# Blockchain in logistics industry: in fizz customer trust or not

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Received 30 June 2018
Revised 6 February 2019
13 November 2019
Accepted 22 December 2019

## Abstract

**Purpose** – The study is an attempt to explore much talked but less understood issue of "blockchain in logistics industry" in modern perspective. The customers' acceptance of blockchain technology in logistics and supply chain is tested through "Technology Acceptance Model" by using attitude, perceived usefulness (PU), perceived ease of use (PEOU), behavioral intention and use behavior.

**Design/methodology/approach** – Data has been collected through online and offline medium, where active 240 responses have been collected finally using convenience sampling. Confirmatory factor analysis with structural equation modeling (SEM) was carried out for data analysis.

**Findings** – The customers' acceptance of blockchain technology in logistics and supply chain is tested through "Technology Acceptance Model." The findings reveal model fit where PEOU, PU and attitude are the major constructs of the model to realize the substantial gains in logistics process efficiency.

**Research limitations/implications** – Convenience sampling has been considered for the study to collect the data of online users of various technology applications for tracking and shipment detail, whereas a more specified method sampling can be considered for the future research. The study has been conducted in the Indian context, which has been considered as the limitation pertaining to generalization across countries and industries.

**Practical implications** – The findings of this study will be helpful for market practitioners to build transparency between customers and industry to overcome the frictions in logistics. Blockchain will help in monitoring the performance history and previous commitments of logistics professionals resulting in selecting a responsible logistics solution provider. Access to critical data by the authorized member of the supply chain will reduce unsubstantiated disputes.

**Social implications** – Blockchain technology will be available to everyone on the network. This will bring transparency and help logistics professionals such as carriers, shippers and brokers to detect early frauds and prevent thefts. It will increase customer trust toward any financial transaction for tracking the ownership of titles.

**Originality/value** – Blockchain technology is envisioned to be a technology that could be a game-changer for decentralizing infrastructure, introducing transparency and building trust in the supply chain. The current study is a novel addition to the literature where blockchain technology enables the indisputable storage of verified data that was previously kept in safeguarded silos.

**Keywords** Blockchain, Logistics, Supply chain, Technology, Acceptance model (TAM), Transparency

**Paper type** Research paper

**JEL Classification —** L86, K13, O31, M38

Journal of Enterprise Information Management
Vol. 33 No. 3, 2020
pp. 541-558

1741-0398
DOI 10.1108/JEIM-06-2018-0142

## 1. Introduction

Innovation in digital finance, commonly called "Fintech," is gaining attention from Silicon Valley to Wall Street to Tokyo and even to developing countries such as India and China. Blockchain is a distributed database that holds records of digital data or events in a way that makes them tamper-resistant. By "sharing" databases between multiple parties, blockchain basically removes the requirement for mediators who were hitherto indispensable to act as trusted third parties to verify, record and coordinate transactions. Moving from centralized to a decentralized and distributed system, blockchain efficiently liberates data that was previously kept in safeguarded storage houses. It is estimated that seven out of 10 major global companies are presently exploring ways in which they can apply blockchain technology to their businesses. Walmart recently teamed up with IBM to increase transparency in their supply chains. Then there is the Blockchain in Trucking Alliance (BiTA), with over 60 members including FedEx, DHL, UPS, Visa and Uber Freight, to name a few. One major advantage of blockchain is to create transparency and trust as every member of the logistics network has access to the same data, offering a single point of truth (Tapscott and Tapscott, 2016). Adoption of blockchain in the supply chain has the potential to strengthen supply chain transparency and logistics effectiveness (Abeyratne and Monfared, 2016).

It is not also surprising to some logistics experts that believe blockchain to have "hidden enormous potential" (O'Marah, 2017), to be a real twenty-first century platform for economic restoration (Casey and Wong, 2017) and to "transmute the entire supply chain and dislocate the way we manufacture, market, procure, and consume our goods" (Dickson, 2016). Collectively, blockchain might be nothing less than the "holy grail" (Popper and Lohr, 2017). Conversely, what is natural with any emerging technology, the hype around blockchain appears largely driven by technology benefactors, advisors and journalists. Logistics operators, particularly small and medium-sized companies, proclaim to have bare minimum knowledge about blockchain (Kersten *et al.*, 2017). The claim can be described not only through the innovation of the technology but also through the lack of convincing use cases that clearly show blockchain's benefit over existing IT solutions. Logistics and SCM research on blockchain is still in its infancy (Zhao *et al.*, 2016) and ought to look into possible applications (Yli-Huumo *et al.*, 2016). The implementation of the blockchain technology solutions with the organization is difficult and lack of customer's knowledge adds to this challenge. Implementation of blockchain technology is like the orchestration of sustainable practices with environmental regulations (Saberi *et al.*, 2018).

