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Understanding Blockchain Adoption in SMEs: A Mixed-Method Study of Digital Transformation, Resilience, and Senior Leadership Support

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Understanding Blockchain Adoption in SMEs: A Mixed-Method Study of Digital Transformation, Resilience, and Senior Leadership Support

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Abstract:

This study investigates the adoption of blockchain technology (BCT) by small- and medium-sized enterprises (SMEs), focusing on the interplay between digital transformation, market volatility, and organizational resilience. The goal of this research is to assess how perceived usefulness and perceived ease of use shape SMEs' intention to adopt BCT. This research integrates the Technology Acceptance Model with the Dynamic Capabilities Theory and explores how perceived usefulness, ease of use, and resilience influence SMEs' adoption intentions under the boundary conditions of senior leadership support (SLS). Conducted in India from November 2023 to February 2024, a mixed-method approach combining qualitative insights from interviews and case studies with quantitative analysis from survey data is employed to provide a comprehensive understanding of the factors driving or hindering BCT

adoption. The findings also underscore the critical role of SLS in fostering resilience and guiding SMEs through the digital transformation process, highlighting the need for tailored strategies to support BCT integration in resource-constrained environments. This research contributes to bridging the knowledge gap on BCT's impact on SMEs, offering practical implications for entrepreneurs seeking to leverage BCT for competitive advantage amid volatility. This study reveals that SMEs' successful adoption of BCT hinges not only on perceived usefulness and ease of use but also on the strategic alignment of digital capabilities with resilience-building efforts, particularly under strong SLS.

Keywords: SMEs; Intention to adopt; Blockchain technology; Digital transformation; VUCA

Managerial Relevance Statement:

The findings of this study provide valuable insights for engineering managers and policymakers looking to encourage BCT adoption among SMEs in volatile business environments. For practitioners, understanding how perceived usefulness and ease of use drive adoption enables the creation of more user-friendly BCT with intuitive interfaces and accessible training programs. Additionally, the study emphasizes how digital transformation and organizational resilience significantly impact SMEs' ability to integrate BCT, stressing the need for strategic investments in digital infrastructure and skill development initiatives. Policymakers can utilize these insights to design targeted incentives, regulatory frameworks, and support programs that lower adoption barriers and boost SMEs' competitiveness. A surprising revelation from this study is that when resilience is paired with SLS, SMEs are more likely to adopt BCT.

1. Introduction

Blockchain technology (BCT) has the potential to revolutionize small- and medium-sized enterprises (SMEs) [1]. In resource-scarce yet hypercompetitive environments typical of SMEs [2], BCT can improve efficiency by streamlining transactions and fostering trust through

transparent, decentralized record-keeping systems [3], [4]. This can result in greater efficiencies and cost savings [4], particularly through smart contracts that facilitate automated agreements and payments without intermediaries, thus lowering transaction costs [5]. BCT also replaces intermediaries with transparent systems [3], [4], increasing transaction trust. Yet, do the benefits of enhanced trust and reduced business costs from BCT extend to SMEs? As knowledge spreads and participatory tools become more accessible, significant opportunities emerge for SMEs to incorporate BCT into their operations [6]. BCT may transform SME operations by addressing challenges and improving efficiency [1]. However, the complexity of implementing BCT and the related regulatory ambiguities may deter some SMEs, especially those lacking the necessary skills [7].

While BCT implementation can be challenging and regulatory uncertainties exist, proper use can strengthen SMEs in complex scenarios. Tools to boost competitiveness through efficient operations are available. For instance, perceived usefulness and ease of use under SLS may influence the adoption of BCT. Thus, SMEs can drive economic development through innovation. That said, today's volatile, uncertain, complex, and ambiguous (VUCA) environment presents serious challenges for SMEs, particularly in maintaining competitiveness and operational efficiency. Global digital transformation necessitates more research on how SMEs adapt to uncertainty, particularly regarding the adoption of BCT, as it has vital implications for their long-term sustainability. Given these broader global trends, it is essential to examine how SMEs in specific emerging countries like India navigate the challenges and opportunities of BCT adoption.

The growth of the Indian economy heavily depends on SMEs, which contribute nearly 30% of the GDP and 45% of total exports¹. While BCT has the potential to double the

¹ According to the concept note on Enterprise Development, 2024 → <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdnbbsr.s3waas.gov.in/s395192c98732387165bf8e396c0f2dad2/uploads/2024/09/20240920593348940.pdf>

productivity of SMEs, adopting such emerging technologies remains nearly impossible due to a lack of financial resources, insufficient digital infrastructure, and an unclear regulatory environment. With government initiatives like Digital India and Start-Up India, Indian SMEs can enhance transparency and efficiency while simultaneously boosting competitiveness in the rapidly digitizing global economy. However, Indian SMEs, unlike those in developed economies, exhibit a unique structure that leads to equally unconventional technology adoption patterns, warranting deeper research. This analysis highlights crucial aspects of Indian SMEs, focusing on the factors that enable and restrict BCT adoption, particularly in emerging markets, while providing evidence-based recommendations to industry leaders, policymakers, and technology providers.

However, a significant gap exists concerning the impact of BCT on SMEs, a sector vital to many economies [8]. While existing research has largely concentrated on large corporations, the unique challenges and opportunities that SMEs face in adopting BCT remain underexplored [9]. This research is essential for SMEs seeking long-term survival strategies that leverage BCT for operational efficiency, cost reduction, and competitive advantage [10]. Understanding the factors influencing BCT adoption, including hurdles and potential benefits, is crucial for policymakers, industry players, and entrepreneurs considering new technologies [7]. Additionally, as BCT evolves to a more advanced level, this study has practical implications for developing tailored solutions and support mechanisms that enable SMEs to adopt BCT effectively. Consequently, this research highlights the importance of BCT for SMEs, as it promotes innovation, economic growth, and resilience within the SME sector.

Additionally, a substantial research gap remains in comprehending the interaction between an organization's degree of digital transformation, resilience, perceived usefulness, ease of use, and intention to adopt BCT. Previous studies have examined various factors that hinder BCT adoption, yet no research has investigated how far an organization's level of digital

transformation can influence its resilience and likelihood of adopting BCT. Furthermore, the impact of market pressures and the role of senior leadership support (SLS) in moderating the relationship between perceived usefulness, ease of use, and adoption intentions have not been sufficiently explored.

This study integrates user acceptance elements from the Technology Acceptance Model (TAM) and resilience and digital transformation characteristics from the Dynamic Capabilities View (DCV) to address the above gaps and provide a comprehensive understanding of the factors influencing BCT adoption at both individual and organizational levels. TAM aids in assessing the behavioral dimensions of BCT adoption, while DCV offers a framework for examining how SMEs navigate disruptive innovations in unpredictable circumstances. We employ a mixed-methods approach to capture the multifaceted nature of BCT adoption among SMEs and allow for data triangulation, enabling findings from qualitative research to be validated and enhanced by quantitative results and vice versa. Given the complexity of BCT and the diverse contexts in which SMEs operate, the comprehensive methodological framework we adopt addresses both the breadth and depth of the phenomena under investigation. Hence, the research questions are:

RQ1: How do perceived usefulness and perceived ease of use influence SMEs' intention to adopt BCT?

RQ2: How does an SME's level of digital transformation and resilience impact its capability to adopt BCT in volatile business environments?

This study integrates the TAM and the DCV to analyze BCT adoption in SMEs through the lens of personal and organizational factors. It first examines from the TAM perspective how perceived usefulness and perceived ease of use affect SMEs' intention to adopt BCT, considering decision-making as both a rational and behavioral process. This is further enhanced by DCV, which explores how an SME's digital transformation and level of resilience influence

its ability to adopt BCT in a turbulent business environment, focusing on the adaptive capacity to meet technological and regulatory demands. While TAM elaborates on the behavioral aspects of adoption, DCV describes the digital maturity and resilience necessary for a firm to implement BCT effectively. The relationship suggested by these theories is that perceived usefulness and ease of use may influence the intent to adopt; however, an SME's ability to navigate VUCA and harness dynamic capabilities will ultimately drive successful adoption and implementation. Thus, by integrating TAM and DCV, this study provides a holistic framework that captures behavioral drivers of BCT adoption while emphasizing the vital role of resilience in supporting digital transformation efforts within SMEs.

