Technology in Society 68 (2022) 101927

Contents lists available at ScienceDirect

Technology in Society

journal homepage: www.elsevier.com/locate/techsoc

Behavioural antecedents to blockchain implementation in agrifood supply chain management: A thematic analysis

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ARTICLE INFO

Keywords:
Agri-food sector
Behaviour
Blockchain
Supply chain management
Partnerships

ABSTRACT

Despite its perceived utility, several companies and managers continue to hold reservations about blockchain implementation in supply chain management. To elucidate the causes, we examine the behavioural and organisational antecedents that influence the adoption of blockchain technology in supply chain management. To do this, we undertake thematic analysis on blockchain-related agri-food business news and expert opinions from the Ovid database's Agricola section. Four themes are central to our model: organisational adoption strategies, technical advantages, environmental obstacles, and implementation intention. Using these themes, we build a thematic map and derive three propositions about the role of behavioural antecedents to blockchain implementation intention in supply chains, thus substantiating Behavioural Reasoning Theory (BRT) and Technology Organisation and Environment (TOE) theory's core arguments. Our findings elucidate novel factors influencing blockchain adoption in supply chains. More specifically, we show that managers who consider the technological benefits associated with blockchain capacity are able to provide stakeholders with new opportunities and embrace adoption strategies such as product launch and partnership formation while also considering environmental and contextual barriers such as market fragmentation, scarcity of research, and regulatory restrictions.

1. Introduction

Blockchain is regarded as the next disruptive technology after the internet [1,2]. In managing traditional supply chains with multiple layers of stakeholders, blockchain is able to address counterfeiting and transparency concerns. The smart contracts and distributed ledger features of blockchain technology offer advantages in business process reengineering [3,4], and this has continued to generate increased research attention from supply chain management scholars [5,6]. Numerous studies have examined the factors influencing blockchain adoption in businesses [7] and supply chain management [8–11]. Several applications were analysed in the food supply chain [12], such as the information system architecture for a blockchain-managed supply chain in the grape wine industry [13]and a cooperative model for sustainability in e-agricultural supply chain management [14]. The extant literature on the precursors to blockchain adoption in supply chain management [7,8,15] has dwelt extensively on the models of technology acceptance, especially the Unified Theory of Acceptance and Use of Technology (UTAUT), which includes behavioural models such as Theory of Planned Behaviour (TPB) and Theory of Reasoned Action (TRA). While the TRA explicates the predictive role of managers' intentions in their implementation behaviour, the TPB maintains that managers who have a positive attitude towards blockchain feel social pressure to implement it, and believe that it is easy to implement, are more likely to invest in blockchain for managing their supply chains.

Additionally, there are strands of studies that focus on the broad framework, adoption determinants, and challenges [13,16,17], with a heavy emphasis on the technology, organisation, and environment (TOE) framework and a few studies [15] on behavioural considerations in blockchain adoption. Despite the amount of research on the deployment of blockchain in supply chains, certain issues remain unresolved. For example, UTAUT, one of the most extensively applied theories, ignores context-specific rationales (or justifications) for implementation behaviour. Thus, the conceptual models used in the studies that incorporated UTAUT generally neglect the notion that reasons are significant determinants of adoption behaviour, as the (BRT)central premise asserts [18]. Furthermore, various studies have examined the potential benefits of blockchain deployment in supply chain management, but only a few have attempted to analyse blockchain acceptance based on individual and organisational behaviour [17]. Despite the positive research trend, empirical research in this subject is still scarce, as there are few examples

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https://doi.org/10.1016/j.techsoc.2022.101927
Received 14 November 2021; Received in revised form 2 February 2022; Accepted 4 February 2022
Available online 8 February 2022

Abbreviations

TAM	Technology Acceptance Model
UTAUT	Unified Theory of Acceptance and Use of Technology
DEMATEL	Decision Making Trial and Evaluation Laboratory
TOE	Technology, Organisation and Environment
DOI	Diffusion of Innovation
BRT	Behavioural Reasoning Theory
SCM	Supply Chain Management
TRI	Technology Readiness Index
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action TRA

of blockchain-based supply chain management in practice [19], and some of the criteria necessary for effective implementation remain unknown. Furthermore, there is a need for additional empirical investigation on blockchain implementation within specific industries or referring to specific objectives [8,12,20].

