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THE ROLE OF BLOCKCHAIN TECHNOLOGY IN IMPROVING EFFICIENCY AND REDUCING COSTS IN COMPANIES

A systematic literature review

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ABSTRACT

The application of blockchain technology offers companies a number of opportunities to increase efficiency, especially in the areas of data management, cybersecurity and automation. The systematic literature review used in this research aims to explore the benefits and challenges of applying blockchain technology at the enterprise level. It draws on research published between 2018 and 2024. The results show that blockchain can help reduce costs by eliminating intermediaries, increasing process transparency and reducing the risk of abuse. Decentralised technology enables the use of automated smart contracts that increase the efficiency and speed of transactions. However, the implementation of blockchain poses significant technological and regulatory challenges, especially in terms of scalability and legal compliance. The results suggest that blockchain has significant potential to optimise business operations, but its successful implementation requires strategic planning.

JEL codes: O33, M15, D24

Keywords: blockchain technology, blockchain in business, cost efficiency, corporate efficiency, blockchain

1 INTRODUCTION

Blockchain, originally the underlying technology of cryptocurrencies, has seen rapid development and is now a key factor reshaping business operations. It has attracted considerable interest in both academic and industrial circles owing to its potential for increasing efficiency, especially in data management, cyberse-

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curity and automation. The characteristics of blockchain, including decentralisation, immutability and transparency offer businesses unparalleled opportunities for optimising operational workflows and reducing costs. This research examines the potential of blockchain technology for increasing the efficiency of business operations, highlighting the manifold benefits and challenges of implementation.

In today's business environment, companies are facing difficulties in maintaining data integrity, ensuring cybersecurity and enhancing operational efficiency, among others. The distributed ledger system used in blockchains offers a solution to a number of problems companies are currently grappling with (Harakeh, 2024). A study by Han et al., (2024) confirms that the adoption of the technology may facilitate efficiency improvement by enabling transparent data sharing, real-time verifiability and secure transactions. The high computing and energy costs of operating blockchain networks cause a difficulty to many enterprises. The lack of a standardised regulatory framework is also a major obstacle for global companies willing to implement the technology in multiple jurisdictions (Ibrahim–Truby, 2022).

Applications extend beyond financial transactions to areas such as supply chain management, healthcare and legal contracts (Hackius, 2020). Sedlmeir et al., (2022) highlight that blockchain technology enhances trust in supply chains by providing tamper-proof records, which is crucial in high-compliance industries. According to the study of Gkogkos et al., (2023), it advances sustainability in the agri-food industry, as it caters for the transparent traceability of products' journey from farm to table. Similarly, Della (2023) investigated how blockchain can foster greater corporate autonomy by exploiting functionalities such as smart contracts enabling automated contract conclusion and performance without intermediaries. In Kromes (2024), businesses utilizing blockchain technology reported a marked improvement in the speed of transactions and operational reliability.

Our research aims to systematically explore and evaluate the literature published between 2018 and 2024 using the PRISMA model to elucidate the potential of blockchain technology for improving operational efficiency within business organisations (Moher et al., 2009). Business applications of particular interest include cost reduction by eliminating intermediaries, process optimisation and operational risk mitigation (security, data management). Furthermore, we address the dual challenge posed by technical and regulatory obstacles facing businesses in blockchain implementation, with specific recommendations for when it is more worthwhile to opt for blockchain as a service and when to develop an own solution. Focusing on efficiency improvement, the paper gives an insight into strategic considerations enterprises should take into account for the successful adoption of blockchain technology.

The main research questions are as follows:

- RQ1: What are the direct business effects of blockchain technology?
- RQ2: When should businesses source blockchain technology from external suppliers (Blockchain as a Service/BaaS)?
- RQ3: When should a business develop its own blockchain network?

The novelty and contribution of this research to the literature is that it goes beyond a general overview of the business applications of blockchain technology, providing a targeted analysis of the technology's potential for achieving efficiencies and cost reduction in business operation. While most previous studies focus on the financial sector, this paper has a broader analytical scope, including supply chains, data management, business process automation and regulatory challenges. The paper is structured as follows: *Section 2* outlines the applied methodology; *Section 3* presents the findings and identified research clusters; and *Section 4* provides a summary of results and directions for future research.

2 MATERIALS AND METHODS

The reference period of this research is 2018–2024. The analysed data were collected from the Web of Science Core Collection database. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) model provided the methodological framework for this study, which ensured consistency and transparency in our systematic literature review. Data collection and screening was carried out following Moher et al., (2009).

In line with the PRISMA model, the review was structured along the following four phases:

1. **Identification**: In this phase, the Web of Science Core Collection was searched for relevant studies using predefined keywords and Boolean operators (AND, OR, truncation). The search provided 1726 hits.
2. **Screening**: Duplicates (n = 159) were removed from the search results and the remaining 1567 studies were pre-screened based on title and abstract. Using the TAA (Title Abstract Alignment) method, we excluded papers that were not in alignment with our research objectives, e.g. missing empirical analysis or having a focus other than the efficiency improvement potential of blockchain for business.

3. **Eligibility**: In this phase, the full text of the studies was analysed and an additional 39 publications excluded for an irrelevant topic, lack of empirical data, deficient methodology or overlapping content. As a result, 67 studies were kept for final synthesis.
4. **Included**: The analysis was carried out on the 67 studies selected in the previous steps. These were examined in detail for answers to our research questions, methodological rigor and practical relevance.

The entire four-step process is visualised in the PRISMA flowchart (*Figure 2*) which transparently represents the selection criteria. This method guarantees that the literature review conducted followed a pre-defined instead of an ad hoc manner but according to a repeatable and systematic logic.

This increases the internal validity of the research as well as the verifiability of the results in a transparent manner and for critical review purposes.

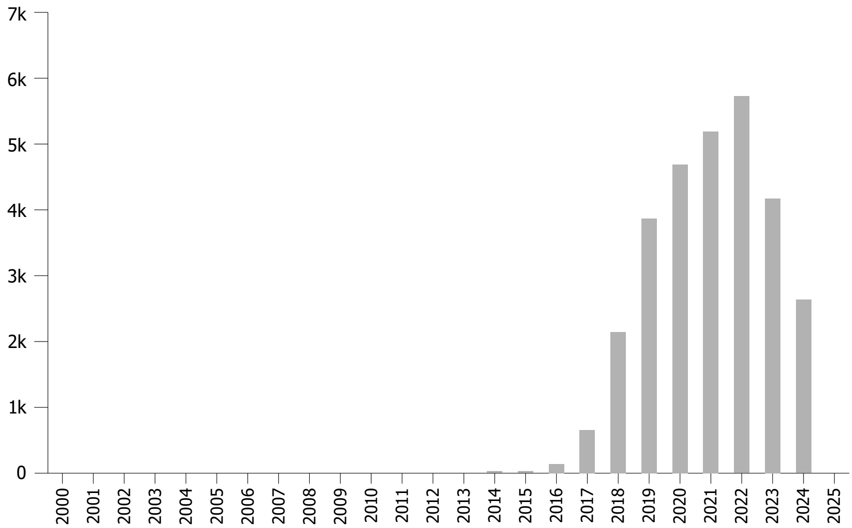
Employing the PRISMA model was particularly appropriate for this research, as the literature on the business applications of blockchain technology has proliferated in recent years. Targeted and relevance-based selection was essential for avoiding excessive information.

The following operators were used for keyword search:

- *AND* to combine keywords (e.g. 'Blockchain AND Corporate efficiency').
- *OR* to connect synonyms (e.g. 'Blockchain OR Distributed Ledger Technology [DLT]').
- *TRUNCATION* to handle word forms flexibly (e.g. 'efficien*' covers hits for efficiency, efficiencies, efficient).

We used the following keywords: Blockchain, Corporate efficiency, Enterprise blockchain, Blockchain benefits for companies, Distributed ledger technology (DLT), Blockchain adoption. We searched between 2018 and 2024, a period seeing a dynamic growth in publications on the topic, as is apparent from *Figure 1*. That was also the rationale for selecting this period.

Figure 1
Number of publications on blockchain technology between 2000 and 2024



Source: Web of Science (2024)

The data show steadily growing scholarly interest in the business applications of blockchain technology from 2018 on, with the number of publications reaching a peak in 2022, followed by a slight decline by 2024. This trend reveals that blockchain technology remains a focal topic for the scientific community, especially in the context of applied economics and business process efficiency.

