arab Emirates has extensive experience in pharmaceutical and chemical manufacture, which are critical businesses. The production of high-tech aerospace and defense products by companies like Strata in Abu Dhabi will be a critical industry, generating a mix of high-value exports, robust and innovative industrial clusters, and lucrative employment opportunities that attract skilled workers. Operation 300bn, which began on March 22, 2021, serves as a catalyst for the UAE's future manufacturing and industrial aims. The ten-year strategy aims to establish the industrial sector as a catalyst for a sustainable economy, increasing its GDP contribution from AED 133 billion in 2017 to AED 300 billion by 2031. The Ministry of Industry and Advanced Technology will lead the plan and carry out programs and efforts to help 13,500 small and medium-sized industrial firms. The plan focuses on new sectors that use cutting-edge technology and handle the challenges posed by the Fourth Industrial Revolution (4IR) [9].

Manufacturing accounts for the vast majority of the UAE's gross domestic output. It is the third largest industry in terms of nominal GDP, after mining, manufacturing, and retail/wholesale commerce. In 2022, the manufacturing sector accounted for slightly less than 10% of the UAE's nominal GDP.

2. Literature Review

Businesses It is possible to develop particular competencies by making use of the resources that a company currently has. This is because every business is a collection of resources. The organization is able to attain and retain a short-term and long-term competitive edge over its rivals thanks to the acquisition and maintenance of these specialized talents and capabilities. Resource-based theory, also referred to as the "resource-based view" [10], is the theoretical foundation for this approach. As a consequence of this, an organization makes use of a wide range of resources, such as financial resources, initiative, and staff. The concrete ideas and technologies that underpin these resources are the foundation.

In a commercial and economic climate in which the majority of businesses have access to the same fundamental resources, differentiation is based on the level of innovation that a company possesses [11]. Management of the supply chain that is efficient is essential because it incorporates all of the resources that a firm possesses. The emergence of information technology presented businesses with a unique opportunity to enhance and refine their supply chain processes. This was a win-win situation for everyone involved. Although businesses invested money in information technology (IT) equipment and updated their integration processes, the benefits of a more flexible supply chain and improved customer service more than compensated for the expense. For the reason that it lessens the total level of uncertainty and improves decision-making by making use of data that is easily accessible, it makes perfect sense to put money into this [12].

Supply chain operations and the supply chain itself are always evolving, just like businesses and the

economy as a whole. Without robust supply chains, businesses are unable to prosper in the current environment, which is characterized by rapid change. Supply networks that are both flexible and engaging are absolutely necessary. Based on the findings of Um, Lyons [13], the sole approach to achieve this objective is to utilize information technology to either integrate or virtualize the processes of both the provider and the customer.

Especially in the industrial sector, virtualization has become an indispensable tool in today's highly competitive business environment. Virtualization exemplifies this integration. According to Yu and Jacobs [14], supply chain integration and virtualization can be advantageous to both customers and suppliers since they can increase customer and supplier flexibility and efficiency. Ivanov [5], held that the internet and artificial intelligence programs have contributed to an increase in the virtualization of supply chains. The effect has resulted in a reduction in the requirement for human interaction involved in a number of tasks, including decision-making. According to Ivanov [15], virtualization has assisted businesses in overcoming previously insurmountable obstacles, such as communication over enormous distances. Singh and Modgil [6], contends that due to the utilization of virtual supply chains, the organization has been able to successfully adapt to the customs, values, and practices of both its customers and its suppliers.

Based on the integration goals that are being pursued, a supply chain can be divided into two distinct types: supplier integration and customer integration. This is although a well-integrated supply chain is beneficial to both customers and suppliers. The authors Chopra and Meindl [16] argue that manufacturers coordinate inter-organizational strategies, practices, and processes to incorporate customers and suppliers into cooperative and synchronized operations. Using this line of thinking, we divide information technology into two groups: consumer IT and provider IT. These categories are considered in our research. System integration and process integration are the two components that make up Supply Chain Integration (SCI[5, 13, 14]. The integration idea allows for the separation of these two components. According to Weenk [17], system integration is defined as the process of combining data inputs from many different sources. In order to keep an open line of communication with their customers and suppliers, manufacturing organizations generally set up cooperative platforms and networking technologies. To meet the high expectations of their customers, manufacturers collaborate with their suppliers to enhance the production methods and product quality of their products. Customers are also able to participate in the design and production phases of the product. Specifically, system integration and process integration are what Huo, Zhang [18] refer to as the "hard" and "soft" components of supply chain integration (SCI).

