Blockchain Technology's Impact on Mineral Resources Business Model Innovation

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Abstract. Mining corporations are rethinking blockchain because technology improves transparency, efficiency, and security in natural resource transactions. Blockchain and mineral resource transactions require further study. The effects of blockchain on mining value generation, delivery, and capture are examined. Mining management affects blockchain business model innovation.

Keywords: Blockchain technology; Mineral resource trading; Mining industry; Value configuration; Business model innovation.

1. Introduction

Blockchain might improve natural resource transaction speed, safety, and transparency. Permanent blockchain. From banking to mining, blockchain is utilised. Transaction authentication, mineral resource transaction efficiency, and mining ecosystem trust may increase. Consider technology, ethics, and security while evaluating its mining business model innovation.

Technology and design, not revenues and losses, have dominated blockchain mining research. Unexpectedly, blockchain may enhance mining.

Studies provide two important contributions. It includes all technology to assist mining companies use blockchain. It then evaluates blockchain-enabled mining business model innovation value generation, delivery, and capture pros and cons.

This article explores mining business model innovation. We evaluate numerous blockchain options for mineral resource exchange, including pros and cons. Private, consortium, and public blockchain mining models are investigated. Conclusions guide and restrict research.

What blockchain does to natural resources is intriguing. Our study shows that public, private, and consortium blockchain networks innovate business models. Blockchain business models affect technology, services, and value. Update value delivery to new sources.

2. Business model innovation and blockchains in the mining industry

Business models increase mining competitiveness (Amit & Zott, 2012). Digitalization helps mining businesses react to market changes (Kraemer, Dedrick, & Yamashiro, 2000). Blockchain safeguards mineral resource transactions (Frizzo-Barker et al., 2020). It verifies transactions, disintermediates, improves efficiency, and trusts mining ecosystems (Abbas et al., 2020). Adoption creates ethical, security, and technical issues (Fotaki et al., 2021).

Mining company value is seldom addressed in blockchain and internet business model innovation. Assessing blockchain adoption benefits without downsides. Uncertainty may boost blockchain mining.

Mining models enable new enterprises, operations, and governments. Blockchain might alter mining.

Fast blockchain execution impacts mining value chains. Mineral resource trading model and value shift.

Most blockchain literature involves tech and apps. Blockchain's impact on mining strategy and value is uncertain. Academic and practical case studies complete the picture. Blockchain improves supply chain transparency, cost, and sustainability. Help mining firms' blockchain businesses.

3. Conceptual approach

This conceptual research investigates blockchain's influence on mining business model innovation. We examine blockchain's mineral resource transaction pros and cons. Privacy and scalability may restrict blockchain mining. Blockchain influences mining models.

The blockchain mineral resource scenario. We study public blockchain platforms, private blockchain asset monitoring, and consortia blockchain supply chains. Impact of blockchain on business models and value. Blockchain mining business model transition pros and cons. Book about business model innovation. Ending with mineral trade value drivers.

Talking blockchain and mining business model innovation. It analyses several blockchain networks' technological characteristics and benefits and downsides to assess how blockchain adoption may affect mining businesses' value generation, distribution, and capture. Private, consortium, and public blockchain mining may alter business strategies.

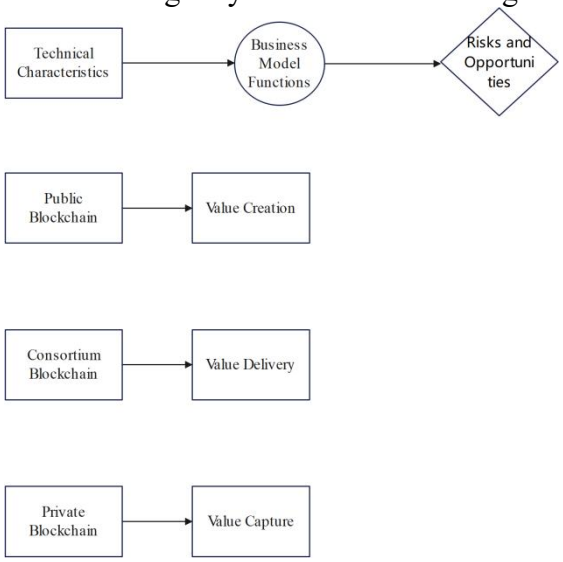

Fig. 1 Framework for the Analysis of Blockchain Technologies and Business Models in the Mining