SMEs face challenges that hinder BCT adoption. Factors like resilience, digital transformation, perceived usefulness, market pressures, and ease of use critically influence decision-making in volatile environments. This research merges these elements to deepen the understanding of BCT adoption, its ties to digital maturity and resilience, and organizational preparedness. It also explores the importance of BCT in reshaping power in various industries. Moreover, this research focuses on SLS as a moderator between perceived usefulness, perceived ease of use, resilience, and adoption intentions. The latter addresses the most challenging questions related to the adaptation of business practices and the implementation of BCT through this study. Ultimately, this research provides actionable insights for SMEs, policymakers, and industry leaders by identifying the key enablers and barriers to BCT adoption, emphasizing the pivotal role of SLS in fostering the role of resilience in rapidly evolving markets.

2. Background Literature

This research is guided by two theories, TAM and DCV, providing a theoretical foundation for understanding different factors affecting BCT adoption within SMEs. From the TAM perspective, the user's perceived usefulness and ease of use determine whether there will be

technological acceptance. However, DCV goes beyond TAM by explaining how organizations can improve their capacity to absorb new technologies like BCT amid uncertainties caused by digital disruption. Therefore, a comprehensive approach is presented, which considers both individual and organizational drivers for adopting BCT among SMEs experiencing turbulence. This also highlights the complexity involved in situations where changes are anticipated with certainty. Nonetheless, some environmental shifts may be expected regarding SMEs' adoption of BCT applications under such circumstances.

Many SMEs struggle to afford BCT software applications due to their limited budgets [7]. BCT can be quite complex for SMEs with restricted resources because of the initial implementation, maintenance, and the need for highly specialized knowledge. As a result, many perceive BCT as complicated, especially given its regulatory uncertainties. Nonetheless, these costs are justifiable when considering long-term benefits, such as reduced transaction costs by eliminating intermediaries, enhanced efficiency, and improved supply chain credibility through its inclusion [8]. Alternatively, there are other avenues, like public investment paired with government grants or utilizing BCT-as-a-service models for those that cannot manage it independently. In other words, if we make BCT affordable or free at the entry-level, even smaller players can leverage its transformative potential without facing immediate financial burdens.

2.1 VUCA in Business Environments

VUCA is widely recognized and utilized in fast-paced business environments [11]. It stands for Volatility, Uncertainty, Complexity, and Ambiguity [12], describing dynamic markets that continually change and are difficult to predict. This framework also encompasses another aspect, namely, the volatility induced by rapidly evolving business landscapes, where economic events lead to market shifts or technological disruptions occur [13]. Conversely, when uncertainty prevails, situations become more challenging for firms because they are

unsure of what lies ahead [14]. Therefore, organizations should focus on adaptive strategies rather than long-term planning, as the turbulent environment necessitates frequent reassessment of their goals [15]. However, this understanding of VUCA is incomplete. Additionally, it offers hope for those who are unfortunate enough to navigate the myriad challenges they face [16]. Still, cultivating an agile innovation culture and embracing flexible adaptation remain critical competencies that enterprises must develop to thrive, particularly in highly volatile market conditions, even though these scenarios can be exceedingly ambiguous.

VUCA (Volatility, Uncertainty, Complexity, and Ambiguity) can pose challenges for SMEs to comprehend. SMEs typically have fewer resources compared to larger organizations, making them vulnerable to stiff competition and market fluctuations as well as unforeseen interruptions. As a result, such environments demand flexibility and speed from SMEs [11]. Often, difficulties related to decision-making hinder the adoption of new technologies [12]. This adaptation would enable SMEs to prosper during turbulent times characterized by VUCA. In these situations, SMEs need agile capabilities to adjust swiftly within a dynamic marketplace and foster innovation while remaining competitive in unpredictable business settings [14].

As a result, SMEs in these areas should grow more robustly to navigate uncertainty without sacrificing profits [17]. It is essential for SMEs to instill certain competencies in their employees to avoid wasting time adapting to new changes. Such institutions confront challenges directly and seize any opportunities that arise during uncertain times. Therefore, adopting a VUCA mindset represents a crucial time for SMEs to prepare for disruptions and achieve long-term growth despite shifting business environments [16].

Utilizing BCT, SMEs can successfully tackle VUCA environments. A notable example is BCT, which introduces certainty into transactions and supply chain management through clear, decentralized, and immutable systems [15]. This also enhances trust among various stakeholders. Nonetheless, the implementation of BCT is significantly influenced by the

VUCA operational environment. SMEs considering the introduction or adoption of such innovative technology during unstable economies or an unclear legal framework face considerable challenges ranging from potential risks to benefits [16]. However, despite the difficulties these organizations encounter regarding BCT implementation, it will empower them to develop survival strategies and improve their ability to manage uncertainties and cope with crises often present in complex corporate scenarios.

2.2 Technology Acceptance Model (TAM)

The TAM is one of the primary theories that explain how individuals accept and adopt new technologies into their lives [18]. According to this theory, if users perceive a technology as useful and easy to use, they are more likely to adopt it [19]. Conversely, perceived usefulness assesses whether one expects the technology to enhance performance and help achieve specific goals [20]. Additionally, perceived ease of use refers to how simple or complicated it is to understand and apply technical skills [21]. These perspectives influence whether a user is willing to utilize this type of technology. TAM's straightforwardness and emphasis on the end-user have led to its widespread acceptance as a model for technology acceptance in various contexts [22]. Developers and designers can leverage these insights when creating user-friendly technologies that fulfill common needs [23]. By making the technology intuitive and user-friendly and effectively communicating its value, developers facilitate its integration into users' daily routines [24].

2.3 Dynamic Capabilities View (DCV)

DCV considers three main aspects: sensing, seizing, and reconfiguring [25], [26]. Sensing involves actively recognizing emerging market shifts and potential threats that are part of the research processes [27]. The firm must seize these by efficiently utilizing its resources and developing innovative solutions [28]. Reconfiguring involves modifying existing resource bases such as skills, structures, and technologies to meet changing environmental demands

[29]. Through effective management of these capabilities, firms continuously adjust to remain competitive in business; thus, they achieve long-term success [30].

2.4 Integrating the Theories

Conversely, when examining how SMEs adopt BCT, a deeper understanding of the topic can be achieved by integrating the TAM and DCV during technology adoption within organizations [13]. TAM primarily focuses on individual-level factors such as ease of use and perceived usefulness, which help assess the adaptability of new technological products without considering other relevant issues [16]. Additionally, the TAM may overlook major broader organizational influences on adoption in VUCA conditions [17]. However, combining TAM with DCV offers a comprehensive view of what drives individuals or organizations to adopt specific technologies. This means that individuals must have positive perceptions, while strategic thinking and adaptability are essential for organizations during the adoption process.

Furthermore, the personal acceptance levels within organizations based on TAM and DCV can illustrate how dynamic capabilities are influenced by these acceptance levels, despite their varying scopes. Decision-makers in SMEs should also consider whether their firms can implement and sustain this innovation when adopting BCT [10]. These theories enhance our understanding of how personal beliefs affect organizational outcomes while organizational actions shape individuals' attitudes [11]. If top management believes that BCT is valuable and user-friendly, they may decide to allocate the necessary resources for proper integration, which reflects dynamic capabilities. Conversely, an organization could foster positive employee attitudes toward new technologies if it possesses strong dynamic capabilities. One can combine TAM with DCV to explain how both individual and organizational factors contribute to technology adoption in SMEs.