Our study therefore chooses to advance knowledge in the areas of blockchain and supply chain management by empirically examining the behavioural and organisational factors driving blockchain implementation in agri-food supply chain management. To this aim, we explore the behavioural and organisational factors affecting blockchain implementation by analysing what happens in the agri-food sector, based on data from business news and expert commentaries. This study makes three significant contributions. First, we develop a framework for explaining the behavioural precursors to blockchain implementation through the interaction of individual traits and technical, organisational, and environmental factors. Second, we contribute to managerial practice by increasing the understanding of organisational adoption strategies that determine the success of blockchain implementation in the supply chain and can be influenced by environmental barriers. Third, by examining our research question in the agri-food sector, we uncover new determinants of blockchain adoption in supply chains; our findings are thus useful for stakeholders in the agri-food industry, as they suggest new reasons for blockchain adoption, thereby increasing blockchain utilisation and making the agri-food supply chain more traceable and reliable. In summary, our study is rooted in the idea that intentions are considered a good proxy for studying action [21]. Following this line of reasoning, we raise the research question:

How do behavioural factors affect the adoption of blockchain technology in supply chain management?

Having introduced the study in this section, the remaining parts are thus structured. Section 2 presents the materials and methods, Section 3 includes the results, Section 4 discusses the findings, and we conclude the study in Section 5.

2. Materials and methods

The purpose of this study is to determine how behavioural factors affect the application of blockchain technology in the agri-food supply chain. Our desire to investigate the behavioural aspects of blockchain implementation in the agri-food supply chain is prompted by several factors. First, the supply chain suffers accountability and traceability issues as a result of the enormous number of people and procedures involved in moving food items from the farm to the market, generating concerns about food safety and global food security. In addition, supply chains are characterised by uncertainties regarding decision-making by stakeholders [22], thus making the achievement of efficiency a cumbersome process [23]. Moreover, it is pertinent to address the challenges of transforming industrial materials and taking them through the supply network, thus necessitating full deployment of the triple bottom line concept to attain sustainable management [24]. Worldwide agri-food production is vulnerable to pests and diseases, weather fluctuations, and high transaction costs. Additionally, the recent epidemic necessitates restricted physical interactions between supply chain entities, hence raising the value chain's uncertainties, risks, and complexities. In this dispensation, digital technologies have proven to significantly influence consumer behaviour [25] and supply chain network design [26]. Thus, managing a safe and sustainable agri-food supply chain implies many challenges that can be addressed with the utilisation of blockchain technology. This has aroused research interest among supply chain management scholars. In this regard, the framework, adoption barriers and precursors of blockchain implementation in supply chains have been studied [10–12]. Some studies take the organisational approach, while only a few approach the subject matter from the individual perspective, and none have integrated both approaches. Therefore, to the best of our knowledge, our study is the first to investigate the organisational and individual behavioural factors affecting blockchain implementation in supply chain management.

We used a qualitative methodology that enables the emergence of generalisable themes from data [27] because blockchain is still a new technology with limited implementation in supply chain management [10]. This is due to the early stages of blockchain implementation in the agri-food supply chain [28] possibly requiring exploratory analysis. The analysis is therefore based on news from the agri-food value chain extracted from the Ovid database's [29] 'agricola media sector', using the keyword 'blockchain' and specifying the publication years as 2018–2020 to guarantee that only recent items are included. This section contains industry news stories from a variety of media outlets, as well as expert commentaries on the use of blockchain in the agri-food supply chain.

Following the initial search, we manually examined business news and expert commentaries from 77 sources to determine which sources were acceptable for evaluation based on their contents. To avoid reinventing the wheel, we remove journal publications in favour of press releases and business news from renowned international agri-food research institutes, media outlets, agri-businesses, and blockchain service providers. The article ought to incorporate news on blockchain technology and be explicit regarding the agri-food market. The 39 publications that result, which might be considered expert perspectives about blockchain in the agri-food value chain, are combined to produce our dataset, which we imported into NVivo 12 and utilise to perform thematic analysis using Braun & Clarke's six-step procedure [30]. Our analytical approach is summarised in Fig. 1.

As depicted in Fig. 1, we begin by familiarising ourselves with the dataset's contents, noting any intuitions that occur in response to our predefined research question. We next code the materials in a systematic manner, emphasising major areas of the information, as line-by-line coding is deemed inappropriate given the nature of our dataset. We examined the dataset carefully and produced codes through analysis, conceptualization, and constant comparison of its contents. We then organised the codes according to topics, which allowed for the formation of new themes. Following that, the themes were examined to ensure that each one logically captures the underlying codes, is clarified by the dataset's contents, and is also different from the others. By grouping and renaming the themes, explaining their relationships, and deriving meaning from the dataset, we polished them. Finally, we construct narratives that describe the data collection method and analytic results.