There are a number of problems within the industry; including transparency in supply chains with many end consumers not knowing where their products have come from, complex processes with intermediary freight brokers and a lack of accountability when it comes to losses that occur within the often complex and opaque process. Blockchain offers numerous advantages for the supply chain sector. For instance, physical actions in silos can be documented in a blockchain in the form of digital information, and multiple operations, such as orders and payments, can be automatically arranged. After the release of Bitcoin in 2009, not only the business world but also entire educated lot became aware of blockchain technology. Major strata still believe blockchain and cryptocurrency to be the same thing. Therefore, negative sentiments against cryptocurrency sometimes tend to be transferred to the blockchain technology discussion. The current study aims to understand the consumer acceptance and adoption toward a new technology that will help in future to have more security and transparency related to all type of transactions. With the help of blockchain technology, the companies can save the cost by having efficient and automated processes. After exploring the prospect use of blockchain technology in logistics, the current study has been structured, and conceptual framework has been proposed in this study where four major determinants, that is, attitude, perceived ease of use (PEOU), perceived usefulness (PU) and

behavioral intention, effect on the use behavior have been analyzed. Hence, the objective of the study is as follow as:

(1) To understand the impact of various antecedents such as attitude, perceived ease of use and perceived usefulness on behavioral intention vis-à-vis behavioral intention impact on use behavior toward the use of blockchain technology for product information such as tracking detail and product counterfeit.

(2) To prove the aforementioned objective, TAM (technology acceptance model) has been used with all the antecedents (Davis, 1993) to analyze the adoption intention toward blockchain technology for product information such as tracking detail and product counterfeit.

## 2. Literature review

Blockchain technology is emerging significantly across different domains such as health care, fashion, retail, citizen services, automotive and manufacturing and energy. The technology has an effect like a pebble in the market and has created the ripples, in the ocean of technology, in different domains outwardly including logistics also. Blockchain has the potential to increase the business efficiency for the betterment of the logistics business (Kückelhaus *et al.*, 2018). According to IDC report (2018), blockchain technology has huge potential in future and expected to reach $9.7 billion by 2021 globally, vis-a-vis, logistics industry will be considered as the top most customer for this change. It has been estimated that distribution and services will have a market size approximately $1,000 million globally with a compound annual growth rate (CAGR) of 82 percent. Blockchain technology has tremendous opportunities across industries and can be unfolded for the betterment of the industry. Blockchain works as a digital ledger, which has all the details about the transactions and the information for the same. It notifies about any transaction that happens digitally, whereas the information about the parties will not be disclosed.

### *2.1 Use of blockchain technology in logistics: evidence from industry*

The scope of blockchain technology is not limited to financial applications and cryptocurrencies but has largely expended to other applications, such as Internet of Things (IoT), smart contracts and smart properties (Mougayar, 2016). The logistics industry in particular offers auspicious breakthroughs for upcoming business models (Deloite, 2017) and started to advance traction from an increasing number of supply chain managers, who study deploying blockchain technology (Bastian *et al.*, 2018).

Imagine what if organizations could eliminate the necessity for intermediaries in the world of logistics? What if transactions could be recorded, verified and synchronized separately without involving third parties? If this happens, it would drastically eliminate a whole layer of complication from present global supply chains (Ari Sivula *et al.*, 2018). This is the promising feature that blockchain offers to the logistics industry. Chronicled[1] combines blockchain with Artificial Intelligence and IoT devices to automate traceability and promptly approve financial transactions in the shipping industry. Chronicled's blockchain-enabled IoT-based devices provide logistics companies enhanced understandings into environmental conditions and transfer-of-custody processes. Consequently, organizations can efficiently and prudently move their products all over the world.

Similarly, SkyCell[2] offers specially designed temperature-controlled container solutions to pharma industry by protecting the most sensitive medicines, drugs and injections. SkyCell has placed its entire infrastructure in a decentralized blockchain platform. SkyCell believes that this is achieved through their unique amalgamation of hardware, software and service, which made them unbeatable by mastering logistical

challenges and eliminating temperature excursion. In less than a period of two years, it has emerged as one of the global commercial blockchain alliances that collectively generate more than $1 trillion annual revenues.

Similarly, UK-based Provenance uses blockchain to increase transparency in the retail sector. For providing better business practices, Provenance retailers document the origination of their foodstuffs and display their supply chains on a ledger. Provenance's objective for applying blockchain is to hold retailers accountable while helping members make higher-quality, more trustable products.

Blockchain technology is particularly adept at simplifying complex and fragmented processes – like those that are commonly found within the logistics and supply chain industry (Table I). Blockchain technology records transactions, tracks assets and creates a transparent and efficient system for managing all documents involved in the logistics process.