The definitions of all the constructs are shown in Table 1.

Table 1: Definitions of Constructs

Constructs	Definitions	Sources
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Level of Digital Transformation	The level of digital transformation refers to how extensively an organization has incorporated digital technologies into its fundamental business operations.	[42]
VUCA	Volatility, uncertainty, complexity, and ambiguity are some components of the VUCA environment that significantly affect business activities today.	[11]
Perceived Usefulness	Assessing the extent to which individuals perceive technology as beneficial in improving their performance.	[11]
Perceived Ease of Use	Perceived Ease of Use refers to the subjective evaluation of the difficulty level in learning and utilizing a particular technology.	[11]
Resilience	Resilience refers to an organization's ability to adapt and recover from various disruptions effectively.	[42]
Intention to Adopt BCT	Examining an organization's readiness to embrace BCT.	[84],[42]
SLS	The support and resources provided by top-level management for an initiative.	[71],[72]

3. Research Design

This study employed both qualitative (Study 1) and confirmatory (Study 2) research designs. Mixed methods research provides an opportunity for researchers as it combines the benefits of qualitative and quantitative approaches [31]. The mixed methods approach delivers in-depth insights into complexities that cannot be fully understood using a single technique or methodology; integrating interviews/observations with surveys/statistical analysis enhances this [32]. Researchers can utilize this method to better validate their findings while reinforcing their credibility and reliability. However, by doing so, they produce empirical evidence and data that can be generalized beyond the specific case under consideration. Ultimately, mixed methods were selected because, unlike other approaches, they are designed to address complex issues that arise in life, providing a more integrated perspective on answering challenging research questions. In conclusion, mixed methods research offers a comprehensive view of issues, making it well-suited for tackling complex research questions and real-life challenges. After extracting constructs from Study 1, we conducted Study 2 using the PLS-SEM technique to obtain the final results.

3.1 Exploratory Study (Study 1)

3.1.1 Research Design

Since the academic literature on SMEs' intention to adopt BCT is underdeveloped, we initially chose a qualitative approach to be prepared for future developments. Data was collected

through semi-structured interviews and a qualitative analysis [33]. Open-ended questions were posed during these discussions, allowing us to engage participants meaningfully on specific aspects. Participants were given time to express their thoughts in their own words. Furthermore, this technique aims to gather insights into alternative perspectives rather than simply validating existing knowledge.

3.1.2 Sample & Data Collection

We analyzed various reports, including grey literature, news articles, and annual reports, to identify factors influencing BCT adoption intentions worldwide. To understand the factors affecting global BCT adoption, we carefully examined a range of secondary data, such as industry white papers, government policies, technical reports from leading blockchain firms, publications from research institutes, and even market research focused on SMEs. These reports were chosen for their relevance to BCT adoption by SMEs and the credibility of their sources, including the World Economic Forum, NASSCOM, Deloitte reports, and other recently published documents from the last five years. For instance, NASSCOM's report (2022) on BCT adoption in the SME sector in India highlights regulatory challenges and scalability issues, while Deloitte's Blockchain Survey (2021) discusses cost and security as the most significant perceived barriers to adoption. These secondary data sources helped us identify the key issues for our qualitative interviews, ensuring that our primary data collection was rooted in industry discussions and observations. Using purposive sampling, we targeted managers from twenty-two SMEs in India, emphasizing diversity. We reached out through professional networking platforms like LinkedIn and social media channels such as WhatsApp, Facebook, and Instagram, focusing on specific participant categories. They were initially contacted via personal messages, phone calls, emails, text messages, or various other means of communication. At the beginning, we provided details about the project, interview protocols, and consent forms. The interviews lasted between twenty-five and forty-five minutes each,

conducted in either English or Hindi, based on the participants' preferences, over a period of two months. A structured interview schedule with open-ended questions was utilized to gain insights into individuals' experiences, motives, challenges, opportunities, and strategies in BCT. This approach employed narrative techniques to capture central themes and patterns through thoughtfully crafted questions, aiming to minimize bias and encourage authenticity.

3.1.3 Data Analysis & Interpretation

Translations were performed on Hindi interviews into English for verbatim transcription. To maintain anonymity, participants' demographic details were coded with numbers [34]. Grounded theory principles were applied using open, axial, and selective coding to derive the themes [35] (Please refer to Online Appendix 1). At this stage, open codes were identified and organized into categories specific to the context [36]. To ensure rigor and reliability, we employed practical double coding. A consensus among team members was established after several roundtable discussions to identify emergent themes. Consequently, a reliability analysis was performed by a panel of experts to confirm consistency in categorization.

3.1.4 Results of NVIVO Analysis

Figure 1 presents the results of the NVIVO analysis, which is based on the responses of all participants in the qualitative research. From this qualitative study, we have identified key factors, including the level of digital transformation, VUCA, perceived usefulness, perceived ease of use, resilience, and the intention to adopt BCT, which has been further examined in Study 2.



Figure 1: Word Cloud using NVIVO

3.2. Confirmatory Study (Study 2)

3.2.1 Development of Hypothesis

3.2.1.1 Level of Digital Information

Regarding digital information, there is an abundance of diverse views on potential solutions [37]. Furthermore, regular updates for digital content are possible, enabling users to consistently access current knowledge [38]. Conversely, there are arguments against this idea, such as the risk of being overwhelmed by excessive information. Practically speaking, given the vast amount of information available, considerable effort is needed to distinguish facts from falsehoods [39]. Additionally, one can easily feel lost due to the sheer volume of data, lacking a clear starting point. Unfortunately, this is not an equal situation, as access to technology and proficiency vary significantly across different groups [40]. This leads to an uneven distribution of benefits, favoring some over others [41]. Therefore, we posit:

H1a: *The level of digital information has a positive effect on perceived usefulness*

While digital information underpins the effectiveness of information use, various factors complicate this [42]. At times, an excess of information makes it challenging to quickly locate the specific details needed for a task [43]. Additionally, navigating through complex apps or websites can be extremely frustrating, particularly when users are unfamiliar with the interface.

Furthermore, as previously mentioned, the reliability of information can vary significantly [44]. Poorly written instructions or outdated content can negatively impact user experience [45]. Nonetheless, other reasons support the author's perspective. Access to well-organized, easy-to-understand informational resources can greatly enhance user experience [46]. Search engines that filter results based on user queries or intuitive interfaces that guide users through processes can markedly improve user experience [47]. Moreover, digital information can be updated frequently, ensuring people always have access to the most effective and current methods for completing tasks [48]. Thus, we hypothesize:

H1b: *The level of digital information has a positive effect on perceived ease of use*

Digital information has the potential to significantly increase individual and community resilience levels [49]. This wealth of knowledge prepares individuals for any eventualities in advance [50]. Through online platforms, people can easily access learning materials, emergency plans, and system alerts [51]. Consequently, individuals in such scenarios would have an enhanced ability to make informed choices when faced with challenging situations, such as disasters or other forms of humanitarian crises [52]. This accessibility enables people to form accurate opinions based on available facts [53]. The importance of this statement is supported by organizations like Save the Children, which advocate for increased access to education in the poorest communities worldwide. Additionally, modern communication technologies help establish strong social ties, which are essential during times of crisis and recovery [53]. However, many complex factors concern the impact of digital information on resilience [42]. Therefore, we often feel stressed and anxious when inundated with news and information. This is especially true when encountering harmful or deceptive content [54]. Those spreading false rumors during such moments contribute to inefficiencies in crisis management, as situations may become more complex due to misleading information propagated online [55]. If not adequately addressed, this can hinder effective response

measures during emergencies or other critical periods. Furthermore, heavy reliance on technology creates potential vulnerabilities. During crises, individuals might feel helpless as they become overly dependent on modern communication devices for everything—such as talking with friends or solving their problems—especially if the technology becomes inaccessible [56]. Therefore, we hypothesize:

