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# Blockchain Adoption for Provenance and Traceability in the Retail Food Supply Chain:
## A Consumer Perspective

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### ABSTRACT

Blockchain has evolved as one of the disruptive technologies in the landscape of business. The study aims to investigate drivers of consumer adoption of blockchain for product origin and track to trace history before making a purchase. An extended technology adoption model (TAM) has been proposed to examine the consumer perspective for blockchain adoption in the food supply chain. Based on the survey of 208 retail consumers, the proposed model was validated using variance-based structure equation modeling. Findings of the study emphasize the significant role of perceived security and privacy in developing trust, ease of use, and usefulness of blockchain-enabled systems. The relationship between perceived ease of use and attitude is mediated through perceived usefulness. The strong influence of attitude on adoption intention represents the consumer interest for blockchain to understand the product provenance. The study provides vital insights for successful blockchain implementation to enhance supply chain effectiveness.

### KEYWORDS

Blockchain, Perceived Security and Privacy, Supply Chain, Technology Adoption Model (TAM), Trust

### INTRODUCTION

Dynamic business environment and rapid technological advancement has changed the traditional supply chain into an integrated supply chain. The supply chain is a critical component of the entire business process that can be leveraged with technological innovations to gain a competitive advantage (Gunasekaran, Lai, and Edwin Cheng 2008). At the same time, emerging technologies put up a challenge in terms of their adoption and implementation. Prior studies emphasize the variety of emerging technology application in the supply chain domain like procurement process (Wamba et al. 2018), demand forecasting (Seyedan & Mafakheri 2020), product traceability (Anastasiadis et al., 2021), and optimizing performance using blockchain technology (Saberi et al. 2019; Dolgui et al. 2020). More can be done with real-time track and trace of products in the food supply chain. Now a day's companies are investing more in automated food software that allows them to quickly detect problems related to production, product origin, code, expiry, order number, and where the

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product comes into the supply chain. In the same line, blockchain can act as a game-changer through interoperability among different traceability applications without inferring every single entry in the supply chain. Furthermore, blockchain enables traceability across multiple partners, locations, facilities and brings a larger view of the product life cycle to stakeholders (Accenture Report: Tracing the Supply Chain, 2019).

Blockchain has been considered as the spine of the supply chain as it is a shared peer-peer network without any intermediary. Every transaction is represented as a node and the record of these exchanges is kept in a shared and decentralized form where the entire transaction system is verified through cryptography (Chang, Iakovou, and Shi 2020). These fundamental principles lead blockchain technology to enhance the efficiency of the system by reducing redundancy, fraud prevention, and counterfeit detection (Brody 2017; Kersten et al. 2017). According to IDC 2020 report, the worldwide spend on blockchain solutions have increased by 50% in 2020 as compared to the year 2019. As per the IDC update, the blockchain market is expected to grow with exponential rate throughout the forecasted five-year span with a CAGR of 46.4% and touching a nearby total of $ 17.9 billion by 2024 (IDC Spending Guide, 2020).

The dispersion of blockchain technology is still in the initial stage so a structured review of recent rationale on technological innovation, its potential, and efficacy are likely to support both academics and industry people. A review of the literature reveals that the adoption of enterprise blockchain can revolutionaries the retail supply chain in the Indian context (Karamchandani et al., 2020; Kamble et al., 2018). The paucity of research studies focusing on consumer adoption intention toward provenance and traceability of products through blockchain technology provides a strong foundation for this research. Individual actions toward such advanced technology are imperative to be observed to evaluate its scalability. To bridge the literature gap, this study attempts to investigate educated individual adoption behavior towards blockchain technology for food product origin and traceability through extending the Technology Adoption Model (TAM) by additional constructs trust and perceived security and privacy.

This paper is organized as follows: Second section reviews the extant literature followed by the conceptual framework in section three. The survey instrument and study methodology are described in the fourth section. Data analysis and empirical findings of the study are covered under section five and the study is concluded with future research directions under section six.

