

## The effect of blockchain and smart inventory system on supply chain performance: Empirical evidence from retail industry

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### ABSTRACT

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This research aims to fill the research gap with empirical evidence that exists about the impact of blockchain and smart inventory systems on supply chain performance in the retail industry in the UAE. The proposed model is uniquely researched as no prior research explores the link between supply chain performances, blockchain, and smart inventory in prestigious academic journals. A quantitative technique with convenient cluster sampling is used. A descriptive, exploratory, causal and analytical design was applied—a sample size of 303 respondents was used for data analysis through regression and hypothesis with ANOVA. The findings revealed a significant positive impact of blockchain and smart inventory systems on SC performance. Limited construct-based research can be focused on more industries and constructs for future studies. There are numerous chances for businesses to leverage blockchain technology to their advantage over the competition, giving them the chance to strengthen their market position. Managers must carefully consider the qualities of their goods, services, and supply chains to ascertain whether they require or would sufficiently benefit from blockchain.

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## 1. Introduction

A few decades ago, the internet began to take off as a revolutionary and extremely disruptive technology that upended the very foundations of many industries. This disruption spread across numerous supply chains and reconfigured whole value networks (Wu et al., 2007; Tomlin, 2006). Blockchain is a popular term in information technology used in business modules. This technology will become a crucial component of how business sectors operate (Casado-Vara et al., 2018). All industries will use blockchains most frequently in the upcoming years, including business, health, and other financial areas (Saber et al., 2019). A Block chain is a program that functions as a database. Moreover, one of the most intelligent ways to reflect on the things that increase business efficiency and offer specific information about the products and their availability before it runs out of stock in the modern business environment is to use a smart inventory management system (Dutta et al., 2020). The technique of intelligently integrating inventory and offering analytical management approaches is how retail sectors establish a connection between available stock and stock removal. To meet demand promptly in the current competitive market, sophisticated inventory management is required. Additionally, performance in supply chain management refers to how activities are planned to satisfy the needs of end customers (Lee et al., 2022a). It all depends on the product's accessibility to safe delivery. The supply chain's performance evaluation is based on variables such as inventory turnover rate, shipping

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timings, and cash-to-cash cycle time (Farris & Hutchison, 2002; Lee et al., 2022). These indicators assist businesses in creating and running efficient supply chain management systems that are economical and capable of monitoring all activity (Folinas et al., 2004; Shamout et al., 2022). To avoid shipping delays and satisfy client needs, an effective supply chain management system has become crucial in the retail sector (Zairi, 1998; Alshurideh et al., 2022). The retail industry has become more difficult and competitive thanks to the efficient blockchain system because this is where smart inventory systems perform best (Joghee et al., 2021; Alzoubi et al., 2022). The effective use of inventory management through smart inventory and blockchain that affects supply chain performance has been investigated empirically in this research.

## 2. Theoretical framework

### 2.1 Blockchain

Technological innovation has also improved the way that firms operate. Blockchain technology, record keeping, and data retrieval have become more efficient (Ghazal et al., 2021). Blockchain is an open-source ledger system where transactions are tracked for future reference; verification may be trusted because the transaction is relatively permanently recorded (Cole, Stevenson, & Aitken, 2019; Ghazal, Hasan, et al., 2021). Hundreds of transactions are carried out in the retail sector daily, and it has become quite challenging to record them simply on a computer due to storage and retrieval limits (Stevenson & Aitken, 2019). The use of blockchain technology has several benefits, including creating transparent working conditions, data security, and transparency in transaction processes. It also undoubtedly aids large-scale industrial operations.

### 2.2 Smart Inventory System

Any organization's most complex duty is inventory management since it might be difficult to estimate demand (Baganha & Cohen, 1998). Additionally, it varies by industry (Williams & Tokar, 2008). The demand for goods in the retail sector, where many products are available, including convenience, luxury, and shopping goods, varies and depends on the consumers' spending capacity (Liang, 2013). Smart inventory systems can provide scalability, security, and backups while monitoring inventory levels. The concept of "smart shelves" has made real-time inventory management possible, and the retail sector needs smart inventory systems.

### 2.3 Supply Chain Performance

Supply chain performance is assessed based on factors such as inventory turnover rate, shipping schedules, and transactional duration (Kabilyants et al., 2021). These indicators help companies design and operate cost-effective supply chain management systems and keep an eye on every activity (Queiroz et al., 2019; Wu & Lai, 2019). It is possible since retailers may conduct transactions that should be easily retrievable and verifiable to prevent errors with advanced technological implementation.

