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Block-chain Adoption for Sustainable Infrastructural Development of Logistic Companies of Bangladesh for Mediation Role of Behavior Attitude

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ABSTRACT

Purpose: This study explores the influence of implementing blockchain technology on individuals' behavioral attitudes and the logistics chain for sustainable infrastructural development. The relationship between the adoption of blockchain technology and the implementation of blockchain-based logistic chains is influenced by the mediating effect of behavioral attitudes.

Method: The study specifically examines the target population of ten logistics companies in Bangladesh that are included in the trade directory. The data is collected using the purposive sampling technique. The item's validity is evaluated by a pilot study including a sample of 20 participants. The questionnaire was distributed to a total of 180 respondents, out of which 165 successfully utilized it.

Findings: This study shows important results on the influence of incorporating blockchain technology on individuals' behavioral views and the logistical chain that relies on blockchain.

Real-world implications: The study's findings have a substantial influence on Bangladeshi logistics companies seeking to implement blockchain technology to update their infrastructural development

Originality/value: This study presents the latest findings on the influence of behavioural attitudes on the adoption of blockchain technology by logistic companies in Bangladesh..

Keywords: *Blockchain, Logistic Chain, Behavior Attitude, Sustainable Infrastructural Development*

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1. INTRODUCTION

Logistics involves the effective transportation of goods between various locations and is crucial for the functioning of any business (Rushton Croucher & Baker, 2022). Logistics allows businesses to deliver goods and services to clients efficiently, cost-effectively, and reliably. It enables the movement of goods across borders and various regions, promoting trade and economic development (Ceyhun & Keser, 2020). Logistics improves business value by lowering expenses, boosting customer satisfaction, enhancing quality, and fostering differentiation (Tien, Anh & Thuc, 2019). Logistics utilizes technology, creativity, and optimization to improve operational efficiency and minimize waste, emissions, and energy usage (Upadhyay et al. 2021).

Bangladesh's logistics sector is expected to grow at a Compound Annual Growth Rate (CAGR) exceeding 6.5% during the forecast period (Fakhruzzaman, 2023). The freight forwarding industry plays a crucial role in strengthening the economy

of Bangladesh. Enhanced logistics may boost Bangladesh's exports by 20%. The Bangladesh freight and logistics market is highly fragmented, with more than 1,000 domestic and around 20 international logistics and freight forwarding companies operating in the country (Dappe et al. 2019). Key logistics companies in Bangladesh are Kuehne + Nagel Ltd, Maersk, Bongo Xpress, Bollore Logistics Bangladesh, Navana Logistics Ltd., 3i Logistics Group, A.H. Khan & Co., and Sicho. These companies offer services including shipping, international maritime and aviation freight forwarding, storage, and transportation (Akter, Chhetri & Rahman, 2019).

The adoption of blockchain technology by logistic companies has emerged as a subject of increasing interest in contemporary times. The implementation of blockchain technology has the potential to address prevalent obstacles encountered by logistics companies, including limited transparency, reliance on paper-based processes, fraudulent activities, and operational inefficiencies (Agarwal, 2018). The utilization of blockchain technology has the potential to facilitate the instantaneous monitoring of products and assets, streamline workflows and financial transactions, mitigate errors and conflicts, and enhance trust and cooperation among participants in the supply chain (Cole, Stevenson & Aitken, 2019). This study contributed to the knowledge gap for behaviour attitude towards the block-chain adoption for logistic companies of Bangladesh

2. LITERATURE REVIEW

The concept of blockchain refers to a decentralized system for storing unalterable data, which is accessible to all members of a network who actively participate in the blockchain. The utilization of blockchain technology enables manufacturers to effectively document and observe transactions occurring at each stage within the supply chain (Banerjee, 2018). The utilization of a distributed ledger format offers companies the advantage of accessing a singular, immutable source of information for the purposes of logistics and warehouse planning, management, as well as dispute resolution. Companies also derive advantages from the inherent security features of blockchain technology. Due to the immutable and decentralized nature of blockchain, the task of targeting encrypted information stored within this technology would pose significant challenges for hackers (Ferrag et al. 2018).