## LITERATURE REVIEW

### Blockchain

The blockchain is a shared peer-peer network without any intermediary. The transactions are validated and the parties who are involved in transactions just act as nodes (Mougayar, W. 2016). The transactions are time-stamped and secured by key “hash” (public key) which is cross tallied by everyone in the network. Once data has been entered into the blockchain it cannot be revised which makes it an unchallengeable record of past activity (Francisco and Swanson, 2018). The ‘hash’ encodes all tangible and intangible assets in a digital format that can be traced and transacted with the help of a private key in the blockchain. By operating in a digital environment it becomes possible to lesser down human interactions and this is known as “Smart Contracts”(Crosby et al. 2016). As there are trust issues involved in the accounting system so, blockchain can easily replace it. It not only provides a platform for transactions but also helps supply chain members to get exact data more easily and at a less cost (Ferri et al., 2020). A blockchain is a scattered recording of data, which is circulated among all the parties involved in the supply chain. All the transactions stored in the database of the blockchain (known as blocks) are linked to each other. It can be easily interpreted that blockchain will further integrate the supply chain (Hofmann & Rüsch, 2017).

## Transparency and Traceability in Food Supply Chain

The concept of transparency in the supply chain provides easy access to information to end-users and partners in the supply chain. There is clear visibility of information shared within the supply chain and this is known as transparency in the supply chain. The role of the supply chain is to provide complete knowledge and information during negotiations about components' origins and processes (Ladhari, 2010). The transparency in the supply chain leads suppliers to implement socially accountable acts which further affects customer purchase behavior and compels competitors to match their actions with managers of high visible big brands (Awaysheh and Klassen, 2010). Apple has long maintained its secret about component practices. Only after heavy social pressure, they released information (Markman and Krause, 2014). The UNGC pointed out that traceability cannot replace corporate due diligence to reveal hostile effects (UNGC, 2014). Big companies with a deep understanding of the supply chain and its associated parties often have their traceability code of behavior. Blockchain is the best fit for traceability applications. There are chances of forging whenever products or any associated documents are transferred from one party to another. The technology of blockchain overcomes this problem by associating digital 'token' to physical items at the time of their origin. This helps the final buyer to substantiate the 'token' which provides complete detailed information about the item. The final recipient can completely trust the information received as no party in the supply chain can randomly change information within the blockchain (Pearsona et al 2019). Therefore, blockchain helps in tracing the flow of material from source to end consumer. Since products and their associated tokens are not merchandised between competitors so, it helps in maintain secrecy which in turn maintains participant's confidentiality. If we take the example of any fruit or vegetable then in the database it contains the entire information that is where it was harvested, distributed and the particular name of the farm where the fruit was produced. The distributors can access complete information about the product that is when (weather conditions etc.) and where it was produced whereas customers cannot get the name of the farm where the fruit originated. But all other information can be assessed by customers too (Paul and Kant, 2019).

## Research Model and Hypothesis

The technology adoption model (TAM) is one of the extensively employed models to understand the behavioral aspect of consumers toward new technologies (Youn & Lee, 2019). TAM was derived with the addition of Perceived Usefulness (PU) and Perceived Ease of Use (PEU) from the Theory of Reasoned Action (TRA) which explains "people behavior is specified by their intention to carry out their behavior" (Davis et. al 1989, Azjen 1980). PEU is the use of a particular technology without much of efforts as it helps in reducing intellectual exercise (Liu et al., 2010). People are inclined towards technology usage if they find it easy to use. PEU is positively related to PU because when a system is easy to use then it is perceived to be more useful. PU is the degree to which an individual has confidence that using a particular technology will enhance his performance (Cho 2008).

H1: Perceived ease of use positively influences perceived usefulness.

Attitude (ATT) is described as an overall evaluation of feelings (Venkatesh 2003). ATT is an individual's feeling either positive or negative to perform certain behavior (Ajzen 2005). ATT has three major components that are cognitive, affective, and conative, thus, it is a multidimensional concept. The drawback of the ATT measurement technique is that it takes into consideration only emotional factors (Yen et al 2005). It is an inner inclination of an individual either to act favorably or unfavorably towards a system (Ajzen 1980). PEU and PU are knowingly expected to impact attitude, which also affects intention to adopt new technology Vijayasarathy (2004). PEU and PU are seen as determinants for technology acceptance (Ong et. al 2004). The effect of supposed interactivity on attitude in direction of technology adoption has been explored (Shin et al. 2013). Previous research

studies have dogged that PEU by consumers puts positive effect on their attitude towards using technology. PU is also an essential aspect of attitude as consumers perceives technology to be useful then it positively impacts their attitude towards its adoption (Lim, W.M.; Ting, D.H., 2012).

H2: Perceived ease of use positively influences attitude.
H3: Perceived usefulness positively influences attitude.