Following keyword finalisation, we identified 1726 articles, of which 1567 were kept after the removal of duplicates. Exclusion criteria included:

- only peer-reviewed scientific publications admitted;
- only English-language papers included;
- irrelevance to the research topic or content redundancy.

In the second screening step, the title and abstract of the papers were analysed with the TAA (Title Abstract Alignment) method outlined by Grant and Booth (2009) to identify those that were relevant to our research objectives. In the *screening* phase, we excluded articles that contained only a theoretical introduction to blockchain, without specific business applications or efficiency-related results presented. In the *eligibility* phase, only studies offering empirical evidence and detailed case studies were kept for the final analysis. 1461 articles were excluded in this phase. We performed full-text analysis on the remaining 106 publications and excluded a further 39 based on the pre-defined relevance criteria. The main exclusion criteria were as follows:

Irrelevant topic (n = 21):

The articles seemed relevant based on title and abstract, but full-text analysis revealed that they are not closely connected to the business applications of blockchain technology. Several of the papers had a general theoretical approach to blockchain mechanisms instead of directly addressing the aspects of efficiency gains or cost reduction for businesses (e.g. basic analyses of the technology behind cryptocurrencies).

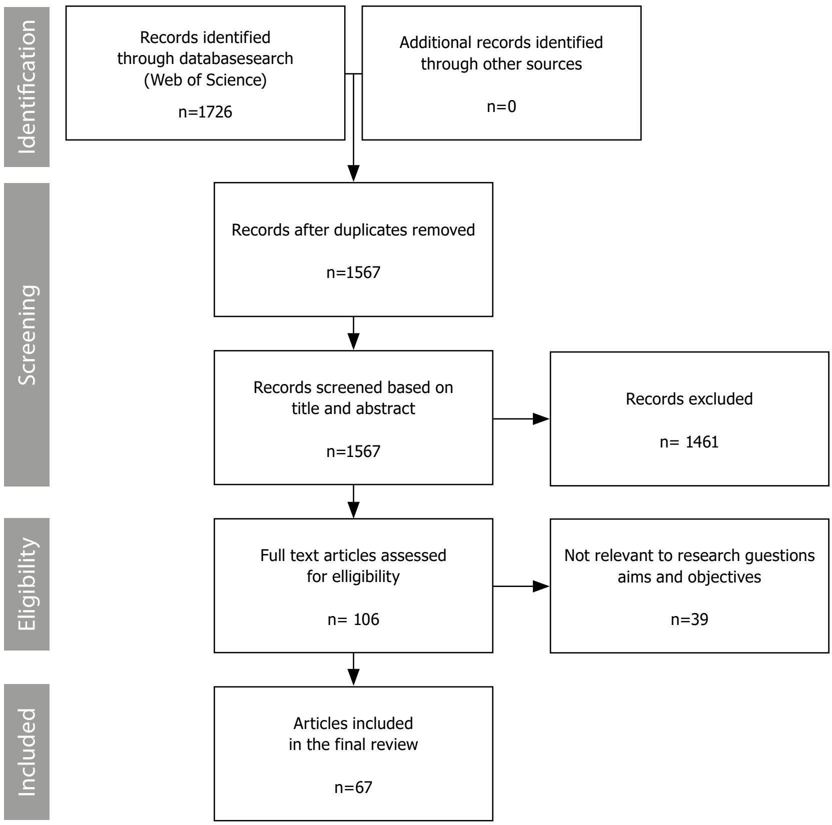
Lack of empirical data and methodological limits (n = 9):

Empirical data or an appropriate description of the methodology were missing in a few of the analysed studies, which compromised the comparability or synthesis of the results. Several articles contained only a theoretical discussion of the opportunities offered by blockchain, but no qualitative or quantitative analysis to substantiate the findings on efficiencies achieved at enterprise level.

Overlapping studies (n = 9):

As certain studies overlapped considerably with previously selected publications, they had no added value to the research. Duplications were detected especially in the case of findings by the same author presented in various papers. At the end of the selection process, which is illustrated in *Figure 2*, 67 relevant articles were admitted to the systematic literature review.

Figure 2
The PRISMA model



Source: own elaboration based on Moher et al., (2009)

In summary, the majority of the studies were removed based on the following exclusion criteria:

- Non-empirical studies (e.g. entirely theoretical works or literature reviews).
- Blockchain technology not analysed from the point of view of efficiency gains and cost reduction.
- Articles not focusing on the business applications of blockchain.
- Lack of a detailed description of the methodology (e.g. unknown data sources).
- Duplicate publications or redundant content.

The PRISMA model was applied with a view to ensuring the transparency of data collection and screening along the following steps:

1. Identification of data sources and performing keyword search.
2. Removing duplicates and pre-screening relevant publications.
3. Full-text analysis based on research questions and objectives.
4. Synthesizing and presenting the results.

The methodology above provided a reliable database for our research as the basis of a comprehensive assessment of the business effects of blockchain technology.

Clustering

Clustering was employed in this research to organise the role of blockchain technology in improving business efficiency into thematic groups for a structured analysis and comparison of our literature review results. Clusters were identified using a combination of text mining methods, statistical clustering procedures and peer validation.

Topical analysis and text mining

The starting point for clustering was topical analysis carried out on the corpus of the 67 relevant articles selected. Keywords, terms and topics were identified in the documents by natural language processing (NLP) techniques. With these techniques, we explored the network of concurrent concepts and focal thematic groupings in the literature.

For text analysis, we used Latent Dirichlet Allocation (LDA), a widely applied modelling technique in cluster analyses on large textual corpora (Blei et al., 2003). The topics discovered as a result of LDA were analysed further to improve validity and grouped according to conceptual similarities.

Requirements for forming clusters included that a topic occurs in at least five different publications, and clearly substantiates the relevance of these publications to the business applications of blockchain technology.

Peer validation and content consistency

Three independent researchers were asked to validate our clustering results by evaluating the groupings. The peer reviewers took the following criteria into account:

- The topic of the articles and clustering accuracy;
- Coherence of content within clusters;
- Relevance to the research objectives.

Cohen's kappa was used for measuring agreement between the researchers. The resulting value of 0.82 indicates a high level of agreement (Landis–Koch, 1977). This confirms that the clusters represent topically consistent and discrete categories.

Final categorisation of clusters

Five main clusters were defined based on the identified topic groups:

1. Security and data protection
2. Automation and smart contracts
3. Cost reduction and transaction efficiency
4. Supply chain management and traceability
5. Increasing trust and decentralised operation

These clusters accurately reflect the main trends observed in the literature and provide for a structured presentation of the research results. After classifying studies into clusters, we specified factors pertinent to our research questions that can also be considered as answers to these questions. Then, we prepared a visual representation of the factors and linked them with the 67 relevant publications.

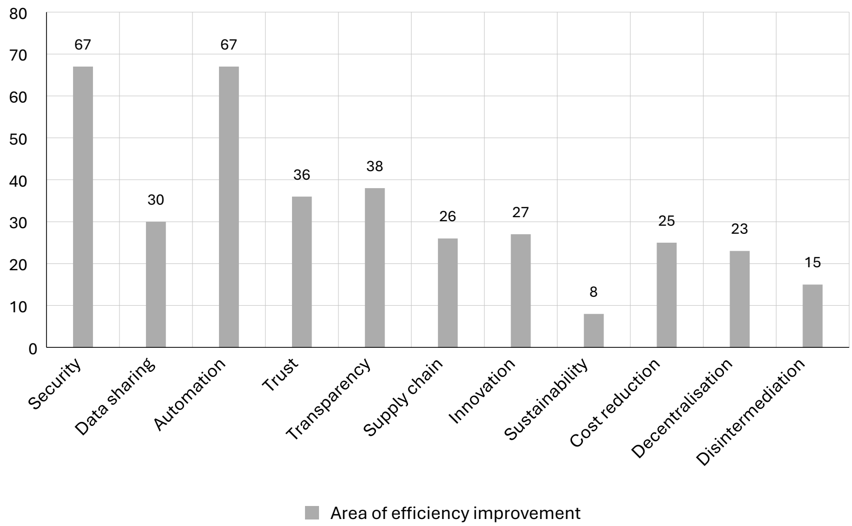
The applied clustering method employs a mix of text mining, topic modelling (LDA), quantitative clustering and peer validation, providing a sound scientific basis for the resulting clusters. The objectivity and reproducibility of clustering rests on the statistical analysis methods used and verification against the literature, supporting the transparency and scientific validity of the research.