The implementation of blockchain technology in logistics companies is not devoid of obstacles. There are several obstacles that impede the extensive implementation of blockchain technology in the logistics sector. These barriers encompass technical intricacy, challenges related to scalability, interoperability issues, regulatory ambiguity, and the absence of established standards and governance frameworks (Dutta et al. 2020). Furthermore, the implementation of blockchain technology necessitates substantial investments in infrastructure, expertise, and organizational transformation. Additionally, it demands a considerable degree of trust and collaboration among partners within the supply chain (Kouhizadeh, Saberi & Sarkis, 2021).

One of the primary obstacles encountered pertains to the behavioral attitude exhibited towards the adoption of novel technologies. The behavior attitude towards the adoption of new technology pertains to the manner in which consumers assess and determine their acceptance or rejection of novel technological products. Various models and theories have been formulated in order to elucidate this phenomenon, including the Technology Acceptance Model (TAM) and the coping strategy approach. The Technology Acceptance Model (TAM) posits that consumers' attitudes are shaped by their perceptions of the utility and usability of a given technology, which in turn are influenced by various external factors including the technology's design, features, and marketing strategies (Opoku & Francis, 2019). The coping strategy approach posits that consumers experience psychological stress and uncertainty when they are confronted with unfamiliar technology products. In response, they employ various coping strategies to manage this situation, including refusal, delay, extended decision-making, and pretest. The various strategies employed have distinct impacts on consumers' beliefs, attitudes, and intentions towards products, thereby either facilitating or impeding their acceptance and utilization of new technologies (Cai et al. 2021). Therefore, in this study mediation role effects of behavior attitude towards Block-chain adoption for logistic companies of Bangladesh would be measured.

Behavior attitude for Block-chain adaptation

The adoption of blockchain technology poses both technical and social challenges, requiring a fundamental change in behavior and mindset for all stakeholders. Individuals who utilize blockchain technology are required to possess trust in the network and its underlying technology, engage in collaborative efforts with other stakeholders, acquire knowledge about the potential advantages and disadvantages of blockchain, and actively engage in the governance and upkeep of the system (Shin, 2019). Furthermore, the implementation of blockchain technology has the potential to yield significant social ramifications, which can shape the attitudes and behaviors of both beneficiaries and users. These impacts encompass the facilitation of financial inclusion, the mitigation of corruption and fraud, and the augmentation of transparency and accountability (Cunha, 2019). Therefore, it is crucial to fully understand and exert control over the behavior and mindset of individuals involved in blockchain technology to guarantee its successful implementation and widespread adoption.

H1: Block-chain adaptation has significant positive relationship with behavior attitude.

Blockchain based logistic chain

Blockchain technology has the potential to enhance the security, efficiency, and transparency of supply chain and logistics. It can facilitate the monitoring and tracing of goods, the automation of contract, payment, and invoice verification and execution, the reduction of costs and errors associated with manual and paper-based processes, intermediaries, and documentation, and the enhancement of stakeholder confidence and collaboration (Raja Santhi & Muthuswamy, 2022). In logistics and supply chain management, blockchain can also facilitate the development of new business models and innovations, such as a decentralized and peer-to-peer platform, the implementation of artificial intelligence and machine learning, and the creation of a circular supply chain (Rejeb et al. 2021). Nevertheless, blockchain encounters certain obstacles and constraints, including concerns regarding the performance and scalability of blockchain networks, the compatibility and integration of blockchain with pre-existing systems and standards, the governance and oversight of blockchain, and the level of adoption and acceptance of blockchain (Choi et al. 2020)

H2: Block-chain adaptation has significant positive relationship with blockchain based logistic chain.

Behavior attitude for blockchain based logistic chain

Understanding the benefits and drawbacks of implementing blockchain technology is crucial for all parties involved in the logistics chain. They must also possess a thorough understanding of the technical and organizational prerequisites needed for the successful execution (Sternberg, Hofmann & Roeck, 2021). Furthermore, it is critical that people exhibit a cooperative manner and show that they are willing to divulge information to outside parties. Additionally, they must continue to adhere to the rules and guidelines set forth by the blockchain network (Zwitter & Hazenberg, 2020). Overcoming challenges and reaping the benefits of blockchain technology can be facilitated by adopting a proactive, optimistic mindset and behavior. Therefore, resistance and reluctance to adopt blockchain technology may result from the presence of a negative and passive attitude and behavior (Dwivedi et al. 2023).