Adoption intention elucidates that to what extent people are willing to try and pains they will take to perform a particular behaviour (Kim, Y.G.Woo, E, 2016). Consumers intention to use new technology is intensely influenced by attitude towards using the technology (Davis, F.D., 1989). The usefulness of using technology in purchase is depicted by various factors which are convenience, variety of products and it also saves time which further emphasizes on customers intention to adopt technology (Ramus, K.; Asger Nielsen, N, 2005) Generally, the blockchain –based solutions are not considered trustworthy. But when technology users do intensive study of technology their understanding of technology increases and they find it more reliable (Gefen 2003). Technology reliability stimulates an individual's attitude (ATT) toward a particular technology which also inspires their willingness to use that technology. Whereas lack of trust (TRT) for particular technology die away an individual's interest to use it (Tseng 1999). TRT is important in the supply chain and for technology acceptance and sharing of information (Roberts 2017). The favorable reaction of an individual to adopt technology is described as an individual's total capable response to use it with joy and pleasure (Ajzen 1991).

H4: Attitude positively influences adoption intention.
H5: Trust positively influences attitude.

Security is of major concern to the partners in the supply chain. Most importantly, it deals with unpredictable infrastructure and erratic users of the system (Taylor 1995). Privacy is a key element for consumers. It is of major concern as people have to control with whom they communicate and the type of information they communicate (Chang and chan 2008). Security and privacy are two chief parameters of concern for all stakeholders. Security takes account of advance technologies which shelters customers from risk of fraud (Rananathan & Ganapathy, 2002). Security is one of the important factor which encourages customers to adapt technology (Laforet & Li, 2005). Privacy controls the communication process of customers and make them feel secure. Privacy is considered as one of the main element for adoption of technology (P&AB, Harris, 2005). Findings (C.Liu,J.T. Marchewka, 2005) depict that there is relationship between privacy and customers intention to use technology. It is explicit that when privacy is a concern there customers are reluctant to provide complete personal information for using a system (Sheehan & Hoy, 2005). Privacy has been a significant barrier for the use of online system (Cranor et al., 1999). It can be clearly said that Security and Privacy impacts perceived ease of usefulness for adoption of technology as when risk is less customers accept technology easily. Similarly customers believe if there is privacy of the information shared by customers in a system then they feel easy to use technology.

H6: Perceived security and privacy positively influences perceived ease of use.
H7: Perceived security and privacy positively influences perceived usefulness.

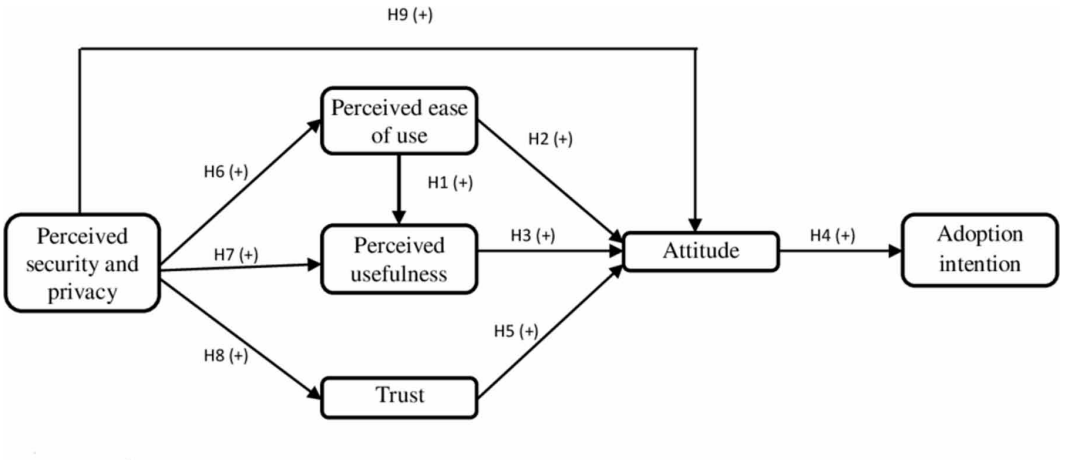
Security has always been a hindrance to the adoption of new technology (Godwin, 2001). Security is a warning which creates an environment that likely leads to monetary loss to network resources in the form of alteration of data or rejection of service (Sathye, 1999). Security extortions mostly happen at the server or the client level (Kalakota & Whinston, 1997). Perceived security and privacy (PSP) is described as the perception of the individual to safeguard themselves against the harm from

security coercion and protection of personal data in an online system (Yousafzai et. al, 2003). PSP is the trust that individuals show in the system to do a transaction safely and also to keep the privacy of information. Furthermore, individual perception of the secured system finally helps in developing a favorable attitude towards the system.

