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Evolution or involution: A systematic literature review on blockchain adoption factors from an organisation's perspective

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Evolution or involution? A systematic literature review on blockchain adoption factors from an organisational perspective

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Abstract

Despite the volume of research into blockchain and its applications, actual adoption by organisations appears limited. To understand the potential reasons for the gap between research and practice, a systematic literature review of blockchain adoption factors is undertaken. We develop a mixed-method approach to integrate qualitative data coding with quantitative data analysis. Using thematic analysis, 880 adoption factors are identified and grouped into 29 themes, which offer a comprehensive summary of current developments in the literature. Using statistical analysis, the identified factors are dissected into technological, organisational, and environmental dimensions to provide an overview of each theme. Themes are then classified as enablers or barriers to examine firms' readiness for blockchain adoption. We demonstrate that recent literature on blockchain adoption has focused on elaboration of existing themes (involution) rather than development of new themes (evolution). Based on the recognised patterns and trends in the literature, we critique the speculative hype of blockchain research and project future research directions that may facilitate blockchain adoption in practice.

Keywords: Blockchain Adoption; Systematic Literature Review; Research Trend

Highlights:

- Identify 880 factors and 29 themes of blockchain adoption by organisations.
- Develop multi-dimensional theoretical frameworks to analyse factors and themes.
- Recent research on blockchain is mainly an involution rather than an evolution.
- Directed research: extensively studied themes are more intensively studied.
- Future research on blockchain is likely to focus on environmental enablers.

1 INTRODUCTION

Blockchain technology has received extensive attention for its potential to deliver immutability, traceability, and transparency, so it promises unique business benefits in promoting trust (Yadav et al., 2021; Yavaprabhas et al., 2022) and reducing costs (Pereira et al., 2019; Allen et al., 2020). The technology has been proposed as transformative for organisations in many industries, including decentralised finance (Makridis et al., 2023), healthcare systems (Balasubramanian et al., 2021), academic publishing (Mohan, 2019), sustainability and energy management (Hojckova et al., 2020), supply chain management (Brookbanks & Parry, 2022), central bank digital currency (Guo & Zhou, 2023), digital identity (Wolfond, 2017), and digital government (Tan et al., 2022). Consequently, there has been a surge in media coverage and academic research on blockchain. As shown in **Figure 1**, the average annual growth rate of blockchain-related publications is 75.3% compared to 4.7% of all publications between 2010 and 2022. Despite the rapidly growing attention, adoption of blockchain technology across industries remains limited (Queiroz et al., 2022). Most blockchain projects still appear to be in the planning or testing stage (Ostern et al., 2022; Sternberg et al., 2021), and no blockchain use cases have yet reached the plateau of productivity stage in the Gartner Hype Cycle (Perdana et al., 2021; Litan, 2022).

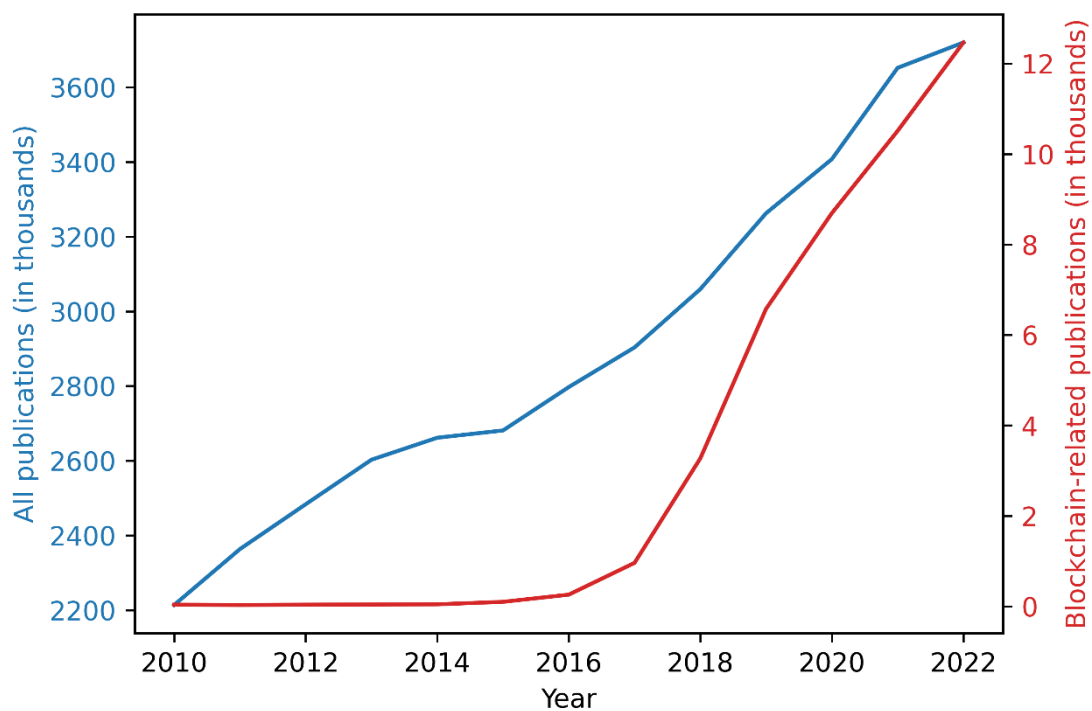


Figure 1 The research hype in blockchain.

Data Source: Scopus.

There are two logical possibilities for the gap between the research and the actual adoption of blockchain – either because of underused technology or because of excessive research ‘hype’. Thus, this review follows two storylines to understand the gap: the primary one is on blockchain adoption *per se*, while the secondary one is on the research into blockchain adoption. Corresponding to the two storylines, we aim to answer the following research questions (RQs).

RQ1 *What are the themes of blockchain adoption factors from an organisational perspective?*

RQ2 *How has the research on blockchain adoption developed over time?*

To answer the questions, a Systematic Literature Review (SLR) is conducted based on three major literature databases up to 2022. After applying exclusion criteria, the final sample consists of 75 papers from which 880 factors of blockchain adoption are identified. These factors are aggregated into 29 themes using qualitative thematic analysis. Quantitative tools are employed to examine the extent to which themes align in the technology-organisation-environment (TOE) framework. We also develop a novel theoretical framework to capture the extent to which themes are enablers, barriers, or ambiguous to blockchain adoption. It is termed the barrier-enabler-ambiguous (BEnA) framework, which extends previous reviews from categorising factors as either barriers or enablers (Stornelli et al., 2021, Vu et al., 2021). Combining qualitative and quantitative analyses, we conclude that the development of recent literature on blockchain adoption is mainly an ‘involution’ (elaboration of existing themes) rather than an ‘evolution’ (introduction of new themes).

In the review, we also find that most research to date has analysed empirical data in diverse contexts to identify potential barriers and enablers to blockchain adoption. These studies employ large sets of factors and modelling approaches like DEMATEL and ISM to understand the interdependencies among these factors in a specific context (Balasubramanian et al., 2021; Mangla et al., 2022; Govindan et al., 2022). Alternatively, other researchers have examined causal mechanisms behind the adoption decision through theoretical lenses, such as the technology acceptance model (Kamble et al., 2019), the unified theory of acceptance and use of technology (Wong et al., 2020), and the fit-viability perspective (Liang et al., 2021). These papers typically utilise a smaller number of factors and focus on a specific mechanism. The two strings of research have spawned notable literature reviews including Hastig and Sodhi (2020)’s summary of critical drivers of blockchain adoption in supply chain management and Vu et al. (2021)’s survey of enablers and barriers to blockchain adoption in food supply chains. However, the existing reviews are based on a selected sector, which may not be generalisable to other sectors.

In contrast, our SLR covers a more comprehensive literature and blockchain adoption factors, which represents the first contribution of our paper. To the best of our knowledge, this is the

first review that encompasses factors influencing blockchain adoption across various sectors, rather than being limited to a particular one. The understanding of these factors and their common themes is organised within the TOE framework and the BEnA framework, highlighting the multi-dimensionality of blockchain adoption. By integrating the TOE and BEnA frameworks, we distinguish between factors that facilitate or hinder blockchain adoption. Our findings move beyond simply listing factors or aggregating them into common themes, providing a more nuanced understanding of the multi-dimensionality of blockchain adoption.

The second contribution of our paper is to provide a ‘developmental’ review of the literature over time instead of a static snapshot of the literature at a point in time (e.g., Hastig & Sodhi, 2020). The chronological analysis enables us to gain an in-depth insight into how the literature develops over time. Inspired by Kant (1790) and Geertz (1963), we use the terms ‘evolution’ and ‘involution’ to distinguish the two patterns of literature development, i.e., outward progression (i.e., introducing new themes) and inward progression (i.e., elaborating on existing themes). Based on the patterns and trends identified from the review, we can better evaluate the existing research and inform the future research.

The third contribution is methodological. The mixed-method approach coupling qualitative thematic analysis and quantitative data analysis is novel to systematic reviews. Thematic analysis is suitable for hierarchically synthesising the qualitative textual data on adoption factors, but it calls for statistical methods such as correlation and regression to reveal the relationship hidden in the qualitative textual data. Using statistical methods akin to meta-analysis, we calculate average effects of factors across all sample articles to present themes along the TOE dimensions and BEnA dimensions. In the mixed-method approach, qualitative and quantitative techniques are integrated, not compiled, to better analyse and synthesise the literature.

Following the introduction, Section 2 describes the methodology used in this review. Section 3 summarises the themes of blockchain adoption factors to address RQ1. Section 4 investigates how these themes develop over time to address RQ2. Future research directions are discussed in Section 5 based on the identified patterns and trends of the literature. Section 6 concludes.

2 METHODOLOGY

To ensure the rigour the review follows the recommended three-stage SLR of Tranfield et al. (2003) and Denyer & Tranfield (2009), illustrated in **Figure 2**. In the planning stage, a review panel is formed, an exploratory review is conducted, and the search strategy and selection criteria are set. The review panel (Step 1-1) comprises a panel leader (the first author) and three members (the co-authors). The panel leader manages the SLR method design and conducts each step of the process. One member double-checks each decision to enhance the methodological rigour. Any disputes between the leader and the member are resolved through regular

meetings with the other two members. The review panel helps minimise possible retrieval, selection, and expectancy biases of the review (Tranfield et al., 2003; Castañer & Oliveira, 2020). Prior to the formal systematic review, we conduct an exploratory review (Step 1-2). The insights gained from the exploratory review assist us in establishing the search strategy and selection criteria used in the data collection during the formal review (Rotolo et al., 2022). In the conducting stage, we collect data through a comprehensive search (Step 2-1) and a meticulous screening (Step 2-2) before analysing data in Step 2-3. Findings are presented orderly in the reporting stage, structured in a similar fashion to empirical research, which utilises papers as data (Denyer & Tranfield, 2009).