H3: Behavior Attitude has significant positive relationship with blockchain based logistic chain.

H4: Behavior Attitude mediating effect on relationship between block-chain adaptation and blockchain based logistic chain.

Conceptual Framework

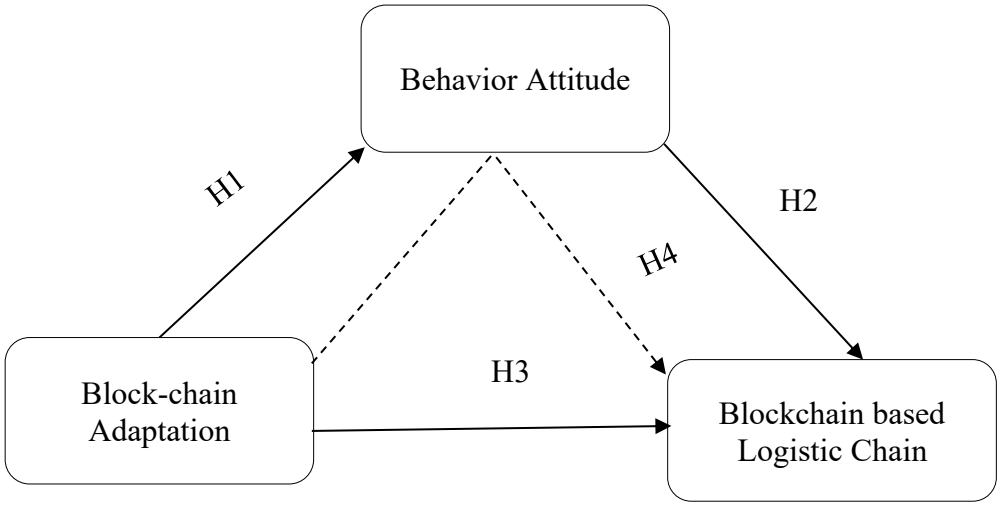

Figure 1: Conceptual Framework

3. METHODOLOGY

This study investigates the impact of adopting blockchain technology on individuals' behavior attitudes and the logistics chain that is based on blockchain. The association between block-chain adoption and blockchain-based logistic chain is influenced by the mediating effect of behavior attitude. The questionnaire was created by utilizing a comprehensive analysis of existing literature and subsequently confirming the reliability and validity of the measurement scales. The questionnaire employs a 5-point Likert scale, with a range of 1 representing "strongly disagree" and 5 representing "strongly agree". The study employed a quantitative approach, utilizing a closed-ended questionnaire administered through Google Forms to collect survey data online. Prior to data collection, the questionnaire's validity is assessed using the item objective congruence (IOC) test. The study focuses on the target population of ten logistics companies in Bangladesh that are listed in the trade directory. The data is gathered by the utilization of the purposive sampling technique. The item's validity is assessed by a pilot research including a sample of 20 respondents. A total of 180 respondents received the questionnaire, and 165 of them were able to use it, resulting in a usability rate of 91.67%. The data were analyzed using structural equation

modeling (SEM) with the software Smart Partial Least Squares (Smart PLS) and Statistical Package for Social Science (SPSS). The study's demographic statistics reveals that male respondents accounted for 92 individuals, representing 55.76% of the total, while female respondents accounted for 73 individuals, representing 44.24% of the total. The percentage of individuals with less than 1 year of experience using the blockchain is 44.85%, while the percentage of individuals with more than 1 year of experience is 55.15%. The educational attainment of the respondents in the survey is as follows: 32 (19.39%) have less than a bachelor's degree, 67 (40.61%) have a bachelor's degree, 57 (34.55%) have a master's degree, and 9 (5.45%) have a PhD.

Data Analysis and Discussion

The SEM model at Smart PLS 4 is used in the study to analyze and assess the survey data. A statistical technique for establishing the link between observable and latent variables is structural equation modeling (Hair et al., 2021). PLS-SEM bootstrapping and the PLS-SEM algorithm are two processes in the structural equation modeling process that are used to calculate the data. Structural equation modeling uses the measurement and structural model's components.