H8: Perceived security and privacy positively influences trust.
H9: Perceived security and privacy positively influences attitude.

Based on the above discussion the hypothesized conceptual research model is represented in **Figure 1** below:

**Figure 1. Conceptual framework**




## METHODOLOGY

Extended Technology Acceptace Model (TAM) has been used as a framework to design the conceptual framework. Quantitative research followed with a cross-sectional survey design has been used to understand respondent adoption intention towards blockchain in the retail food supply chain.

### Measures

Scale validated from previous literature was used to develop the survey instrument. The latent construct of perceived security and privacy (PSP) and trust (TRT) has been used in addition to perceived ease of use (PEU), perceived usefulness (PU), attitude (ATT), and adoption intention (AI) to extend the existing TAM model. A semantic differential scale anchored from 1 (extremely bad) to 7 (extremely good) was used to measure attitude. Other latent constructs were measured on a Likert scale ranging from 1 (strongly agree) to 7 (strongly disagree). Detailed descriptions of variables are represented in **Table 1**.

**Table 1. Construct Definition**

| Construct | Scale | Reference |
|---|---|---|
| Attitude (ATT) | ATT1:Using blockchain technology is extremely bad (1) / extremely good (7); | Kim and Han, (2010) |
| | ATT2:Using blockchain technology is extremely undesirable (1) / extremely desirable (7); | |
| | ATT3:Using blockchain technology is extremely unenjoyable (1) / extremely enjoyable (7) | |
| | ATT4:Using blockchain technology is extremely unfavorable (1) / extremely favorable (7) | |
| Perceived security and privacy (PSP) | PSP1: Use of the blockchain-based system is technically secure | Pikkarainen et al. (2004) |
| | PSP2: Use of the blockchain-based system is robust in terms of application | |
| | PSP3: I have confidence in the system | |
| | PSP4: I believe the system for the confidentiality of data | |
| Perceived ease of use (PEU) | PEU1: Learning a blockchain-based system would be easy for me | Venkatesh et al. (2012) |
| | PEU2: I feel a blockchain-based system would be easy to implement | |
| | PEU3: It is easy to be skillful in a blockchain-based system | |
| | PEU4: Blockchain-based system is easy to use | |
| Perceived usefulness (PU) | PU1: Blockchain-based system would enhance my product choice performance | Venkatesh et al. (2012); Taylor and Todd (1995) |
| | PU2: Blockchain-based system would increase my purchase efficiency | |
| | PU3: Blockchain-based system would enhance my effectiveness | |
| | PU4: Blockchain-based system would reduce my purchase processing time | |
| Adoption intention (AI) | AI1: I intend to use a blockchain-based system | Chow (2001); Paul et al. (2016) |
| | AI2:I would use a blockchain-based system | |
| | AI3: I would plan to use a blockchain system | |
| | AI4: I would put the required effort to use a blockchain system. | |
| Trust (TRT) | TRT1:It is trustworthy | McCloskey (2006); Connolly and Bannister (2007) |
| | TRT2: It gives an impression of promise and commitment | |
| | TRT3: It keeps my interest in consideration | |
| | TRT4: This system can be used in the long run | |

## Data Collection

A questionnaire was used as a survey instrument to ascertain responses from respondents within the age group of 18 years and above. The survey instrument was developed in English and experts from industry and academia were consulted to attain content validity. One professor from marketing, information technology and two professionals working in the supply chain department was consulted. The suggested changes were incorporated in the questionnaire. Youth were mainly targeted as the respondents of study as youth not only in India but in the entire Asian region holds more than 30% of the total population size (Youth in India, 2017). The educated individual can better comprehend the