3 RESULTS

3.1 RQ1: What are the direct business effects of blockchain technology?

Blockchain technology has emerged as a tool reshaping the business sector, revolutionising traditional frames of operation. Allowing to its features such as decentralisation and immutability, blockchain offers a number of opportunities to increase business efficiency in various areas, including data management, cybersecurity and automation (Glavanits, 2020). 11 factors were selected during the cluster analysis of the publications. *Figure 3* shows how many times – in the 67 pre-selected relevant publications – blockchain technology was mentioned in connection with each factor as a tool to increase efficiency.

Figure 3
Factors in tapping the efficiency improvement potential of blockchain technology, identified by cluster analysis



Source: own elaboration based on study results (2024)

As the figure shows, security and automation are key factors mentioned in every publication among the effects of blockchain technology on the business sector, but transparency as well as increasing data sharing efficiency and trust are also important. The results of our literature review are summarised separately in the tables below. The *Table 1* shows the results for RQ1.

Table 1
Results for RQ1 based on the systematic literature review

RQ1: What are the direct effects of blockchain technology in the business sector? Factors based on clusters	Sources collected according to the PRISMA model
Improved security	Azanzi–Alkhatib, 2022; Ali et al., 2021; Alladi et al., 2019; Alshareef–Tunio, 2022; Ameyaw et al., 2023; Antal et al., 2021; Antsipava et al., 2024; Bhattacharya et al., 2022; Bikos–Kumar, 2022; Botene et al., 2021; Boukis, 2020; Callinan et al., 2022; Chang et al., 2020; Chavali et al., 2024; Cheng–Chong, 2022; Choi et al., 2020; Dede et al., 2021; Della Pietra, 2023; González et al., 2022; Du et al., 2023; Duan et al., 2020; Funlade–Geo, 2024; Gao et al., 2022; Geleziunaite–Sean, 2023; Gkogkos et al., 2023; Glavanits, 2020; Grant–Booth, 2009; Haaren-van et al., 2022; Hackius–Petersen, 2020; Han et al., 2024; Harakeh et al., 2024; Hui et al., 2022; Ibrahim–Truby, 2022; Ingle et al., 2023; Iranmanesh et al., 2023; Ismail et al., 2023; Jasimin–Nordin, 2022; Juszczyk–Shahzad, 2022; Kaufman et al., 2021; Keresztes et al., 2022; Košťál et al., 2019; Kromes et al., 2024; Ktari et al., 2024; Kumar et al., 2024; Mohammed et al., 2023; Hadarra et al., 2021; Mthimkhulu–Jokonya, 2022; Nezhyva et al., 2021; Piesciorovsky et al., 2024; Rahman et al., 2024; Rajasekar et al., 2020; Reddy et al., 2021; Rejeb et al., 2023; Roszkowska, 2020; Sedlmeir et al., 2022; Soltani et al., 2022; Straubert–Sucky, 2021; Strugar et al., 2018; Taherdoost, 2022; Tahir et al., 2024; Teisserenc–Sepasgozar, 2021; Thakur, 2022; Yang et al., 2019; Yuthas et al., 2021
More efficient data sharing	Alanzi–Alkhatib, 2022; Ali et al., 2021; Antsipava et al., 2024; Bikos–Kumar, 2022; Chang et al., 2020; Chavali et al., 2024; Duan et al., 2020; Grant–Booth, 2009; Haaren-van et al., 2022; Han et al., 2024; Hui et al., 2022; Ibrahim–Truby, 2022; Ingle et al., 2023; Iranmanesh et al., 2023; Jasimin–Nordin, 2022; Juszczyk–Shahzad, 2022; Keresztes et al., 2022; Ktari et al., 2024; Hadarra et al., 2021; Nezhyva et al., 2021; Piesciorovsky et al., 2024; Rahman et al., 2024; Rejeb et al., 2023; Sedlmeir et al., 2022; Taherdoost, 2022; Tahir et al., 2024; Thakur, 2022; Yang et al., 2019; Yuthas et al., 2021
Increased automation	Alanzi–Alkhatib, 2022; Ali et al., 2021; Alladi et al., 2019; Alshareef–Tunio, 2022; Ameyaw et al., 2023; Antal et al., 2021; Antsipava et al., 2024; Bhattacharya et al., 2022; Bikos–Kumar, 2022; Botene et al., 2021; Boukis, 2020; Callinan et al., 2022; Chang et al., 2020; Chavali et al., 2024; Cheng–Chong, 2022; Choi et al., 2020; Dede et al., 2021; Della Pietra, 2023; González et al., 2022; Du et al., 2023; Duan et al., 2020; Funlade–Geo, 2024; Gao et al., 2022; Geleziunaite–Sean, 2023; Gkogkos et al., 2023; Glavanits, 2020; Grant–Booth, 2009; Haaren-van et al., 2022; Hackius–Petersen, 2020; Han et al., 2024; Harakeh et al., 2024; Hui et al., 2022; Ibrahim–Truby, 2022; Ingle et al., 2023; Iranmanesh et al., 2023; Ismail et al., 2023; Jasimin–Nordin, 2022; Juszczyk–Shahzad, 2022; Kaufman et al., 2021; Keresztes et al., 2022; Košťál et al., 2019; Kromes et al., 2024; Ktari et al., 2024; Kumar et al., 2024; Mohammed et al., 2023; Hadarra et al., 2021; Mthimkhulu–Jokonya, 2022; Nezhyva et al., 2021; Piesciorovsky et al., 2024; Rahman et al., 2024; Rajasekar et al., 2020; Reddy et al., 2021; Rejeb et al., 2023; Roszkowska, 2020; Sedlmeir et al., 2022; Soltani et al., 2022; Straubert–Sucky, 2021; Strugar et al., 2018; Taherdoost, 2022; Tahir et al., 2024; Teisserenc–Sepasgozar, 2021; Thakur, 2022; Yang et al., 2019; Yuthas et al., 2021
Building trust	Alanzi–Alkhatib, 2022; Ali et al., 2021; Alladi et al., 2019; Alshareef–Tunio, 2022; Antsipava et al., 2024; Bhattacharya et al., 2022; Botene et al., 2021; Boukis, 2020; Chang et al., 2020; Duan et al., 2020; Gao et al., 2022; Geleziunaite–Sean, 2023; Gkogkos et al., 2023; Grant–Booth, 2009; Hackius–Petersen, 2020; Han et al., 2024; Harakeh et al., 2024; Hui et al., 2022; Ismail et al., 2023; Jasimin–Nordin, 2022; Kaufman et al., 2021; Kromes et al., 2024; Ktari et al., 2024; Rajasekar et al., 2020; Reddy et al., 2021; Rejeb et al., 2023; Sedlmeir et al., 2022; Soltani et al., 2022; Strugar et al., 2018; Taherdoost, 2022; Teisserenc–Sepasgozar, 2021; Thakur, 2022; Yang et al., 2019; Yuthas et al., 2021