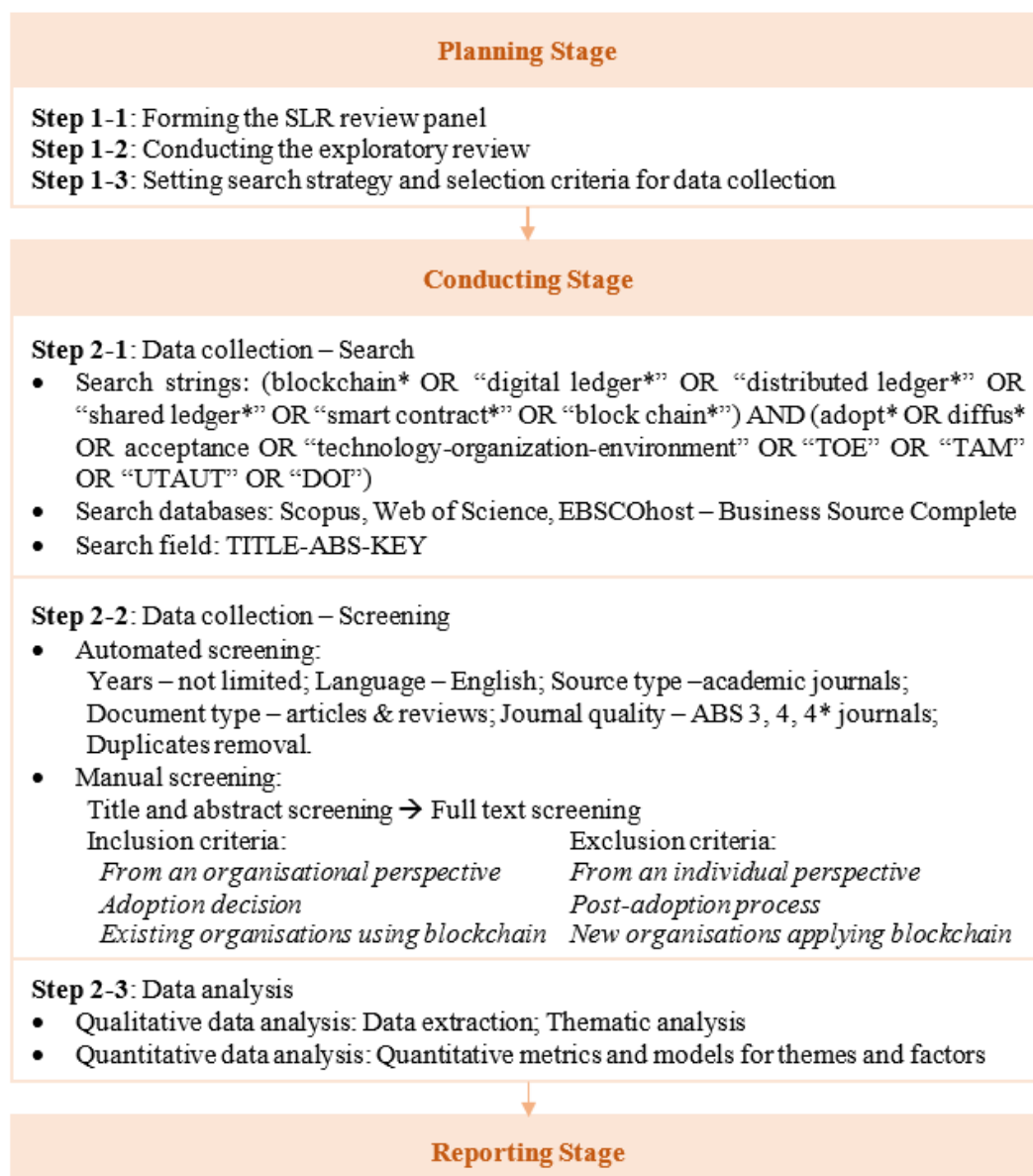


Figure 2 An overview of the SLR process.

Detailed descriptions and justifications of data collection (Steps 2-1 and 2-2) can be found in Supplementary Material. Eventually, 75 papers are selected for data analysis. **Figure 3** summarises the number of papers that go through each selection step.

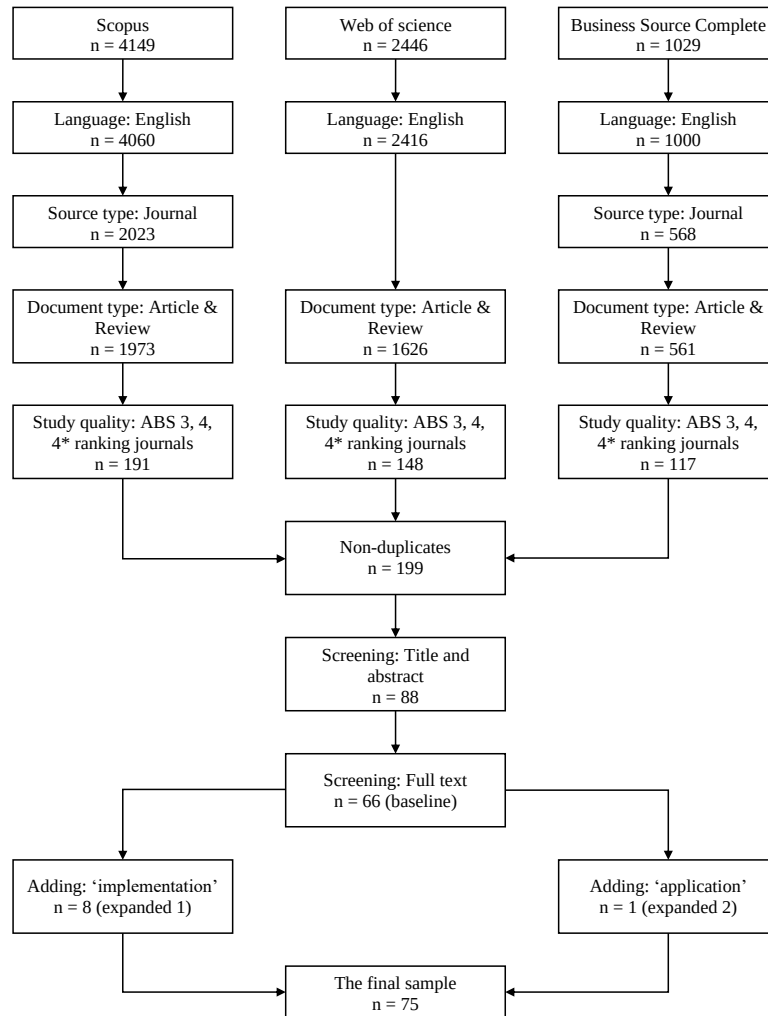


Figure 3 The number of papers included in the search and screening process.

We develop a mixed-method approach that encompasses both qualitative data coding and quantitative data analysis (Step 2-3).

Identification of themes. To code the qualitative textual data, we initially utilise Microsoft Excel spreadsheets to extract publication information (e.g., title, authors, journal, year, etc.) and substance data (e.g., research questions, adoption factors, theoretical perspectives, research methodology, key findings, etc.). We obtain 880 factors related to blockchain adoption from the 75 papers. We then apply thematic analysis to aggregate the factors to 29 themes to answer RQ1. To ensure the reliability of thematic analysis, we adopt the procedures of thematic analysis proposed by Nowell et al. (2017).

Analysis of themes. We use a quantitative approach to analyse the themes. First, we quantify the attributes of the themes along the technology, organisation, or environment dimensions in line with the TOE framework (Tornatzky & Fleischer, 1990; Baker, 2012). Second, we measure the extent to which each theme is an enabler or a barrier to blockchain adoption. Where a theme cannot clearly be identified as an enabler or barrier, we label it ‘ambiguous’. We term this new analysis framework as barrier-enabler-ambiguous (BEnA) where ‘En’ is used to avoid confusion with the ‘E’ dimension in the TOE framework. We combine the two theoretical frameworks to provide a multi-dimensional understanding of the identified themes.

To demonstrate the distribution of themes along the TOE dimensions, we compute the TOE ratios for each theme as follows. Denote the total number of factors in theme t of paper p as $N_{p,t}$, where $t = 1, 2, \dots, N_{theme}$ ($N_{theme} = 29$) and $p = 1, 2, \dots, N_{paper}$ ($N_{paper} = 75$). We assign values of 3, 2, 1, or 0 to each dimension of a factor based on its primary, secondary, or tertiary relevance or irrelevance to the given dimension. For example, the factor ‘technological capabilities of the firm’ involves both organisational and technological dimensions, but it is more related to the organisation than technology. Therefore, $O = 3$ (primary dimension), $T = 2$ (secondary dimension), and $E = 0$ (irrelevant). For measurement comparability, we normalise these assigned values and denote the normalised values of d (for factor f belonging to theme t in paper p) as $V_{p,t,f}^{(d)}$, where $d = T, O, E$. In the aforementioned example, this will be $3/(3 + 2 + 0) = 0.6$, $2/(3 + 2 + 0) = 0.4$, and $0/(3 + 2 + 0) = 0$ for O, T, and E dimensions respectively. The computation formula for TOE shares of each theme $s_t^{(d)}$ can be summarised in equation (1). Similarly, we can calculate the BEnA shares of each theme using the same process for $d = B, En, A$. The only difference is that a given factor can only act as a barrier or an enabler or have an ambiguous effect on blockchain adoption. Therefore, the factor’s value $V_{p,t,f}^{(d)}$ for each BEnA dimension can be either 0 or 1, which is a special case of the normalisation process.

$$s_t^{(d)} = \frac{1}{N_{paper}} \sum_{p=1}^{N_{paper}} \frac{1}{N_{p,t}} \sum_{f=1}^{N_{p,t}} V_{p,t,f}^{(d)} \text{ for } f = 1, 2, \dots, N_{p,t}. \quad (1)$$

Analysis of trends. To answer RQ2, we analyse the development of themes and factors in the literature in two ways. First, using papers as the units of analysis, we examine the distribution of factors along the TOE and BEnA dimensions across years. It shows how attention to these factors changes chronologically. If we let t in the formula (1) represent time (instead of theme), definition of TOE and BEnA ratios for a given t (i.e., year) is a straightforward extension. Second, using themes as the units of analysis, we calculate the number of unique factors per theme over time and trace the emergence of new themes over time. This allows us to determine whether more factors are used to elaborate existing themes (i.e., an involution) or whether new

themes are introduced (i.e., an evolution). We further examine the correlation between the development of factors and themes to project the future directions of research on blockchain adoption. The results of all analyses are reported in the next sections.