technical information (Chan, 2001). A survey was conducted among customers of major supermarkets in the National Capital Region- Delhi (India) with an instrument of 24 statements. National Capital Region- Delhi is known for the strong presence of conveniently located large supermarket chain. Respondents were targeted using non-probabilistic convenience sampling technique based on the subjective judgement of the researcher. Blockchain being the evolving technology, selection of respondents based on enumerator's decision maintains accuracy and authenticity of response. Customers of supermarkets delivering variety food products namely Big Bazaar, Easy Day, Reliance Fresh, Spencer's and some popular grocers in study region were considered. Respondents have been selected based on previous food products purchase and familiarity with the technology intervention in the retail supply chain. Respondents were approached from mid-July 2019 till year-end on retail locations with an assurance that the collected response would be used only for academic research. Firstly, the study participants were briefed about the technological context of research study. Secondly, a questionnaire with demographic profile of respondents followed with the statements measuring blockchain adoption intention was presented to them. Due to personal constraints of some of the respondents the questionnaire was shared through social media platform. A total of 400 questionnaires were circulated and 208 complete in all aspects yielding a response 52% rate, was retained for analysis. The common method of bias was addressed through a full collinearity test and VIF for all latent construct was found to be below 5 (Kock and Lynn, 2012). As per **Table 2**, the demographic profile of respondents that out of the total 208 respondents, 122 (58.65%) were female, and 86(41.34%) were male. 34.61% of respondents were within the age group of 18-30 Years; 38.49% of respondents were within the age group of 31-42 Years and the remaining were above 43Years of age. The majority of respondents were postgraduates (47.11%) followed by graduates (35.09%) and others. Respondents were asked to express their understanding about some of the retail supply chain technologies (Radio-frequency identification (RFID), Point-of-sale (POS), global positioning system (GPS), electronic data interchange (EDI), online shipment tracking, electronic product code, barcode, enterprise resource planning (ERP), chatbots, artificial intelligence (AI) solutions, Blockchain solutions) to evaluate their level of familiarity with technology. Data descriptive confirms that 45% of respondents of the study were having an intermediate level of familiarity with the recent technology used in retail.

## ANALYSIS

Data analysis was performed using Smart-PLS 2.0 and SPSS 18.0 software. Structure equation modeling based on the two-step approach (Anderson & Gerbing, 1988) was employed for analysis. Firstly, the measurement model was tested for reliability and validity of data. Secondly, path coefficients among constructs were evaluated in a structural model to test the hypothesis.

### Measurement Model Assessment

The measurement model was examined in terms of convergent validity, discriminant validity, and reliability. **Table 3** represents that the indicators with loading below 0.7 were dropped and the remaining indicators establish reliability. Internal consistency among items was measured through composite reliability (CR). The identified CR value for AI, ATT, PEU, PSP, PU, and TRT was found to be above 0.7 (ranging from 0.792 to 0.910) and considered reliable. The AVE for all latent constructs was well above the defined threshold of 0.5 (ranging from 0.792 to 0.910). Moreover, the convergent validity was attained through factor loading, CR, and AVE (Chin,1998; Nunally & Bernstein, 1994). Square roots of AVE values are represented diagonally in the latent variable correlation matrix (**Table 4**). All off-diagonal correlation values were well below the Square roots of AVE values and confirm good discriminant validity (Chiu & Wang, 2008). Cronbach's Alpha was assessed to attain reliability. Cronbach's Alpha value range from 0.761 to 0.901 (>0.7), indicating reliability. However, Kock, (2015) demonstrates that establishing convergent and discriminant validity is not sufficient enough to overcome common method bias and recommend a full collinearity test. VIF values for all latent

**Table 2. Respondents Profile**

| | Number | Percentage (%) |
|---|---|---|
| **Gender** | | |
| Male | 86 | 41.34% |
| Female | 122 | 58.65% |
| **Age** | | |
| 18-30 Years | 72 | 34.61% |
| 31-42 Years | 81 | 38.94% |
| 43 and above Years | 55 | 26.44% |
| **Education Qualification** | | |
| Graduate | 73 | 35.09% |
| Post Graduate | 98 | 47.11% |
| Doctorate and others | 37 | 17.78% |
| **Familiarity level with technology in retail** | | |
| Basic | 68 | 32.69% |
| Intermediate | 94 | 45.19% |
| Advanced | 46 | 22.11% |
| **TOTAL** | **208** | **100%** |

constructs were found to be below 3.3, hence eliminate the possibility for model contamination with common method bias (Kock & Lynn, 2012).