3. Results

We conduct thematic analysis on our dataset using the six processes stated in Refs. [30,32] and construct a thematic map as described in Ref. [31]. In the thematic map, links between topics are drawn based on insights from the dataset and existing literature. In general, we ensure validity by situating our study within an established theory [33], in this case, a paradigm constructed using a combination of BRT and the TOE framework. This ensures that our measures are comparable.

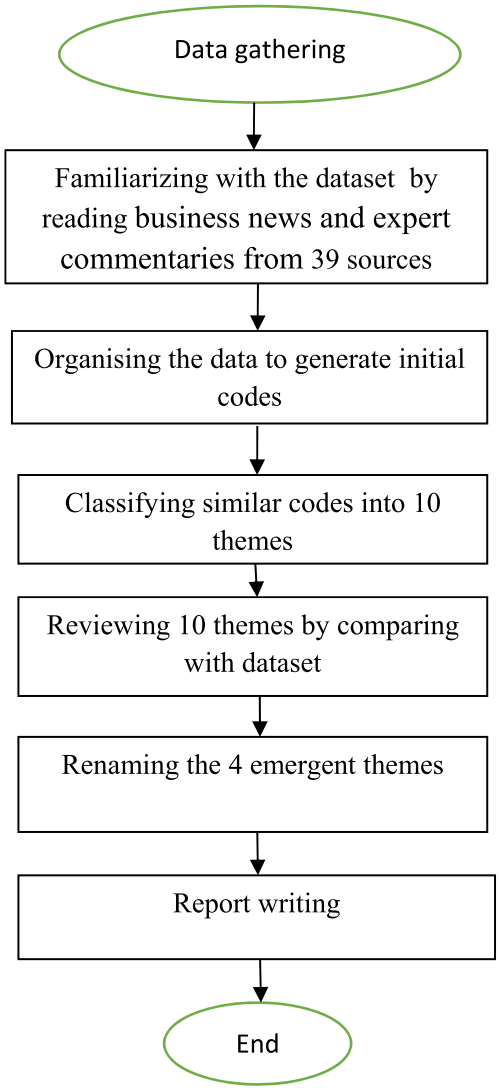

Fig. 1. Methodological approach (adapted from [30,31].

Additionally, we ensure the validity of our findings by ongoing interaction and observation [34]. Additionally, by fully recording the actions followed, we make our method traceable and replicable. The themes and their associated codes are summarised in Table 1, as is the relationship between each theme and its implementation aim.

3.1. The emerging themes

The analysis of news items reveals four major themes: technological benefits, organisational adoption strategies, environmental barriers, and intentions to implement blockchain. Five more subthemes are woven into these central topics. For example, 'organisational adoption methods' is divided into product launch and partnership strategies, while 'environmental barriers' includes market fragmentation, research intensity, and government regulations.

Theme 1. Technological benefits of blockchain in agri-food supply chains

Agri-businesses accrue numerous benefits due to blockchain technology's technical peculiarities. First, the potential of blockchain to improve agri-food product traceability is a large technological benefit. Additionally, blockchain technology can effectively store data, enabling improved access to protected data at reduced transaction costs. Then, by eliminating the demand-supply gap, enhancing consumer trust, and minimising food waste, blockchain contributes to streamlining supply chain complexity. All of these factors contribute to the overall performance of the supply chain.

The immutability of the blockchain assures data confidentiality and trustworthiness, as no partner has the authority to unilaterally modify any information recorded on it. This ensures that all supply chain stakeholders participate in decision-making, that choices must be unanimous, and that any necessary revisions must be agreed upon by all partners prior to becoming network-binding.

Table 1
Integrated themes, underlying codes, and sample references.