Promoting transparency	Alshareef–Tunio, 2022; Ameyaw et al., 2023; Antal et al., 2021; Antsipava et al., 2024; Botene et al., 2021; Boukis, 2020; Chavali et al., 2024; Cheng–Chong, 2022; Dede et al., 2021; Della Pietra, 2023; González et al., 2022; Du et al., 2023; Duan et al., 2020; Gao et al., 2022; Geleziunaite–Sean, 2023; Gkogkos et al., 2023; Haaren-van et al., 2022; Han et al., 2024; Harakeh et al., 2024; Hui et al., 2022; Iranmanesh et al., 2023; Ismail et al., 2023; Keresztes et al., 2022; Košťál et al., 2019; Kromes et al., 2024; Ktari et al., 2024; Mthimkhulu–Jokonya, 2022; Nezhyva et al., 2021; Piesciorovsky et al., 2024; Rahman et al., 2024; Rejeb et al., 2023; Sedlmeir et al., 2022; Soltani et al., 2022; Straubert–Sucky, 2021; Taherdoost, 2022; Teisserenc–Sepasgozar, 2021; Yang et al., 2019; Yuthas et al., 2021
More efficient supply chain management	Alshareef–Tunio, 2022; Bikos–Kumar, 2022; Boukis, 2020; Cheng–Chong, 2022; Choi et al., 2020; Du et al., 2023; Haaren-van et al., 2022; Harakeh et al., 2024; Ingle et al., 2023; Iranmanesh et al., 2023; Ismail et al., 2023; Jasimin–Nordin, 2022; Kaufman et al., 2021; Košťál et al., 2019; Kromes et al., 2024; Ktari et al., 2024; Kumar et al., 2024; Mthimkhulu–Jokonya, 2022; Rahman et al., 2024; Rajasekar et al., 2020; Roszkowska, 2020; Sedlmeir et al., 2022; Soltani et al., 2022; Tahir et al., 2024; Yang et al., 2019
Technological innovation	Alladi et al., 2019; Alshareef–Tunio, 2022; Antal et al., 2021; Botene et al., 2021; Chang et al., 2020; González et al., 2022; Duan et al., 2020; Geleziunaite–Sean, 2023; Glavanits, 2020; Haaren-van et al., 2022; Hackius–Petersen, 2020; Harakeh et al., 2024; Ibrahim–Truby, 2022; Ingle et al., 2023; Ismail et al., 2023; Juszczyk–Shahzad, 2022; Košťál et al., 2019; Kumar et al., 2024; Mthimkhulu–Jokonya, 2022; Piesciorovsky et al., 2024; Rajasekar et al., 2020; Straubert–Sucky, 2021; Strugar et al., 2018; Tahir et al., 2024; Teisserenc–Sepasgozar, 2021; Thakur, 2022; Yang et al., 2019
Promoting sustainability	Choi et al., 2020; González et al., 2022; Geleziunaite–Sean, 2023; Han et al., 2024; Iranmanesh et al., 2023; Kaufman et al., 2021; Rahman et al., 2024; Taherdoost, 2022
Cost reduction	Alshareef–Tunio, 2022; Ameyaw et al., 2023; Antal et al., 2021; Antsipava et al., 2024; Bhattacharya et al., 2022; Funlade–Geo, 2024; Gkogkos et al., 2023; Glavanits, 2020; Hackius–Petersen, 2020; Hui et al., 2022; Iranmanesh et al., 2023; Ismail et al., 2023; Juszczyk–Shahzad, 2022; Kaufman et al., 2021; Kromes et al., 2024; Kumar et al., 2024; Piesciorovsky et al., 2024; Rajasekar et al., 2020; Reddy et al., 2021; Roszkowska, 2020; Sedlmeir et al., 2022; Straubert–Sucky, 2021; Teisserenc–Sepasgozar, 2021; Yang et al., 2019
Decentralisation	Alanzi–Alkhatib, 2022; Alladi et al., 2019; Alshareef–Tunio, 2022; Antsipava et al., 2024; Cheng–Chong, 2022; Dede et al., 2021; Della Pietra, 2023; González et al., 2022; Funlade–Geo, 2024; Gao et al., 2022; Gkogkos et al., 2023; Grant–Booth, 2009; Hackius–Petersen, 2020; Ibrahim–Truby, 2022; Iranmanesh et al., 2023; Jasimin–Nordin, 2022; Keresztes et al., 2022; Kromes et al., 2024; Ktari et al., 2024; Piesciorovsky et al., 2024; Reddy et al., 2021
Disintermediation	Alanzi–Alkhatib, 2022; Alshareef–Tunio, 2022; Antsipava et al., 2024; Botene et al., 2021; Chavali et al., 2024; Dede et al., 2021; Glavanits, 2020; Haaren-van et al., 2022; Iranmanesh et al., 2023; Mthimkhulu–Jokonya, 2022; Rajasekar et al., 2020; Reddy et al., 2021; Roszkowska, 2020

Source: own elaboration based on study results (2024)

Based on the results, blockchain does not only mark technological innovation but also a fundamental transformation in business operations. Security is one of the main benefits of blockchain, as it exploits cryptographic techniques to ensure the integrity, authenticity and reliability of data (Alladi et al., 2019). In these decentralised networks, each data block is assigned a unique identifier and stored in a system controlled in a distributed manner by participants. This makes unauthorized access and fraud practically impossible, especially in the context of processing sensitive financial data (Ali et al., 2021). In the banking sector, blockchain-based solutions can reduce the risk of cybersecurity incidents causing damage in the order of billions in the global economy each year (Alanzi–Alkhatib, 2022). According to a study, the introduction of blockchain-based systems reduced fraud cases by 30% in the banking sector (Chang et al., 2020).

Blockchain technology can improve the efficiency of data sharing significantly (Antsipava et al., 2024). In contrast to conventional databases, blockchain technology provides real-time access to the data to all participants, while also ensuring data security and authenticity (Straubert–Sucky, 2021). This is especially important in healthcare, where sharing patient data accurately and timely can be critical for providing appropriate care. The accuracy of diagnoses and treatment efficiency can be improved this way, in addition to preserving the integrity of the data and the privacy of patients (Botene et al., 2021). A study found that information transmission through blockchain between healthcare institutions eliminated 50% of administrative errors (Thakur, 2022). Businesses may secure a competitive edge also in decision-making by reducing duplicate data and providing authentic information (Rahman et al., 2024).

Automation is another major benefit offered by blockchain technology. Smart contracts are programmed contracts within blockchain networks that execute the transactions automatically when certain pre-defined conditions are met (Gkogkos et al., 2023). As such, they significantly reduce the administrative burden and save time in business processes. In the insurance sector, smart contracts can be used for paying damage compensation automatically if the conditions are met, thereby speeding up processes and increasing customer satisfaction (Zou–Bao, 2023). Smart contracts can shorten the processing time of insurance claims significantly (Calliman et al., 2022).

Transparency is particularly important in international trade where parties often do not have any personal contact, and building up trust may therefore be problematic. In this environment, blockchain enables parties to trade directly at a reduced risk of fraud and increased transparency (Zhang et al, 2022). According to Straubert–Sucky (2021), blockchain adoption increased trust between trade partners. Transparency contributes to the accountability of businesses and improves the credibility of business operations for investors and customers alike. These are major benefits in industries such as finance, enabling clients to accurately trace how their money is used (Ibrahim–Truby, 2022). In the food industry, blockchain can be employed to track the entire life cycle of products, guaranteeing transparency from farmer to consumer. This, in turn, helps detecting counterfeit products and increases consumer trust (Mohamed et al., 2023). The emergence of blockchain technology has a transformative impact on supply chain management. The origin and quality of products is increasingly important to consumers. Transparency reduces food fraud (Rejeb et al., 2023). The TradeLens platform, developed jointly by Maersk and IBM, deploys blockchain technology to enhance global supply chain efficiency. By real-time tracking of shipments and administrative process automation, the platform reduces delays and costs. A study reports that the implementation of Trade Lens shortened shipping time by 15% and cut administrative costs by 20% (Dede et al., 2021).

Blockchain technology opens up new possibilities for innovation, including decentralised financing arrangements and digital asset tokenization. Tokenization is a means of exchanging assets such as real estate or works of art digitally, creating new markets for investors. In addition to boosting the efficiency of business operations, these innovations create novel opportunities also for consumers (Chavali et al., 2024). In the world of art, blockchain led to the tokenization of digital works of art and the emergence of NFTs (non-fungible tokens). It created new markets for artists and collectors by permitting the clear specification of, and trade in, the copyright of digital works of art. The value of the NFT market was USD 2 billion in 2021 (Goghie, 2024).