H1c: *The level of digital information has a positive effect on resilience*

3.2.1.2 VUCA

In a rapidly changing world marked by uncertainty, individuals and organizations seek clear, stable, and efficient solutions [57]. During periods of volatility, access to tools and resources that can help navigate swift market shifts or unexpected events can be immensely beneficial [58]. In moments of ambiguity, it becomes increasingly vital to have information or frameworks to predict the future or make informed decisions [59]. However, the relationship between VUCA and perceived usefulness is not always straightforward. Finding practical answers to complex problems remains challenging amidst the intricacies and uncertainties of a VUCA environment [60]. With a plethora of strategies and frameworks available, individuals can easily feel overwhelmed and struggle to choose the best approach [15]. Furthermore, particular solutions can become obsolete almost immediately due to VUCA's rapid dynamism, leaving one feeling disheartened upon realizing their efforts were in vain [11]. Thus, we hypothesize:

H2a: *VUCA has a positive effect on perceived usefulness*

The existence of VUCA may encourage the development of simpler solutions that might not be feasible otherwise [11]. Designers often create user-friendly tools that require minimal training when tasked with adapting swiftly to dynamic changes and making quick decisions [15]. Additionally, the pressure to differentiate in a competitive market may heighten focus on user experience, leading to the creation of intuitive interfaces and straightforward instructions

[61]. Therefore, in such contexts, VUCA fosters simplicity in terms of user-friendliness. However, the challenges that arise from a VUCA environment may obscure this perception of simplicity [15]. As challenges evolve and new threats emerge, there may also be a necessity for comprehensive yet intricate solutions to be developed [62]. Still, these solutions can be more difficult to learn, which may deter individuals from using them due to their perceived lack of user-friendliness [15]. Moreover, the demand for quick pivots could result in launching solutions before they receive adequate user testing, potentially leading to a confusing or frustrating user experience [14]. Therefore, we hypothesize:

H2b: *VUCA has a positive effect on perceived ease of use*

3.2.1.3 Perceived Usefulness

Once individuals recognize that BCT effectively addresses their anxieties, it becomes significantly easier to adopt and implement it in their endeavors [20]. BCT provides various benefits, including enhanced security for online transactions, transparency in supply chains, and efficient records management [63]. Furthermore, when people see opportunities to improve efficiency, security, or trust in a specific area, they are generally more inclined to embrace BCT [64]. However, the connection between adoption and perceived usefulness is not always clear-cut. Numerous factors can often hinder the adoption of valuable technology [20]. A primary concern is the novelty of BCT. Individuals may feel hesitant to try it due to a lack of technical skills and difficulty utilizing it in practical situations [65]. Additionally, BCT can be complex, filled with technical jargon and a rapidly changing landscape that may overwhelm newcomers [66]. Therefore, we hypothesize:

H3: *Perceived usefulness has a positive effect on the intention to adopt BCT*

3.2.1.4 Perceived Ease of Use

BCT seems user-friendly for people, and even without extensive technical knowledge, they are more likely to consider adopting it [64]. This is reflected in aspects such as user-friendliness,

clear instructions, and the availability of support [67]. If BCT is perceived as easy and user-friendly, it is likely to encourage individuals to explore its potential benefits for their work areas [19]. To help users quickly understand how BCT function, suggestions have been made for developers to focus on creating interactive interfaces that offer continuous learning opportunities [68], [69]. Therefore, we hypothesize:

H4: *Perceived ease of use has a positive effect on the intention to adopt BCT*

3.2.1.5 Resilience

Organizations that value resilience are encouraged to adopt BCT, as it reduces risks and increases adaptability [70]. In the VUCA environment, key features such as immutability, transparency, and distributed ledger systems provide significant benefits for businesses utilizing BCT [71]. Consequently, BCT enhances visibility and traceability in supply chains, making it easier to identify disruptions and respond accordingly [63]. Moreover, this attribute maintains data integrity while protecting against cyber-attacks, thereby improving overall organizational resilience against cyber threats [72]. Finally, organizations must thoroughly evaluate the specific use case and weigh its potential benefits against implementation hurdles, ensuring they have the necessary resources to effectively deploy such technologies [63]. The implementation and integration of BCT can only occur when a thorough understanding of the concept of resilience is achieved [73]. Therefore, we hypothesize:

H5: *Resilience has a positive effect on the intention to adopt BCT*

3.2.1.6 SLS as a Moderator

Leaders who are dedicated to the cause highlight its significance and strengthen subordinates' confidence that it is an effective tool for the organization's advantage [74]. The expectation is that this enhanced sense of usefulness will create a greater desire to incorporate BCT into daily business operations [75]. Ultimately, SLS for BCT primarily contributes to its perceived usefulness, which, in turn, affects the decision to adopt it [76]. For it to be effective, this

moderation must involve clear communication, address concerns, and deliver tailored messages to various stakeholders within the firm [77]. Thus, we hypothesize:

H6a: *SLS has a moderating effect on the association between perceived usefulness and intention to adopt BCT*

Organizations can promote a more positive perception of BCT by addressing employees' concerns and offering training opportunities on how to use the technology [78]. SLS is essential in shaping users' perceptions of the ease or difficulty of using BCT [79]. However, this approach will only be effective if technological complexities are addressed and user training and support systems are readily available [80]. Creating an environment that recognizes potential challenges and equips employees with the necessary skills allows senior leaders to strengthen the connection between perceived ease of use, adoption intention, and BCT [77]. Hence, we hypothesize:

H6b: *SLS has a moderating effect on the association between perceived ease of use and intention to adopt BCT*

Senior leaders greatly influence employees' and stakeholders' attitudes toward BCT, as they are especially dedicated to building organizational resilience [11]. There is a high likelihood of BCT adoption when the strong connection between it and resilience is recognized [11]. Therefore, SLS is essential in connecting organizational durability with a readiness to adopt BCT [80]. However, for this moderation to succeed, it must be executed with a detailed plan that shows a clear understanding of how BCT enhances resilience over time [81]. By doing so effectively, senior leaders can help others recognize this connection while aligning efforts with the broader goals of resilience, as noted by several authors such as [82]. Consequently, we hypothesize:

H6c: *SLS has a moderating effect on the association between resilience and intention to adopt BCT*

Hence, Figure 2 describes the hypothesized model.

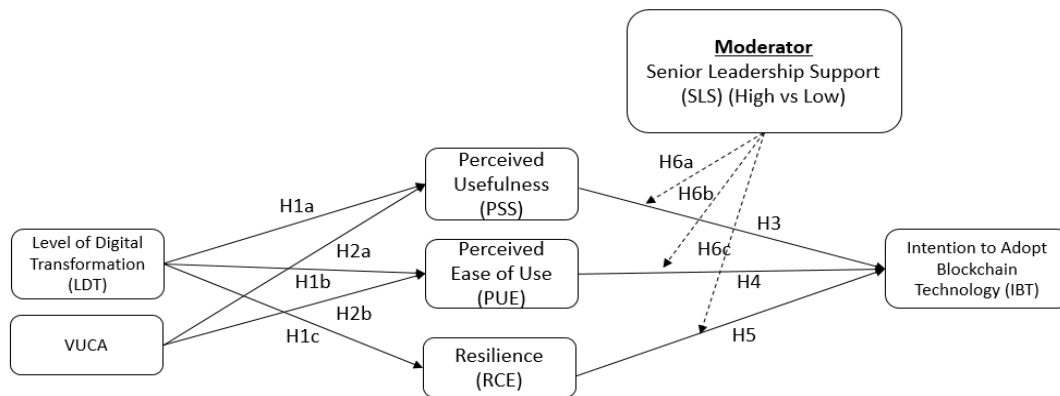


Figure 1: Hypothesized Research Model

[Notes: Theoretical Bases: *VUCA in Business Environment*; *Perceived Usefulness & Perceived Ease of Use* draw on the TAM; *Level of Digital Transformation, Resilience, & SLS* draw on the DCV]