Integrated themes	Underlying codes	Sample references
Technological benefits-Blockchain implementation intention	Enhanced tracking, efficient storage, immutability, improved data access, new partnership opportunities, information reliability, lower transaction costs, increased commodity movements.	'Information generated through blockchain about nuances of supply chain can also help the stakeholders identify new opportunities across the globe to comply with customer needs and enable faster adoption of blockchain in the supply chain'.
	Accountability, entangled food chain, supply chain complexities, food borne diseases, food wastage, supply chain efficiency, real-time potential, consumer distrust, commodity sorting, demand-supply gap, stakeholder value	'To counter the concerns such as food wastage, lack of provenance data, delayed payments, and unavailability of crop insurance consumers and other supply chain stakeholders are increasingly demanding for improved transparency in the agriculture and food supply chain. Blockchain technology is pitched to be the leading contender in the agriculture and food system to streamline the handling of all these concerns'.
Environmental barriers –blockchain implementation intention	Market fragmentation, insufficient research, excessive regulations	'The market is highly fragmented with the presence of a huge number of small to medium sized companies'.
Organisation adoption strategies-Blockchain implementation intention	Partnership establishment, product launches, collaborations.	'Companies adopting strategies such as product launches, development and partnerships, collaborations, and joint ventures. Large number of players in the market are focusing on establishing partnerships to carry out pilot test projects. This key strategy has also been on a rise for successful implementation of blockchain'.

Theme 2. . Organisational adoption strategies for blockchain in agri-food supply chains

Adoption strategies refer to the processes and procedures that agri-food companies must follow to become familiar with and continue to use the blockchain. For example, some firms prefer to launch new products or services on the blockchain to increase their patronage by providing an opportunity for customers to become familiar with the technology. Similarly, other businesses build alliances using blockchain, ensuring that the technology is adopted by all organisations in the supply chain.

Theme 3. Environmental barriers to blockchain implementation in

agri-food supply chains

Throughout this context, environmental barriers relate to impediments to blockchain adoption in the supply chain that are primarily induced by environmental and contextual factors. Environmental barriers are essentially external constraints in the environment that can obstruct the operation of the blockchain. First, the agri-food supply chain is defined by geographically dispersed small and medium-sized firms that may lack technology expertise, financial capacity, and other enabling elements. Additionally, because blockchain technology is still in its infancy, additional research is necessary to ascertain how it adapts to and addresses supply chain concerns. Additionally, the government's extensive regulation of blockchain for business purposes may limit the technology's application potential.

Theme 4. Implementation intention

According to behavioural theories, intention is an excellent predictor for actual behaviour. Implementation behaviour is used in this context to refer to managers' intents or mental states on their commitment to using blockchain in supply chain management. Managers agree to deploy blockchain technology after carefully assessing the proper technological, organisational, and environmental considerations. Thus, the implementation objective is an excellent predictor of actual blockchain implementation efforts.

3.2. Theme integration

Following the identification of four themes that encompass the behavioural and organisational components of blockchain implementation in supply chain management, we examine how each of the remaining three themes connect to the outcome, namely, the implementation intention. Using existing literature as a guide [31], relationships between themes are developed by regular evaluation of their underlying codes and careful observation of the dataset to derive relevant conclusions. For example, as demonstrated by the sample data:

> 'Companies are adopting strategies such as product launches, development and partnerships, collaborations, and joint ventures. A large number of players in the market are focusing on establishing partnerships to carry out pilot test projects. This key strategy has also been on the rise for the successful implementation of blockchain' (Data extract from *Agricola*).

The relationship between organisational adoption strategies and implementation intention is such that the strategy employed by businesses when deploying blockchain has a significant impact on the outcome of blockchain operations. Having previously shown in the theoretical section that action is a suitable proxy for intention, a successful application of blockchain implies that a predetermination to adopt the technology existed prior to its actual deployment. Intuitively, there is a connection between organisational adoption strategies and the ambition to deploy blockchain, and this connection is such that strategy drives intention. Table 1 summarises the connection between themes.

3.3. Intentions to implement blockchain technology in agri-food supply chains

In this section, we examine the themes, their underlying codes, and the relationship between each theme and implementation behaviour, resulting in the formation of three valuable propositions.

Using two theoretical frameworks, TOE and BRT, to produce a concept that enables the TOE framework to be used to root the behavioural aspects affecting the application of blockchain in supply chain management. As depicted in Fig. 2, we propose a model that investigates the influence of technical advantages, organisational adoption strategies, and environmental barriers on the intention to use blockchain technology in agri-food supply chains.

Both behavioural and organisational components are included in the thematic map. For example, whereas the outcome, implementation intention, is a behavioural construct, benefits, barriers, and strategies are organisational constructs. The map was constructed using the themes derived from the underlying data, as detailed later.