4. Value creation, delivery and capture: a blockchain perspective in the mining industry

4.1 Blockchain technical characteristics

Blockchain. Each participant stores data in tamper-proof blocks on their devices. Smart contracts cut intermediaries.

Public, consortium, and private blockchain mining have merits and drawbacks. Data accessibility, decentralisation, and operational complexity vary. Free blockchain access compromises privacy. Private and consortium blockchains prohibit member data.

Table 1. Mapping blockchain technological traits, advantages, and dangers to mining business model functions and value configurations.

Functions of BM	Blockchain Benefits and Risks	Value shop	Value network	Value chain
Value creation	Trustable collaboration	Public Consortium	Public Consortium	Public Consortium
	Inflexible	Public	Public	Public

	transactions			
	Controlled value	-	Private Consortium	Private Consortium
	Privacy issues	Public	Public	Public
Value delivery	Service Delivery	-	Public Private Consortium	Public Private Consortium
	Service Disruption	Public	Public	Public
	Network Effect	Public	Public	Public
	Scalability Challenge	Public Consortium	Public Consortium	Public Consortium
Value capture	Cost Efficiency	Public	Public	Public
	Increased Investment	Public Private Consortium	Public Private Consortium	Public Private Consortium

Technical characteristics of the blockchain:

- Public Blockchain: accessibility – permissionless, control over transactions – decentralized, complexity - high
- Consortium Blockchain: accessibility – permissioned, control over transaction – partially decentralized, complexity – medium
- Private Blockchain: accessibility – permissioned, control over transactions – centralized, complexity – low

4.2 Value creation

4.2.1 Trustable collaboration - inflexible transactions

Blockchain cooperation platforms may change mining companies' ambitions. Horizontal trust boosts mining stakeholder innovation and value. Strategic stakeholder engagement helps natural resource merchants innovate (Kiel, Arnold, & Voigt, 2017). Blockchain stakeholders may benefit from free idea sharing (Scekic et al., 2018). More stakeholders in value production and exchange networks boost trust (Morkunas et al., 2019; Zavolokina, 2020).

Consortium and public blockchains enhance data quality and accessibility. Blockchain and smart contracts make data immutable and transactions unmediated. Trustless disintermediation verifies stakeholder mining value data (Bauer et al., 2019). Smart contracts provide accurate natural resource transactions (Beck, Stenum Czepluch, Lollike, & Malone, 2016; Kowalski, Lee, & Chan, 2021). It enforces contracts and rewards or punishes transaction conditions violations (Scekic et al., 2018). Data access is another dependable collaboration necessity. Miners get consensus-synchronized transaction data from nodes (Maull et al., 2017; Tiscini, 2020). Complete transaction history is available (Chong et al., 2019). Resources for mining firm product and service strategy development are below (Caro et al., 2018; Chong, 2019).

Different companies mine public and consortium blockchains. Value marketplaces like ChainMinerals alter public blockchain mining. Trusted connections help clients establish natural resource trading business solutions, explain Chong et al. (2019). Open-source blockchain mining promotes public networks (Kazan, Tan, & Lim, 2015; Pazaitis, 2020). Software and public company mining (Kazan et al., 2015). User helps transparent stakeholders (Pazaitis, 2020). Hyperledger collaboration helps 200+ mining IT vendors develop solutions. Partnerships aid mining financing, supply chain management, and other solutions (Morkunas et al., 2019).