3 RESULTS: THEMES

Using textual analysis, we identify 880 factors which are aggregated into 29 themes. All the themes are derived from existing literature to avoid arbitrariness. The general principle in selecting the themes is to strike a balance between theme size and definition clarity. Themes containing broad or mixed information in their definition are large and diverse, so it is necessary to break them into several smaller themes with clearer definitions. Themes that are too small tend to be a special case of other themes, and so where appropriate, are merged into larger themes. The following bullet points present the definitions of the themes (in the alphabetic order), along with representative examples of factors and references. The list provides an answer to RQ1.

- **Accessibility** refers to organisations' access to the necessary environmental infrastructure for blockchain implementation, particularly IT infrastructure (Sabeti et al., 2019). Examples include: good interfaces (Bai et al., 2021), absence of blockchain infrastructure (Govindan et al., 2022), limited information about infrastructure (Mangla et al., 2022).
- **Adaptability** is the need for organisations to sustain themselves in a changing environment (Bai & Sarkis, 2020). Examples include: stronger risk management (Sodhi et al., 2022), improved resiliency of the system (Sharma et al., 2021), and mitigated disruption risks (Narwane et al., 2021).
- **Capability** refers to organisations' objective competencies in adopting a blockchain system (Hastig & Sodhi, 2020). Examples include: technical capability (Agi & Jha, 2022), financial resources (Liang et al., 2021), and human capital (Ahi et al., 2021).
- **Collectivity** refers to four core organisational activities in blockchain adoption: collaboration, coordination, cooperation, and communication ('4C'), reflecting a collective approach within or between organisations (Majchrzak et al., 2015; Castañer & Oliveira, 2020). Examples include: employee resistance to change (Ali et al., 2021), top management support (Kamble et al., 2021), goal alignment (Hastig & Sodhi, 2020), cooperation commitment (Kurpjuweit et al., 2021), and cooperation to adopt common supply chain objectives (Agi & Jha, 2022).
- **Compatibility** is the degree to which an innovation is suitable or able to integrate with existing systems and processes within organisations (Orji et al., 2020). Examples include: integration with legacy systems (Rana et al., 2022), lack of organisational culture for changing (Govindan et al., 2022), lack of new organisational policies for using

blockchain technology (Kouhizadeh et al., 2021), and lack of technology vision in the organisation (Sodhi et al., 2022).

- **Competitiveness** is the strategic interdependence among competitors during blockchain adoption, where competitors influence an organisation's understanding and intention to adopt blockchain (Orji et al., 2020). Examples include: inter-vendor competition (Cho et al., 2021), mimetic pressures (Hew et al., 2020), competitive pressure (Kamble et al., 2021). and competition intensity between two platforms (Li et al., 2021).
- **Complexity** is the perceived difficulty in understanding and using an innovation (Kamble et al., 2021). Examples include: perceived ease of use (Turhan & Akman, 2021), complexity in set up/use (Mathivathanan et al., 2021), and increased IT handling complexity (Sternberg et al., 2021).
- **Connectivity** refers to the real-time availability of data among involved stakeholders in a blockchain system (Samad et al., 2022). Examples include: real-time information availability to agro-stakeholder (Yadav et al., 2021), timely information capture (Huang et al., 2022), and supply chain disconnections (Wang et al., 2019).
- **Efficiency** refers to the ability of a blockchain system to enhance the cost-effectiveness of various processes and transactions for organisations, which is determined relative to the total work and/or cost incurred (Sodhi et al., 2022). Examples include: transaction speed (Bai et al., 2021), cost reduction (Sharma et al., 2021), and efficient decision-making (Karakas et al., 2021).
- **Feasibility** refers to the practicality and viability of adopting an innovation in a specific context, with the evaluation focusing on the cost-benefit analysis (Huang et al., 2022). Examples include: adoption cost (Cho et al., 2021), training cost (Sodhi et al., 2022), sufficiency of internal control mechanism (Ali et al., 2021), and assessment of blockchain's business value (Ostern et al., 2022).
- **Flexibility** refers to ease to change records on a blockchain system, which is related to blockchain's immutable nature (Rana et al., 2022). Examples include: lack of contract mutability (Drummer & Neumann, 2020), and immutability challenge of blockchain technology (Kouhizadeh et al., 2021).
- **Interoperability** refers to the ability of different systems to exchange and make use of information. It may involve different blockchains, as well as other information systems in organisations (Kurpjuweit et al., 2021). Examples include: standardization of blockchain system (Dutta et al., 2020), establishing rules and standards for interoperability (Agi & Jha, 2022), and diverging blockchain standards and protocols (Drummer & Neumann, 2020).
- **Legality** refers to the law enacted by the legislature that organisations should consider in blockchain adoption (Hastig & Sodhi, 2020; Xu et al., 2022). Examples include: lack

of legal security (Govindan, 2022), no legal recourse in case of contract breach (Drummer & Neumann, 2020), and legal issues (Rana et al., 2022).

- **Legitimacy** refers to an organisation's tendency to conform to rules and norms established primarily by suppliers, clients, and industry associations during decision-making processes (Hew et al., 2020). Examples include: customer requirements, trading partner pressure (Wamba et al., 2020), industry wide initiatives (Agi & Jha, 2022), and normative pressures (Hew et al., 2020).
- **Maturity** refers to the phased features of an innovation, which can be represented by its position in a technology life cycle (Govindan et al., 2022). Examples include: infantile challenges of BCT (Dwivedi et al., 2022), lack of technological development (Mangla et al., 2022), and immature technology (Toufaily et al., 2021).
- **Novelty** refers to an innovation's distinctive qualities in comparison to alternative technologies (Falcone et al., 2021). Examples include: relative advantage (Hew et al., 2020), smart contract (Samad et al., 2022), decentralisation (Yousefi & Tosarkani, 2022), and cryptographic and tamper proof (Sharma et al., 2021).
- **Policy** refers to the rules and norms set by the government (executive branch), which are typically supportive of organisations' adoption of blockchain technology (Mangla et al., 2022). Examples include: strong support for start-ups from government bodies (Balasubramanian et al., 2021), lack of governmental policies (Kouhizadeh et al., 2021), and government policy and support (Orji et al., 2020).
- **Popularity** refers to the acceptance rate of suppliers, clients, competitors towards blockchain technology (Bai et al., 2021). Examples include: participation degree (Bai & Sarkis, 2020), user resistance (Kurpjuweit et al., 2021), stakeholder acceptance (Hastig & Sodhi, 2020), and network effect (Sharma et al., 2021).
- **Privacy** is the system's ability to safeguard user identity and control over personal or commercially sensitive data (Toufaily et al., 2021). Examples include: immutability and encryption (Yousefi & Tosarkani, 2022), loss of keys (Liu et al., 2021), and privacy leakage (Zhao et al., 2019).
- **Regulatory** refers to the regulations made by the government (executive branch), which are typically restrictive, and that organisations must follow during the adoption of blockchain technology (Agi & Jha, 2022). Examples include: lack of government regulations (Sharma et al., 2021), lack of regulatory standards and experience (Liu et al., 2021), and regulatory compliance (Rana et al., 2022).
- **Reliability** refers to the likelihood of a blockchain system to work smoothly without system faults or errors (Bai & Sarkis, 2020). Examples include: occasional errors (Liu et al., 2021), and inaccurate inputs (Vu et al., 2021).

- **Scalability** refers to effectiveness of a blockchain system for organisations as the system grows, which is determined relative to the marginal work and/or cost incurred (Sodhi et al., 2022). Examples include: throughput capacity (Bai & Sarkis, 2020), storage capacity and scalability (Zhao et al., 2019), limited scalability (Dwivedi et al., 2022), and longer latency time (Sharma et al., 2021).
- **Security** refers to the system's ability to protect data from getting into the wrong hands through a breach, leak, or cyber-attacks (Kurpjuweit et al., 2021; Rana et al., 2022). Examples include: malicious attacks (Liu et al., 2021), security risks on public blockchains (Drummer & Neumann, 2020), and hacking possibilities (Wang et al., 2019).
- **Subjectivity** refers to the influence of personal beliefs, perceptions, or feelings on decision-making, rather than facts, including the preferences of decision-makers and the interchange of thoughts and feelings among decision-makers (Husserl, 1931; Buchanan et al., 1998). Examples include: hesitancy (Saberli et al., 2019), personal innovativeness (Falcone et al., 2021), and varying opinions among decision-makers (Bai & Sarkis, 2020).
- **Sustainability** refers to the (un)sustainable prospects that blockchain technology enables for the environment and society (Yousefi & Tosarkani, 2022). Examples include: job creation (Bal et al., 2021), procedure justice (Falcone et al., 2021), lower carbon footprint (Yousefi & Tosarkani, 2022), and ethical issues (Rana et al., 2022).
- **Traceability** refers to the quality of a blockchain system to discover information about where, when, and how products are produced and transacted/exchanged (Sharma et al., 2021). Examples include: tracking product components (Bai & Sarkis, 2020), proving provenance (Yousefi & Tosarkani, 2022), and monitoring of agro-practices and process (Yadav et al., 2021).
- **Transparency** refers to the quality of a blockchain system to operate in a way being easy to see what actions are performed (Karakas et al., 2021). Examples include: visibility (Samad et al., 2022), and enhanced food chain transparency (Vu et al., 2021).
- **Trust** refers to the spirit in which a trusted party, whether between individuals or individuals and blockchain technology, will fulfil its obligations as expected by the trusting party (Falcone et al., 2021). Examples include: trustworthiness (Bai et al., 2021), trust towards BCT (Sharma et al., 2021), inter-organisational trust (Choi & Siqin, 2022), partnership trust (Huang et al., 2022), and enhanced trust (Sternberg et al., 2021).
- **Uncertainty** encompasses various risks related to blockchain adoption from market regulators and players in the environment (Chowdhury et al., 2022). Examples include: market turbulence (Orji et al., 2020), regulatory uncertainty (Dutta et al., 2020), uncertain government policies (Govindan et al., 2022), and legal and contractual uncertainty (Sharma et al., 2021).

Themes are separately developed by different authors in diverse research contexts, so there is overlapping among theme definitions. To examine the extent of overlapping, we quantify the co-occurrence of themes by a correlation matrix, finding that most entries are either weak or statistically insignificant (see Supplementary Material). The correlation analysis indicates that the identified themes are adequately distinctive. These themes form the basis for the analyses of patterns and trends in the literature.

3.1 TOE analysis of themes

In light of the TOE framework, we can position the themes in a ternary plot (**Figure 4**) based on analysis of underlying factors in the technology (T), organisation (O), and environment (E) dimensions. The decomposition of themes follows the formula of $s_t^{(d)}$ in subsection 2.2. For instance, the T-ratio of a theme indicates the proportion of factors of the theme are technology-related. In the ternary plot, the theme's T, O, or E ratios measure the theme's proximity to the three vertices. The size of a circle represents the total number of factors assigned to each theme. The colour of a circle represents the theme's dominant dimension.