### Structural Model Assessment

Non-parametric bootstrapping was employed to examine the proposed relationships and the results of path analysis are represented in Figure 2. The predictive ability of the model was measured through $R^2$ against the suggested range of 0.19, 0.33, and 0.67 indicating weak, moderate, and substantial effects (Chin,1988). The structural model result represented in **Figure 2** explains 19.8%, 32.6%, 23.5%, 45.6%, and 36.4% variances in PEU, PU, TRT, ATT, and AI of blockchain in the retail supply chain, respectively. Stone-Geisser $Q^2$ criterion was also used to measure the predictive relevance of the model. The blindfolding procedure with a $Q^2$ value was found to greater than zero establishes predictive relevance (Hair et al., 2014). As hypothesized, the findings of the study do not provide much empirical support for the effect of PEU and PSP on consumer ATT (H2: $\beta$=0.043, t=0.836; H8: $\beta$=0.020, t=0.374). In contrast, PSP was found to be the significant predictor for PEU, PU and consumer TRT (H6: $\beta$=0.346, t=8.469; H7: $\beta$=0.441, t=12.903; H8: $\beta$=0.512, t=17.241). Similarly, PU and consumer TRT exert a significant positive influence on consumer ATT (H3: $\beta$=0.236, t=7.602; H5: $\beta$=0.429, t=11.357). PEU was found to be the significant predictor for PU (H1: $\beta$=0.313, t=7.627). The results also reflect the significant positive association between ATT and blockchain in the retail supply chain (H4: $\beta$=0.543, t=18.736). Moreover, the result supported all hypotheses except H2 and H9.

## DISCUSSION

The study aims to test the extended TAM model on intention to use blockchain in the retail supply chain, and it is one of few attempts to investigate youth adoption intention for blockchain to attain

**Table 3. Convergent Validity and Reliability**

| Construct | Item | Loadings | AVE | CR | α |
|---|---|---|---|---|---|
| PEU | PEU1 | 0.778 | 0.559 | 0.792 | 0.761 |
| | PEU2 | 0.748 | | | |
| | PEU3 | 0.716 | | | |
| | PEU4 | 0.438* | | | |
| PU | PU1 | 0.761 | 0.617 | 0.828 | 0.797 |
| | PU2 | 0.812 | | | |
| | PU3 | 0.782 | | | |
| TRT | TRT1 | 0.717 | 0.712 | 0.908 | 0.842 |
| | TRT2 | 0.871 | | | |
| | TRT3 | 0.889 | | | |
| | TRT4 | 0.886 | | | |
| ATT | ATT1 | 0.838 | 0.714 | 0.882 | 0.831 |
| | ATT2 | 0.783 | | | |
| | ATT3 | 0.909 | | | |
| | ATT4 | 0.564* | | | |
| AI | AI1 | 0.783 | 0.773 | 0.91 | 0.901 |
| | AI2 | 0.454* | | | |
| | AI3 | 0.973 | | | |
| | AI4 | 0.872 | | | |
| PSP | PSP1 | 0.861 | 0.687 | 0.868 | 0.821 |
| | PSP2 | 0.838 | | | |
| | PSP3 | 0.785 | | | |
| | PSP4 | 0.387* | | | |