Mine value networks facilitate mineral resource trade and collaboration (Zavolokina et al., 2020). The mining industry may use public blockchains to create an open online learning platform that securely connects education providers and certification bodies for on-demand training. Trusted IP validation protects students and providers. Payment confirmation on public blockchains may hinder mining. Trade partner trust, financial transaction efficiency, and natural resource trading cooperation increase (Chang, Chen, & Wu, 2019; O'Leary, 2017). Blockchain-based corporate mediation may increase value network consortia stakeholder consensus and data sharing (Chong et

al., 2019). All must assure quality in value-creating ChainMining. Cash stockpile management and reliable disintermediation maximise mining resource usage (Chong et al., 2019). Industry consultants may mine consortium blockchains (Gerth & Heim, 2020).

Value chain miners make mining gear together. Open blockchain data boosts market trust. Transparency reduces information asymmetry, making blockchain-enabled mining commodities fair (Chen & Bellavitis, 2020; O'Leary, 2017). ChainMine alters mining with public blockchain mineral monitoring. The technology was constructed safely utilising company data. Collaboration ensures safe, traceable product delivery (Chong et al., 2019). Blockchain consortium supplychain. Its trustworthy value exchange simplifies mining supply chain management (Chong et al., 2019).

Inflexible transactions undermine consortium and blockchain data. Mine value chains, networks, and shops may split stakeholders. Transactions may take longer (Chen & Bellavitis, 2020). Data validation testing for enterprises, consumers, suppliers, and institutions is forbidden. Ahangama & Poo (2016) say distributed data storage cannot correct transactions. The code employs smart contracts. Mining data transactions cannot manage surprises (Christidis & Devetsikiotis, 2016). These transactions cannot improve natural resource trading since data is irreversible (Schweizer et al., 2017). It enables hypothesis-driven mining business context and application testing (Beck & Mller-Bloch, 2017). Inflexible transactions hinder mining product and company growth (Schweizer et al., 2017...).

4.2.2 Controlled value - privacy issues

Benefit: Assessing service and product quality and customer preferences may assist mining organisations enhance blockchain solutions (Bauer et al., 2019; Behnke & Janssen, 2020). Transactional data improves mining. Kohtamaki, Parida, Oghazi, Gebauer, Baines, Frank, Mendes, Ayala, & Ghezzi (2019) enhance it. Customisation and quality management need data accessibility, validity, and centralization. Bauer et al. (2019) advise trustworthy miners acquire customer data. Organisational trust increases with system actor data authorization and verification (Zheng et al., 2017). Miners may dynamically access data and deliver value-added services by verifying system data (Bauer et al., 2019). Data traceability drives public and consortium blockchain value.

Controlling value chains and networks enhances mining business models (Chong et al., 2019; Zhang, Yi, & Wang, 2021). Mining businesses transfer value via value shops like open innovation platforms (Chong et al., 2019). Solution, implementation, and analysis of changing customer value, Stabell & Fjeldstad (1998). Mining finance value network companies use consortium blockchain data to develop complicated credit and risk-control models to reduce consumer and enterprise financial risks. Data validation and analysis improve mining trade partner blockchain-based consortia network cooperation (Chang & Chen, 2020; Rahmanzadeh, Pishvaee, & Rasouli, Regulatory smart contracts verify mineral trades, improving importers' mining and transaction supply chains. Companies may build stakeholder value networks using ChainSecure or private blockchains. Mediation improves business processes and reduces stakeholder investment risk and cost (Chong Et al., 2019). Consumer-mining business disintermediation improves trust and customer journey (Kumar et al., 2020).

Mine equipment manufacturers may create private blockchain supply chain digital twins for operations, maintenance, product repair, and innovation (Mandolla, Petruzzelli, Percoco, & Urbinati, 2019). Private blockchains change mining logistics (Zhao et al., 2019). Customers may track mining supply chain safety, quality, and compliance via distributed ledgers (Tiscini et al., 2020). Mining supply chain consortiums vary (Behnke & Janssen, 2020). Consortium blockchain ChainLogistics. Reliable value exchange simplifies mining customer logistics (Chong et al., 2019). IBM and MineTrack distributed minerals and data using blockchain (O'Leary, 2017).