| Authors | Titles | Findings |
|---|---|---|
| Grover *et al.* (2019) | Diffusion of blockchain technology | Blockchain technology has been diffused across different industries such as transportation, communication and trade. All the industries have been classified based on the innovation-decision process. |
| Singh *et al.* (2019) | Blockchain technology in corporate governance: disrupting chain reaction or not? | Blockchain technology plays a vital role in providing information among various stakeholders such as customers, creditors, suppliers and investors and helping in adoption of new technological methods of trading to reduce the risk of transaction in corporate governance. |
| Sivula *et al.* (2018) | Blockchain in logistics: mapping the opportunities in construction industry | Blockchain has emerged as a promising technology for varied range of industries to provide extended customer value, transparency and enhanced service network. The relative advantage compared to prevailing technologies collectively with a vast and high degree of trialability depicts high potential for a broad diffusion of blockchain technology across industries. |
| Tijan *et al.* (2019) | Blockchain technology implementation in logistics | Blockchain has been widely used in logistics sector. Challenges in logistics such as damage to goods, order delay, omissions, wrong deliveries, errors and multiple data entry are minimized to major extent. |
| Perboli *et al.* (2018) | Blockchain in logistics and supply chain: a lean approach for designing real-world use cases | Evidences opine that blockchain increases the competence, consistency and transparency of the overall supply chain and augments the inbound processes resulting in reducing the logistics costs and in optimizing the overall operations and the research challenges. |

**Table I.**
Summary of findings for selected studies

(*continued*)

| Authors | Titles | Findings |
|---|---|---|
| Deloite (2017) | Continuous interconnected supply chain using blockchain and Internet of Things in supply chain traceability | The main drawback that traditional supply chain faces is the lack of trust-based information. Blockchain and IoT offer portable solutions brought to complex structures.<br>Sharing an exclusive blockchain across the different stakeholders of the supply chain (consumer, freight and production) ensures that the exchanged and manipulated wares are authenticated, thus preventing potential fraud and making information accessible. |
| Hackius Niels and Petersen Moritz (2018) | Blockchain in logistics and supply chain: trick or treat? | Adoption of blockchain technology in the traditional supply chain enhances overall efficiency and gives positive impact on the various areas of the logistics industry such as wagon transportation, intercontinental transportation (air and ocean), supply chain management and shipment tracking.<br>Though blockchain is entirely a new technology, it continues to revolutionize the future of logistics, permitting for a more precise in-transit visibility and delivery of goods. |
| Poszler *et al.* (2019) | Blockchain start-ups in the logistics industry: the technology's potential to disrupt business models and supply chains | Applications of blockchain in supply chain can be grouped into five use-case clusters.<br>Dominant use cases cover provenance tracing of assets as well as automation of supply chain operations while aspects of supply chain finance are only supported occasionally in blockchain applications.<br>Virtual on-demand supply chain will form the next revolutionary step of blockchain technology in supply chain management and logistics, which coincides with the ongoing service transformation of the industrial sector. |
| Gregor *et al.* (2019) | Blockchain technology in supply chain management: an application perspective | Use of blockchain in logistics operations offers the possibility for (data related) products and or services that are inexpensive, quicker and more safe than existing technologies.<br>With blockchain technology, current market frictions can be overwhelmed by producing peer-to-peer networks in many senses.<br>The finding depicts that existing business practices and models are prone to this innovation.<br>Present distribution of applications of blockchain technology across industries and goods depicts its high degree of trialability. |

**Table I.**

*2.2 Theoretical foundation*

*2.2.1 Technology acceptance model.* Lack of technical knowledge or may be less interest in using new technology can be considered as the key reason of not adopting the new technology. There are factors that have been observed as the key challenges in the process of adaptation such as unavailability of good technical resources to develop user-friendly blockchain tool (Mougayar, 2016). Accepting a new technology and adopting the same as a part of daily routine process is a long-term process, wherein, each individual will perceive in its own way (Jharkharia and Shankar 2005; Swan, 2015; Mougayar, 2016; Kumar *et al.*, 2018; Jain and Singh, 2016). TAM (Davis, 1993); (Davis *et al.*, 1989) posited that there are two major dimensions, that is, PU and PEOU, that have been used to predict the attitude of an individual while using a new technology platform. These two constructs are most important while understanding the attitude of an individual toward a new technology adopted for business perspective. The said dimensions of TAM have been used in the TAM as an external indicator to determine the effect of these dimensions on the attitude and behavioral intentions of an individual toward using a new technology. There are various studies that have analyzed the two major dimensions, that is, PEOU and PU, to understand the TAM application in the market scenario. PEOU and PU have been used as the two major dimensions based on TAM to understand the attitude of an individual toward using new technology (Pavlou, 2003); (Gefen *et al.*, 2003; Lee and Chen, 2019; Valaei *et al.*, 2019). TAM has been adopted in various studies as well to determine the acceptance of new technology by a user. TAM is an ideal method to determine the acceptance of new technology and has been determined.