3.3.1. Technological benefits-blockchain implementation intention

The technological benefits of utilising blockchain technology in agri-food supply chains include improved tracking, efficient data storage, immutability, increased data access, new cooperation options, and information reliability. According to the underlying algorithms, the blockchain enables players in the agri-food supply chain to track the flow of goods across the supply chain while also supporting effective food storage. Additionally, because a blockchain-based supply chain is immutable, it enables the detection of inaccurate data, guaranteeing that only reliable information is saved and distributed across supply chain partners. Food-borne disease epidemics have occurred in the food

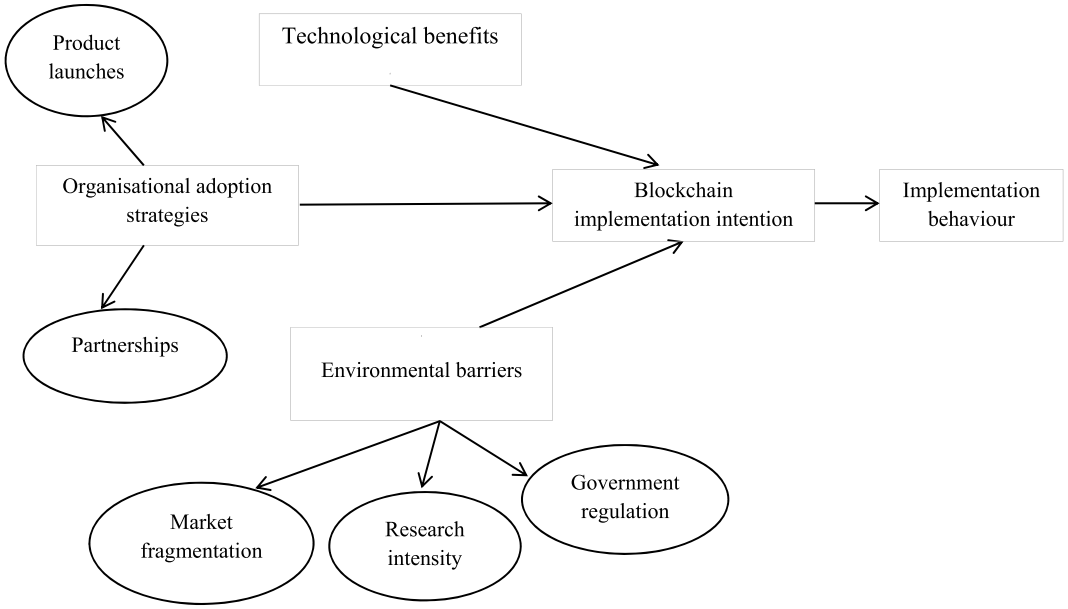

Fig. 2. Thematic map of the themes as identified from available data.

industry as a result of the actions of one or more agents along the supply chain; the blockchain's provenance and traceability capabilities enable the identification of infected food crops that are unfit for consumption, which can be easily sorted out to help prevent epidemics. Additionally, the data extraction explains:

> 'To counter the concerns such as food wastage, lack of provenance data, delayed payments, and unavailability of crop insurance, consumers and other supply chain stakeholders are increasingly demanding improved transparency in the agriculture and food supply chain. Blockchain technology is pitched to be the leading contender in the agriculture and food system to streamline the handling of all these concerns'(Expert commentary extracted from *Agricola*).

Managers are more receptive to incorporating blockchain technology into their supply chain when they have a firm grasp of its technical utility. This demonstrates a substantial association between the technical benefits of blockchain and managers' intentions to implement it within their operations. One of the frequently touted benefits is the technology's extensive knowledge base, which opens up new avenues for supply chain sustainability. In light of this knowledge, we propose our first proposition:

Proposition 1. *The desire to implement blockchain technology in agri-food supply chains is fueled by an awareness of the technological benefits, since the knowledge held on blockchain provides stakeholders with new potential for supply chain sustainability*.

3.3.2. Environmental barriers-blockchain implementation intention

Environmental concerns abound in regard to supply chain management using blockchain. These are limits placed by environmental and contextual variables, such as market fragmentation, regulatory requirements, and a general lack of blockchain testing. Government regulation of blockchain adoption is another sort of environmental constraint. Because blockchain is a relatively new technology, not all countries have the same approach. Some hesitations could occur in contexts where cryptocurrencies have been blacklisted, for example. Moreover, because blockchain is still in its infancy, additional exploratory study is required to assess its viability and adaptability to industry-specific market requirements.