Increasing the efficiency of the company through the utilization of virtual supply networks. The constantly expanding information technology sector presents businesses with a variety of opportunities as well as obstacles. Over the past few years, there has been a substantial amount of disruption in the business environment. According to Singh and Modgil [6], Internet and Internet of Things strategies are essential for any company that wants to thrive and maintain its position in today's fast-paced economy. The unrestricted flow of information is absolutely necessary in the competitive business world of today. According to Um, Lyons [13], it is essential to link the information systems

of both the supplier and the customer through a virtual network to ensure that the flow of information is consistent with real-time conditions. Numerous researchers, like [19-21], came to the conclusion that supply chain integration strengthens and improves interactions between suppliers and customers. Joint ventures, as a consequence, improve the ability of the parties involved to make strategic decisions regarding inventories, sales, distribution, and manufacturing. Scott and Mula [22]. Both Chang and Ellinger [23] and Villena and Gomez Mejia [20] state that the major responsibility of the SCI is to enhance operational effectiveness, which in turn encourages strategic cooperation. According to the findings of a number of research studies, supply chain integration improves operational efficiency while simultaneously benefiting both customers and suppliers.

An earlier study by Pintuma and Aunyawong [24] found that the use of information technology-based strategies frequently results in an increase in supply chain efficiency. These procedures make it possible for businesses to combine several activities that are associated with the supply chain. Some examples of how these procedures enable businesses to do this include coordination, integration, and general collaboration across numerous operations from the beginning to the end of the supply chain. Increasing the efficiency of supply chain operations through the application of information technology leads to a more efficient utilization of limited financial and human resources. increases the overall efficiency of the organization, which ultimately leads to improved financial performance [17]. According to Pintuma and Aunyawong [24] and Ponte and Puche [25], these technologies have made it possible for businesses to construct "just-in-time" systems, which improve the flow of data across a wide range of complex procedures. Electronic data interchange (EDI) technologies, for example, enhance communication, which in turn optimizes corporate processes, hence enhancing customer satisfaction and the efficiency of business processes.

Additionally, according to Zhang and Van Donk [26], information technology can assist firms in increasing the number of collaborative partnerships they have developed. Supply chain integration (SCI) and coordination are all significantly facilitated by information technology, which is an essential enabler [27]. Research has shown that factors like how well partners work together, their reliance on each other, and their ability to build and keep long-term relationships can affect how well information technology helps with supply chain integration (SCI). The fact that partners in the supply chain do not have access to efficient information technology applications for SCI networks is a significant problem since it frequently prevents them from exchanging information in an effective manner. It is because of these limits that the process of integrated supply chain management is less efficient [28].

The Internet and other forms of information technology (IT) have experienced fast expansion, which has had a considerable impact on the integration of manufacturing supply chains. SCI is able to provide businesses with data that is correct, up-to-date, and reliable as a result of information technology, which makes communication and collaboration easier (Chae et al. 2005). According to Kim [29], information technology is dependent on its networks to facilitate the flow of information between buyers and suppliers. In this way, suppliers are able to enhance their expectations for the timely manufacturing of parts and components while simultaneously receiving constructive criticism.

Leuschner, Rogers [30] discovered that information technology makes it easier to create and maintain frameworks and agreements for supply chain collaboration. According to Huo [31], the utilization of information technology makes it easier to coordinate both tactical and strategic activities within the context of Supply Chain Integration (SCI). In the past, researchers have discovered that the use of information technology can facilitate the recovery process following spinal cord injury. Several studies have demonstrated that the implementation of e-business technology can enhance both internal and international communication, as well as facilitate the integration of product information. The ability to make decisions based on the most recent information is one of the ways that supply chain integration can improve operational efficiency [32]. According to Handfield, Petersen [33], this component is associated with greater production because it involves reducing expenses and improving quality. According toHan, Wang [34], firms that are more efficient with their operations tend to have superior financial performance.

2.1 Research Model

Based upon the review of existing literature, the following research model is presented in figure 1.