### 2.4 Operational Definitions

Variables	Description	References
<b>Blockchain</b>	One sort of distributed ledger with the capacity to keep track of transactions permanently is blockchain.	(Alazab, Alhyari, Awajan, & Abdallah, 2021)
<b>Smart Inventory System</b>	An inventory management system that is highly innovative, based on cutting-edge technology, and designed to manage and control inventory flow while accommodating client expectations.	(Bose, Mondal, Sarkar, & Roy, 2022)
<b>Supply Chain Performance</b>	The SC performance is a collection of operations with a strong focus on the client and enabling product availability through prompt delivery.	(Hald & Kinra, 2019)

## 3. Literature review

### 3.1 Relationship and Impact of Blockchain on Supply Chain Performance

Different authors have argued that blockchain's supply chain management performance is highly influential (Treiblmaier, 2018). A Blockchain is a practical and secure method of obtaining information about particular business specifics; only interested individuals or departments may access the database and update information for new records in particular chains (Francisco & Swanson, 2018). The use of blockchain will increase consumer confidence, allowing consumers to monitor a product's journey across the supply chain with total assurance. Prior literature has confirmed that blockchain technology's efficiency in the supply chain may increase market access, fair trade, and price equality for parties in the chain (Kim & Shin, 2019).

**H<sub>1</sub>:** *Blockchain has a significant impact on SC performance.*

### 3.2 Relationship and Impact of Smart Inventory on Supply Chain Performance

Bose et al. (2022) stated that blockchain technology made the smart inventory system's development feasible. The significance of a smart inventory system is that inventory management is the crucial business tool for managing all business inventories at once. Without inventory management, businesses cannot operate effectively or handle their vast amounts of data. Several smart processes are now available on the market to assist business sectors in managing their vast supply chains, tracking their purchases, and keeping an eye on their stocks.

**H<sub>2</sub>:** *Smart inventory system has a significant impact on SC performance.*

### 3.3 Relationship and Impact of Blockchain and Smart Inventory System on Supply Chain Performance

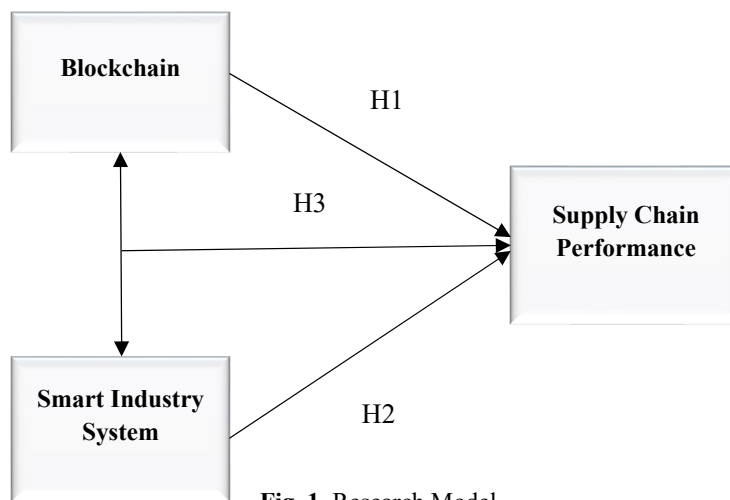
The literature on technology adoption models and their extensions for blockchain technology and supply chain management, as well as the resented theoretical frameworks, strongly imply that the performance of the supply chain is heavily reliant on the blockchain and smart inventory system (Mondol, 2021; Treiblmaier, 2018).

**H<sub>3</sub>:** *Blockchain and smart inventory systems have a significant impact on supply chain performance.*

### 3.4 Problem Statement and Research Gap

One of the business operating processes in the retail business sector that links internal and external information and business relations through a transparent and stable supply chain process is supply chain management and its performance metrics. Supply chain management in the retail business sector and its performance is crucial, enhancing business efficiency and customer satisfaction to increase the competitive business advantage. The purpose of this research is to focus on the factors affecting the supply chain performance of a retail business, such as; blockchain and smart inventory. To find empirical evidence of blockchain and smart inventory system impact on supply chain performance.

### 3.5 General Research Model



**Fig. 1.** Research Model

### 3.6 Research Methodology and Design

A quantitative technique was used to investigate the empirical evidence for the research. An online survey is conducted using the cluster sampling technique to assess the blockchain and smart inventory system's impact on supply chain performance. A descriptive, exploratory, causal and analytical research design was applied. An online questionnaire was sent to the management department of retail companies in the UAE.

### 3.7 Population, Sample & Unit of Analysis

The selected population for the research is management department employees working in retail companies based in Abu Dhabi, UAE. A sample size of 303 respondents was used for analysis out of 700 questionnaires sent via email. The survey correspondents are (The Inventory Manager, IT Manager, Marketing & Advertising, and SC Manager).

An online questionnaire containing 27 items was designed to assess the model variables with a five-point Likert scale extending from (1=strongly disagree to 5=strongly agree). Nine items were used to measure the blockchain, 10 for the smart inventory system and 8 for supply chain performance.