Risk: Data accessibility and decentralisation enhance privacy breaches and data mining (Lu et al., 2019; Tiscini, 2020). To protect society, mining companies must respect privacy. Open blockchains harm privacy (Feng, He, Zeadally, Khan, & Kumar, 2019). Unauthorised network access encourages crime (Notheisen et al., 2017). Proofs-of-cost, proof-of-stake, and proof-of-space prevent hostile access to public blockchains but complicate implementation. Private and consortium

blockchain mining is selective. Pre-validated IDs demonstrate participation. Networkers or leaders choose members. Closing transactions improves privacy (Morkunas et al., 2019). Second, private and consortium permissioned blockchains allow network users to access data while the central authority supervises transactions (Zheng et al., 2017). Users approve data sharing.

4.3 Value delivery

4.3.1 Service delivery - service disruption

Quality and accessibility of blockchain data allow safe and efficient stakeholder interactions, boosting mining service delivery. Lower supplier-receiver middlemen boost natural resource trade and decentralised trust system interoperability. Decentralised blockchain connections may improve mining companies' cross-organizational collaboration. Consumer data transaction partners streamline mining (Morkunas et al., 2019). Validating data prevents blockchain network changes (Bauer et al., 2019). Accessibility, legitimacy, and disintermediation benefit permissionless and permissioned blockchain mining. Service delivery optimisation may help blockchain miners.

Blockchain logistics facilitate inter-organizational mining supply chain agreements. According to Caro et al. (2018), smart contracts transfer mining logistics asset ownership via data input. Verified smart contracts end. Purchases save time for all mineral resource producers (Morkunas et al., 2019). Blockchain minimises intermediaries, increasing use. World mining finance may skip banks and currency converters (Morkunas et al., 2019).

Mine-valued chains, enterprises, and networks provide several services. Mine service issues. Companies frequently lack customer service and product utilisation. Mining firms are stakeholders. In mining value stores, customers develop apps. Users provide services (Chong et al., 2019; Stabell & Fjeldstad, 1998). Access to private blockchain data and resources helps network mining. Blockchain speeds mining supply chains (Chong et al., 2019). Two ways private blockchain network consortiums may reduce mining service throughput (Chang, Luo, & Chen, 2019; Gerth & Heim, 2020). Interorganizational data exchange disintermediation increases cross-border mineral exports (Chang, Luo, & Chen, 2019). Blockchain may allow private on-demand mining (Gerth & Heim, 2020; Li, Barenji, & Huang, 2018). In online learning, Sun et al. (2018) advocate mining public blockchains for degrees and certificates.

Permissioned blockchains help value chain miners. Mine equipment component production and prototyping shorten idea-to-market time (Mandolla et al., 2019). Mining consortium blockchain applications improve company production (Chong et al., 2019; Qiao, 2018). Smart contracts accelerate mineral commodity delivery and mining payment confirmation (Chong et al., 2019). Record mineral production using blockchains. The improved system offers a new service (Chong et al., 2019).

Blockchain miners may disrupt services (Behnke & Janssen, 2020; Chong et al., 2019). Data validation and access vary per blockchain type, increasing risk. For three reasons, private and consortium mining blockchain networks are more adaptable and interoperable (Chong et al., 2019; Zavolokina, 2020). Just players, regulators, and consortiums may join private blockchains (Morkunas et al., 2019). Public blockchains may hinder mining. Outside traffic hinders public blockchain processing (Okon et al., 2020). Limiting user data and network interaction improves speed, latency, and capacity.

Poor public blockchain security (Zheng et al., 2017). Protecting public network mining requires longer block digital record entry verification (Yli-Huumo et al., 2016). Erroneous encryption may damage public data or waste computer resources (El Ioini, Pahl, & Helmer, 2018; Gennaro, Goldfeder, & Narayanan, 2016). Zheng et al. (2017) say security weaknesses might delay mining value III, separate mining sector public blockchain organisations, and disrupt the value chain.