The ternary plot (**Figure 4**) reveals two patterns. First, the distribution of themes is heterogeneous across the TOE families. As the largest thematic cluster, the T-family theme also has the widest dispersion, compared to O- and E-family themes which are more concentrated and segmented. Kranzberg's (1986) First Law emphasises that technology is not inherently good nor bad, nor is it neutral. Instead, its usage and consequences depend on the specific circumstances in which it interacts with the market, society, and the environment (Kewell et al., 2017). Our results are in line with the First Law as technological issues are not purely technological but are intertwined with organisational and/or environmental dimensions. For example, *privacy*, despite being a T-family theme, consists of various factors (such as business information sharing, consumer privacy concerns, and encryption techniques) that are enacted through organisational and environmental mechanisms.

Second, the distribution of theme sizes is homogenous across TOE families. Despite substantial differences in theme sizes (big and small circles) within each family, the distribution of theme sizes across thematic families is quite similar. For example, in the E-family, *collectivity* is the most prominent theme with 116 factors and *policy* is the least prominent with 18 factors. The size ratio between the two is $116/18 = 6.4$. In the O-family, *compatibility* is the biggest theme with 148 factors and *adaptability* is the smallest with 24 factors, resulting in a similar ratio of $148/24 = 6.2$. This finding suggests that the within-group heterogeneity exceeds the between-group heterogeneity in the distribution of theme sizes (i.e., the number of factors of the theme).

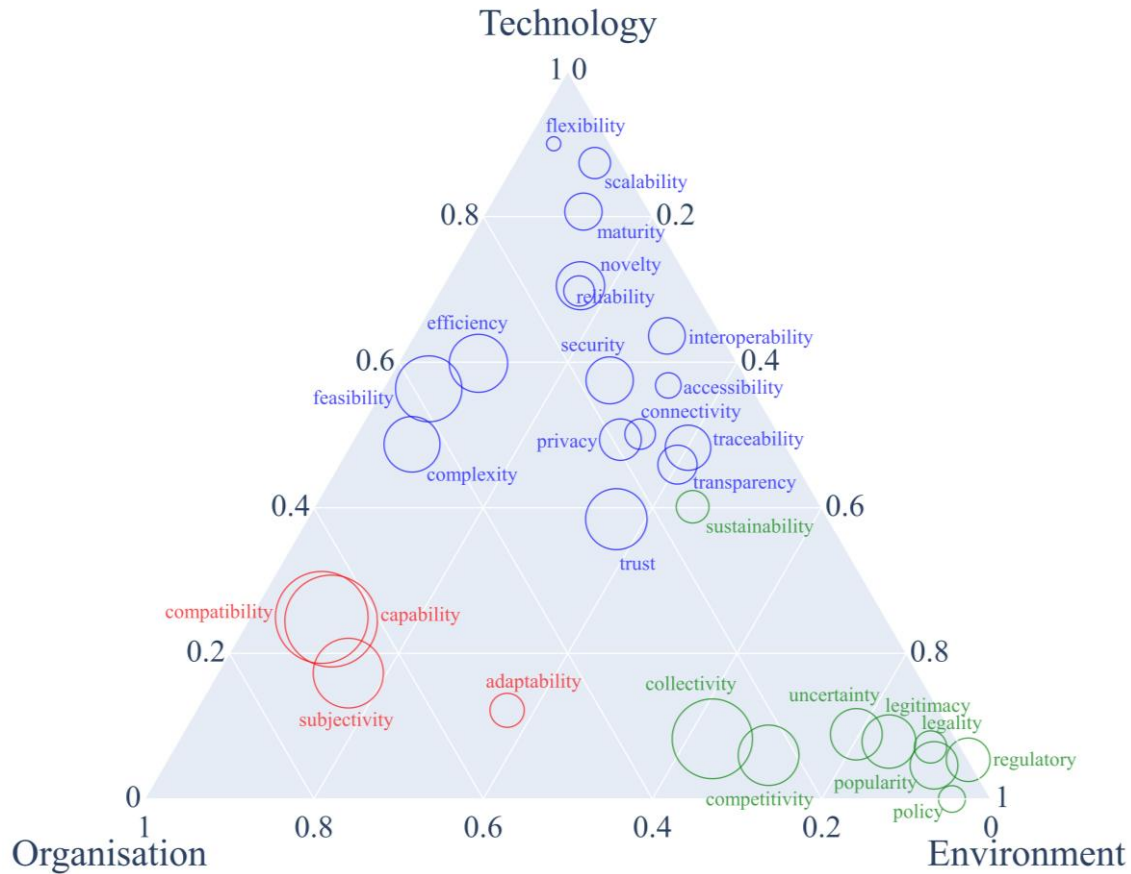


Figure 4 The TOE composition of themes.

Notes: Blue = Technology-oriented, Red = Organisation-oriented; Green = Environment-oriented

Apart from the two general patterns, we also identify a special theme that stands out among other themes in terms of TOE attributes. While most themes are located along one or two dimensions, *trust* is positioned closest to the center with a balanced set of TOE attributes. This implies that trust-related factors involve multiple dimensions and stakeholders. The interdependence of the trust theme makes it one of the most challenging issues to tackle during blockchain adoption (Queiroz et al., 2021).

3.2 BEnA analysis of themes

The TOE framework provides a perspective on the factors related to the decision of blockchain adoption (Tornatzky & Fleischer, 1990), but it does not inform the way in which these factors affect the decision. For this purpose, we categorise factors into ‘barriers’ (B) or ‘enablers’ (En) to blockchain adoption (e.g., Karakas et al., 2021; Vu et al., 2021). To make it logically complete, we add an ‘ambiguous’ (A) category to form the BEnA analysis framework. The A category encompasses three cases.

- (i) **Conditional factors** (64.00%) are commonly presented in game theoretical papers (e.g., Fan et al., 2022), where a mathematical model is developed to determine an optimal solution (to adopt or not) in the Nash equilibrium. The optimal solution is conditional on factors such as cost, price, quantity, competition intensity, and customer trust in product information. These factors account for the majority in the A category.
- (ii) **Indeterminate factors** (15.20%) have unclear effects on adoption. For example, it remains to be determined how some psychological factors such as hesitancy and regret aversion (*subjectivity*) affect decision-makers (Sternberg et al., 2021). When the regression significance of control variables in empirical papers are unreported, we also consider them as indeterminate (e.g., Falcone et al., 2021).
- (iii) **Insignificant factors** (20.80%) are found to be not statistically significant in empirical papers. For example, firm age and size have no significant effect on manufacturers' intention to participate in a blockchain-based Halal traceability system (Hew et al., 2020).

The BEnA framework provides a 'readiness analysis' for blockchain adoption because it categorises themes in terms of signs of the effects. **Figure 5** illustrates how themes align in the BEnA dimensions. Again, the size of each circle indicates the number of factors of each theme, and the colour denotes if the theme belongs to the T-, O-, or E-family. Three patterns are shown in the ternary plot.

First, weak enablers and barriers (farther from the B or En vertex) tend to be more ambiguous (closer to the A vertex). This statement is not a tautology, because the finding is statistically true rather than definitionally true—some weak barriers (e.g., *popularity*) or weak enablers (e.g., *sustainability*) may have low ambiguity. If we draw two regression lines from the B vertex and the En vertex, the slopes suggest negative correlations. The gradients of the two regression lines also implies that, on average, weak enablers (steeper slope) tend to be more ambiguous than weak barriers (flatter slope), which can partially explain the gap between the hype and the actual adoption of blockchain—enablers are contingent, but barriers are more definite.

Second, bigger themes are likely to be more ambiguous. Themes closer to the center tend to have larger circle size (i.e., more factors are associated with them) than those located close to the vertices. Themes that have been elaborated in the literature (with more factors) are more likely to cover both enablers and barriers as well as conditional factors. Nevertheless, the most prominent themes (e.g., *capability*, *compatibility*) lie on the barrier side. It implies that scholarly debates, often rooted in practical use cases of blockchain, have been focused on the challenges to adoption.

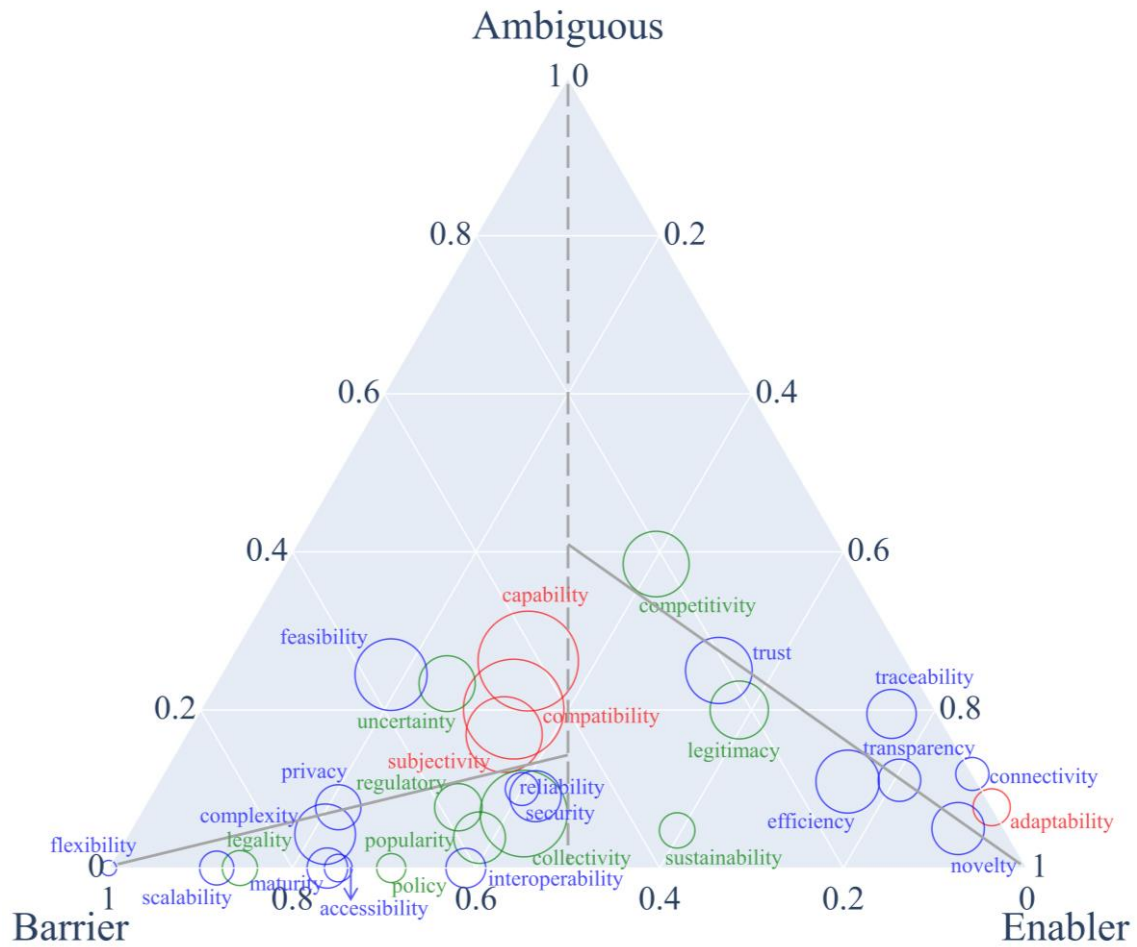


Figure 5 The BEnA composition of themes.