In this regard, the agri-food supply chain has unique challenges, including the upstream sector's vulnerability to weather changes, the lack of standardised commodity pricing schemes for particular farm products, development threats and uncertainties, and pest and disease concerns. While blockchain, as a distributed ledger technology, has the potential to assist in overcoming those obstacles, additional research is required to fully understand how blockchain operates and how it helps in overcoming the mentioned environmental barriers. Due to a lack of information regarding the proper strategy for blockchain-supply chain integration, managers' willingness to integrate blockchain into their supply chains remains limited. On the basis of this realisation, we make the following proposition.

Proposition 2. *The willingness to use blockchain in agri-food supply chains is significantly limited by environmental barriers, as the market is highly fragmented due to poor government regulation and little research, resulting in a frail industry-specific implementation framework*.

3.3.3. Organisational adoption strategies-blockchain implementation intention

Two major organisational adoption strategies are identified in our study: connection building and product introduction.

Small and medium-sized firms comprise the agri-food supply chain. Due to blockchain's technological requirements, partnerships and collaborations become vital for businesses to pool resources and conduct transactions on the blockchain. The blockchain architecture's decentralised nature, paired with its peer-to-peer operating system, enables cooperating businesses to have equal access to and control over the information transmitted. Additionally, blockchain data are immutable, which means they cannot be updated without the unanimous permission of all parties.

Additionally, product launches on the blockchain have the potential to pique managers' interest in integrating blockchain into the agri-food supply chain. Regardless of the deployment strategy, the success of blockchain implementation is dependent on supply chain partners' willingness to collaborate in a fragmented sector and apply industry-specific research-based guidelines throughout the supply chain. Constraints imposed by the environment have an effect on the link between adoption strategies and intention to implement. In summary, we propose the following based on the findings of the thematic review:

Proposition 3. *The effectiveness of blockchain implementation in agri-food supply chains is driven by the supply chain entities' organisational adoption strategies, which might be influenced by environmental barriers.*

4. Discussion

Our findings indicate that not only organisational aspects but also behavioural characteristics are critical factors to consider when implementing blockchain in supply chain management [35]. On the one hand, based on theories of technology acceptance such as Technology Acceptance Model (TAM) and UTAUT, most of the prior research [8,15,36] established that individual behavioural dimensions such as trust, social influence, facilitating condition, performance expectancy, and technical affinity all influence blockchain adoption intention. On the other hand, research employing the TOE framework [16,20] has demonstrated that organisational characteristics frequently influence blockchain adoption in supply chains.

We bring these two schools of thought together through an analysis of the behavioural and organisational factors driving blockchain adoption. Although [37] infused behavioural (TPB) and organisational (TAM and Technology Readiness Index (TRI)) theories, our study is the first to combine BRT and TOE to provide a theoretical framework for examining the combined influence of behavioural and organisational factors on blockchain adoption. Our findings demonstrate that managers' reasoning, specifically their "reasons for" (benefits), "reasons against" (barriers), and adoption strategies, all influence blockchain implementation intention and that these three constructs are weighed against prevailing technological, environmental, and organisational conditions, respectively. To summarise, as demonstrated by our conceptual model and the three propositions that arose from this study, managers consider the technical benefits, organisational implementation strategies, and environmental implications of using blockchain to manage their supply chains.

Our findings indicate that technological advantages are critical determinants of blockchain implementation, which is consistent with recent research indicating that the perceived value of blockchain technology is a crucial deciding factor for adoption [38]. When managers see the potential benefits of blockchain technology for supply chain management, incorporating it makes sense.

Additionally, we find that organisational adoption strategies are important to the successful use of blockchain technology. This is challenging prior research [16] which indicated that senior management support has no effect on blockchain implementation. A possible explanation for this discrepancy in findings is the peculiarity of the agri-food supply chain, which comprises mostly small firms [39] as collaborating enterprises demanding cooperative implementation of a blockchain strategy. Additionally, organisational strategy has a key role in the adoption of supply chain innovation [40,41].

Our findings are at the intersection of two well-established theories: BRT and TOE. Whereas BRT focuses on the individual behavioural elements that influence blockchain implementation, TOE focuses on the

technical, organisational, and environmental contexts in which blockchain implementation occurs. We present a holistic view of the elements driving blockchain application in supply chain management through our findings, thereby substantiating the central assertions of BRT and TOE. As a result, we create a theoretical framework that enables an evaluation of the technical, organisational, and environmental antecedents of blockchain implementation from an individual behavioural standpoint. This conceptual framework established by thematic mapping provides a comprehensive analysis of not only environmental barriers but also other elements, such as technology benefits and organisational adoption strategies.