2.2.1.1 Attitude. According to theory of reasoned action (TRA) (Ajzen and Fishbein, 1980; Davis, 1993), attitude of an individual plays an important role toward understanding the effect of new technology on an individual's behavioral belief. Attitude is considered as an important variable while understanding the intention and desire of an individual in terms of using the technology. This construct helps in understanding the intentions of an individual as one of important constructs of TAM where understanding the acceptance of an individual is the primary success factor and considered as an important aspect as well. As a part of TAM (Davis, 1993), behavioral intentions have been considered as another important construct to understand an individual's intention toward using a new technology

2.2.1.2 Perceived ease of use. PEOU plays a big role in terms of understanding an individual's feeling of ease of using the technology for various purposes. PEOU is an important antecedent of TAM to understand the acceptance of an individual of using a new technology. It is an important antecedent, while determining the impact and behavioral intentions of an individual in terms of using a new technology though this construct will not be able to determine the impact of the technology on an individual's behavior directly, but it will work as an important antecedent in predicting the same behavior due to change in technology. In the age of petabyte, where technology has a lot of importance in the life of an individual, contribution of TAM has its own importance for a researcher in determining the impact of new technology on the attitude and intentions of an individual. Technology plays a major role for an individual in terms of providing different features and functions, whether the importance of technology will be related to hedonic or utilitarian feature, still the presence of technology will remain there for an individual and impact too. PEOU is an important antecedent of TAM, which shows the effortless intentions of an individual toward using a new technology and also shows the extent to which the new technology will be having an ease in the life of human being (Davis *et al.*, 1989). Though, at the surface level, the purpose of using the technology will remain same, still the improvement in terms of having better features and ease will make the acceptance of new technology of an individual a lot more important. In case of blockchain technology, PEOU works as an antecedent of TAM to understand the provided feature of transparency in information while getting the information of product in terms of logistics operations

2.2.1.3 Perceived usefulness. PU is another important antecedent of TAM and determines the extent to which an individual would consider himself in terms enhancing the knowledge and skills in using a new technology ((Davis *et al.*, 1989). It determines the degree of an individual's belief about the usefulness of new technology. TAM has posited the two major antecedents in the model that play an important role in describing the impact of these two constructs on the attitude and intentions toward using a new technology. As per the previous studies, which have considered TAM, perceptions in terms of usefulness and ease of use have a lot of impact on an individual toward using a new technology platform and using the same for further application purpose. As per the findings of these studies, there is a correlation between PU and intention to use, which is positive in nature, whereas the relationship between PU and attitude is comparatively weak in nature (Davis *et al.*, 1989); (Jackson *et al.*, 1997) and (Lucas *et al.*, 1999).

## 3. Development of the conceptual framework

The aim of the study is to understand the adaptation and acceptance of user toward using a new technology. After reviewing various papers and research articles, it has been analyzed that the requirement of the current study is need of the current market situation for the benefit of the market practitioners and academicians. There are various factors of TAM related to attitude, PEOU and PU, which have a lot of impact on the behavior intention of use of technology. To understand the acceptance of user, structural equation modeling (SEM) has been used in the current study (given in Figure 1). According to a study performed by Bollen (1989), various relationship networks have been derived based on theory by using statistical methodologies such as SEM. In the current study, the analysis for the study has been performed in two steps. Primarily, confirmatory factor analysis (CFA) has been performed for the current study to analyze the influence of these major determinant factors on the user behavioral intention and actual behavior; then SEM has been performed to analyze the model fit of the conceptual model with the theoretical model (given in Figure 2).

### *3.1 Model testing*

The current study is an effort to determine the model fit between conceptual framework and TAM. Though there have been different previous studies where the model fit methods have been used to understand the adaptation of proven theoretical model in the current business scenario (Jain *et al.*, 2018a; Jain *et al.*, 2018b). With the advent of technology, it has been observed that technology is changing spontaneously in the current business scenario. This change has been accepted by customers in a positive way, which has been determined and proven by various studies by using theoretical model of TAM by using its three major constructs such as PEOU, PU and attitude. The model fit will show the effect of these constructs on the consumer intention to use new technology in a positive way or negative one. To prove the said relationships, all the items have been analyzed for three major determinants

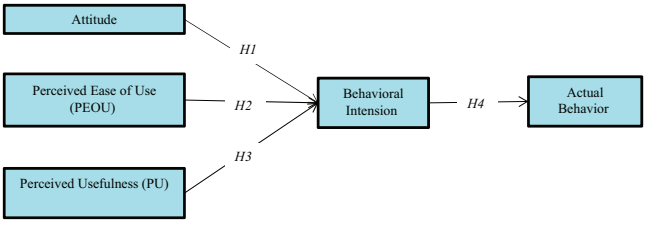


**Figure 1.**
Conceptual framework

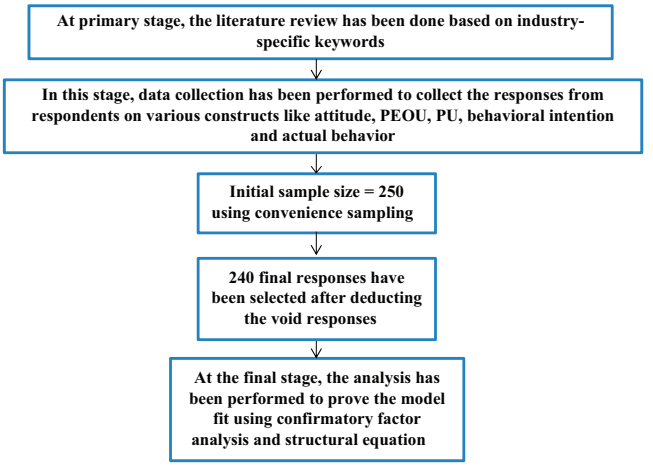


**Figure 2.**
Flow chart of study

to understand the use behavior toward using blockchain technology for logistics industry. The analysis has been performed by using CFA and SEM.