Notes: Blue = Technology-oriented, Red = Organisation-oriented; Green = Environment-oriented.

Third, the BEnA distribution of themes is homogenous among TOE families. For all three families, more themes are on the barrier side and fewer themes are on the enabler side. As themes become more prominent (bigger circles), they also become more ambiguous for all three families. The average proportions of barriers (i.e., B-ratios) in the T-, O-, and E-family themes are 47%, 34%, and 50%, respectively. The smaller B-ratio of O-family themes suggests that the main challenges to blockchain adoption come from the environment and the technology. These barriers are beyond the control of the decision-makers, which aids understanding of the gap between the hype and the actual adoption.

In summary, our findings highlight the multi-dimensionality of blockchain adoption. Technology-oriented aspects of adoption are not solely determined by technology itself but are interdependent on factors from organisations or external environments. Technology serves as a means to an end, rather than an end in itself. Furthermore, our findings reveal that the effects

of adoption barriers, which mostly pertain to technology or environmental aspects, are more unequivocal. In contrast, the impact of enablers tends to be contingent and conditional.

4 RESULTS: TRENDS

The identified themes and the analyses of the themes summarise the state of the art, but how has the literature developed to this state (RQ2)? The answer to this question may help prediction of future research directions. Analysis requires a developmental perspective to see the trends in research. We distinguish two types of development: evolution and involution.

The term ‘involution’ was first coined by the German philosopher Kant in 1790 (Kant, 1790; Wang & Hui, 2021). Anthropologist Geertz later used ‘involution’ to describe a phenomenon in which *‘agriculture could not be extended outward, and labor could only be constantly devoted to the limited production of rice’* (Geertz, 1963). In this case, agricultural development reached a point of inward over-elaboration, with population growth failing to result in increased productivity (White, 1983). Inspired by this tradition, we borrow the terms ‘evolution’ and ‘involution’ to describe outward or inward progressions in research. Evolution refers to the emergence of new themes, while involution describes the elaboration of existing themes by addition of novel factors. Without evolutionary breakthroughs, the literature ‘involutates’, engaging in introspection of discipline or subject. Involution risks monodisciplinary over-elaboration, with publications potentially increasing complexity and failing to adopt transdisciplinary thinking that can introduce novelty (de Jong et al., 2016; Gooding et al., 2023).

4.1 Trend analysis of themes

We use the number of new themes (T_t) to measure the extent of evolution and the (average) number of factors per theme (F_t) to measure the extent of involution. Quarterly data are used, so t is a particular quarter in the sample period¹. **Figure 6** suggests a significantly positive trend of F_t , but there are no new themes ($T_t = 0$) after 2020Q1. This shows that the literature has focused on developing factors within established themes, rather than building up new themes. This is evidence for involution in the research.

Note that the number of factors per theme (F_t) is computed based on each paper and then averaged. Within each paper there should not be duplicate factors, ensuring the uniqueness of

¹ Regarding time variable t , we use the quarterly frequency for two considerations. First, our search date is in April 2022. The final sample only completely covers the first quarter of 2022, so the quarterly frequency minimises observation loss compared to yearly or half-yearly frequencies. Second, the number of observations are mostly zero if we use monthly or a higher frequency. Fewer observations lead to higher standard errors of the estimated trend. Thus, the quarterly frequency is the optimal choice.

factors per theme. Arguably, there might be duplicates of factors across papers, but this situation only reinforces our proposition of an inward-looking literature as duplication provides even less information than involution.

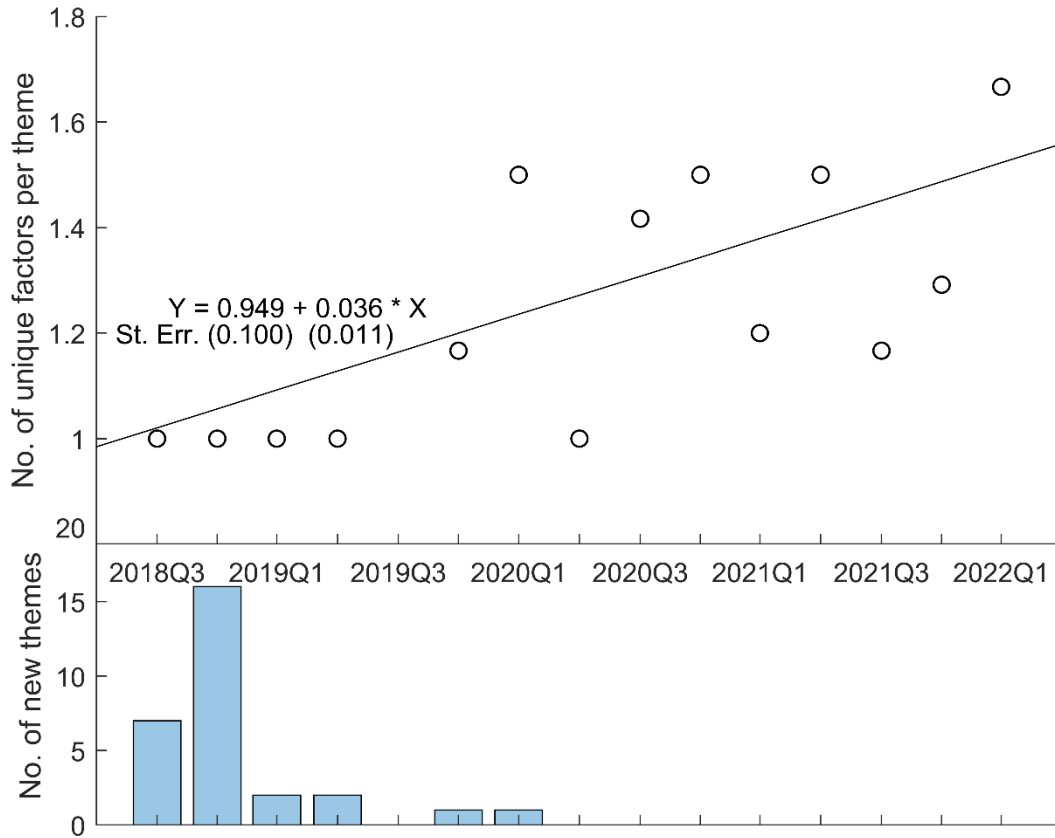


Figure 6 The trend of the number of factors and the number of new themes

To better capture the trends in the literature, we report the proportions (averaged over papers) of factors belonging to TOE and BEnA dimensions in **Table 1**.

Table 1 The average proportions of TOE/BEnA dimensions over time

Year	T	O	E	B	En	A
2018	0.34	0.36	0.30	0.56	0.29	0.14
2019	0.42	0.29	0.29	0.41	0.45	0.15
2020	0.29	0.40	0.31	0.23	0.44	0.33
2021	0.30	0.34	0.36	0.33	0.40	0.27
2022	0.32	0.27	0.41	0.40	0.47	0.14

In the TOE dimensions, researcher's attention shifts to the E-family factors in later years. Neither T-ratio nor O-ratio exhibits a clear trend from 2018 to 2022, while the E-ratio expands substantially from 30% to 41% (**Table 1**). This implies that environmental factors (e.g., coordination complexity, regulatory uncertainty) have received greater attention from researchers

examining blockchain adoption. This trend in research emerges because blockchain is a technology built on collaboration (part of the business environment), without which the technical benefits simply disappear. Other important E-family themes include support and regulation from the government, which have, thus far, lagged behind business practice (e.g., *regularity*, *legality*, and *policy*).

In the BEnA dimensions, researcher's attention gradually switches from barriers to enablers over time. As shown in **Table 1**, the En-ratio has risen significantly from 29% to 47%. This implies that research has shifted from explaining 'why not adopt' (barrier factors) to addressing 'why and how to adopt' (enabler factors). This trend in research reflects a changing attitude in business practice, as empirical findings are mostly based on interviews and surveys of practitioners. We expect the gap between the hype and the actual adoption to be a short-run phenomenon. As environmental conditions (such as related policies and regulations and the legitimacy of blockchain) mature, more organisations are expected to adopt blockchain solutions to explore the potential benefits (Hojckova et al., 2020; Orji et al., 2020).

4.2 'Directed' research change

The previous subsection demonstrates how factors and themes of research in blockchain adoption have developed over time. Building on the identified trends in the development, this subsection attempts to further establish an overarching relationship among the research trends – the directed research change. This is inspired by the economic theory 'directed technological change' by Acemoglu (2002). The theory postulates that the direction of 'technical progress' (research intensity in this case) depends on the 'market size' (research extensity in this case). A larger market size motivates greater input in that area.

To establish the relationship, we quantify two constructs: (i) research intensity (i.e., how intensively themes are investigated) is measured by the proportion of factors belonging to a theme; (ii) research extensity (i.e., how extensively themes are investigated) is measured by the proportion of papers investigating a theme.

The scatter plot in **Figure 7** demonstrates a significantly positive relationship between research extensity and intensity of themes. The upward-sloped regression line suggests that if a theme is investigated by more papers (extensity), then more factors are likely to be researched on this theme (intensity). Put differently, the research on blockchain is directed by the subject popularity (cf. 'market size' in the directed technological change theory). For example, the most discussed themes (*compatibility* and *capability*) have 15 times more factors than the least discussed themes (*flexibility* and *accessibility*).