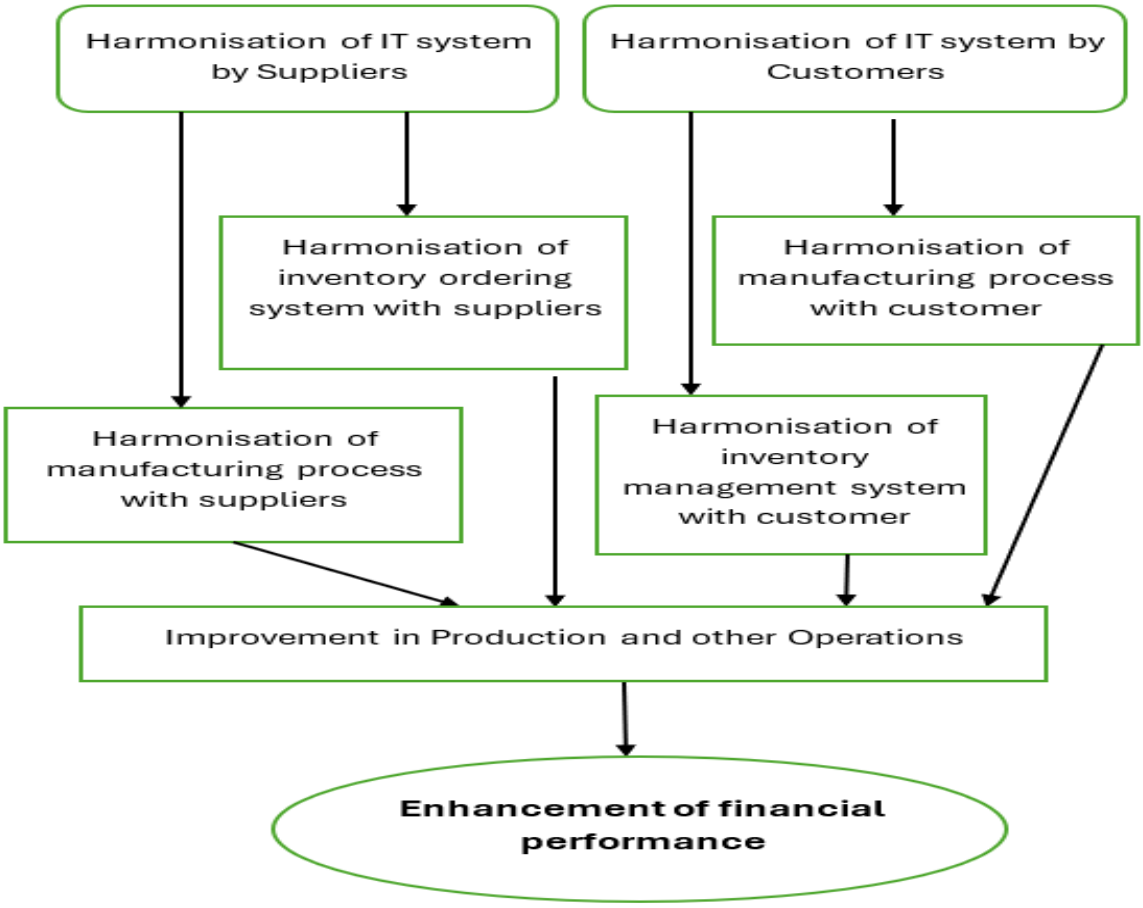

Figure 1. Research model

Source: Present Research

2.2 Research hypothesis

Based upon the research mentioned above, the following research hypotheses are formulated.

H1. Harmonisation of IT system by Suppliers has a positive impact on Harmonisation of manufacturing process with suppliers.

H2. Harmonization of the inventory management system by customers has a positive impact on the harmonization of the manufacturing process with customers.

H3. Harmonisation of IT system by Suppliers with is positively related to Harmonisation of manufacturing process with suppliers.

H4. Harmonisation of inventory management system by Customers is positively related to Harmonisation of manufacturing process with suppliers.

H5. Harmonisation of manufacturing process with suppliers has a positive impact on the Improvement in Production and other operations.

H6. Harmonisation of inventory ordering system with customers has a positive impact on Improvement in Production and other operations.