4.3.2 Network effects - scalability challenge

Mine blockchain networks impact digital and physical goods and services (Schmidt & Wagner,

2019). This non-intermediated blockchain network helps all platform users (Kundu, 2019). Blockchain mining enhances networks (Fu, Wang, & Zhao, 2017). Decentralised governance and data accessibility enhance networks. Large-scale distributed ledger access allows blockchain mining. User growth boosts tech (Schmidt & Wagner, 2019). Distributed open-access systems need blockchain mining for security due to network effects.

Stores, networks, and mining chains have network effects. Mining value companies and blockchain-based open innovation platforms harness network effects. Users want mining businesses to innovate and share (Chong et al., 2019). Network effects occur when miners, suppliers, and consumers utilise blockchain platforms (Chong et al., 2019). Interaction aids mineral dealers. New vendors and logistics providers improve blockchain mining consortia supply chain efficiency and transparency, suggest Gerth & Heim (2020).

Chong et al. (2019) found network effects in public blockchain-based mineral production traceability systems in mining value chains. More mining businesses using blockchain and sharing data improves the system, giving customers a complete mineral supply chain view. When miners trust blockchain traceability, it helps (Tiscini et al., 2020).

Blockchain enhances networks, but too many miners limit scalability (Gervais et al., 2016; Kundu, 2019). Scalability allows the blockchain network manage more transactions and users without slowing (Zheng et al., 2017). Scalability difficulties plague public blockchain networks, which everyone uses. Users and transactions slow networks and increasing costs (Gervais et al., 2016). Blockchain may not work for mining firms due to transaction volumes.

Private and consortium blockchains are less scalable owing to fewer participants and speedier consensus (Morkunas et al., 2019). Transactions and users may limit permissioned blockchain development (Kundu, 2019). Blockchain mining companies may require a platform, consensus mechanism, and side chains or payment channels to dump transactions off the main blockchain (Zheng et al., 2017).

4.4 Value capture

4.4.1 Cost efficiency - increased investment

Blockchain might improve mining companies' value capture and cost efficiency. Blockchain's decentralisation and irreversibility may help mining companies save money and improve efficiency, according to Ahluwalia, Mahto, & Guerrero (2020) and Morkunas et al. (2019). Automating smart contracts reduces blockchain costs. By removing middlemen, self-executing contracts may automate mineral resource payments, asset monitoring, and supply chain management (Bauer et al., 2019; Chong, 2019).

The transparent, tamper-proof blockchain transaction record may lower mining firm compliance, auditing, and dispute resolution expenses (Ahluwalia, Mahto, & Guerrero, 2020). Mining businesses may trace materials and transportation using blockchain (Tiscini et al., 2020). Transparency may increase stakeholder trust and save costs (Morkunas et al., 2019).

Blockchain may lower value configuration mining costs. Mining enterprises may profit from blockchain-based customisation and problem-solving. Client-specific solutions may be faster and cheaper with blockchain data exchange and automation (Chong et al., 2019). Blockchain may lower mining value network expenses by coordinating mineral resource transaction partners. Decentralised blockchains directly connect mining businesses, suppliers, logistics providers, and other stakeholders, lowering transaction costs and enhancing network efficiency (Chong et al., 2019; Morkunas, 2019).

Blockchain may reduce mining value chain mineral production and distribution costs. Tracking minerals from extraction to consumption using blockchain might enhance mining supply chains, waste reduction, and inventory management (Ahluwalia, Mahto, & Guerrero, 2020). Smart contracts may save mining businesses time and money by automating supplier payments and other tasks (Bauer et al., 2019).

Blockchain might lower mining costs and promote investment. Training, infrastructure, and

blockchain software are costly (Notheisen et al., 2017). Mining companies could explore blockchain due to its high initial cost and extended payback (Tiscini et al., 2020).