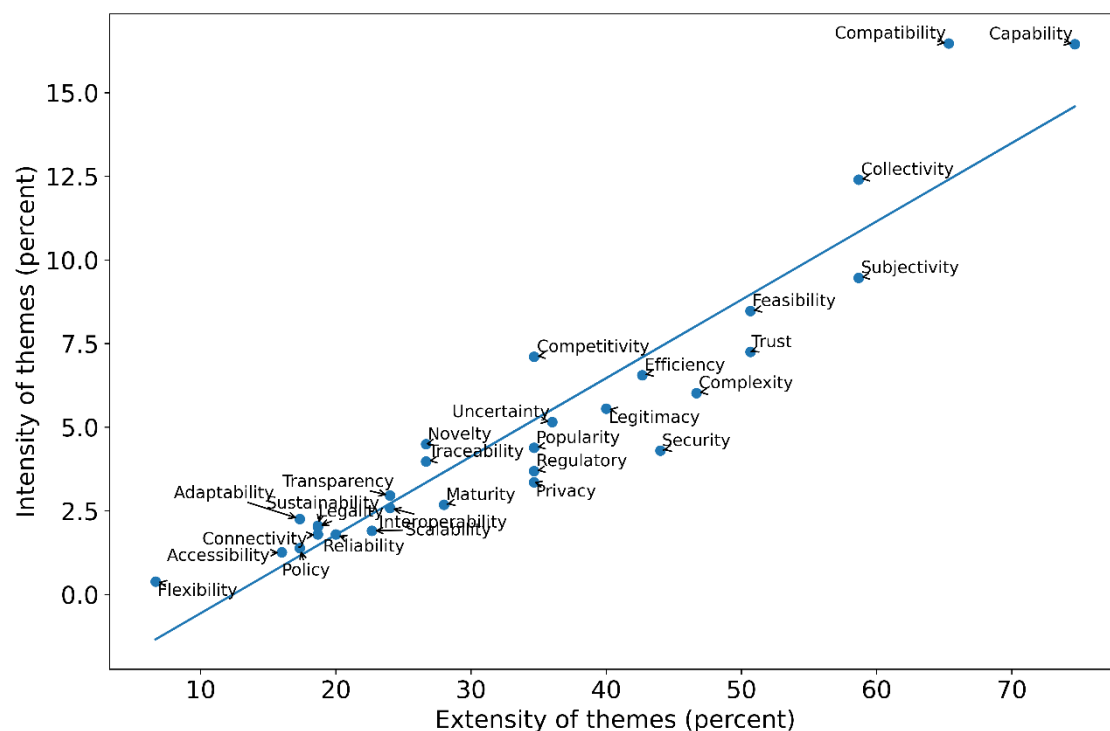


Figure 7 The relationship between intensity and extensity of themes

This ‘directed’ research change has an important implication for the future research agenda. If an extensively investigated theme tends to be more intensively explored, then the theme size will grow faster than other themes. Unbalanced theme sizes eventually break the general principle of theme identification and definition stated in section 3, so an overgrown theme is destined to be broken down into several smaller themes. This process is evolutionary because new themes emerge.

We witnessed evolutionary development in the earlier years, before 2020. For example, the three themes *regularity*, *legality*, and *policy* originally belonged to one aggregate theme since they are all related to the authority. As an increasing number of papers and factors are devoted to this theme, different foci have been developed. Factors related to *regularity* are restrictive rules set by the government (Sharma et al., 2021). They are different from factors related to *legality*, which are restrictive rules set by the legislature (Xu et al., 2022). The former are temporary rules, while the latter are permanent rules. Beyond these restrictive rules, supportive *policies* are also implemented by policymakers to enhance blockchain adoption (Orji et al., 2020).

5 FUTURE RESEARCH AGENDA

Based on the two sets of results, we propose four emerging research directions. These projections are strictly evidence-based rather than loose conjecture.

The first direction is to highlight themes that demonstrate significant interconnectedness across all three dimensions of TOE, as identified in our analysis. These types of themes cannot be well studied within one single dimension, so multiple views are needed to study these multi-dimensional themes that involve multiple stakeholders. Notably, the theme *trust* plays a pervasive role across all TOE dimensions, acting as both a consequence and a prerequisite for its adoption (Sternberg et al., 2021). The adoption of blockchain technology remains limited (Litan, 2022), preventing a comprehensive examination or realisation of its potential as a trust solution across industries. While the importance of trust as a determinant for adoption decisions has been increasingly recognised (e.g., Wong et al., 2020), less attention has been given to the trust-building process influencing these decisions, specifically the antecedents of trust for blockchain adoption. Future research can explore different aspects of trust, such as trust in blockchain technology, trust in blockchain providers, and trust in interorganisational participants, and investigate the connections between these aspects and the mechanisms of trust formation in blockchain adoption/rejection decisions. Integration of these views can form a wealth of future research on blockchain adoption.

The second direction is to highlight themes with high ambiguity ('A') in the BEnA analysis. These themes require further study to fully understand their role. There are three cases in this category. For the *insignificant* factors (e.g., top management support, performance expectancy, effort expectancy), they are theoretically relevant, but empirically rejected. A deeper explanation is needed to explain the plausibility and the generalisability of the findings. The *indeterminate* factors (e.g., hesitancy, regret aversion, some tensions between opposing perceived adoption factors), call for more research into why these factors are neglected. For the *conditional* factors (e.g., competition intensity, organisation sector, trustworthiness), the moderation effects and mediation effects of other factors are to be examined to clarify how these factors take effect in blockchain adoption. The ambiguity of themes should become smaller as the research progresses.

The third direction is to highlight development of new themes. It seems inevitable to have involution, duplication, or speculation, alongside the emergence of a much-hyped technology. Hype leads to bubbles. For example, when the Internet hype peaked in the 1990s, academia and newspapers featured the 'information superhighway' (Ljungqvist & Wilhelm, 2003), which led to the Dot-Com bubble in 2000 (Wagner & Cockburn, 2010). Blockchain may prove to be no different. Research is not immune to the hype of disruptive technologies. While much research provides original insights into blockchain, much more during the hype is involutionary nuance, duplicative nuisance, or even noninformative nonsense, such as that associated with the hype related to 'sustainability' (Kirchherr, 2022). The papers included in our sample are from reputed journals. If the quality standard is relaxed, the originality of research would be weaker. We hope to see evolutionary research to reflect the real needs in practice as a response

to the long-standing issue of bridging the gap between research and practice (Makin, 2021; Dal Mas et al., 2023). According to the trend analysis, we find that E-family (environmental) factors and En-family (enabling) factors start to gain increasing attention in research. Therefore, new themes and theories are likely to emerge from environmental enablers (such as *sustainability* and *legitimacy*).

The final direction is to highlight decomposition of larger themes. According to the finding of ‘directed’ research change, the unbalanced expansion of popular themes inevitably leads to the emergence of new themes. Therefore, sizable themes such as *capability* and *compatibility* are likely to spawn new themes in blockchain research. For example, the theme *collectivity* effectively refers to four subthemes of organisational activities including collaboration, coordination, cooperation, and communication (Castañer & Oliveira, 2020). These subthemes place different emphasis on inter-organisational activities, but the differences are too subtle to be separated in current research. Future research may expand and clarify these subthemes to create new distinctive themes. Similarly, another large theme is *legitimacy*, which refers to an organisation’s tendency to conform to rules and norms established primarily by suppliers, clients, and industry associations during decision-making processes (Hew et al., 2020). It involves many stakeholders with very different weights. One possible new theme to spin off from *legitimacy* is strong leadership within an industry and within a country (Hew et al., 2020; Kouhizadeh et al., 2021).

In addition to the four evidence-based research agenda items, we also propose other future lines of research that emerged from the SLR. Five underpinning theories account for more than half of those used in the blockchain adoption literature. These theories, all present classical perspectives in technology adoption, include game theory, technology acceptance model, technology-organisation-environment framework, unified theory of acceptance and use of technology, and diffusion of innovations theory (see Supplementary Material). These established theories are effective in explaining themes from a single disciplinary perspective. However, potential new themes, such as industrial leadership and trust-building, could better fit in different theoretical frameworks that recognise the transdisciplinary nature of blockchain technology adoption (Chandler & Kirsch, 2018; Mačiulienė & Skaržauskienė, 2021). Another possible trend is to combine an individual perspective with an organisational perspective on blockchain adoption. According to the identified themes, meeting consumer needs is an important factor of blockchain adoption (Choi & Siqin, 2022; Fan et al., 2022). Several themes such as *legitimacy*, *popularity*, *security*, *privacy*, and *transparency* are particularly relevant to individual users. However, there can be discrepancies between perceived needs and actual needs (Raddatz et al., 2021). Few papers investigate blockchain acceptance from an individual perspective (Tandon et al., 2021) and compare with an organisational perspective.

6 CONCLUSIONS

In this paper, we offer an in-depth, integrative review of blockchain adoption factors, and extract the patterns and trends of the research through a developmental view. Drawing on results from an SLR to identify blockchain technology adoption factors, we employ further analysis via a mixed-method approach. We have identified 29 themes that classify the factors in blockchain adoption research and map these themes across technology-organisation-environment (Tornatzky & Fleischer, 1990) and barrier-enabler-ambiguous dimensions. We demonstrate the trends found in the literature, showing that research on blockchain adoption after 2020 is mainly an involution rather than an evolution. We propose that the current trend is temporary due to the ‘directed’ research change. As the extensively studied themes get investigated more intensively, we expect to see new themes born out of the old themes, and new theories to accommodate the new themes. Descartes views the development of knowledge as ‘a tree of knowledge’, where new knowledge grows out of old when old frameworks fail to solve new problems (Ariew, 1992; Cottingham, 1992). For example, in ancient Greece, philosophy was the only field of knowledge, but in the late 1990s, myriads of scientific fields (new themes) emerged from this ‘old theme’ (Shapin, 2018). Today, areas of investigation that were once part of philosophy have become separate academic disciplines (Briggle & Frodeman, 2016). Our findings echo the general pattern of human knowledge development. Our trend analysis suggests that new themes are most likely to emerge from environmental enablers. The current research focus starts to shift from ‘why adoption does not happen’ (barrier factors) to ‘why and how to adopt’ (enabler factors).

The patterns and trends of blockchain research are representative examples of other research hyperbole alongside technological hyperbole. The insights gained in this paper are generalisable to other similar ‘research fevers’ in the past, in the present, and in the future. For example, the number of publications on ‘e-commerce’ jumped from 378 to 1363 from 1999 to 2000 (source: Scopus), a growth rate of 261% over one year before the Dot-Com bubble. Similarly, a research trend for Artificial Intelligence (AI) is emerging. The total academic publications on AI-related topics are 43,985 in 2021 and 49,675 in 2022, marking an annual growth rate of 12.9% (source: Scopus). It is significantly higher than the growth rate of all publications (1.9%) and close to the growth rate of blockchain-related literature (18.5%) over the same period. Despite the hyperbole around AI in academic research, a recent critical review suggests that AI research is missing the adoption in practice (Herrmann & Masawi, 2022). In particular, the review reveals that much of the published research on big data focuses on machine and deep learning rather than big data per se in practice. It seems that much of the research is led by academia’s interests rather than industry needs. Overall, the research effort is rising substantially while research productivity is declining sharply (Bloom et al., 2020). To address this gap between research and actual adoption, future research should prioritise reality and accuracy

over hyperbole to advance knowledge (Herrmann & Masawi, 2022). A gap between the hype and adoption of any disruptive technologies is at least partly due to the speculative research trying to ride on the trend.