H7. Harmonisation of inventory management system with supplier is positively related to Improvement in Production and other operations.

H8. Harmonisation of inventory management system with supplier is positively related to Improvement in Production and other Operations

H9. Improvement in production and other operations has a positive impact on the enhancement of the financial performance of sample companies.

3. Research Design

3.1 Data and sample

To validate the sample, we first chose the five main industrial sectors in manufacturing sector of UAE. As the first step, we selected the top three companies from each industrial sector as cited in table 1 below.

Table 1. The sample composition of the manufacturing sector of UAE

Industry	**Target sample**
Petrochemicals & Plastics	30%
Metals & Steel	10%
Food & Beverage Processing	30%
Automotive & Aerospace	10%
Pharmaceuticals	20%

Only managers and executives familiar with virtual or online supply chains were surveyed. The researcher worked hard to ensure that these firms used a virtual supply chain and were in sync with their suppliers and customers. We provided potential survey participants with the relevant documentation. We distributed six hundred questionnaires to companies and authorities that met the criteria. Because response rates in such studies are low, we contacted, emailed, and texted respondents

to ensure they received the questionnaire. After three weeks, we received 160 responses, 122 of which were appropriate for the study. The response rate was 20.3%, which is low but normal for such surveys [35, 36]. Table 2 lists respondents by title.

Table 2. Percentage composition of respondents

Position	Percentage of Sample	Respondents
Senior level managers	18.8%	23
Operational-level manager	29.3%	36
Management professionals	34.4%	42
Consultants	17.5%	21
Total	100%	122

All participants had appropriate managerial experience, as four years was the minimum criterion. As a result of their experiences, each responder had a good understanding of integrated supply chain management.

4. Results and Discussion

4.1 Testing the Reliability and Validity of the Data

A Confirmatory Factor Analysis (CFA) was used to validate the factor structure of a set of observed variables. The researchers tested the premise that observable variables have underlying latent constructs, as shown in Table 4 below. To evaluate the underlying components of our study hypotheses, we used a multivariate statistical method known as confirmatory factor analysis.

Table 3. Results of CFA

		Factor Load							
	Item	1	2	3	4	5	6	7	8
1	Harmonisation of IT system by Suppliers 1	0.787							
	Harmonisation of IT system by Suppliers2	0.783							
	Harmonisation of IT system by Suppliers3	0.853							
2	Harmonisation of IT system by Customers1		0.802						
	Harmonisation of IT system by		0.802						

	Customers2								
	Harmonisation of IT system by Customers3		0.802						
3	Harmonisation of inventory ordering system with suppliers1			0.877					
	Harmonisation of inventory ordering system with suppliers2			0.734					
	Harmonisation of inventory ordering system with suppliers3			0.795					
4	Enhancement of financial performance 1				0.814				
	Enhancement of financial performance 2				0.786				
	Enhancement of financial performance 3				0.747				
	Enhancement of financial performance 4				0.842				
5	Improvement in Production and other Operations1					0.782			
	Improvement in Production and other Operations2					0.738			
	Improvement in Production and other Operations3					0.814			
	Improvement in Production and					0.746			

	other Operations4								
	Improvement in Production and other Operations5					0.835			
6	Harmonisation of manufacturing process with customer1						0.798		
	Harmonisation of manufacturing process with customer2						0.793		
	Harmonisation of manufacturing process with customer3						0.783		
7	Harmonisation of manufacturing process with suppliers 1							0.829	
	Harmonisation of manufacturing process with suppliers 2							0.757	
	Harmonisation of manufacturing process with suppliers 3							0.803	
8	Harmonisation of inventory management system with customer1								0.847
	Harmonisation of inventory management system with customer2								0.810
	Harmonisation of								0.791

	inventory management system with customer3								
	Eigen Values	7.012	5.031	3.138	2.013	2.336	2.115	3.823	2.453
	Cumulative Variance Explained	40.996	46.182	53.382	2.214	64.120	70.661	78.674	88.598

Almost every construction had an adequate Cronbach's alpha score of at least 0.70. All components demonstrated outstanding unidimensionality; hence, CFA results for Cronbach's alpha values were expected. The results reveal that, according to dependability [36], both the validity constructs and the overall instruments are reliable.