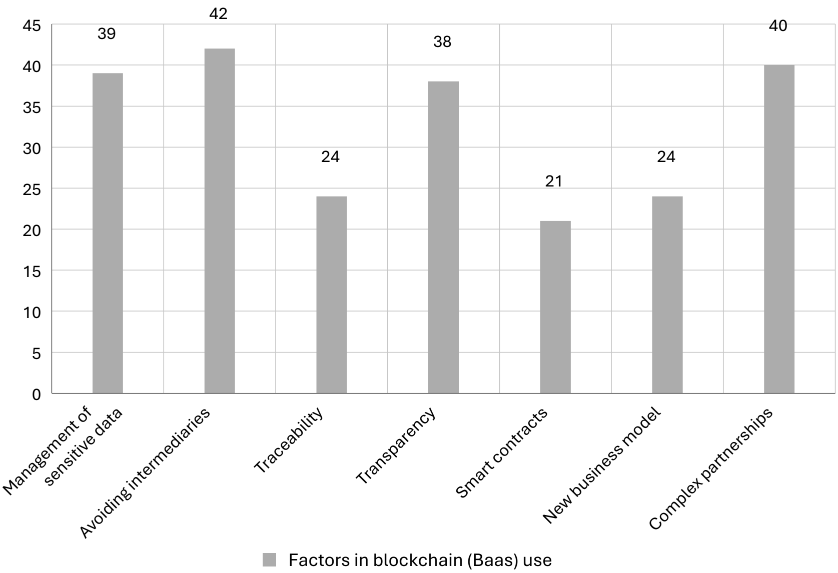
Sustainability is an increasingly important consideration in business, and blockchain can be put to great use in this area as well. Transparent data management allows enterprises to accurately measure and reduce their environmental impact. In the energy sector, blockchain can be used for tracking energy sources to make sure that energy comes from sustainable sources (Ismail et al., 2023). Mercedes-Benz employs blockchain technology for tracking CO_2 emissions and the share of renewable materials in its supply chain. The technology ensures accurate measurement of, and compliance with, sustainability targets, and greater transparency in supply chains (Reddy et al., 2021).

Enterprises may also achieve significant savings on reduced administrative costs and minimum intermediation in blockchains. The savings potential is especially significant in industries incurring considerable expenses in processing transactions and involving intermediaries (Cheng–Chong, 2022). In the context of international money transfers, blockchain-based systems lowered transaction fees while increasing the speed and security of transactions (Antal et al., 2021). As the need for central authorities is removed, participants can connect directly, which boosts the efficiency of processes and reduces costs (Jasimin–Nordin, 2022). In the energy sector, blockchain makes direct trade between energy users possible, among others by peer-to-peer (P2P) energy distribution (Juszczyk–Shahzad, 2022). Finally, the reduced need for intermediaries results in both cost savings and more streamlined business processes. Disintermediation also means that businesses can respond more quickly and efficiently to market needs, thereby improving client satisfaction and confidence (Yuthas et al., 2021). Some platforms allow users to borrow and lend money to each other directly without a need for banks. This not only implies lower costs but also shorter transaction times, while increasing the flexibility and accessibility of the system (Chang–Chen, 2020).

3.2 RQ2: When should businesses source blockchain technology from external suppliers (Blockchain as a Service/BaaS)?

Definition of the factors of efficiency improvement was of central importance in this research, as these provide the basis for our guidance to enterprises on whether using blockchain technology as a service or developing their own version is the more viable alternative. The business applications of blockchain take centre stage in corporate technology strategies today as a tool to transform traditional processes by capitalizing on its features of decentralisation, transparency and high security. A nuanced understanding of technological capabilities and the specific needs of the business environment is a prerequisite to recognising the ideal conditions for blockchain implementation (Boukis, 2020). Blockchain as a Service (BaaS) is a cloud-based service whereby enterprises and developers can create blockchain-based applications and solutions without building and operating their own infrastructure. BaaS providers handle basic technical tasks such as network configuration and maintenance, updates, and security issues (Bhattacharya et al., 2022). It is a cost-effective alternative especially for enterprises lacking in-house blockchain expertise. The technology can be utilized for smart contracts, decentralised applications (dApps) and other blockchain-based tools. As the technical background is ensured by the BaaS provider, enterprises using the service can concentrate on their business goals (Antal et al., 2021).

Figure 4
Factors supporting the use of BaaS, identified by cluster analysis



Source: author's elaboration based on study results (2024)

Our cluster analysis identified the seven imperative factors of blockchain adoption in *Figure 4*. The figure shows how many times – in the 67 pre-selected relevant publications – each factor was mentioned as an incentive, or the adoption of blockchain for business advocated. According to these factors, implementing the technology may be worthwhile for enterprises processing sensitive data and wishing to avoid intermediation costs. It is also worth considering if traceability and transparency would add value to workflows and production. It may also be an effective solution for enterprises involved in complex business partnerships (high number of partners, low level of confidence), or planning to introduce smart contracts or a new business model.

Table 2
Results for RQ2 based on the systematic literature review

RQ2: When should businesses source blockchain technology from external suppliers (Blockchain as a Service/BaaS)? Factors based on clusters	Sources collected according to the PRISMA model
Processing sensitive data	Alanzi–Alkhatib, 2022; Ali et al., 2021; Alladi et al., 2019; Bhattacharya et al., 2022; Bikos–Kumar, 2022; Botene et al., 2021; Chang et al., 2020; Chavali et al., 2024; Cheng–Chong, 2022; Choi et al., 2020; Della Pietra, 2023; Funlade–Geo, 2024; Geleziunaite–Sean, 2023; Grant–Booth, 2009; Hackius–Petersen, 2020; Han et al., 2024; Harakeh et al., 2024; Hui et al., 2022; Iranmanesh et al., 2023; Ismail et al., 2023; Jasimin–Nordin, 2022; Kaufman et al., 2021; Košťál et al., 2019; Kromes et al., 2024; Ktari et al., 2024; Kumar et al., 2024; Mohammed et al., 2023; Piesciorovsky et al., 2024; Reddy et al., 2021; Rejeb et al., 2023; Soltani et al., 2022; Straubert–Sucky, 2021; Strugar et al., 2018; Taherdoost, 2022; Tahir et al., 2024; Teisserenc–Sepasgozar, 2021; Yang et al., 2019; Yuthas et al., 2021
Avoiding intermediaries	Alshareef–Tunio, 2022; Ameyaw et al., 2023; Antal et al., 2021; Antsipava et al., 2024; Bhattacharya et al., 2022; Bikos–Kumar, 2022; Botene et al., 2021; Chang et al., 2020; Chavali et al., 2024; Cheng–Chong, 2022; Choi et al., 2020; Dede et al., 2021; Della Pietra, 2023; González et al., 2022; Du et al., 2023; Funlade–Geo, 2024; Gao et al., 2022; Glavanits, 2020; Grant–Booth, 2009; Haaren-van et al., 2022; Harakeh et al., 2024; Hui et al., 2022; Ibrahim–Truby, 2022; Ingle et al., 2023; Juszczyk–Shahzad, 2022; Keresztes et al., 2022; Košťál et al., 2019; Kromes et al., 2024; Ktari et al., 2024; Kumar et al., 2024; Mthimkhulu–Jokonya, 2022; Rahman et al., 2024; Rejeb et al., 2023; Roszkowska, 2020; Straubert–Sucky, 2021; Strugar et al., 2018; Tahir et al., 2024; Teisserenc–Sepasgozar, 2021; Thakur, 2022; Yuthas et al., 2021
Demand for traceability	Alshareef–Tunio, 2022; Antal et al., 2021; Antsipava et al., 2024; Bikos–Kumar, 2022; Botene et al., 2021; Boukis, 2020; Chavali et al., 2024; Choi et al., 2020; González et al., 2022; Du et al., 2023; Gao et al., 2022; Geleziunaite–Sean, 2023; Ingle et al., 2023; Jasimin–Nordin, 2022; Juszczyk–Shahzad, 2022; Košťál et al., 2019; Mohammed et al., 2023; Mthimkhulu–Jokonya, 2022; Rajasekar et al., 2020; Sedlmeir et al., 2022; Soltani et al., 2022; Tahir et al., 2024; Yang et al., 2019; Yuthas et al., 2021
Increasing transparency	Alshareef–Tunio, 2022; Ameyaw et al., 2023; Antal et al., 2021; Antsipava et al., 2024; Botene et al., 2021; Boukis, 2020; Chavali et al., 2024; Cheng–Chong, 2022; Dede et al., 2021; Della Pietra, 2023; González et al., 2022; Du et al., 2023; Duan et al., 2020; Gao et al., 2022; Geleziunaite–Sean, 2023; Gkogkos et al., 2023; Haaren-van et al., 2022; Han et al., 2024; Harakeh et al., 2024; Hui et al., 2022; Iranmanesh et al., 2023; Ismail et al., 2023; Keresztes et al., 2022; Košťál et al., 2019; Kromes et al., 2024; Ktari et al., 2024; Mthimkhulu–Jokonya, 2022; Nezhyva et al., 2021; Piesciorovsky et al., 2024; Rahman et al., 2024; Rejeb et al., 2023; Sedlmeir et al., 2022; Soltani et al., 2022; Straubert–Sucky, 2021; Taherdoost, 2022; Teisserenc–Sepasgozar, 2021; Yang et al., 2019; Yuthas et al., 2021
Introducing smart contracts	Alanzi–Alkhatib, 2022; Antal et al., 2021; Bikos–Kumar, 2022; Choi et al., 2020; Gkogkos et al., 2023; Hackius–Petersen, 2020; Ibrahim–Truby, 2022; Ismail et al., 2023; Jasimin–Nordin, 2022; Kaufman et al., 2021; Keresztes et al., 2022; Kromes et al., 2024; Piesciorovsky et al., 2024; Roszkowska, 2020; Sedlmeir et al., 2022; Soltani et al., 2022; Straubert–Sucky, 2021; Taherdoost, 2022; Tahir et al., 2024; Teisserenc–Sepasgozar, 2021