Measurement Model

Through observable variables, the measurement model quantifies latent variables (Kang & Ahn, 2021; Pansuwong et al. 2023). The measurement model used in this study comprises of the composite reliability and Cronbach's alpha. Cronbach's alpha is above 0.70 (Griethuijsen et al., 2015), and a composite reliability of above 0.70 is regarded as acceptable (Hair et al., 2021). An AVE of at least 0.50 is strongly advised as a general rule and for adequate converge (Hair et al., 2021).

Table 1: Reliability and validity

	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
Blockchain Adoption	0.914	0.936	0.744
Behavior Attitude	0.876	0.915	0.731
Blockchain Based Logistic Chain	0.932	0.952	0.831

Source: Author Compilation

Structural Model

The linkage and relationship of the latent variable are represented by the structural model (Kang & Ahn, 2021). The structural model used in this work displays the path analysis, coefficient of determination, and effect size.

Path Analysis

The association between the variables is established through path analysis (Harris & Tao, 2022). The path analysis in this paper displays the path coefficient value, SD, p-value, and t-value. The range of the path coefficient is -1 to +1. If the p-value is less than 0.05 and the t-value is more than 1.96, the hypothesis is accepted (Hair et al., 2021).

Table 2: Path Analysis

Hypothesis	Beta	Standard deviation	T value	P values
Blockchain Adoption -> Behavior Attitude	0.846	0.022	39.058	0.000
Blockchain Adoption -> Blockchain Based Logistic Chain	0.560	0.065	8.646	0.000
Behavior Attitude -> Blockchain Based Logistic Chain	0.368	0.070	5.264	0.000
Blockchain Adoption -> Behavior Attitude -> Blockchain Based Logistic Chain	0.311	0.059	5.239	0.000

The first hypothesis is “Block-chain adaptation has significant positive relationship with behavior attitude.” In table 2 shows that the path coefficient and p-value for hypothesis 1 is 0.846 and 0.000 which shows that the hypothesis 1 is accepted. Therefore, the result is consistent with the Raddatz et al. (2023) and Kabir and Islam, (2021).

The second hypothesis is “Block-chain adaptation has significant positive relationship with blockchain based logistic chain.” In table 2 shows that the path coefficient and p-value for hypothesis 1 is 0.560 and 0.000 which shows that the

hypothesis 2 is accepted. The result is in line with AlKubaisy and Al-Somali, (2023) and Hye et al. (2020).

The third hypothesis is "Behavior Attitude has significant positive relationship with blockchain based logistic chain." In table 2 shows that the path coefficient and p-value for hypothesis 1 is 0.368 and 0.000 which shows that the hypothesis 3 is accepted. The result is constant with Mukherjee et al. (2023).

The fourth hypothesis is "Behavior Attitude mediating effect on relationship between block-chain adaptation and blockchain based logistic chain." In table 2 shows that the path coefficient and p-value for hypothesis 1 is 0.311 and 0.000 which shows that the hypothesis 4 is accepted. The result is consistent with Nguyen and Nguyen, (2021) and Lin et al. (2021)

Coefficient of Determination (R^2)

The coefficient of determination (R^2) is a measurement of how much of an endogenous construct's change is accounted for by its predictor construct. R^2 values of 0.75, 0.50, and 0.25 are considered to be substantial, moderate, and weak, respectively (Hair et al., 2021). The result shows that the value of R^2 of behavior attitude is 0.716, and blockchain based logistic chain is 0.797 which is moderate and substantial respectively. This indicate that the independent variable has a 71.6% variance in behavior attitude and 79.7% variance in blockchain based logistic chain.

Effect size (f^2)

The effect size (f^2) measures how much a predictive construct has an impact on an endogenous construct (Hair et al., 2021). According to Cohen (2013), a small, medium, and large effect is one with an effect size of 0.02 to 0.14, 0.15 to 0.34, and above 0.35.