3.2.2 Methodology

We have utilized a confirmatory study to understand better the intention to adopt BCT. The model has been applied using quantitative analysis. The time frame spanned from October 2023 to March 2024. The participants consist of managers at different levels (senior, middle, and junior) from different SMEs in India. Participants were chosen according to specific screening criteria. The questions for selecting the respondents are provided below: Q1. *Are you currently employed as an SME manager?* Q2. *Do you have any knowledge about BCT SMEs?* Q3. *Could you kindly provide me with the contact details (email/WhatsApp) of any of your peers or relatives currently employed as managers in SMEs? (Optional)*

A comprehensive online survey was distributed to 1,632 participants from various cities across India via email, LinkedIn, Facebook, and WhatsApp. During the data collection phase, 456 responses were obtained from different participants. The KMO test was employed to assess sampling adequacy, which indicated that the sample was sufficient. The measures were derived from previous studies on the intention to adopt BCT (see Online Appendix 2).

We selected a sample of more diverse and representative participants to enhance sampling adequacy and minimize potential biases in the study. We achieved this by ensuring that various demographics, including gender, management level, and educational background,

were represented proportionally. This approach addresses the overrepresentation of certain groups, such as middle management males, and contributes to a more balanced perspective on BCT adoption. Furthermore, including SMEs from different regions and industries across India will improve the overall applicability of the findings. We prioritized the anonymity of responses to minimize biases and ensured that survey questions were carefully constructed to avoid leading influences on respondents' answers. Lastly, we conducted pre-survey testing with a diverse pilot group and adjusted the questionnaire based on their feedback. This process helps identify and address potential sources of bias before the full-scale data collection begins.

Thorough analysis and adjustments were based on initial feedback from 23 individuals, including managers and academics. The items were assessed using a seven-point scale ranging from 1 ('strongly disagree') to 7 ('strongly agree'). Most SMEs analyzed were 15 years old or younger. Male participants constituted 67.54% of the sample. A significant number of individuals hold diplomas (43.2%) and work in middle management positions (37.94%) (Table 2). The SLS is high among the SMEs.

Table 2: Demographic Details

Demographic Measures	Category	(n=456)	
		Frequency	Percentage
Organization Age	Less than or equal to 15 Years	259	56.80%
	More than 15 years	197	43.20%
Gender	Male	308	67.54%
	Female	148	32.46%
Profile of employees	Junior Manager	167	36.62%
	Middle-level Manager	173	37.94%
	Senior Manager	116	25.44%
Education	Diploma	197	43.20%
	Graduate	147	32.24%
	Post Graduate	112	24.56%
Senior Leadership Support	High	320	70.18%
	Low	136	29.82%

3.2.3 Analysis and Results

Our study adopted PLS-Structural Equation Modeling (PLS-SEM) using the Smart PLS package to conduct our analysis. This method is increasingly popular among researchers due to its capacity to address complex research questions. A key feature of PLS-SEM is its ability

to manage models that include multiple variables and relationships, unlike other SEM procedures. Consequently, this is beneficial for unraveling the factors that contribute to the phenomenon under investigation. Moreover, a focus on predictive accuracy aligns with studies aimed at identifying crucial elements that lead to specific outcomes. Unlike other SEM techniques, PLS-SEM does not strictly require normality assumptions when analyzing data, offering greater flexibility [6]. Thus, PLS-SEM proves extremely valuable for interdisciplinary researchers seeking to understand the intricate connections between various academic fields and use them to predict or accurately forecast future events.

The model's performance in the SLS context was assessed in three stages of the study. Important insights are derived from comparing estimated path coefficients. Our analysis primarily involves evaluating measurement and structural models, along with conducting multi-group analyses. We perform preliminary checks on the results obtained before the primary analysis stage to ensure reliability. These checks include examining the normality of data and identifying any potential common method biases.

Common Method Bias (CMB) must be considered in studies where a single source measures both independent and dependent variables. This study employed a procedural approach to address CMBs. This approach is more effective than statistical methods because it takes methodological issues into account prior to data collection. Therefore, testing for multicollinearity was necessary before hypothesis testing. To detect significant multicollinearity, all VIF values were assessed against established criteria [83]. A VIF of five or less indicates that no multicollinearity exists. No significant multicollinearity concerns were found, as VIF values remained below the threshold [83]. Thus, this alleviated concerns, allowing the authors to proceed with hypothesis testing confidently. In other words, the absence of a standard method indicates evidence of bias. Online Appendix 2 illustrates factor loadings across different periods, questions, and source constructs.

Before analyzing the structural model, we established the measurement model by confirming both convergent and discriminant validity. Convergent validity is typically achieved when the loading and composite reliability (CR) are above 0.7, and the average variance extracted (AVE) is greater than 0.5. Table 3 presents the results of the convergent validity test for the science and social science programs. Based on the provided data, it is clear that the loading, AVE, and CR values all exceed the designated thresholds. Specifically, the loading and CR values are above 0.7, while the AVE values exceed 0.5. The presence of convergent validity has been confirmed in this study.

Table 3: AVE, CR & Reliability Values

Constructs	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
PSS	0.798	0.8	0.881	0.712
RCE	0.804	0.805	0.884	0.718
IBT	0.922	0.922	0.944	0.81
LDT	0.817	0.828	0.891	0.731
PUE	0.837	0.842	0.902	0.754
VUCA	0.836	0.837	0.901	0.753

Establishing discriminant validity is crucial in any research framework to demonstrate that a construct differs from other constructs based on empirical evidence. For the discriminant validity to be considered valid, the heterotrait-monotrait (HTMT) ratio values must remain below 0.9. Table 4 presents the results of the HTMT analysis, showing that all values were below the specified threshold. The study has successfully established discriminant validity, confirming each construct's distinctiveness in the research framework.

Table 4: HTMT Results

	PSS	RCE	IBT	LDT	PUE	VUCA
PSS						
RCE	0.584					
IBT	0.637	0.709				
LDT	0.622	0.514	0.627			
PUE	0.675	0.462	0.569	0.592		
VUCA	0.638	0.571	0.692	0.73	0.613	

The results presented in Table 5 provide strong support for all hypotheses except two in the complete sample. The findings from each category sample closely align with the overall sample. Notably, all hypotheses are significant, except for two in the overall sample. After

hypothesis testing, the model's ability to explain the data is assessed. The R-squared (R2) values for the endogenous variables are 33%, 17.7%, 50.3%, and 31.8% for PSS, RCE, IBT, and PUE, respectively. The study's predictive relevance was determined by analyzing Q-squared (Q2) values. The values for the endogenous constructs, PSS, RCE, IBT, and PUE, are 0.319, 0.17, 0.337, and 0.311, respectively, indicating varying levels of predictive relevance across the samples. Understanding the impact of independent variables on the dependent variable is crucial for grasping the magnitude of their effects. Effect sizes of 0.02 are considered small, 0.15 medium, and 0.35 significant [85]. Table 4 presents the f2 values. SLS significantly moderated the relationship between SLS and RCE but had no moderating effect on SLS & PSS and SLS & PUE. The model fit values are SRMR = 0.046 and NFI = 0.855, demonstrating a solid fit for both time frames.