Previous research has examined the impact of behavioural determinants on blockchain adoption independently [15] and concurrently [10,20,41,42] proposed paradigms for studying the combined effect of technological, market, and institutional factors on blockchain adoption; however, behavioural aspects were mainly ignored in the concept, which was not contextualised in supply chain management. Thus, our findings bridge this divide by developing a framework for studying the individual and organisational characteristics that influence blockchain implementation in supply chain management. It has been asserted that businesses' ability to leverage people, organisational, and technological elements concurrently will go a long way towards assuring the successful implementation of blockchain technology in supply chains [43].

As a result, we theorise that blockchain adoption in supply chains is influenced by a combination of human behavioural and organisational characteristics. These occurrences are summarised in our model, which is illustrated in Fig. 2 and is made of organisational and individual-level constructs. Individual constructs were obtained from codified data and are consistent with BRT [18], whereas organisational constructs were likewise produced from data and are consistent with the TOE framework's assertions [10]. Thus, each of the TOE's components consolidates the three proven behavioural constructs of "intentions," "reasons for," and "reasons against". To gain 'technological benefits,' for example, two components are required: technology (as defined in TOE) and benefits (from BRT). Benefits are viewed as "reasons for," whereas barriers are interpreted as "reasons against" [44].

Before selecting whether to deploy blockchain technology, managers should carefully analyse the technological benefits of digitalizing supply chains, such as their ability to facilitate provenance and enhance the sustainability of agri-food products [26]. We discover that the adoption strategies are well considered from an organisational standpoint (organisational adoption strategies), implying that the process by which an organisation becomes acquainted with blockchain technology can also influence managers' intentions to implement the technology in their supply chains, thus corroborating the findings of [45] that organisational readiness promotes blockchain adoption intention. Finally, our thematic analysis reveals that the barriers to blockchain implementation are related to environmental factors, which we refer to as environmental barriers. Environmental barriers also influence blockchain implementation intention.

Additionally, managers can use behavioural factors such as potential benefits, adoption strategies, and perceived barriers to substantiate their behavioural intention to use blockchain in the supply chain's technological, organisational, and environmental elements, respectively. More precisely, in line with previous research that has used BRT to examine human decision-making processes related to technology or innovation adoption [18,44], we define the "reasons for," and "reasons against" as potential benefits and perceived barriers, respectively, while a third construct, adoption strategies, emerges, implying that managers rationalise their intent to introduce blockchain after these three critical organisational antecedents. The dataset reveals two primary strategies for adoption: partnership formation and product introductions. This finding corroborates [10]'s argument that managers should work with other supply chain managers to guarantee successful blockchain deployment.

5. Conclusions

In this study, we investigate the behavioural antecedents of blockchain implementation in supply chains. In accordance with the technique provided by Ref. [30], we conduct thematic analysis on agri-food media news concerning blockchain, which we previously obtained from the Agricola section of the Ovid database.

5.1. Theoretical contributions

Our findings have implications for both theory and practise. As a theoretical contribution, we extend the claims of BRT by offering adoption procedures as a guide to implementation intentions. This shows that the manner in which organisations become acquainted with blockchain technology may have an effect on managers' desire to implement the technology into supply chain management on a consistent basis.

Most of the extant studies on blockchain adoption were based on TAM, the principal of which is UTAUT, which fails to recognise "reasons" as significant determinants of adoption behaviour. Our study deviates from this by engaging BRT which posits that reasons are good predictors of adoption behaviour. Furthermore, existing studies have examined blockchain implementation at the organisational level, while our study investigates the organisational and individual behavioural factors affecting blockchain acceptance.

Additionally, we supplement BRT by integrating it with TOE to create an integrated structure that enables a thorough examination of the behavioural antecedents of blockchain implementation based on managers' consideration of technical, organisational, and social factors. As a result, BRT bolsters the TOE framework by explaining the impact of behavioural aspects on the use of blockchain in supply chain management. Each of the TOE framework's three components effectively ties to the BRT's major statements, most notably the reasons for and against blockchain use, as well as supply chain management adoption strategies. Thus, we demonstrate, for the first time to our knowledge, how BRT may be utilised in conjunction with TOE to shed light on the behavioural antecedents of blockchain implementation in supply chain management. Additionally, the conceptual model, which takes into account technical advantages, organisational adoption strategies, and environmental barriers, gives managers a unique perspective on blockchain for supply chain management.