As technology advances, mining businesses struggle to preserve blockchain investments (Lacity, 2018). Blockchain laws may push mining businesses to educate and enhance infrastructure (Notheisen et al., 2017). Miners with limited budgets or conflicting aims may not commit (Yli-Huumo et al., 2016).

Public blockchains need more infrastructure and resources than private or consortium blockchains, raising mining investment risk (Morkunas et al., 2019). Engaging and computing may boost Bitcoin and Ethereum prices (Bauer et al., 2019). Private or consortium blockchains' flexibility may lower mining businesses' investment risks (Chong et al., 2019).

To reduce investment risk, mining businesses should assess cost-benefits and develop blockchain adoption plans that support their long-term goals (Tiscini et al., 2020). Smaller blockchain pilots may evaluate feasibility before investing (Lacity, 2018). Business, technology, and research organisations may help miners use blockchain (Morkunas et al., 2019).

Finally, blockchain technology may lower mining costs but boost investment. Mining businesses must weigh blockchain deployment costs and advantages against value goals. Stakeholder involvement and smart blockchain implementation may lower investment risks and boost mining industry value capture.

5. Implications of blockchains for business model innovation in the mining industry

5.1 Implications for value shops

Blockchain technology may help value-shop miners start or change enterprises. Blockchain may help value stores cooperate and solve issues (Chong et al., 2019). Public or consortium blockchain networks may assist mining enterprises build trust with experts, suppliers, and customers by sharing ideas, skills, and resources to create new mining solutions (Bauer et al., 2019; Morkunas, 2019).

Decentralised, transparent blockchain enables inclusive mining (Morkunas et al., 2019). Blockchain verifies stakeholder contributions and offers rewards (Pazaitis, 2020). Smart contracts may automate participant agreements and boost creativity (Kowalski, Lee, & Chan, 2021).

Value miners may benefit from blockchain-tokenized IP and intangibles (Bauer et al., 2019). Blockchain tokens allow miners fractionally hold and transfer IP rights, boosting investment and commercialization (Morkunas et al., 2019). This IP management strategy may help mining value shops secure R&D financing and engage stakeholders in successful discoveries (Chong et al., 2019).

Blockchain's novelty and efficiency impact value store mining (Amit & Zott, 2012). Mining innovation benefits tokenized open innovation platforms. Innovative business models may help mining value shops find new value sources (Morkunas et al., 2019). Blockchain may reduce transaction costs, enable real-time data sharing, and automate repetitive operations using smart contracts, improving innovation efficiency (Bauer et al., 2019; Kowalski, Lee, & Chan, 2021).

Mining value enterprises must carefully choose a blockchain network (public, private, or consortia) and create their platform or tokenization scheme to strengthen blockchain-based business models (Chong et al., 2019). Blockchain and mining may improve the company's model (Beck & Mller-Bloch, 2017). Blockchain may help mining.

5.2 Implications for value networks

Blockchain-based value network miners may benefit from stakeholder engagement and value sharing. Blockchain links miners, suppliers, logistics, and consumers in mining value networks.

Private or consortium blockchain networks may securely record mining value network transactions and agreements, improving transparency, traceability, and accountability (Bauer et al.,

2019). Decentralisation decreases brokers and clearing houses, lowering transaction costs (Zavolokina et al., 2020). Smart contracts may automate supply chain contracts and royalty payments for timely, accurate fulfilment (Chong et al., 2019).

Blockchain may enhance mining value network earnings (Morkunas et al., 2019). Mining businesses may provide blockchain-enabled supply chain management to other sectors using their logistical experience and blockchain infrastructure (Chong et al., 2019). Secure blockchain commodity transactions may work.

Mining blockchain value networks complements and locks in (Amit & Zott, 2012). Decentralised cooperation and value-sharing may improve mining company networks (Schmidt & Wagner, 2019). Environmental advantages exceed switching costs, therefore this network effect may maintain members (Morkunas et al., 2019). Blockchain commodities trade and supply chain management may increase mining value networks (Chong et al., 2019).