Table 5: Hypothesis Results

Hypothesis Relationship	Beta	T value	P-Value	2.50%	97.50%	f-square	Decision
H1a: LDT -> PSS	0.3	5.668	0	0.185	0.396.6%	0.085	Supported
H1b: LDT -> RCE	0.421	9.349	0	0.325	0.501	0.215	Supported
H1c: LDT -> PUE	0.291	5.993	0	0.193	0.384	0.079	Supported
H2a: VUCA -> PSS	0.341	6.571	0	0.237	0.439	0.11	Supported
H2b: VUCA -> PUE	0.339	7.446	0	0.247	0.427	0.107	Supported
H3: PSS -> IBT	0.208	3.785	0	0.1	0.317	0.039	Supported
H4: PUE -> IBT	0.181	3.477	0.001	0.079	0.282	0.031	Supported
H5: RCE -> IBT	0.479	9.52	0	0.379	0.573	0.269	Supported
H6a: SLS x PSS -> IBT	0.073	0.713	0.476	-0.123	0.276	0.001	Not Supported
H6b: SLS x PUE -> IBT	0.094	1.114	0.265	-0.077	0.258	0.003	Not Supported
H6c: SLS x RCE -> IBT	-0.237	2.028	0.043	-0.466	-0.02	0.015	Supported
	R-square	Q² predict					
PSS	0.33	0.319					
RCE	0.177	0.17					
IBT	0.503	0.337					
PUE	0.318	0.311					

Before conducting a Multi-Group Analysis (MGA), establishing measurement invariance is essential to determine the most suitable type of MGA to employ. The Measurement Invariance of Composite (MICOM) method in Smart PLS was specifically

designed to accommodate the unique characteristics of Smart PLS [86], distinguishing it from covariance-based Structural Equation Modeling (SEM) techniques. The MICOM method consists of three key steps: assessing configural invariance, evaluating compositional invariance, and ensuring equal means and variances (Table 6). Partial measurement invariance is established after completing the first and second tests, allowing meaningful comparisons between different groups. When all three steps are fulfilled, comparisons can be made both between groups and for the entire group, achieving complete measurement invariance. Through careful analysis, we ensured that the indicators, data treatment, and algorithm settings remained consistent across both groups. The study successfully passed this initial step of configural invariance, thanks to the meticulous and systematic recording and treatment of data. An analysis using MICOM was conducted for steps two and three, as outlined in Table 5. From the findings, we determined that compositional invariance was present. Based on the permutation p-values, we concluded that the original correlation for each variable did not significantly differ from 1, as the p-values were greater than 0.05. Furthermore, in the third step of the study, full measurement invariance was successfully achieved. It was evident from the permutation p-value for the confirmation construct that it exceeded 0.05. No notable distinctions exist in SLS, whether high or low. Consequently, the study achieved complete invariance, enabling a comprehensive comparison across the group.

Table 6: Measurement Invariance Assessment (MICOM)

MICOM Procedure		Configural Invariance	Compositional Invariance		Partial Invariance Established	Equal Mean Assessment		Equal Variance Assessment		Full Variance Established
			Original Correlation	Permutation p-Values		Original Difference	Permutation p-Values	Original Difference	Permutation p-Values	
Senior Leadership Support (High vs Low)	PSS	Yes	0.999	0.345	Yes	-0.075	0.452	0.08	0.654	Yes
	RCE	Yes	1	0.894	Yes	0.07	0.49	0.484	0.026	No
	IBT	Yes	1	0.603	Yes	-0.11	0.297	0.193	0.265	Yes
	LDT	Yes	0.999	0.605	Yes	0.011	0.926	-0.109	0.496	Yes
	PUE	Yes	1	0.61	Yes	-0.025	0.782	-0.136	0.275	Yes
	VUCA	Yes	0.999	0.518	Yes	-0.131	0.195	0.227	0.131	Yes

The results for both groups revealed no significant differences when we examined the Multiple Group Analysis (MGA) outcomes. Using PLS-MGA, we investigated disparities by applying the MGA test to data from both categories. Table 7 illustrates the variations in path coefficients between the two datasets. Except for one, none of the hypotheses for MGA were supported. Consequently, the results did not provide evidence in favor of the hypotheses, except for one. Table 7 outlines the variations in path coefficients observed.

Table 7: Multi-Group Analysis

Relationship	PLS MGA		Decision
	Difference (SLS_H - SLS_L)	P value (2-tailed)	
PSS -> IBT	-0.087	0.408	Unsupported
RCE -> IBT	0.272	0.013	Supported
LDT -> PSS	-0.134	0.197	Unsupported
LDT -> RCE	-0.002	0.967	Unsupported
LDT -> PUE	0.086	0.396	Unsupported
PUE -> IBT	-0.137	0.101	Unsupported
VUCA -> PSS	0.035	0.729	Unsupported
VUCA -> PUE	-0.098	0.299	Unsupported

4. Discussion

As SMEs navigate the complexities of digital transformation, BCT has emerged as a promising yet challenging innovation. Despite its potential to enhance transparency, efficiency, and security in business operations, SMEs often struggle with its adoption due to concerns about usability, regulatory uncertainties, and resource constraints. This study seeks to bridge this gap by examining the key factors influencing SMEs' intention to adopt BCT to provide a comprehensive understanding of this phenomenon. Specifically, we explore how digital transformation and VUCA environments shape perceptions of BCT's usefulness, ease of use, and resilience-building potential. Additionally, we investigate the moderating role of SLS in facilitating BCT adoption, shedding light on whether strong leadership can enhance an SME's capacity to leverage resilience for digital transformation. This research unpacks these relationships to provide valuable insights into the strategic and technological factors that drive

or hinder BCT adoption. It offers both theoretical advancements and practical guidance for SMEs, policymakers, and technology providers in emerging and resource-constrained markets.

The first hypothesis we test in this study concerns the impact of digital information on perceived usefulness in the context of BCT implementation in SMEs (H1a). In today's fast-paced business world, SMEs rely on easy access to real-time digital information to make informed decisions [87]. Having abundant digital details at one's disposal can significantly enhance its perceived usefulness by fostering more informed decision-making. People can carefully compare options based on their needs by relying on data sources and understanding how this technology can improve their lives. This process instills greater confidence in users that the device will be valuable.

Similarly, digital information enhances the perceived ease of use of BCT for SMEs considering its implementation (H1b). With clear instructions and real-world examples, users gain confidence in learning about and navigating these systems, especially in contexts with significant uncertainty surrounding business transactions recorded using BCT. Furthermore, digital information enhances the resilience of SMEs adopting BCT (H1c). Digital information responds to the pressing need for SMEs to acquire up-to-date knowledge about market trends, regulatory changes, and emerging technologies [88] and equips people to be more prepared for anticipated disruptions, increasing their resilience. Access to current information, historical trends, and proven practices enables individuals or entities to identify potential pitfalls, anticipate substitutes or better practices, and learn from past experiences, which offers various options based on robustness, such as developing digital skills among staff or improving flexibility.

Furthermore, VUCA environments prompt firms investing in BCT to reevaluate how they perceive value creation, fully decoding complexities like the uncertainties surrounding BCT utility (H2a) [11]. SMEs encounter significant challenges in maintaining competitiveness

and flexibility in the VUCA world [89]. In such an environment, traditional approaches may become ineffective, driving individuals and organizations to seek guidance during implementation stages while supporting personnel in managing uncertainty, ultimately making them more open to the potential benefits of newer technologies, which boosts their appeal for gaining a competitive edge or enhancing stability.

Similarly, the VUCA environment positively influences SMEs' perceptions of the ease of using BCT (H2b) [11]. The complexity of a VUCA world may heighten the perceived ease of use in adopting new technologies. In a VUCA environment, customers may favor technologies that are easy to understand and adapt to. Thus, developers can be encouraged to enhance more intuitive graphical user interfaces with appropriate training resources [87].

Moreover, SMEs' perceived usefulness of BCT enhances the intention to adopt it (H3). When individuals recognize how BCT can effectively tackle their issues, boost productivity, or offer other advantages such as secure transactions and transparent supply chains, they are more likely to invest time and resources in implementing it [90]. BCT is increasingly sought after as it ignites organizations' desire to integrate it into their operations.