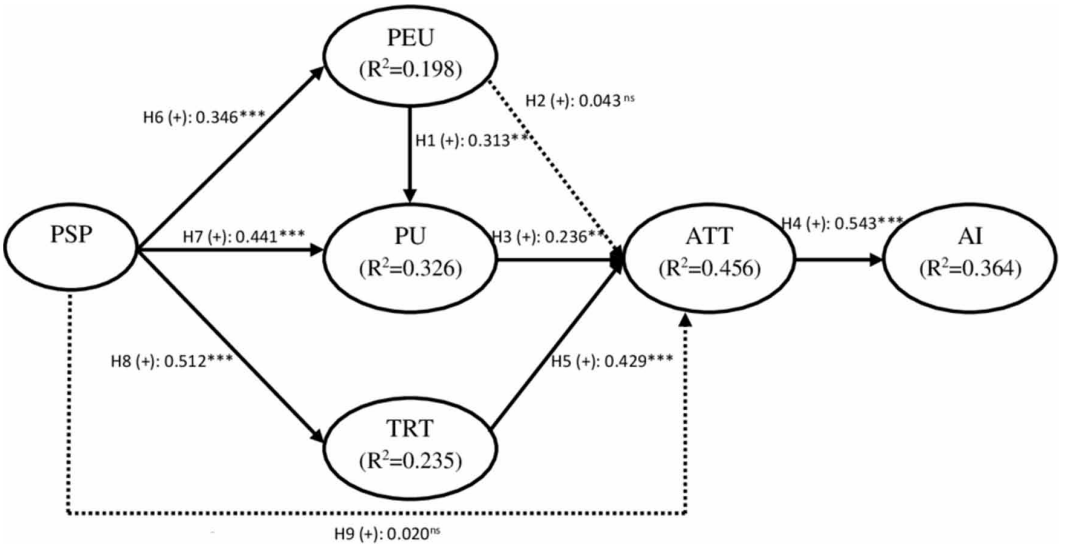
*Item deleted: factor loading<0.7

**Table 4. Discriminant validity**

| | AI | ATT | PEU | PSP | PU | TRT |
|---|---|---|---|---|---|---|
| AI | ***0.879*** | | | | | |
| ATT | 0.515 | ***0.844*** | | | | |
| PEU | 0.488 | 0.391 | ***0.747*** | | | |
| PSP | 0.47 | 0.365 | 0.461 | ***0.828*** | | |
| PU | 0.438 | 0.613 | 0.484 | 0.328 | ***0.785*** | |
| TRT | 0.534 | 0.584 | 0.465 | 0.482 | 0.483 | ***0.843*** |

Note: Diagonal bold value (square root of AVE)

**Figure 2. Modeling results**




transparency and traceability in the retail food supply chain. The proposition highlighted between PEU, PU, ATT, and AI is in line with the original model. As represented in Figure 2 PU exerts a significant positive influence on ATT and ATT also has a significant positive influence on AI. The model was extended using TRT and PSP. TRT was found to a significant precursor for ATT. PSP also significantly influences PEU, PU, and TRT. However, PSP alone was not sufficient enough to develop a favorable attitude for determining provenance and traceability using blockchain in the supply chain.

The finding of the study deviates from the literature which states a PEU helps in formulating favorable ATT toward technology adoption (Pattansheti et al. 2016; Chen, and Chen 2012). The insignificant impact of PEU on ATT for blockchain in the Indian retail supply chain portrays that consumers perceive blockchain-enabled system is difficult to comprehend and use, so the benefit of a blockchain-enabled system outweighs the amount of effort required to use the system. However, the influence of PU on ATT is in line with the literature (Gamal Aboelmaged 2010; Lee 2009; Kamble et al., 2018). This finding further strengthens the consumer viewpoint of blockchain enables supply chain effectiveness for positive use-performance relationship. Furthermore, PEU strong influence on PU is probably a reason for consumer's favorable attitude towards recent technological advancements. Lower technological complexity strengthens consumer belief towards the effectiveness of technology and its usefulness. Therefore it can be inferred that PU mediates the relationship between PEU and ATT. Constructs in the proposed framework impact ATT with a difference in intensity and ATT is considered as a significant precursor for right behavior and action. The strongest influence of ATT on AI as compared to any other relationship in the model represents the prominent role of consumer ATT for accepting blockchain to understand the provenance and track to track history of product before making a purchase. High trust level and feeling of usefulness with technology incline consumer's interest in the adoption of blockchain-enabled supply chain application system. With high trust and faith, convenience and usability, the innovation can develop the individual assumption to act emphatically toward blockchain-based solutions (Albayati et al., 2020). The contrary relationship between perceived security and risk highlights that the perceived risk for the individual is increased when trust is decreased. Trust is one of the key elements to support the confidence in the innovation to believe how proficiently this innovation can be utilized with less exertion. PSP is the primary component in this model to portray the intricacy level of blockchain innovation and application. PSP was found as a significant precursor for PEU, PU and TRT. PSP act as stimuli that exhibits individual

belief in the system capabilities and the organism is PEU and PU which finally drives human behavior in term of response (Lai 2016). An increase in system security and data privacy enhances consumer trust and confidence in a technology-enabled system. Framing a conducive environment for PEU is vital for organizations planning to implement a technology-enabled system and may use it as a mediator to enhance perceived usefulness and consumers' intention to use it (Lai 2017).

## Theoretical Implications

The capabilities of blockchain to revolutionaries business have attracted the attention of practitioners and researchers which are evidenced in terms of its application areas i.e finance, production, retail, education, etc. The paucity of research studies to understand consumer adoption for blockchain-based application systems can be bridged through the outcome of the present research findings. The proposed research framework has been adapted from the widely accepted Technology Acceptance Model (TAM). The constructs in addition to original TAM constructs provides a good fit to the model and contribute 36% on the consumer blockchain adoption intention and provides valuable insights to researchers. There are many other disruptive technologies like artificial intelligence, big data, and internet of things (IOT) which can further be aligned with blockchain to make its implementation more robust. Further research can be extended to understand upcoming technologies' implementation and adoption intention to enhance the system efficacy.