## 4. Research methodology

### *4.1 Sample design*

The current study is analyzing the acceptance of new technology by user with the help of TAM, which has been given by (Davis *et al.*, 1989) with special reference to logistics industry. The current study has respondents from varied demographic profiles such as 18–40 years of age respondents specifically who are using different modes of technology to track the status of shipment and financial transaction while doing the online shopping within 4–5 months online. There are 250 active online shoppers selected as respondents on the basis of previous online purchase using electronic media, and they are also using different platforms to shop online such as mobile application, electronic shopping, Instagram, Facebook and mobile commerce. Out of 250 sample size, 240 responses have been used finally to analyze due to the nonavailability of some responses for some factors. Though the respondents have no experience of blockchain technology previously, they have familiarity with various mobile applications in their daily routine.

The demographic analysis of the study is as follows (given in Table II):

### *4.2 Hypothesis*

The current research focuses on the following hypothesis:

*H1.* User's attitude is positively related to the behavioral intention of using blockchain technology in logistics industry with special reference to product information such as tracking detail and product counterfeit.

*H2.* Perceived ease of use is positively related to behavioral intention of using blockchain technology in logistics industry with special reference to product information such as tracking detail and product counterfeit.

*H3.* Perceived usefulness is positively related to behavioral intention of using blockchain technology in logistics industry with special reference to product information such as tracking detail and product counterfeit.

| Variable | Category | Count | % |
|---|---|---|---|
| Gender | Female | 100 | 41.6 |
| | Male | 140 | 58.3 |
| Internet access | Mobile phone | 72 | 30 |
| | Desktop/laptop | 168 | 70 |
| Marital status | Married | 138 | 58.5 |
| | Single | 102 | 41.4 |
| Education | Undergraduate | 83 | 34.4 |
| | Graduate | 102 | 43.3 |
| | Others | 55 | 22.2 |
| Total | | 240 | |

**Table II.**
Sample demographics

*H4.* Behavioral intention to use is positively related to actual behavior of blockchain technology in logistics industry with special reference to product information such as tracking detail and product counterfeit.

### *4.3 Research instruments*

A questionnaire has been designed to measure three major determinants, that is, attitude, PEOU, PU, behavioral intention to use and actual behavioral. There are 15 items used in the current study to analyze the influence and perform the model fit analysis. In the questionnaire, 15 items have been developed on Likert scale to understand the acceptance of use toward the new technology, that is, blockchain technology. These items have been developed for five major categories of factors, that is, attitude, PEOU, PU, behavior intention and actual use behavior.

## 5. Results

The reliability coefficient of all the 15 items have been developed on Likert scale to test the stated hypotheses and prove the proposed conceptual framework, goodness of fit test, reliability, convergent and discriminant validity have been used in the study to test the hypotheses.

The cronbach alpha value for the 15 items proves the reliability test (Hair, 2007) provided in Table III.

### *5.1 Confirmatory factor analysis*

In the current study, based on conceptual model, there are three exogenous variables and two endogenous variables. To perform the analysis and result findings, CFA has been used to find the effect of observed variables. In the conceptual model, there are three exogenous variables (attitude, PEOU, PU) and two endogenous variables (behavior

| reliability statistics (Cronbach's $\alpha$) | | |
|---|---|---|
| Cronbach's alpha | Cronbach's alpha based on standardized items | N of items |
| 0.925 | 0.928 | 15 |

**Table III.**
Reliability coefficient

intention and actual behavior to use). Behavioral intention to use has been used as a mediating variable, which has been used to prove the relationship and connection between actual behavior as endogenous variable and attitude, PEOU and PU as exogenous variables. It has been posited that the estimated value of regression observed variable above 0.3 is considered to be normal in nature and above 0.5 is considered to be healthy (Hair, 2007). All the items, which have been the part of analysis, have been validated and fulfill the validity test requirement.

Finally, out of 15 items, only 12 items have been considered for the final analysis (provided in Table IV). As from the measurement model indices, it is clear that 12 items have the high value of indices for four major factors, which have been underlying factors of TAM. The loading values of these factors are proving the relationship with the underlying factors as per TAM.