Three topics emerge as a result of the thematic analysis, from which we offer three significant contributions to the literature. First, we propose that the BRT framework complements the TOE framework by clarifying the behavioural implications of blockchain adoption in supply chain management. The second proposition is that technology advantages positively influence supply chain implementation intentions. Third, our analysis demonstrates that organisational adoption strategies are crucial for the successful implementation of blockchain in supply chains and are influenced by environmental barriers.

5.2. Managerial implications

Our findings also have several implications for managerial practice. First, by contextualising our study in the agri-food supply chain, we respond to calls for increased industry-specific empirical studies on blockchain technology, which is necessary to unravel the latent factors inhibiting blockchain utilisation by managers. By identifying some of those factors in this study, we lend our contribution to the call for increased adoption of blockchain technology in agri-food supply chain management. Blockchain is critical to enhance transparency in the agri-food supply chain, just as it also increases trust and enhances collaboration among supply chain actors [15]. Therefore, the use of blockchain in agri-food supply chain management will help facilitate information sharing, reduce uncertainties and increase agri-food market efficiency. Another implication of increased blockchain utilisation in the agri-food

supply chain is the elimination of middlemen who sometimes reap off producers' gains and whittle down the strength of the relationship between producers and consumers. Since blockchain facilitates direct buyer–seller transactions, managers can take advantage of the technology to maintain one-on-one relationships with customers and other stakeholders along the agri-food supply network.

One of the primary technological advantages of blockchain that managers should consider is its potential to give stakeholders new chances for sustainability. Managers are continually looking out for innovative ways to promote supply chain sustainability, and blockchain, as an emerging technology with its immutability, encryption, and provenance capabilities, will aid in improving supply chain sustainability management. Blockchain technology enables stakeholders to build new partnerships, eliminate intermediaries, and increase responsibility, simplifying the monitoring and evaluation of agri-business activities in the process. Consider the danger of food contamination during discussions about the importance of open agri-food supply systems. Additionally, blockchain technology is reshaping traditional business models in domains such as inventory management, procurement, and postharvest processing of agri-food products from field to market.

The three behavioural factors we have identified in this study could also provide justification for managers when considering blockchain implementation. Essentially, the effectiveness of blockchain implementation is determined in part by the organisation's adoption strategies, which are in turn influenced by environmental barriers. Supply chain managers should also consider proper implementation strategies such as product launch or partnership creation, as these have been demonstrated to improve the possibility that other partnering managers will incorporate blockchain into their supply chain. On the other hand, organisations must struggle with environmental constraints such as market segmentation, analysis, and regulatory oversight. Managers can use this information to decide the most effective way to integrate blockchain technology into their supply chain. Following a thorough assessment of their needs and objectives, as well as the unique characteristics of their supply chain, partnering managers may agree on an optimal implementation strategy for blockchain use in their supply chain. For instance, in the case of geographically dispersed small and medium-sized firms, supply chain collaborations are crucial.

5.3. Limitations and suggestions for further research

Our study is not without limitations, which could open spaces for further research. First, we collect data from secondary sources; future studies could consider surveys or in-depth interviews with managers to acquire additional understanding of the behavioural elements affecting blockchain implementation in supply chain management. Then, due to the nature of our dataset and in answer to our research question, we employ a qualitative method. The study, however, could benefit from complementary quantitative analysis. Additionally, the three assertions advanced in this paper could be empirically tested to aid in our understanding of the subject.

Moreover, because this analysis is exploratory in nature, future research should employ an interpretivist approach that allows for the validation of hypotheses and the production of pertinent deductions. Finally, while we focused on the agri-food supply chain, it would be fascinating to investigate the antecedents to blockchain implementation in other industries, such as health or fashion.

Author contributions

Conceptualization, KFO and NDP; methodology, KFO and NDP.; software, RV; validation, NDP and RV; formal analysis, KFO and NDP.; investigation, KFO, NDP and RV.; resources, NDP and RV; data curation, KFO, NDP and RV; writing—original draft preparation, KFO and NDP; writing—review and editing, NDP and RV.; visualization, KFO, NDP and RV.; supervision, NDP and RV; project administration, RV; funding acquisition, RV.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of competing interest

All authors have read and agreed to the published version of the manuscript.

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