## Managerial implications

The findings of the study provide vital insights for managers for the successful implementation of blockchain in the retail supply chain with the consumer interest in consideration. Primarily study highlights construct relative importance from a consumer perspective for successful blockchain implementation in retail and their contribution in developing an attitude for adoption intention. The study establishes a relationship between PSP, PU, TRT, ATT, and AI. PEU was not significant enough in developing ATT directly but at the same time, it influences ATT through PU. Finding implies that the consumers perceive that using blockchain is free of efforts and this would further help them to gain complete product knowledge before making the purchase and enrich their shopping experience. Furthermore, the intention to use a blockchain-based application system depends upon its usefulness.

Consumer perspective for blockchain adoption generates avenues for retailers to implement blockchain enabled food traceability system. Retailers can share track to trace history of food products with all supply chain stakeholders in order to enhance stakeholder trust and loyalty. Consumer reliance on system security strengthens retailer's opinion to enhance security and safety of food in supply chain. Contamination at any point can easily be traced by retailers to be share with higher authorities and consumers down the line. Contamination of food item at any stage in the retail supply chain leads to the outbreak of food borne illnesses. It takes days to identify the source of outbreak and in the meantime it affects the livelihood of many parties involved in supply chain. In the year 2018 alone there were 18 outbreaks of food borne illnesses in USA. Hyperledger Fabric blockchain-based food traceability system developed by retail giant Walmart is one among the few used cases to address the issue related with provenance and traceability of food products. Hyperledger Fabric has been applied by Walmart for the traceability of 25 food products from different categories like fresh fruits/vegetable, meat & poultry, dairy and multi-ingredient products. In case of mangoes the time required to get the provenance details went from 7 days to 2.2 seconds (Hyperledger, 2019).

Consumer inclination towards blockchain based traceable goods provides insight for retailers implementing blockchain should focus on its user-friendly interface. They should also focus on developing easy use blockchain-based application system so that the maximum benefits can be attained through its application. PSP and TRT were also identified as key constructs to identify consumer adoption intention. Retailers should create awareness among consumers regarding how the benefits like safety, sustainability, and ethnicity can be attained through blockchain in the supply chain.

Marketers should work in a direction to validate the claims of product identity, visibility, certainty, temper evidence, and traceability to overcome mistrust among consumers.

## CONCLUSION AND FUTURE WORK

The technology Adoption Model (TAM) has been differently applied in many studies to examine individual adoption intention towards new technologies (Arpaci 2016). Blockchain has shown a rapid expansion across the globe with a variety of applications for a secure and safe operational environment. However, the blockchain technology was not welcomed as per the expectations, and sensing the limited application of blockchain this paper aimed to explore its adoption intention in the retail food supply chain. The study gives insights into the factors influencing consumer adoption intention. Perceived security and privacy have been identified as crucial factors affecting perceived usefulness, ease of use, and trust towards blockchain technology in the retail supply chain. Research provides a holistic view on the adoption of new technologies and technology implementation would diffuse as their awareness gets increased among people. Omni channel customer is conscious, informed and demands authentic and ethically sourced products than ever before. This pushes retailers considering best interest of consumers may work in a direction to have distributed ledger technology based traceable supply chain to address some of the emerging issues like food fraud, food borne illness, illegal production, food recalls and counterfeits. Blockchain can play transformative roles for business affecting everything from product to price and profit.

Due to the inherent nature of blockchain, there are limitations in this study too like any other study. Blockchain applies to all different commodity supply chains; hence consumer adoption intention toward the same may further be explored. A wide range of research can be carried out considering different technology adoption models for understanding consumer viewpoints regarding blockchain attributes like flexibility, agility, immutability, etc. A longitudinal research methodology can be followed to explore the diffusion level of innovative technology in the retail supply chain. NITI Aayog (2020) report on blockchain implementation for enabling ease of business, ease of living, and ease of governance provides the impetus for future research on the understanding penetration level of blockchain in Indian businesses. Blockchain is not a standalone technology and heavily depends on accurate data which can be collected by introducing various Internet of things (IoT) at different touchpoints in the supply chain. Furthermore, there is scope to analyze blockchain applications in association with the internet of things, radio frequency identification, machine learning algorithms, and big data analytics.

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