### *5.2 Measurement model*

All the constructs have been measured based on the measurement model (provided in Figure 3) and have been analyzed also. To find the model fit, various constructs have been analyzed on the basis of model. With the help of CFA, the relationship between all the constructs has been analyzed on the basis of conceptual model of the study. Further, to find the model fit, the findings of the CFA have been analyzed based on the postulated theory and have been compared also to determine the model fit (given in Table V).

| Variable | Code | Attribute | Factor loadings |
|---|---|---|---|
| Factor 1 (Attitude) 3 items | ATT1 | Getting product tracking information through blockchain technology is time-saving and genuine | 0.94 |
| | ATT2 | Getting personalized information about the product shipment is a good idea | 0.51 |
| | ATT3 | With the help of blockchain technology, data transparency related to financial transaction is a good idea | 0.62 |
| Factor 2 (Perceived usefulness) 3 items | PU1 | Allows authorized participants to log in would be useful for getting information about the product | 0.72 |
| | PU2 | Valuable information about the product tracking is important to me | 0.77 |
| | PU3 | Relevant tracking information would enhance my effectiveness in getting useful product information | 0.68 |
| Factor 3 (Perceived ease of use) 2 items | PEOU1 | With blockchain technology, user can browse information specific to the product, which would be easy to help in avoiding counterfeit | 0.82 |
| | PEOU2 | For me, access to secure private data and information based on my requirement is easily available from website | 0.73 |
| Factor 4 (Behavior intention to use) 2 items | BI1 | I intend to use the blockchain technology in checking the status of shipment for products as much as possible | 0.66 |
| | BI2 | I intend to use the blockchain technology for tracking the ownership of titles in the future and also if services will be provided | 0.63 |
| Factor 5 (Actual use) 2 items | AU1 | I would feel comfortable using blockchain technology for logistics purpose on my own over the Internet | 0.61 |
| | AU2 | Blockchain technology is a reliable way for me to take care of my personal data and information | 0.72 |

**Table IV.**
Measurement model indices

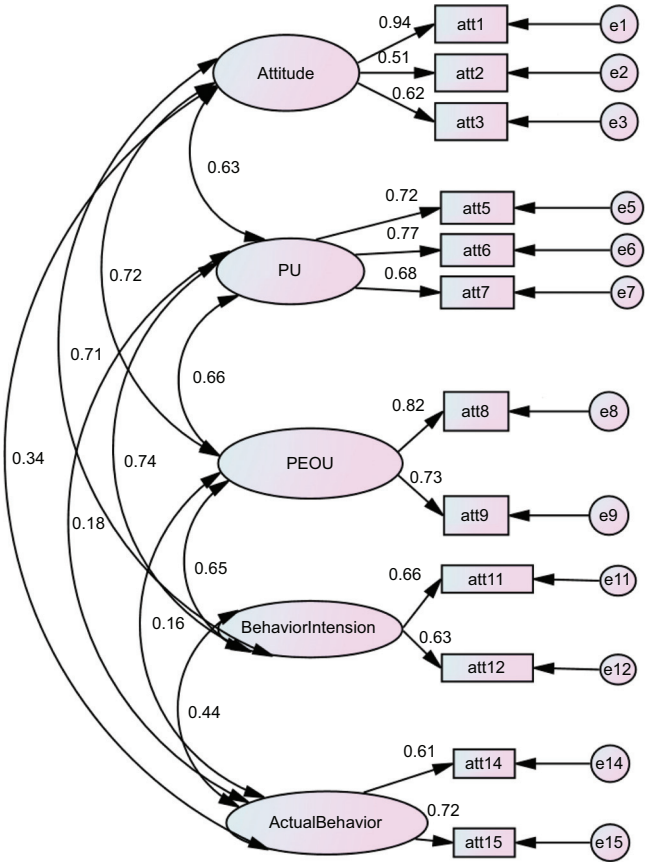


**Figure 3.**
Measurement model

*5.3 Construct validity*

To find the model fit, all the constructs have been measured using construct validity. With the help of construct validity, it is easily measured that the items are fulfilling the purpose of analyzing and measuring the dimensions. CFA has been used to find the reliability analysis of all the items, which have been considered for the study on Likert scale. To perform the

| Statistic | Recommended value | Obtained value |
|---|---|---|
| Chi-square value | | 324.878 |
| Df | | 210 |
| CMIN/DF | < 5.00 | 3.24 |
| GFI | > 0.90 | 0.921 |
| AGFI | > 0.80 | 0.932 |
| TLI | | 0.873 |
| CFI | > 0.90 | 0.951 |
| RMSEA | < 0.10 | 0.074 |

**Note(s):** All the values of the indices of measurement model are fulfilling the acceptable range of the model fit

**Table V.**
Model fit indices for measurement model

statistical analysis, AMOS 19 has been used in the current study. The result values confirmed the model fit of study in the current scenario.

*5.4 Structural model*

In the process of testing model fit (given in Table VI), performing SEM analysis (given in Figure 4) is the next step while doing the measurement model validity. The conceptual model of the current study has been designed on the basis of TAM.

*5.5 Estimated standardized path coefficients*

The standardized path coefficients should be significant in nature to fulfill the primary requirement of model fit and it's the primary requirement of the SEM analysis. As per the Table VII, all the constructs are significant in nature.