Adopting a new business model	Ali et al., 2021; Alladi et al., 2019; Antsipava et al., 2024; Bhattacharya et al., 2022; Della Pietra, 2023; González et al., 2022; Funlade–Geo, 2024; Gao et al., 2022; Gkogkos et al., 2023; Glavanits, 2020; Harakeh et al., 2024; Iranmanesh et al., 2023; Ismail et al., 2023; Jasimin–Nordin, 2022; Keresztes et al., 2022; Kumar et al., 2024; Mohammed et al., 2023; Nezhyva et al., 2021; Rahman et al., 2024; Reddy et al., 2021; Roszkowska, 2020; Taherdoost, 2022; Teisserenc–Sepasgozar, 2021
Due to complex partnerships	Alanzi–Alkhatib, 2022; Alladi et al., 2019; Ameyaw et al., 2023; Antal et al., 2021; Antsipava et al., 2024; Bhattacharya et al., 2022; Chang et al., 2020; Chavali et al., 2024; Cheng–Chong, 2022; Dede et al., 2021; Della Pietra, 2023; Funlade–Geo, 2024; Gao et al., 2022; Geleziunaite–Sean, 2023; Glavanits, 2020; Grant–Booth, 2009; Haaren-van et al., 2022; Hackius–Petersen, 2020; Han et al., 2024; Harakeh et al., 2024; Ibrahim–Truby, 2022; Iranmanesh et al., 2023; Juszczyk–Shahzad, 2022; Kaufman et al., 2021; Keresztes et al., 2022; Košťál et al., 2019; Mohammed et al., 2023; Mthimkhulu–Jokonya, 2022; Nezhyva et al., 2021; Piesciorovsky et al., 2024; Rahman et al., 2024; Rajasekar et al., 2020; Reddy et al., 2021; Rejeb et al., 2023; Soltani et al., 2022; Taherdoost, 2022; Teisserenc–Sepasgozar, 2021; Thakur, 2022

Source: own elaboration based on study results (2024)

In terms of the processing of sensitive data, blockchain technology offers a secure and immutable data storage solution, which has particular importance in industries where data integrity and privacy are critical (Bikos–Kumar, 2022). In the healthcare sector, protecting sensitive data in patients' records is essential. Decentralised and cryptographically encoded blockchain systems ensure that only authorised persons have access to the data, while guaranteeing the integrity and authenticity of information (Botene et al., 2021). A number of business transactions are traditionally executed through intermediaries, which involves higher costs and slower processing. Blockchain allows for peer-to-peer transactions by connecting parties directly, reducing the need for intermediaries as well as the associated costs (Choi et al., 2020). Change–Chen (2020) highlight the central importance of fast and cost-effective transactions in the financial sector. Accordingly, considerable efficiency gains can be achieved by adopting the technology.

Alshareef–Tunio (2022) underline the significance of transparency in the food and pharmaceuticals industry where verifying product origin and quality is a fundamental requirement. Blockchain may serve as an excellent tool in the trade of diamonds for tracing the path of gems from the mines to jewellery shops, so that the origin and legality of the products is verifiable (Choi et al., 2020). Transparency is closely connected to traceability, but the latter refers primarily to open and accessible information. The open ledger structure of blockchain allows network participants real-time access to relevant information, building trust and reducing information asymmetry (Gonzáles et al., 2022). Smart contracts are self-executing agreements whose terms and conditions are defined in the program code and executed automatically when certain conditions are met. This way, the risk of non-performance is significantly lower, as are legal costs, since there is no need for third-party validation. The Ethereum platform was originally designed for running smart contracts, enabling developers to create different decentralised applications for business logic automation (Piesciorovsky et al., 2024).

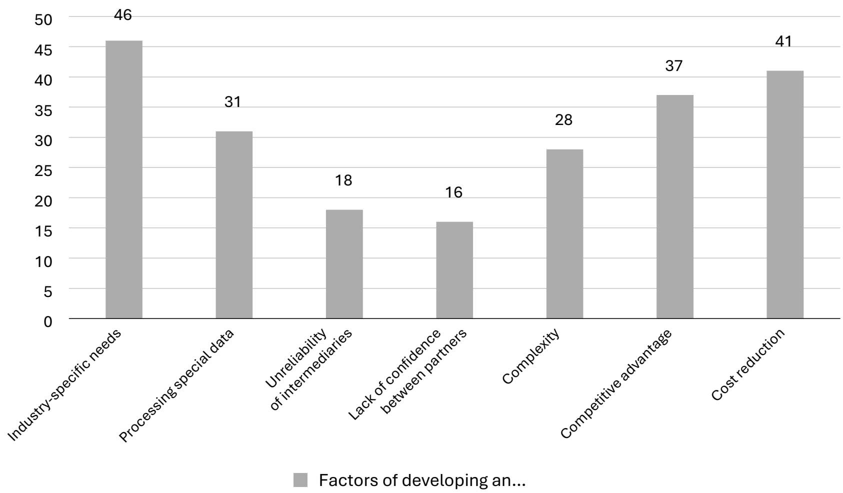
Decentralised systems open up possibilities for introducing new services, business models and products that had not been possible before. Kodak and Wenn Digital developed a platform for managing rights to photographs where photo copyright is registered, and service fees are settled by photographers in a dedicated cryptocurrency called KODAKCoin. The platform represents an entirely new business model in digital rights management (Alladi et al., 2019). In managing complex partnerships, the technology can be utilized for coordinating multi-party processes effectively (Ameyaw et al., 2023). Blockchain technology ensures real-time access to data to all parties, thereby eliminating delays and misunderstandings that may hinder collaboration. The achievable efficiency gains are especially pronounced in industries facing a heavy administrative burden due to complex supply chains and cross-border transactions and compliance requirements (Du et al., 2023). In the context of complex partnerships, blockchain may provide solutions also for industry-specific challenges, such as the integration of renewable energy sources and decentralised energy production in the energy sector (Juszczyk – Shahzad, 2022). The factors above jointly suggest that adopting blockchain technology may be the most advantageous for enterprises that process sensitive data, aim at eliminating costly intermediaries, or where traceability and transparency are top priority (Haaren-van et al., 2022). Implementing smart contracts and new business models does not only reduce operative costs but also creates possibilities for market innovation. Furthermore, blockchain has a wide range of potential applications across various sectors of the global economy due to its capability for managing complex partnerships more effectively (Funlade–Geo, 2024).

3.3 RQ3: When should businesses develop their own blockchain?

Enterprises having more ambitious and long-term objectives may decide to go beyond blockchain-as-a-service (BaaS) and develop their own solution. In this case, the enterprise uses only its own infrastructure and expertise to create a blockchain for process management and automation.