The extent to which SMEs believe that BCT is easy to use also contributes to the intention to adopt it (H4). Viewing BCT as friendly, with simple user interfaces and readily available training resources or support from robust communities, encourages consideration of its acquisition [91]. This alleviates doubt while reinforcing the inclination to allocate funds for training alongside learning what is necessary to execute any blockchain-related plans, thus boosting the determination of firms' management teams to embrace this innovative concept.

Furthermore, the level of resilience significantly affects SMEs' intention to adopt BCT (H5). BCT improves resource allocation processes, streamlines operations, and mitigates fraud risks, enabling firms to manage challenges swiftly and recover more effectively. Therefore, organizations that prioritize resilience are highly likely to adopt BCT.

However, SLS may have little relevance to the relationship between the perceived usefulness and intentions to adopt BCT in SMEs (H6a). The impact of perceived usefulness is not conditioned by SLS. Also, SLS may not significantly impact the relationship between perceived ease of use and SMEs' intention to adopt BCT (H6b). Firms tend to focus more on individuals' ease of using technology rather than SLS. While SLS may be crucial in fostering a supportive environment for embracing technological advancements, it may not directly moderate how perceived ease of use influences intention to adopt BCT. Employees might still find it challenging to adapt or even make progress despite strong SLS. In SMEs, where resources are limited and expertise is scarce, the ease of using BCT may hinge more on an individual's familiarity with digital tools and the technology's simplicity rather than top-down SLS [92]. Thus, while leadership affects resource allocation decisions in SMEs, it does not necessarily shape personal perceptions regarding how easy a particular technology is to use.

However, SLS significantly strengthens the role of resilience in the intention to adopt BCT among SMEs (H6c). Firms with high SLS are better positioned to leverage their resilience toward BCT adoption. Consequently, strong SLS is essential for encouraging SMEs' adoption of BCT. SLS helps employees feel secure enough to navigate obstacles such as resistance to new ideas, resulting in a positive attitude shift toward innovation. This showcases a confident, proactive approach and fosters a sense of assurance among employees. Such leadership and resilience are critical in guiding the BCT adoption process. What sets SLS's role in fostering organizational resilience apart is that how leaders engage and promote technology adoption significantly strengthens the role of resilience in BCT adoption. As such, SLS is vital during the implementation of BCT in SMEs.

5. Theoretical Implications

This study enriches the emerging literature on SMEs' adoption of BCTs [1], [2] by integrating the TAM and the DCV, offering a nuanced understanding of the interplay between technology

acceptance, resilience, and digital transformation in VUCA environments. It incorporates perceptions of technology and capabilities in strategy formulation as determinants of adoption behavior. The study tests the perceived usefulness and perceived ease of use of SMEs in the BCT context [1],[7], corroborating TAM's assertion that decisions regarding technology adoption are critically based on the benefits and resources derived from it. The conclusion aligns with previous research and notes that, despite the ample information available to SMEs about BCT's potential and functionality, these firms must understand TAM as the new paradigm for early adoption. Moreover, the study refines TAM by demonstrating how, in the conditions of a VUCA world, perceptions of usefulness and ease of use become more fluid and responsive to market and technological changes. Unlike traditional applications of TAM that often emphasize individual behavioral intent, this study highlights the organizational-level drivers of adoption, emphasizing the role of VUCA environments and digital information transformation in shaping SMEs' BCT adoption. This bolsters technology acceptance literature by suggesting that the heightened need for familiarity and support with technology in the external operating environment indicates that the strategic rather than operational context of BCT is viable.

This framework is further strengthened by the DCV perspective, which illustrates how enabling resilience in SMEs helps integrate BCT into their processes. Unlike TAM, which emphasizes the behavioral components of adoption, DCV highlights the significance of digital transformation, market awareness, and leadership-enabled agility as crucial factors that assist SMEs in navigating uncertainties. This study contributes to the discussion of DCV as it pertains to BCT adoption, arguing that in high-VUCA contexts, SMEs that invest in developing dynamic capabilities such as resilience and digital transformation are better positioned to adopt BCT. This perspective is novel within existing studies; as we argue, BCT is not merely a

technological innovation but also a strategic enabler, significantly enhancing process efficiency, reducing the likelihood of fraud, and increasing transparency.

Moreover, the study raises questions about traditional interpretations of SLS in relation to technology adoption. While existing literature indicates that top-down leadership is crucial for guiding digital transformation [93], this study finds that SLS does not significantly moderate the relationships between perceived usefulness, ease of use of technology, and adoption intentions. However, SLS does strengthen the link between resilience and BCT adoption intentions, reinforcing the idea that strong leadership is essential for leveraging resilience amid uncertainty. This demonstrates how the DCV perspective can be refined by showing that, as the primary adopters of BCT, leaders—through resilience rather than direct perceptions of utility and usability—play a crucial role in its adoption among SMEs. These findings suggest that the role of leadership extends beyond facilitating technology deployment through influence; it also involves acting as tactical leaders to strengthen an organization's resilience in uncertain times.

In advancing theoretical perspectives on technology adoption in SMEs, this study integrates both individual perceptions of technology and the firm's strategic agility through the TAM and DCV frameworks. It also illustrates how perceived usefulness and ease of use, rather than being purely subjective constructs, are influenced by the external business environment, thereby extending the TAM. Simultaneously, the study shows that BCT adoption goes beyond dynamic capabilities, refining the DCV by emphasizing the firm's ability to view technology as a valuable and usable asset. Consequently, this study offers a comprehensive explanation of BCT adoption and highlights the need for aligned technological readiness and resilience among SMEs to drive digital transformation.

6. Practical Implications

The findings of this study provide several crucial insights for SME managers, policymakers, and technology providers seeking to promote BCT adoption in SMEs. First, considering the significant impact of digital information on perceived usefulness and ease of use, SME managers should invest in digital literacy training and data analytics tools to improve decision-making. Granting employees access to real-time market trends, regulatory updates, and best practices can boost confidence in BCT's advantages while minimizing the uncertainty linked to implementation. Furthermore, utilizing user-friendly digital platforms that deliver clear guidance on BCT applications can help facilitate the transition.

Furthermore, since perceived usefulness and perceived ease of use strongly influence BCT adoption, managers should emphasize tangible benefits such as improved security, operational efficiency, and cost reduction when introducing BCT to employees and stakeholders. Encouraging pilot programs or small-scale implementations can serve as proof-of-concept initiatives, helping employees and business partners experience BCT's advantages firsthand and reducing resistance to change. Moreover, investing in intuitive interfaces, simplified workflows, and customized training programs can further enhance ease of use, making adoption more seamless.

Additionally, the strong link between resilience and BCT adoption underscores the need for SMEs to view digital transformation as a long-term strategy rather than a short-term trend. SMEs that proactively develop resilience by improving resource allocation, workforce upskilling, and cybersecurity infrastructure will be better positioned to integrate BCT effectively. Managers should find ways to embed resilience into the organizational culture, ensuring that BCT adoption is sustained even during economic or technological disruptions. SMEs can also leverage the results of our study to find solutions for digital transformation and navigate uncertainty in adopting BCT. This indicates that SMEs must cultivate a culture of innovation and encourage employees to utilize technology daily. It also means that resilience

propels SMEs toward BCT adoption. This strategy should be supported by an environment conducive to disruptive innovations, including BCTs.

Furthermore, this research demonstrates that SLS is a key catalyst of resilience in the adoption of BCT. This suggests that while SLS alone cannot directly drive BCT adoption, it is instrumental in fostering a resilient organizational environment that enables successful implementation. Managers can secure SLS by controlling resource allocation and offering guidance during implementation phases while addressing personnel needs, among other matters. Consequently, senior executives who promote creative thinking through new approaches create opportunities for translating resilience into BCT adoption, thereby fostering a shared understanding of firm objectives across different levels.