Hypothetical relationships between constructs, which have been conceptualized in this paper, are found to be significant in nature and fulfilling the theorized model fit indices and value of indices are also under the permissible and acceptable range.

| Statistic | Recommended value | Obtained value |
|---|---|---|
| Chi-Square | | 371.545 |
| Df | | 222 |
| CMIN/DF | < 5.00 | 3.200 |
| GFI | > 0.90 | 0.95 |
| AGFI | > 0.80 | 0.920 |
| TLI | | 0.880 |
| CFI | > 0.90 | 0.95 |
| RMSEA | < 0.10 | 0.061 |

**Table VI.**
Model fit indices for structural model

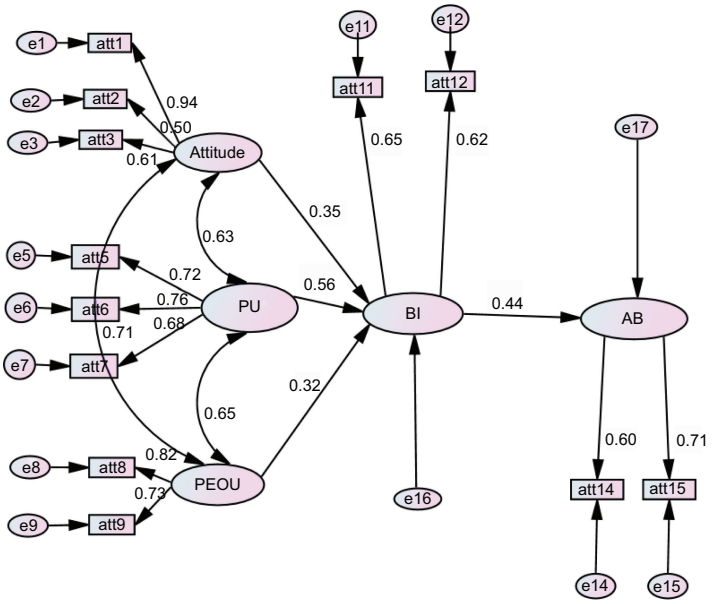


**Figure 4.**
Structural model

*5.6 Summary of findings*

The analysis has been performed to test the proposed model and its hypothesis as per the designed structure of the model. The analysis has been performed in two steps, that is, first step is to perform CFA and then SEM in the second step.

Step 1: Result analysis of confirmatory factor analysis

In the first step, CFA has been performed to assess the discriminant and convergent validity of constructs, that is, attitude, PEOU, PU, behavioral intention and actual behavior. To analyze the result, AMOS 19 software has been used to test the path diagrams for all the constructs and their observed variables. The hypothesis testing has been performed and checked by using different parameters such as Chi-square, goodness of fit index (GFI), adjusted goodness of fit index (AGFI), comparative fit index (CFI) and root mean square of approximation (RMSEA) with their range of acceptance, that is, 0.9, 0.8, 0.9 and 0.08, respectively (Gefen *et al.*, 2003). The acceptable range of the RMSEA should be less than 0.08 for good fit; however, if the value of the index is less than 0.05, then it's an excellent fit (Browne and Curdeck, 1993).

To prove the hypothesis, latent constructs have been analyzed for two major parameters, that is, convergent validity and discriminant validity. The factor loadings of all the constructs have been measured to prove the strength of the relationship and the acceptable range of the factor loading has been considered above 0.5. There are in total 12 items that have been extracted finally out of 15 factors. These 12 factors have loading value above 0.5, whereas the other three factors have low factor loading. The model has 0.074 value of RMSEA, which proves the primary index of model fit and has a good fit (Browne and Curdeck, 1993).

Step 2: Result analysis of structural equation modeling

After the analysis, it has been proved that observed data fits based on the measurement and structural equations as per conceptual model. The values of the model fit indexes have been validated and analyzed to prove the relationship as per conceptual model. The values of all the indexes are falling under the permissible range of acceptance and it proves the model fit. The process of validation of model fit has been analyzed in two steps: factor analysis has been performed in the first to validate the theorized model and SEM analysis has been performed in the second step to test the hypothetical relationship.

## 6. Discussion

The result and findings of the study prove the relationship of the underlying constructs of the posited model, which has been used to find the acceptance of the blockchain technology. The respondents have given their feedback on the basis of items that have been constructed on the basis of previous studies. The findings prove that PEOU, PU and attitude are having strong relationship with behavioral intentions to use the new technology as compared to having low relationship with actual behavior, whereas behavioral intention also shows positive relationship with actual behavior to use new technology. So, the analysis proved that PEOU,

| | | | Estimate | S.E. | *P* |
|---|---|---|---|---|---|
| BI | <— | Attitude | 0.35 | 0.016 | ** |
| BI | <— | PEOU | 0.32 | 0.023 | ** |
| BI | <— | PU | 0.56 | 0.042 | ** |
| AB | <— | BI | 0.44 | 0.012 | ** |

**Note(s):** As per aforementioned table, all the relationships between different constructs are falling under the significance level (0.01*, 0.05**)

**Table VII.**
Significance (*p*) values

PU and attitude for customers are the dominance factors for considering the new technology advantage over the traditional method of technology. It also reflects that customers consider this technology making their life easy and the available information and content online is worth to give ease to customers. With the advent of technology, customers are accessing information and shift to a better technology with a fraction of second. As per findings of the analysis, blockchain has high impact on the consumers and moving at a high pace, though earlier the technology has been used in different industries at a snail's pace. Blockchain technology will hasten the process of trust and transparency among customers. It has been observed that customers show PU and PEOU as the major indicating factors toward accepting technology. The values of estimated coefficients for all the standardized items, which fall under the permissible range of significance in nature, prove the relationship among various constructs and values signify the model fit (see Figure 3 and 4).