Whenever building a blockchain is closely aligned with the strategic objectives and nature of operation of the business, it is essential to have a clear vision of the expected business outcomes, a solid technological basis, and an adaptive approach to potential challenges and opportunities in implementation (Duan et al., 2020). By carefully considering factors such as governance, interoperability, security and stakeholder involvement, enterprises can leverage their proprietary blockchain as an effective tool of increasing efficiency and fostering innovation in their own industries (Geleziunaite–Sean, 2023). By strategic planning and having a long-term investment horizon, enterprises can tap the transformative potential in blockchain technology to secure a lasting competitive advantage (Yuthas et al., 2021).

Figure 5
Factors supporting in-house blockchain development, identified by cluster analysis



Source: author's elaboration based on study results (2024)

Before engaging in such a project, enterprises should assess their innovation capacities. A proprietary blockchain may be particularly advantageous where standardisation and control over network management are critical. In highly regulated industries like finance and healthcare, organisations may find that a custom blockchain better serves legal and operative compliance (Gao et al., 2022). A main advantage of developing blockchain protocols in-house is the possibility to integrate field-specific functionalities (Hui et al, 2022).

Financially, considerable efficiency gains may be secured by developing an own blockchain, which, however, requires appropriate technical and professional expertise (Ingle et al., 2023). Iranmanesh et al., (2023) highlight the critical role of blockchain in the areas of traceability and data management on the example of technologies applied in the agri-food sector. However, companies should weigh these benefits against the costs of developing their own solution, including long-term maintenance and scalability challenges in addition to initial planning and implementation costs (Košťál et al., 2019). By developing their own blockchain, enterprises can avoid intermediaries and make their operation more transparent, which in turn reduces costs and improves decision-making (Keresztes et al., 2022). These benefits are the most apparent in industries operating along complex supply chains or relying heavily on multi-party surveillance, such as manufacturing and logistics (Kaufman et al., 2021).

Many businesses find it difficult to adapt blockchain technology to their specific purposes due to insufficient technical expertise and a high customisation requirement (Kumar et al., 2024). Businesses must take questions such as scalability, interoperability and cybersecurity into consideration already in the planning phase to implement a blockchain infrastructure that effectively supports long-term growth and is adaptable to changing business needs (Ktari et al, 2024). According to Lemos et al., (2022) at an operative level, enterprises can use their proprietary blockchain to design custom solutions addressing specific inefficiencies in their business processes. Using blockchain for the improvement of data integrity and transaction automation through smart contracts significantly improves the speed and reliability of business operations (Hadarra, 2021). These benefits, however, also bring challenges, including the need for continuous updates and integrating blockchain networks into conventional IT infrastructure (Rajasekar et al., 2020).

Table 3
Results for RQ3 based on the systematic literature review

RQ3: When should businesses develop their own blockchain network? **Factors based on clusters**	**Sources collected according to the PRISMA model**
Industry-specific needs	Alanzi–Alkhatib, 2022; Ali et al., 2021; Alshareef–Tunio, 2022; Ameyaw et al., 2023; Antal et al., 2021; Antsipava et al., 2024; Bhattacharya et al., 2022; Bikos–Kumar, 2022; Botene et al., 2021; Boukis, 2020; Chang et al., 2020; Chavali et al., 2024; Cheng–Chong, 2022; Choi et al., 2020; Della Pietra, 2023; González et al., 2022; Du et al., 2023; Duan et al., 2020; Funlade–Geo, 2024; Gao et al., 2022; Glavanits, 2020; Haaren-van et al., 2022; Hackius–Petersen, 2020; Han et al., 2024; Harakeh et al., 2024; Hui et al., 2022; Ingle et al., 2023; Ismail et al., 2023; Kaufman et al., 2021; Košťál et al., 2019; Mohammed et al., 2023; Mthimkhulu–Jokonya, 2022; Piesciorovsky et al., 2024; Rahman et al., 2024; Rajasekar et al., 2020; Reddy et al., 2021; Roszkowska, 2020; Sedlmeir et al., 2022; Soltani et al., 2022; Taherdoost, 2022; Tahir et al., 2024; Teisserenc–Sepasgozar, 2021; Yang et al., 2019; Yuthas et al., 2021
Processing special data	Alanzi–Alkhatib, 2022; Alshareef–Tunio, 2022; Ameyaw et al., 2023; Bhattacharya et al., 2022; Bikos–Kumar, 2022; Chavali et al., 2024; Cheng–Chong, 2022; Du et al., 2023; Duan et al., 2020; Gao et al., 2022; Gkogkos et al., 2023; Glavanits, 2020; Grant–Booth, 2009; Jasimin–Nordin, 2022; Keresztes et al., 2022; Ktari et al., 2024; Mthimkhulu–Jokonya, 2022; Nezhyva et al., 2021; Piesciorovsky et al., 2024; Rahman et al., 2024; Reddy et al., 2021; Rejeb et al., 2023; Roszkowska, 2020; Sedlmeir et al., 2022; Soltani et al., 2022; Strugar et al., 2018; Tahir et al., 2024; Thakur, 2022; Yuthas et al., 2021

Unreliability of intermediaries	Ali et al., 2021; Antal et al., 2021; Bhattacharya et al., 2022; Botene et al., 2021; Boukis, 2020; Chang et al., 2020; Dede et al., 2021; Funlade–Geo, 2024; Geleziunaite–Sean, 2023; Harakeh et al., 2024; Iranmanesh et al., 2023; Jasimin–Nordin, 2022; Juszczyk–Shahzad, 2022; Košťál et al., 2019; Kromes et al., 2024; Mthimkhulu–Jokonya, 2022; Roszkowska, 2020; Straubert–Sucky, 2021
Lack of trust between partners	Alladi et al., 2019; Botene et al., 2021; Chang et al., 2020; Dede et al., 2021; Du et al., 2023; Gao et al., 2022; Han et al., 2024; Iranmanesh et al., 2023; Jasimin–Nordin, 2022; Keresztes et al., 2022; Kumar et al., 2024; Mthimkhulu–Jokonya, 2022; Nezhyva et al., 2021; Sedlmeir et al., 2022; Soltani et al., 2022
Complexity of processes/tasks	Alshareef–Tunio, 2022; Bhattacharya et al., 2022; Boukis, 2020; Cheng–Chong, 2022; Choi et al., 2020; Della Pietra, 2023; González et al., 2022; Duan et al., 2020; Harakeh et al., 2024; Hui et al., 2022; Ibrahim–Truby, 2022; Ingle et al., 2023; Ismail et al., 2023; Juszczyk–Shahzad, 2022; Kaufman et al., 2021; Keresztes et al., 2022; Kromes et al., 2024; Kumar et al., 2024; Mohammed et al., 2023; Mthimkhulu–Jokonya, 2022; Nezhyva et al., 2021; Reddy et al., 2021; Rejeb et al., 2023; Soltani et al., 2022; Strugar et al., 2018; Teisserenc–Sepasgozar, 2021; Yuthas et al., 2021
Securing a competitive advantage	Alladi et al., 2019; Ameyaw et al., 2023; Antsipava et al., 2024; Botene et al., 2021; Boukis, 2020; Cheng–Chong, 2022; Choi et al., 2020; Della Pietra, 2023; González et al., 2022; Funlade–Geo, 2024; Geleziunaite–Sean, 2023; Glavanits, 2020; Haaren-van et al., 2022; Hackius–Petersen, 2020; Han et al., 2024; Ibrahim–Truby, 2022; Ingle et al., 2023; Iranmanesh et al., 2023; Ismail et al., 2023; Jasimin–Nordin, 2022; Košťál et al., 2019; Kromes et al., 2024; Ktari et al., 2024; Mohammed et al., 2023; Nezhyva et al., 2021; Piesciorovsky et al., 2024; Rahman et al., 2024; Rajasekar et al., 2020; Sedlmeir et al., 2022; Straubert–Sucky, 2021; Strugar et al., 2018; Taherdoost, 2022; Tahir et al., 2024; Teisserenc–Sepasgozar, 2021; Yang et al., 2019
Cost reduction	Ali et al., 2021; Alladi et al., 2019; Alshareef–Tunio, 2022; Antal et al., 2021; Antsipava et al., 2024; Bikos–Kumar, 2022; Botene et al., 2021; Chang et al., 2020; Chavali et al., 2024; Cheng–Chong, 2022; Choi et al., 2020; Du et al., 2023; Funlade–Geo, 2024; Gao et al., 2022; Geleziunaite–Sean, 2023; Gkogkos et al., 2023; Glavanits, 2020; Grant–Booth, 2009; Haaren-van et al., 2022; Han et al., 2024; Harakeh et al., 2024; Hui et al., 2022; Ibrahim–Truby, 2022; Ingle et al., 2023; Iranmanesh et al., 2023; Ismail et al., 2023; Juszczyk–Shahzad, 2022; Kaufman et al., 2021; Keresztes et al., 2022; Kromes et al., 2024; Ktari et al., 2024; Nezhyva et al., 2021; Rahman et al., 2024; Rajasekar et al., 2020; Reddy et al., 2021; Soltani et al., 2022; Taherdoost, 2022; Teisserenc–Sepasgozar, 2021; Thakur, 2022; Yang et al., 2019