Table 3. Descriptive Statistics

Item	**HISS**	**HISC**	**HIoSS**	**EFP**	**IPoP**	**HMPC**	**HMPS**	**HIMSC**	**Cronbach's alpha**	**Composite reliability**	**Average Variance**
HISS	1								0.69	0.75	0.70
HISC	0.61**	1							0.70	0.87	0.89
HIoSS	0.40**	0.40***	1						0.68	0.77	0.80
EFP	0.31**	0.51**	0.39***	1					0.71	0.82	0.76
IPoP	0.39**	0.40**	0.36*	0.30***	1				0.73	0.79	0.67
HMPC	0.42***	0.31**	0.38**	0.36***	0.48**	1			0.70	0.76	0.85
HMPS	0.32**	0.43**	0.49***	0.43**	0.29**	0.35**	1		0.67	0.81	0.75
HIMSC	0.51***	0.39***	0.30**	0.29**	0.39***	0.36**	0.40***	1	0.73	0.75	0.62
Mean	3.96	5.1	4	4.6	2.9	4.1	3.6	4.3			
Std. deviation	1.09	1.28	0.967	1.06	0.927	1.15	1.1	1.18			

*** P<0.001, ** p<0.01

Table 5 shows coefficients with composite reliability values that exceed 0.70. Consequently, we will validate the correctness of the questionnaire and the comprehensive model. We determined the discriminant validity of each construct by calculating the square root of the average variance, which was greater than the regression coefficient. As a result, one can conclude that the scale used has sufficient discriminant validity [37]. The scale's content validity is further maintained by the dimension components being derived from prior supply chain research, as previously stated in the literature review section.

4.2 Hypothesis Testing

All previously stated hypotheses were accepted based on the SEM analysis in Figure 2, as their p-values fell below the 0.05 threshold.

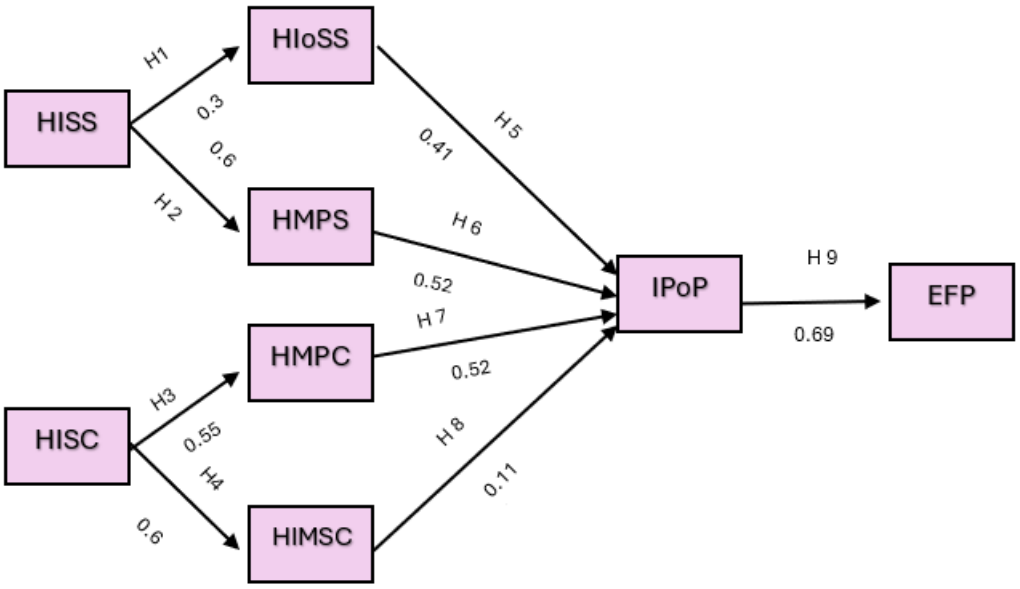

Figure 2. SEM results for the Research Model

Table 4. Results of path analysis for the model using SEM

Path			Estimate	S.E.	C.R.	P
HISS	⟵	HIoSS	0.299	0.048	3.946	***
HISS	⟵	HMPS	0.61	0.04	13.354	***
HISC	⟵	HMPC	0.556	0.056	5.944	***
HISC	⟵	HIMSC	0.602	0.061	13.933	***
IPoP	⟵	HIoSS	0.409	0.043	5.728	***
IPoP	⟵	HMPS	0.052	0.054	0.973	***
IPoP	⟵	HMPC	0.519	0.041	7.304	***
IPoP	⟵	HIMSC	0.113	0.042	3.044	0.002
EFP	⟵	IPoP	0.692	0.051	8.549	***

Businesses improve operational efficiency and financial success through supply chain integration. By integrating suppliers and customers, businesses improve operational efficiency and profitability. These traits help the UAE manufacturing industry grow in a competitive economy.