The review also generates practical implications for different stakeholders in blockchain adoption. For organisations (decision-makers), a comprehensive set of themes of blockchain adoption are made available to them in this review. This knowledge helps organisations to manage various risks more proactively when considering adopting blockchain. For developers, this review provides general principles of developing blockchain-based applications and infrastructure. For policymakers, our review identifies some themes with social values in blockchain adoption such as privacy, security, and sustainability, so government interventions and regulatory legislations are entailed.

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Supplementary Materials

A. Detailed descriptions and justifications of the SLR

In Step 2-1, we use search strings including all relevant blockchain adoption keywords as shown in **Figure 2** in the text, which covers a broader scope than previous reviews (e.g., Vu et al., 2021). The search is conducted through three major literature databases, Scopus, Web of Science (WoS), and Business Source Complete (BSC) managed by EBSCOhost following previous systematic reviews published in leading management journals (e.g., Lu et al., 2018; Vu et al., 2021). The search field is limited to the title, abstract, and keywords (TITLE-ABS-KEY) to avoid including irrelevant texts (e.g., Lu et al., 2018; Creevey et al., 2022; Tan et al., 2022).

In Step 2-2, we filter the papers through a combination of automated screening (e.g., years, language, source type) and manual screening (e.g., content relevance). To minimise retrieval bias the year range is not limited (Castañer & Oliveira, 2020; Pereira et al., 2021; Creevey et al., 2022). The language is limited to ‘English’, following the conventions of SLRs (Follmer & Jones, 2018). The source type is limited to ‘journal’ or ‘academic journal’ because they are peer-reviewed knowledge sources (Battisti et al., 2021). The document type is restricted to ‘article’ and ‘review’, excluding conference proceedings, book series, trade publications, editorials, notes, letters, and other non-refereed publications (Lu et al., 2018; Pereira et al., 2021; Mahmud et al., 2022). To ensure the quality of research included in our review, we only consider papers in journals ranked at ABS 3-star or higher (Academic Journal Guide, 2021). The focus on top-tier journals is a reliable way of capturing high-quality scholarly debates and research trends in systematic reviews (Radealli & Sitton-Kent, 2016; Atewologun et al., 2017). Using journal quality metrics can avoid subjectivity of authors’ judgements (Kirkman et al., 2006; Foss et al., 2010; Radaelli & Sitton-Kent, 2016). Duplicates among the three databases are then removed by matching their DOIs.

The manual screening process involves two phases of evaluation to filter papers, in accordance with general practice established in SLRs (Pereira et al., 2021; Creevey et al., 2022). The first phase focuses on the papers’ titles and abstracts, and the second phase on full texts. The panel leader and two panel members conducted the assessment using systematic review software ‘Covidence’ to facilitate collaboration among reviewers (Kellermeyer et al., 2018). The leader and one member independently evaluated the content relevance of each paper, and another member served as the conflict resolver. As outlined in the assessment criteria of **Figure 2** in the text, the focus is on blockchain adoption from an *organisational* perspective, not individual users as in cryptocurrency trading. We are only interested in existing organisations adopting blockchain rather than new organisations set up to specifically implement blockchain.

To avoid retrieval bias, we use ‘implementation’ and ‘application’ as synonyms of ‘adoption’ so there are three search strings: baseline (‘adoption’), expanded 1 (baseline plus ‘OR implementation’), and expanded 2 (baseline plus ‘OR application’). This ensures the comprehensiveness of our search against the potential ambiguity in the usage of ‘adoption’ in the literature. Including ‘implementation’ and conducting the screening process eventually leads to the inclusion of 8 additional papers, while only 1 additional paper is included when ‘application’ is added to the search term. Finally, 75 papers are selected for data analysis.

In data coding (step 2-3), we adopt the procedures of thematic analysis proposed by Nowell et al. (2017). This method consists of three iterative phases and two specific principles to inductively synthesise the factors to themes. In phase 1, we familiarise ourselves with the 880 adoption factors in the contexts of the papers. In phase 2, we form an initial list of themes widely used in the literature, such as *capability*, *compatibility*, and *complexity*. In phase 3, we map all the factors into the initial list of themes. Phases 2 and 3 follow two principles. The first principle is that each theme has a unique emphasis. We allow for overlapping between theme definitions but no theme is a subset of another. Overlapping in definition is inevitable because these existing themes are developed and used in different papers separately. The second principle is that each factor can be categorised into one theme (one-to-one) or multiple themes (one-to-many). In the latter case, we consider all relevant themes to be equally relevant because there is no universally accepted way of determining the weights. For example, the factor ‘business process reengineering’ (Choi & Siqin, 2022) highlights the changes needed to integrate blockchain into organisations, so the factor belongs to both *capability* and *compatibility*. Several iterations of refining are carried out until the review panel reaches consensus on the final list of themes and the mapping of factors to themes. The finalised themes and their definitions will be presented in the result section.

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B. The correlation histogram of themes' co-occurrence

We perform correlation analysis to identify the potential co-occurrence (not causation) between themes within a factor, as multiple themes can be relevant to one factor. The values of 1 or 0 are assigned based on the relevance of a specific theme to a specific factor. As shown in **Figure B-1**, the distribution of correlation coefficients resembles a normal distribution. The majority lie within the 95% confidence intervals (± 1.96 standard deviations), which suggests that most entries are either weak or statistically insignificant. Additionally, a majority of correlations are negative and not significant, while only a few are positive and significant. Positive/negative correlations indicate co-occurrence/non-co-occurrence between entries and a factor, accounting for some overlap/non-overlaps between theme definitions. A correlation coefficient of 0 signifies no relationship exists between entries. This suggests that most of the themes are not likely to be combined within one factor. Overall, the identified themes in our paper are adequately distinctive, albeit with some inevitable overlap between theme definitions.

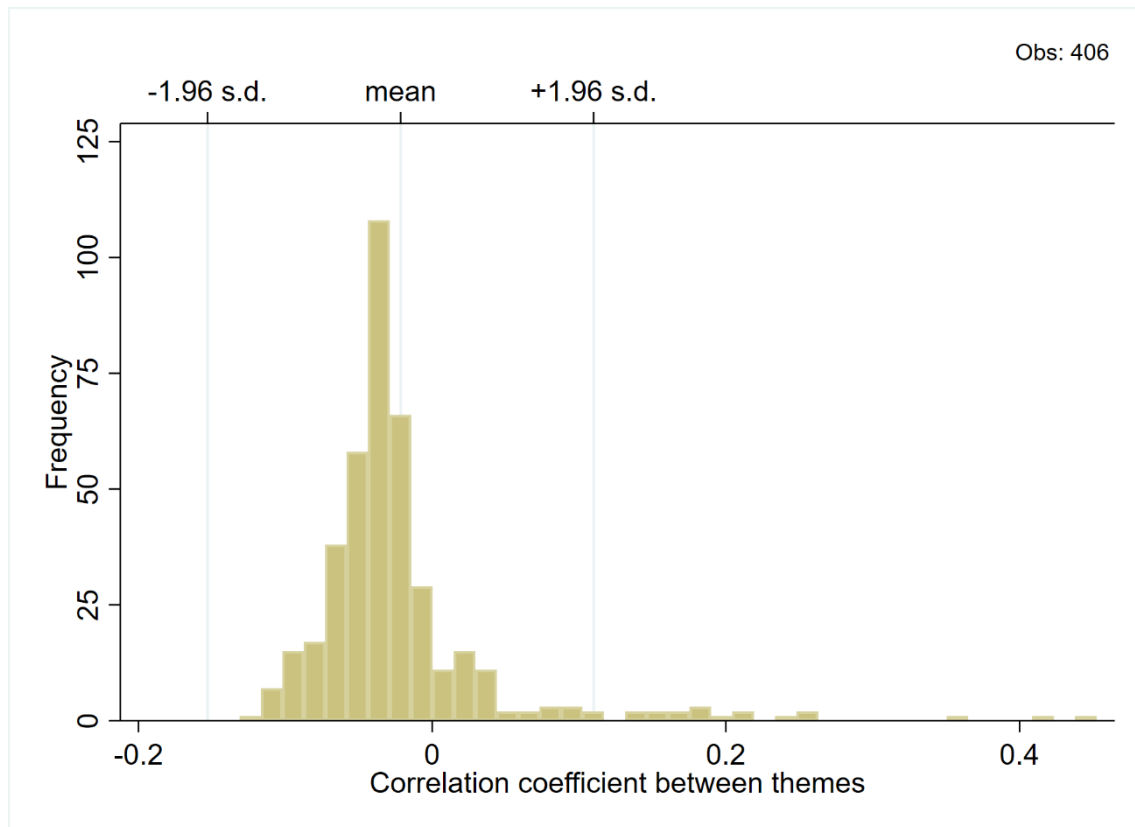


Figure B-1 The histogram of correlation coefficients between themes

C. Descriptive analysis of the final sample

Table C-1 lists the journals associated with their ABS ranking and journal field. 21 journals are found from the final sample of 75 papers. Most of the journals are ABS 3-star outlet (n=15, 71.43%). The OPS&TECH field (Operations and technology management) has the highest number of journals (n=9, 42.85%) and includes the largest number of papers (n=40, 53.33%). The journal IJPR in the OPS&TECH field has the largest number of papers (n=11, 14.67%). Other notable journals for blockchain adoption research are AOR (n=10, 13.33%) and IJPE (n=8, 10.67%).