7. Limitations and Future Research

This study provides important insights into the motivations behind SMEs' adoption of BCT amid digital transformation and uncertainty, but one should be aware of certain critical limitations. First, its findings are not generalizable to other firms with differing resource capabilities determined by various resource allocation methods. Second, the cross-sectional nature of the study limits the ability to test causal relationships between variables over time. Furthermore, self-reported data may introduce bias.

Additionally, there is a need to include larger samples in exploratory longitudinal studies on how adoption progresses under different conditions for SMEs that tend to adopt BCT during periods of change. This approach allows qualitative researchers to understand the contextual factors influencing the purchase decision-making process among SMEs aiming to establish a business involving similar products or services, such as restaurants or clothing shops. It also highlights the necessity for more research to examine how external factors like regulatory frameworks and industry forces influence decisions made by SMEs regarding the

integration of BCT into their operations. Our understanding is that creativity comes with uncertainties.

8. Concluding remarks

This study offers a thorough analysis of the factors influencing BCT adoption in SMEs, integrating insights from both the TAM and DCV. The findings emphasize that access to digital transformation is crucial in shaping SMEs' perceptions of BCT's usefulness, ease of use, and potential to enhance resilience in VUCA environments. Moreover, the study confirms that in high VUCA environments, SMEs recognize the necessity of digital transformation, making them more open to BCT. Additionally, this research reinforces the significance of perceived usefulness, perceived ease of use, and organizational resilience as key drivers of BCT adoption. SMEs that view BCT as beneficial and easy to implement are more likely to adopt it, further supporting the relevance of TAM in digital transformation research. Also, SLS plays a vital role in strengthening the relationship between resilience and BCT adoption. This finding highlights that strong leadership ensures that resilience translates into actionable BCT adoption strategies. Ultimately, this study offers valuable theoretical contributions by extending TAM and DCV to the SME context in emerging markets, emphasizing the role of external market conditions and internal strategic capabilities in digital technology adoption. From a practical perspective, the research provides actionable insights for advocating targeted interventions. As blockchain adoption continues to evolve, future research should explore industry-specific applications and long-term impacts on SME competitiveness, ensuring that firms can effectively harness BCT's full potential in an increasingly digitalized economy.

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Online Appendices

Online Appendix 1: Classification of Codes

Zero Order	First Order	Second Order
Our company has invested heavily in digital transformation over the past few years. We have implemented cloud solutions that allow us to use technology more effectively, upgraded all our systems, and streamlined our processes. Blockchain adoption perfectly matches our digital strategy as it provides a secure and transparent platform for conducting transactions.	We invest in digital transformation, favoring blockchain adoption	Level of Digital Transformation
As a manager of small and medium-sized enterprises (SMEs), I am very much aware of the challenges the VUCA environment poses. It seems like uncertainty is the only thing that can be certain in today's business world, given continuous market pressures. However, in this chaos, there exists some order represented by blockchain technology, which brings about certainty where there was none before. Despite all its complexity and ambiguity, this system gives us control over what happens with our transactions through decentralization and transparency features. Therefore, adopting blockchain technology should be seen as a tactical move and a survival skill necessary for thriving in turbulent times like these.	The volatile market demands the reliability that blockchain offers.	VUCA
Considering the importance of perceived usefulness in taking a position on adopting emerging technologies like blockchain, as managers in small and medium enterprises (SMEs), we are always looking at what benefits technology can bring to our business. Our organizational goals are best met when efficiency, security, transparency, and other things are enhanced by this distributed ledger system called blockchain. It is not enough for us to keep up with trends – we need them to work for us, too, helping our organizations achieve tangible improvements that will enable us to stay competitive within any given market context.	Blockchain's benefits drive our technology adoption decisions.	Perceived Usefulness
When evaluating whether or not to implement blockchain systems, one thing is most important – ease of use perception. User-friendly solutions should be adopted by SME managers who know that staff may be less willing or able than expected when it comes to training on new systems. A user interface with intuitive features and a seamless integration process will make the technology less intimidating. We want a technology solution that can be easily understood and used without much assistance or long-term training needs.	Ease of use is crucial for SMEs to adopt blockchain.	Perceived Ease of Use
The issue surrounding resilience becomes very significant during deliberations over whether we should adopt this digital transaction record-keeping platform, blockchain systems. As SME administrators, we have realized how vital it is for businesses like ours to create strong structures that can survive unforeseen events easily while continuing normal operations. The fact file shows that blockchain has intrinsic elements that enhance security, thus making them more reliable than centralized databases, thereby enabling companies to strengthen their capacity against such risks. This means that by embracing these abilities provided by blockchain technology, we shall effectively deal with data breach threats and bolster the transactional credibility necessary for maneuverability in turbulent business environments.	Blockchain enhances SME resilience amid uncertainties.	Resilience
Our decision to implement blockchain platforms stems from our strategic objective of improving processes to stay competitive within the current setting. As managers in small and medium-sized enterprises (SMEs), we understand how much impact technological advancements could have on various operational methods used by businesses to attain efficiency and transparency. We see it as necessary for us to point out that the main reason we want to adopt this kind of technology is that we need an edge over our competitors and to reduce expenses by using up-to-date methods in conducting activities. Blockchain is a game changer that aligns with our long-term business objectives, empowering us to respond appropriately even when market dynamics change rapidly.	SMEs adopt blockchain for modernization and competitive advantage.	Intention to Adopt Blockchain Technology

Online Appendix 2: Constructs, Sources, and Factor Loadings

Constructs	Item Nos.	Items	Sources	FL	VIF
Level of Digital Transformation (LDT)	LDT1	Our company is actively involved in the process of digital transformation.	[42]	0.85	1.721
	LDT2	By utilizing technology solutions, we can convert this data into an easily understandable format, helping us gain insights from the information we collect.		0.887	2.004
	LDT3	We use technology solutions to make forecasts that aid in our preparation for the future.		0.827	1.786
VUCA	VUCA1	Blockchain technology can reduce volatility resulting from risk dynamics and velocity.	[11]	0.851	1.849
	VUCA2	Blockchain technology can reduce uncertainty and complexity by providing more information and contextual awareness.		0.868	1.93
	VUCA3	Blockchain technology can help minimize ambiguity by reducing confusion, subjective judgment, and strategic misalignment.		0.884	2.124
Perceived Usefulness (PSS)	PSS1	Blockchain technology enables the efficient tracing and tracking of information about processes for risk management.	[11]	0.845	1.785
	PSS2	Blockchain technology enables secure transactions for risk management purposes.		0.848	1.651
	PSS3	Blockchain technology facilitates effective communication with customers and suppliers to manage risks.		0.838	1.688
Perceived Ease of Use (PUE)	PUE1	It would be effortless to utilize blockchain technology.	[11]	0.838	1.804
	PUE2	I find blockchain technology to be straightforward and understandable.		0.875	1.988
	PUE3	Mastering blockchain technology for risk management should come quickly to me.		0.892	2.221
Resilience (RCE)	RCE1	We can handle and adapt to changes that arise from disruptions and emergencies.	[42]	0.829	1.617
	RCE2	We can easily adjust to the disruption.		0.867	1.859
	RCE3	We are constantly aware of our surroundings and stay alert at all times.		0.846	1.78
Intention to Adopt Blockchain Technology (IBT)	IBT1	I foresee my company embracing blockchain technology in the future	[84], [42]	0.895	3.05
	IBT2	In the near future, I anticipate incorporating blockchain technology into my work.		0.904	3.156
	IBT3	Our company plans to revolutionize operations and supply chain management by implementing blockchain technology, a cutting-edge digital transformation strategy.		0.885	2.723
	IBT4	In the future, my organization will incorporate blockchain technology to improve risk management.		0.914	3.492