Table 3: Effect size

	Behavior Adoption	Blockchain Attitude	Blockchain Based Logistic Chain
Behavior Adoption		2.522 (Large Effect)	0.439 (Large Effect)
Blockchain Attitude			0.190 (Small Effect)
Blockchain Based Logistic Chain			

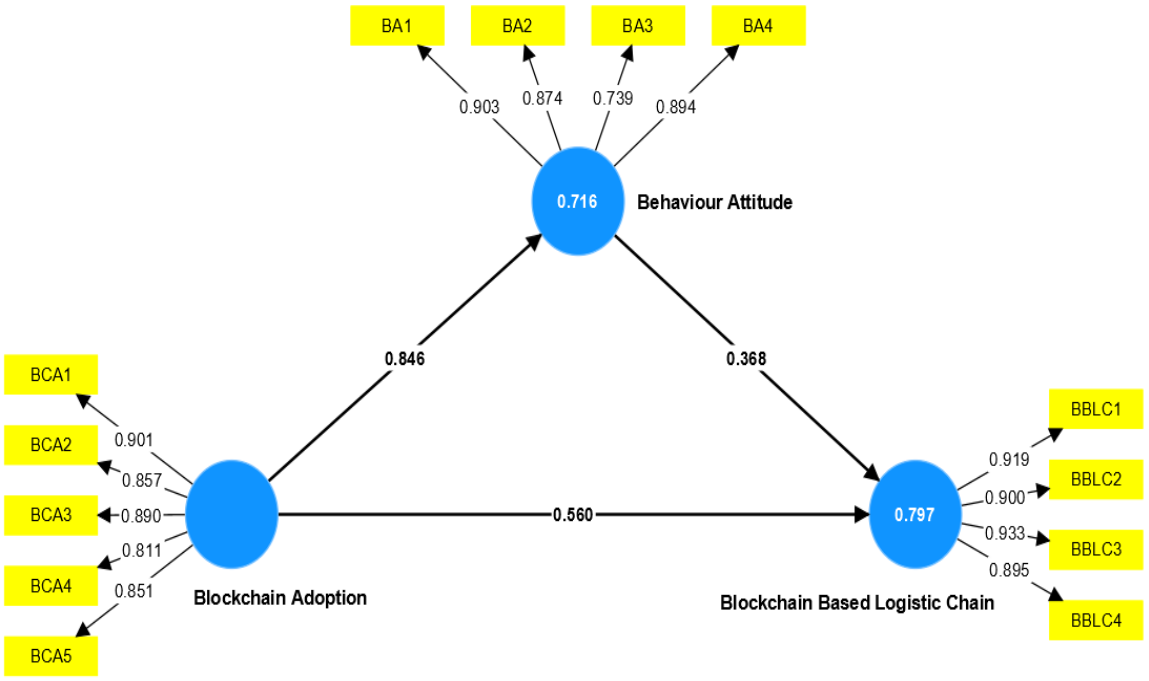

Figure 2: Path Analysis

4. CONCLUSIONS

This study illustrates the impact of integrating blockchain technology on individuals' behavioral attitudes and the logistical chain that depends on blockchain. Therefore, it is crucial to adopt favorable conduct in order to incorporate blockchain technology into the logistics supply chain. Implementing blockchain technology in logistic chains offers significant opportunities to reduce expenses and improve operational efficiency in the logistics industry. Moreover, it has been established that the implementation of tracking and traceability systems in the logistics industry will improve efficiency and effectiveness on both a national and global scale. By employing a shared blockchain, it is possible to synchronize logistical data, track shipments, and automate payments without requiring significant alterations to the internal operations or information technology systems of trucking businesses. Therefore, it is imperative for the indigenous population and government of Bangladesh to use blockchain technology in order to improve and update their logistical supply chain infrastructure.

5. RECOMMENDATIONS

Here are some suggestions for implementing blockchain technology in logistics supply chains to promote beneficial changes towards stakeholder's mindset:

Educate stakeholders: Disseminate knowledge regarding the advantages and practical applications of blockchain technology.

Real-time Connectivity: Emphasize the prioritization of uninterrupted data interchange across the supply chain.

Traceability and transparency: Utilize blockchain technology to achieve complete visibility across the entire process.

Data Security and Privacy: Ensure data security and privacy by addressing concerns and establishing explicit guidelines.

Pilot Projects: Initiate pilot projects by conducting small-scale experiments.

Regulatory Compliance: Emphasize the ways in which blockchain streamlines adherence to regulations.

Training and Skill Development: Invest in acquiring expertise in blockchain technology for training and skill development.

Change Management: Change management involves effectively managing expectations and actively involving stakeholders.

Sustainability: Enhance the environmental friendliness of blockchain technology for sustainable practices.

It is important to keep in mind that achieving successful adoption necessitates the synchronization of both technological and organizational aspects

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