## 4. Data analysis

### 4.1 Demographic Analysis

Data was gathered from managerial departments of all retail companies based on their designations and gender. The results indicate a high number of male respondents (224, 73.9%) with inventory manager job designation (139, 45.9%).

**Table 1**

Personal characteristics of the participants

Items	Description	f	%
<b>Gender</b>	Male	224	73.9
	Female	79	26.1
<b>Job Status</b>	Inventory Manager	139	45.9
	IT Manager	96	31.7
	Marketing and Advertising	36	11.9
	SC Manager	32	10.9

*n=303, Male=73.9%, Female=26.1%*

### 4.2 Reliability, Descriptive analysis & Correlation

To identify the data validity, a reliability analysis was done by measuring Cronbach's Alpha, which indicates good reliability for blockchain=.74, smart inventory system=.84 and supply chain performance=.82. Whereas descriptive analysis depicts the mean value (3.09 & SD=0.73) for blockchain (M=2.72, SD=0.54) for smart inventory system, and (M=3.21, SD=0.54) for supply chain performance. The findings of correlation coefficients depict a high correlation between each construct. There is a significant correlation between blockchain and smart inventory  $r=.800$ ,  $P<0.05$ . Results indicate a high correlation between blockchain and supply chain performance  $r=.719$ ,  $P<0.05$ . The relationship of the smart inventory system also indicates a high correlation ranging  $r=.775$ . Table 2 shows the summary of the data.

**Table 2**

Reliability, Descriptive, and Correlation Coefficients

Variables	Cronbach's $\alpha$	Mean	SD	Blockchain	Smart Inventory System	SC Performance
<b>Blockchain</b>	.74	3.09	0.73	1		
<b>Smart Inventory System</b>	.84	2.72	0.54	.800**	1	
<b>SC Performance</b>	.82	3.21	0.54	.719**	.775**	1

Level of significance \*\* $P<0.05$

### 4.3 Regression & Hypothesis Testing

**Table 3**

Regression and Hypothesis testing using ANOVA

Hypothesis	Regression Weights	Standardized Coefficients			t-value	Hypothesis
		$\beta$	Adjusted $R^2$	Sig		
H <sub>1</sub>	BLC→SCP	.719	.517	.000	4.71	Yes
H <sub>2</sub>	SIS→SCP	.775	.599	.000	9.43	Yes
H <sub>3</sub>	BLC*SIS→SCP	.792	.625	.000	10.19	Yes

\*Level of Significance ( $\alpha\leq 0.05$ ), \*\*Critical t-value ( $df/p$ ) = 1.64

## 5. Discussion of the data

The data analysis and hypothesis testing reached final results that declared the acceptance of hypothesis one for the research with ( $\beta=.719$ ,  $t=4.71$ ) demonstrating a significant positive impact of "blockchain" on "SC performance". It has been argued by (Fosso Wamba, Queiroz, & Trinchera, 2020) that a blockchain system has a high capability to maintain the records technologically that can help to easily focus on supply chain performance. H<sub>1</sub> is accepted. The results showed a significant positive impact of "smart inventory system" on "SC performance" with the value ranging ( $\beta=.775$ ,  $t=9.43$ ) critical value with positive impact led to hypothesis acceptance for the current research. Literature has suggested that the smart inventory system

is a unique way to keep the transactional records for making the best-selling and manufacturing features. So, the H2 is also accepted.

To report the H3 that depicts the relationship and impact of “blockchain” and “smart inventory system” on “SC performance” at level ( $\beta=.792$ ,  $t=10.19$ ) indicates a significant positive relationship among variables that showed acceptance of the third hypothesis. To support the third hypothesis, researchers argued that the blockchain and smart inventory system greatly affect SC performance. The operations of business strategies can gain potential and significant advantages from the innovation in supplier performance through cutting-edge methods and digitization (Stevenson & Aitken, 2019).

## 6. Conclusion

An empirical analysis of the factors influencing organizational acceptance of blockchain technology in supply chain management is the need of the current era. The study's findings offer crucial insights to managers working on blockchain adoption efforts, including taking social influence into account the retail industry's need to accept the advanced technological system that can enhance the customer experience. Moreover, the management can gain a fresh perspective on the supply chain while also spotting mistakes in its performance thanks to the operation of advanced supply chain management. Through various technology analytic capabilities programs, the smart inventory system aids businesses in developing positive approaches to their resolutions, and business management records the inventories to improve supply chain performance.

## 7. Recommendations and limitations

The retail company's manager must adopt advanced strategies to improve supply chain performance by keeping a keen interest in competitive business advantage. This research has some significant limitations. The current research is limited to one industry analysis for supply chain performance with blockchain and smart inventory management. Other industries, like; IT & telecom, are recommended to focus on future research with deep analysis of other constructs.

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