Due to the potential benefits of information technology for industrial firms, UAE suppliers and customers are pushing more investment in technical organisations. Improved communication and coordination will benefit UAE manufacturing enterprises, their clients, and suppliers, resulting in more efficient transactions. However, information technology allows UAE suppliers and customers to engage in more industrial operations. UAE manufacturers use intellectual inputs like information to improve operations, communication, and collaboration. Supplier IT is generally better at system integration than customer IT. Combining approaches makes it much more obvious. UAE network

systems, architectures, and infrastructures may require manufacturing enterprises to prioritise upstream supplier transaction facilitation. However, UAE industrial companies are stressing prompt communication, staff involvement, and downstream customer responsiveness. Various providers and customers use IT to improve supply chain coordination [38]. The UAE manufacturing industry thrives in this competitive economy due to these factors.

UAE suppliers and customers are encouraging technical organizational investment due to information technology's potential benefits for industrial enterprises. UAE manufacturers, clients, and suppliers would benefit from better communication and coordination, resulting in more efficient transactions. However, information technology allows UAE suppliers and customers to conduct more diverse industrial processes. UAE manufacturing companies acquire intellectual inputs, including information, to improve operations, communication, and collaboration. Supplier IT is usually better for system integration than customer IT. Combining methods makes the difference more visible. UAE network systems, architectures, and infrastructure may force manufacturing companies to prioritize upstream supplier interactions. In contrast, UAE industrial enterprises prioritize quick communication, staff involvement, and downstream client responsiveness. Different suppliers and customers use IT differently to improve supply chain collaboration [39].

4.3 Discussion and implication of Results

Integrating supply chain components improves overall organizational performance. When businesses implement IT-based procedures, they improve their operational efficiency and technical skills. These attributes provide them a competitive advantage. The UAE's industrial sector demonstrates this phenomenon. They face fierce competition both domestically and internationally. Supply chain integration allows buyers and sellers to access real-time data and improves communication with other partners in the supply chain. Consequently, the execution of transactions and instructions preserves all resources.

According to research, supplier-customer integration is optional since supply chain integration necessitates module integration [39]. The study found sufifcent evidence that the integration of customer IT systems improved business operational performance. Most clients likely use outdated or incompatible software, which is a key issue. These inaccuracies can reduce efficiency and create issues for both suppliers and customers. The operations are positively influenced.Yu and Zhang [39] found that greater communication between suppliers and customers leads to better business success. The new investigation supports these conclusions. According to research, supply chain integration helps companies succeed. The company's finances improve.

Supply chain innovations lead to better and simpler cooperation between suppliers and customers. Suppliers and customers gain access to real-time data by combining order processing, production, inventory management, and information technology. This suggests a higher chance of collaboration between them and with customers. This significantly increases their operational efficiency. This increase in consumer satisfaction allows them to maintain a greater market share while attracting new customers.

5. Conclusions

In conclusion, it is clear that in today's business world, particularly in the UAE's manufacturing sector, information technology has emerged as an important instrument for distinguishing oneself from competitors. The use of IT improves coordination across various components of supply chains, allowing for an uninterrupted transmission of information between suppliers and purchasers. This study unequivocally proves that information technology has a positive impact on SCI. SCI improves supply chain transparency by allowing businesses to adapt to increasingly globalised markets. Manufacturing enterprises in the UAE must survive and prosper. It improves overall operational performance, including financial performance and supply chain efficiency. Such improvement is possible if suppliers and customers work together to coordinate many aspects of the supply chain, including ordering and production procedures. When suppliers and customers use information technology, they are more likely to invest in technical firms. Collaboration between manufacturing companies in the UAE and their clients can improve productivity, resulting in more fluid transactions for everyone.

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