Table C-1 Journal title, journal ABS ranking, journal field, and papers per journal included in our review

Journal title	ABS	Field	Paper count	%
Int. Bus. Rev. (IBS)	3	IB&AREA	1	1.33
Inf. Manage. (IM)	3	INFO MAN	3	4.00
Inf. Technol. People (ITP)	3	INFO MAN	2	2.67
J. Manage. Inf. Syst. (JMIS)	4	INFO MAN	2	2.67
J. Inf. Technol. (JIT)	4	INFO MAN	1	1.33
Technol. Forecast. Soc. Change (TFSC)	3	INNOV	5	6.67
Ind. Mark. Manage. (IMR)	3	MKT	1	1.33
Comput. Ind. (CI)	3	OPS&TECH	2	2.67
IEEE Trans. Eng. Manage. (IEEE-TEM)	3	OPS&TECH	2	2.67
Int. J. Prod. Econ. (IJPE)	3	OPS&TECH	8	10.67
Int. J. Prod. Res. (IJPR)	3	OPS&TECH	11	14.67
Int. J. Oper. Prod. Manage. (IJOPM)	4	OPS&TECH	1	1.33
J. Bus. Logist. (JBL)	3	OPS&TECH	3	4.00
Prod. Plann. Control (PPC)	3	OPS&TECH	5	6.67
Prod. Oper. Manage. (POM)	4	OPS&TECH	2	2.67
Supply Chain Manage. (SCM)	3	OPS&TECH	6	8.00
Ann. Oper. Res. (AOR)	3	OR&MANSCI	10	13.33
Eur. J. Oper. Res. (EJOR)	4	OR&MANSCI	1	1.33
Manage. Sci. (MS)	4*	OR&MANSCI	1	1.33
Transp. Res. Part E (TRE)	3	SECTOR	6	8.00
Bus. Strategy Environ. (BSE)	3	SOC SCI	2	2.67

Notes: 1) Field is sourced from the ABS list (AJG2021). 2) IBS: International Business Review; IM: Information and Management; ITP: Information Technology and People; JMIS: Journal of Management Information Systems; JIT: Journal of Information Technology; TFSC: Technological Forecasting and Social Change; IMR: Industrial Marketing Management; CI: Computers in Industry; IEEE-TEM: IEEE Transactions on Engineering Management; IJPE: International Journal of Production Economics; IJPR: International Journal of Production Economics; IJOPM: International Journal of Operations and Production Management; JBL: Journal of Business Logistics; PPC: Production Planning and Control; POM: Production and Operations Management; SCM: Supply Chain Management; AOR: Annals of Operations Research; EJOR: European Journal of Operational Research; MS: Management Science; TRE: Transportation Research Part E: Logistics and Transportation Review; BSE: Business Strategy and the Environment. 3) IB&AREA: International Business and Area Studies; INFO MAN: Information Management; INNOV: Innovation and technology change management; MKT:

Marketing; OPS&TECH: Operations and Technology Management; OR&MANSCI: Operations Research and Management Science; SECTOR: Sector Studies; SOC SCI: Social Sciences.

Figure C-1 displays the number of papers published over the years. The graph shows a growing trend of publications on blockchain adoption research, although only 3 papers are published in top management journals in 2018. The final sample of papers was published between 2018 and 2022 and only includes papers published in ABS-listed 3-star and higher journals. Note that we do not limit the year range in the search. This suggests that blockchain adoption research has only recently emerged in top management journals since 2018. This mirrors the finding of Queiroz et al. (2019) who found no papers from top management journals in their selected sample from 2008 to Feb 2018 when focusing on blockchain application in supply chains.

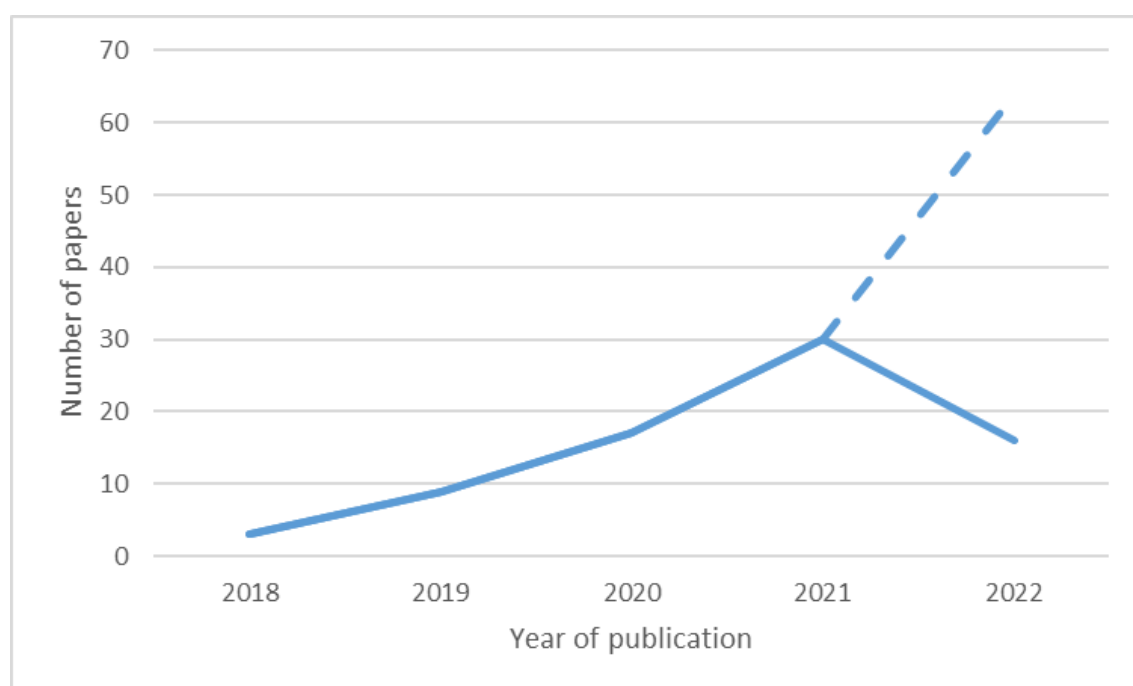


Figure C-1 Distribution of papers over the years (2018–2022)

Notes: The dash line refers to the expected growth in the number of publications from 2021 to 2022. Since our search date is on April 2022, the number of papers in 2022 is not complete. The corresponding expected value is estimated by multiplying the first four months publication proportionately.

Figure C-2 shows the number of papers per field for each year. Initially, papers are only published in the top journals of the OPS&TECH field, maintaining its prominence in the following years. However, new journal fields such as Sector, OR&MANSCI, INFO MAN, IB&AREA, and SOC SCI have emerged in subsequent years. The total number of publications in these newly emerging fields has increased dramatically in 2021, surpassing twice the number of publications in the OPS&TECH field that year. The graph illustrates the trend of publications spreading from the OPS&TECH field to other fields in recent years. In summary, these bibliometric results demonstrate that blockchain adoption has become a topical issue that has attracted the attention of scholars from different fields in recent times.

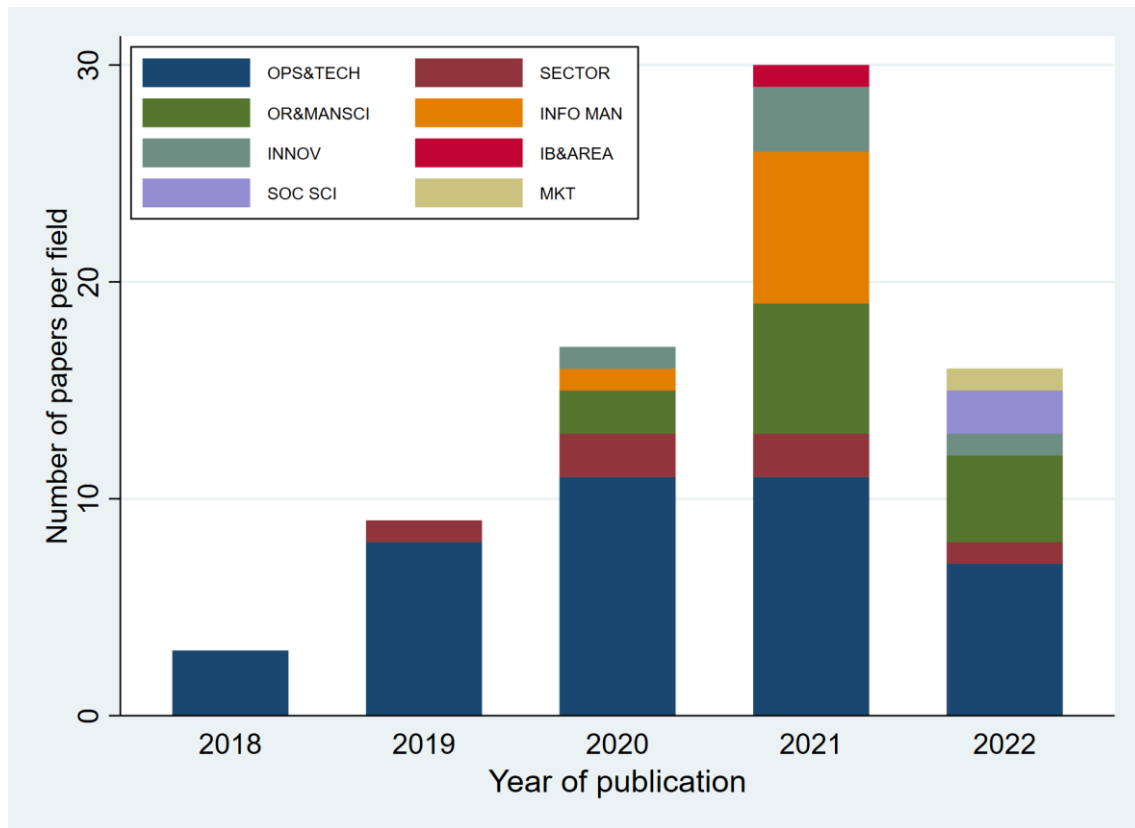


Figure C-2 Distribution of papers by fields over the years (2018-2022)

*Notes: 1) Since our search date is on April 2022, the number of papers in 2022 is not complete. However, we do not calculate the corresponding expected values as we do in **Figure C-1** because new journal fields may appear in 2022. 2) The full name of journal field can be found in the notes of **Table C-1**.*

D. The summary of theoretical lenses

Table D-1 The list of theoretical lenses used in the SLR sample (75 papers in total)

Theoretical lens	Frequency
Game theory	11
Technology acceptance model (TAM)	8
Technology-organisation-environment framework (TOE)	7
The Unified Theory of Acceptance and Use of Technology (UTAUT)	5
Diffusion of innovations theory (DOI)	4
Institutional theory	4
Resource-based view (RBV)	3
Dynamic capability (DC)	3
Network theory (NT)/Social network theory (SNT)	2
Sensemaking theory	2
Affordance theory	1
Balanced scorecard perspectives (BSC)	1
Classic diffusion processes	1
Fit-Viability model(FVM)	1
Fuzzy set theory (FS)	1
Regret theory (RT)	1
Innovation adoption theory (IA)	1
Innovation resistance theory (IRT)	1
IOS adoption theory	1
Neutrosophic set theory (NST)	1
Organizational information processing theory	1
Social capital theory	1
Stakeholder theory	1
Design theory	1
Task-Technology Fit (TTF)	1
Hesitant fuzzy set theory (HFS)	1
Theory of motivation	1
Technology readiness index (TRI)	1
The theory of planned behaviour (TPB)	1
Force field theory	1

Notes: The theories are extracted from the 48 papers in our sample. The sum of the frequency counts is over 48 because multiple theories are possibly used in one paper.