Source: own elaboration based on study results (2024)

In industries where the traceability, authenticity and originality of products or services is of crucial importance, implementing blockchain technology may be highly beneficial. In the food industry, transparency regarding the origin and processing of products is essential for maintaining consumer trust. Similarly, individual blockchain-based systems may prove effective tools in the fight against counterfeit products in the pharma industry (Mthimkhulu–Jokonya, 2022). Processing special data may also justify the development of an own blockchain solution. The structural characteristics of decentralisation and cryptographic security of blockchain technology make it a viable solution also for businesses handling sensitive or confidential data that must be stored and transmitted securely (Sedlmeir et al., 2022). This is a decisive requirement in sectors such as finance, where the integrity of transactions and safety of user data is indispensable (Roszkowska, 2020). The technology also contributes to mitigating lack of trust towards intermediaries and between partners. In enterprises having intricate operating processes that require the integration of several different systems, blockchain technology may offer a unified platform for data management and sharing (Soltani et al., 2022). In addition to improved data consistency and integrity, this also has the benefit of eliminating synchronisation issues between systems as well as the resulting errors (Nezhyva et al., 2021). Businesses often seek innovative technological solutions to secure competitive edge. Blockchain technology opens the way to establishing new business models, increasing process efficiency and strengthening market position (Taherdoost, 2022). Real-time tracking of shipments and automated (smart) contracts may give an advantage to businesses competing on the logistics market (Yang et al., 2019). Regarding cost reduction, Teisserenc–Sepasgozar (2021). argue that blockchain technology can contribute to curbing transaction costs, process automation and minimising the cost of errors. Tahir et al., (2024) suggest that businesses may achieve significant savings by disintermediation and streamlining processes, which improving financial performance in the long term, for example, in construction.

3.4 Summary figure of blockchain applications based on the results

Figure 6
Summary figure of blockchain applications

What are the direct effects of blockchain technology in the business sector?	When should businesses source blockchain technology from external suppliers (Blockchain as a Service/BaaS)?	When should businesses develop their own blockchain?
• Improved security • More efficient data sharing • Increased automation • Building trust between partners • Increased transparency • More efficient supply chain management • Innovation • Promoting sustainability • Cost reduction • Promoting decentralisation • Disintermediation	• Processing sensitive (e.g. medical, financial) data • Avoiding intermediaries (e.g. to reduce costs) • Improving traceability (e.g. food sector) • Increasing transparency (e.g. by streamlining processes and operation) • Introducing smart contracts (for processes that can be automated) • Plans for adopting a new business model (e.g. DeFi) • Involvement in complex partnerships (e.g. consortia)	• Industry-specific needs (e.g. client requirement) • Processing special data which may be complicated or risky to share • Unreliable intermediaries • Lack of trust between partners • Overly complex tasks and operation • Aiming at competitive advantage • Aiming at long-term cost reduction

Source: own elaboration based on study results (2024)

4 SUMMARY

Due to its unique characteristics, including decentralisation, immutability and transparency, blockchain technology has considerable potential for improving business efficiency. The technology revolutionizes business processes, especially in data management, cybersecurity, automation and supply chain management. This study reviewed the literature published between 2018 and 2024 using the PRISMA model, and cluster analysis to identify the key factors and challenges of implementing blockchain technology for business purposes in relation to *three research questions*:

- RQ1: What are the direct effects of blockchain technology in the business sector?
- RQ2: When should businesses source blockchain technology from external suppliers (Blockchain as a Service/BaaS)?
- RQ3: When should businesses develop their own blockchain network?

The first question focussed on the direct effects of blockchain on the business sector in recent years. Our findings show that improved security, transaction automation, increased transparency and cost efficiency are all factors contributing to more efficient business operation. *The second question* explored optimum conditions for using Blockchain as a Service (BaaS), revealing that this service is the most advantageous for businesses processing sensitive data or requiring a high level of traceability and transparency in their processes. *The third question* examined the business case for developing a blockchain in-house. Based on the results, industry-specific needs, processing special data and competitive advantage are all potential factors justifying such an investment.

The research results clearly indicate that blockchain is not only a technological novelty but a strategic solution that may fundamentally change business operation. However, the success of implementation depends greatly on the appropriate management of challenges emerging during the introduction of the technology, including scalability, interoperability and adaptation to the regulatory environment.

5 RECOMMENDATIONS

The research shows that it is indispensable for businesses to analyse their internal processes and industry-specific needs before adopting blockchain technology. It is also important to conduct preliminary impact assessment to evaluate how blockchain integrates with organisational objectives, the added value it creates and how it influences operational processes. Businesses that process sensitive data or that may benefit significantly from eliminating intermediaries from their processes should first consider Baas models providing fast and cost-effective access to blockchain-based systems. The BaaS model offers businesses all the advantages of blockchain technology without high up-front investment. As such, it may be a viable choice for small and medium-sized enterprises that do not have sufficient resources to develop and maintain an in-house solution. Implementing smart contracts facilitates business process automation. These contracts cut administrative costs, speed up transactions and increase customer satisfaction. On the Ethereum and similar platforms, business processes can be translated into code for streamlining business transactions.

Developing a proprietary blockchain may be reasonable for enterprises having special needs, e.g. industry-specific data management obligations, or requiring customised technology to gain a competitive advantage. However, a solid technological background and long-term planning, also including maintenance and scalability considerations, is crucial for this project. In sectors such as healthcare, the food industry or logistics, where traceability and transparency are fundamental, a proprietary blockchain may significantly improve competitiveness and efficiency.

Future research should dig deeper into the scalability and interoperability (ability to cooperate with other systems) challenges of blockchain technology, and steps towards regulatory compliance. Further analyses can help businesses better understand the benefits of, and compromises involved in, adopting the technology, so that they can integrate blockchain into their processes more efficiently. Exploring the long-term effects and different application possibilities of blockchain technology across industries more thoroughly would also be instructive. Comparative analyses on the impact of adopting the technology in different sectors and in businesses of different sizes would provide especially valuable insights. Additional research is needed on the appropriate regulatory framework and difficulties for the technology, e.g. energy demand and scalability issues. Finally, it would be crucial to develop a general strategic model for the implementation of blockchain technology to support enterprises.

6 LIMITATIONS OF THE RESEARCH

In this research, we conducted a systematic literature review of the role of blockchain technology in improving business efficiency using the PRISMA model. The analysis is limited to publications from the period 2018–2014 and may therefore not cover basic research published earlier or the state of the art of blockchain technology. While this timeframe captures recent advancements, it may not be an entirely true reflection of long-term trends or residual challenges (from other IT fields). The methodological scope of the study is also limited, as it relies solely on the PRISMA method and scientific publications in the Web of Science database. While this approach ensures methodological rigor, it may exclude valuable insight from industry reports, case studies and practitioner-oriented sources providing a practical perspective on blockchain acceptance. The diversity of blockchain applications from industry to industry also pose a problem. While this research summarises findings for the industries of finance, supply chain management and healthcare, it may not grasp the nuances of more understudied areas such as real estate and public administration. Therefore, the findings cannot be fully generalised across all industries. The dynamic nature of blockchain technology is another research limitation. Continuously changing consensus mechanisms, solutions for scalability and regulations may quickly render certain findings obsolete. Future research should address these shortcomings by integrating developments in real time and by exploring the long-term effects of blockchain on business efficiency. Despite these limitations, the study provides a comprehensive review that may serve as the basis of future inquiries into strategic blockchain adoption and development.

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