Now imagine the likelihood of easily tracking products from the material that was used to create it, to its purchase in a store or on a website. What would it mean for consumers? With the help of smart phones, by scanning a tag on their trouser or shirt or any other item, they will know the authenticity of the product they are planning to buy. Where it was made, which raw material was used, information will be in their hands, resulting in transparency and traceability. Customers will decide themselves which product to buy with enhanced confidence. This will leave no space for copying and making duplicate goods as blockchain will enable brands to hold and control the data they provide both out to their employees and outside world. This will also enable customers to know and understand the complexity in bringing a new technology in the market.

## 7. Implications from the study

### *7.1 Theoretical implications*

The current study has huge contribution in the literature towards the use of blockchain technology in logistics industry. In this research, the special focus has been given to understand the adoption intention of blockchain technology in logistics industry with special reference to product information like tracking detail and product counterfeit. Various past studies (Grover *et al.*, 2019; Tijan *et al.*, 2019; Poszler *et al.*, 2019; Gregor *et al.*, 2019; Singh *et al.*, 2019) have examined the use of blockchain technology but, the current has measured all the aspects by considering the constructs of technology adoption model (TAM) (Davis, 1993; Davis *et al.*, 1989). There are three exogenous variables like attitude, perceived ease of use and perceived usefulness vis-à-vis two endogenous variables like adoption intention and actual behavior to use the technology have been studied which provides deep insights about the use of blockchain technology.

### *7.2 Implications of blockchain on business revenues*

Using blockchain in logistics will result in enhanced business revenues and better customer relations. The major limitation of the current study is that a generalized approach has been considered for the study instead of some specific variables. Convenience sampling has been considered for the study to collect the data of online users of various technology applications for tracking and shipment detail, whereas a more specified method sampling has been considered for the future research as compared to convenience. Convenience sampling may show the biased results while performing the analysis for the study. A future study for academicians would be related to find the acceptance of new technology based on age, profession and usability.

## 8. Conclusion, limitation and future research

The global logistics industry is increasingly relying on upcoming technology to cut costs, improve processes and enhance transparency. Blockchain technology could be a solution to

many of such logistics issues. In this study, we have performed the analysis and postulated hypothesis, which has been structured on the basis of theorized model described in the literature review. Various constructs of the TAM have been analyzed to check the model fit between conceptual model and theorized model. Three major dimensions, attitude, PU and PEOU, have been analyzed to determine the effect of these dimensions on the behavioral intentions and actual behavior of an individual toward using a new technology (Davis *et al.*, 1989). The findings of the study advocate that the theory of TAM (Davis *et al.*, 1989), attitude, PEOU and PU have direct impact on the online consumer behavioral intentions to use toward using a new technology; vis-à-vis behavioral intentions have the direct impact on actual behavior of using the technology. This proves the relationship of the underlying constructs of the postulated model, which has been used to find the acceptance of the blockchain technology in logistics.

Academicians can also look further at the effect of various promotions done by microcelebrities on consumer's purchase intention.

From a logistics perspective, there are numerous applications that could benefit from the tie-up of blockchain and logistics. The prominent among them are expected as follows:

(1) Blockchain will help in monitoring the performance history and previous commitments of logistics professionals resulting in selecting a responsible logistics solution provider.

(2) Access to critical data by the authorized member of the supply chain will reduce unsubstantiated disputes.

(3) Blockchain and ELDs (electronic logging devices) are a perfect match as ELDs can send a stream of driver behavior and route data to a blockchain in real time. Pairing this information with traffic data and weather data will provide logistics professionals a tool to improve real-time routing.

(4) Last but not the least, every transaction taken through blockchain will be readily available to everyone on the network. This will bring transparency and help logistics professionals such as carriers, shippers and brokers to detect early frauds and prevent thefts.

## Notes

1. Chronicled is US-based, one of the global leading overseas logistics and supply chain solution providers that offers next-generation solutions for logistics intelligence and automation, creating digital ecosystems powered by IoT sensing and blockchain technology for a wide range of applications related to varied goods in various industries.
2. SkyCell, a Switzerland-based leading provider of temperature-controlled container solutions with a key focus on serving global pharma companies and sustainability. Founded in August 2017, the Blockchain in Transport Alliance (BiTA), a member-driven organization, has more than 500 members in over 25 countries.

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