Blockchain business models need governance and incentives for mining value networks (Beck et al., 2018). Blockchain growth and scalability need technology and organisation (Lacity, 2018). Decentralised value generation and trading may help mining value networks compete and reorganise.

5.3 Implications for value chains

Blockchain may help value chain miners operate transparently and sustainably. Blockchain lets miners trace minerals from extraction to use (Bauer et al., 2019; Chong, 2019).

Mining businesses track ore origin, transportation, and quality via blockchain (Tiscini et al., 2020). ESG disclosure reduces conflict minerals and human rights issues (Ahluwalia, Mahto, & Guerrero, 2020). Smart contracts may need value chain sustainability (Kouhizadeh, Saberi, & Sarkis, 2021).

Blockchain may enhance mining value chain supplier networks, say Morkunas et al. (2019). Blockchain real-time inventory, production, and logistical data exchange may improve mining supplier, customer, and company cooperation (Chong et al., 2019). Visibility may reduce inventory, waste, and asset use, increasing productivity and lowering costs (Ahluwalia, Mahto, & Guerrero, 2020). Blockchain lowers financial transaction costs and speed (Bauer et al., 2019).

Blockchain enhances mining value chains (Amit & Zott, 2012). Blockchain traceability and supply chain optimisation may lower mining costs and maximise resources (Ahluwalia, Mahto, & Guerrero, 2020). Blockchain sustainability verification and financial settlement might assist miners and stakeholders (Chong et al., 2019).

Blockchain-based business model viability and scalability need miners to evaluate network capacity, data protection, and regulatory compliance (Lacity, 2018). Governments, IT businesses, and industry partners may recommend mining blockchain implementation (Morkunas et al., 2019). Blockchain might boost mining value chains' efficiency, sustainability, and income.

6. Discussion and conclusions

Blockchain technology may revolutionise mining companies' value generation, distribution, and collection, affecting business model innovation. According to research, blockchain allows new economic activities, structures, and governance mechanisms in value shops, networks, and chains. The research examined public, private, and consortium blockchains' pros and disadvantages to help mining companies compete and profit.

Blockchain may increase mining sector trust, value generation, service delivery, and cost optimisation, study shows. Decentralised, transparent, unchangeable blockchains simplify, protect, and eliminate middlemen. The report listed inflexible transactions, privacy concerns, service interruptions, scalability issues, and increased investment needs as blockchain adoption barriers. Mining firms starting blockchain businesses must examine and mitigate these risks.

Blockchain affects mining value configuration innovation. Blockchain can help mining value

shops create open innovation platforms for stakeholder interaction and value co-creation. IP tokenization boosts investment and income. Trust-based, decentralised blockchain systems let mining value network members participate, cutting transaction costs and enhancing efficiency. Blockchain miners gain from goods.

Blockchain ethical challenges include data privacy, security, and international natural resource transactions. Control blockchain using these ethics. Socially responsible IT planning, implementation, and management.

Technology, economics, law, and social sciences utilise blockchain for minerals. Research should study how these variables impact blockchain technology development and acceptance. Legal limitations may hamper blockchain innovation in natural resources, while openness and sustainability may stimulate it. Blockchain should ethically protect the environment utilising eco-science.

Blockchain enhances mineral supply chain transparency, sustainability, and compliance. Optimise supply chain resources and reduce operational inefficiencies. Novelty, lock-in, complementarity, and efficiency spurred business model development, studies show. Blockchain can differentiate, synergize, and optimise miners.

Blockchain may help mining businesses improve their models, but technical, organisational, and institutional limitations remain. Choose blockchain platforms, governance, incentives, tech infrastructure, and organisational skills carefully. Mining firms should use blockchain and other methods.

Mining blockchain affects asset allocation and stakeholder management. Blockchain traceability, transparency, and accountability may increase local, government, and stakeholder mining company confidence. Mining companies may distribute money by monitoring and rewarding shareholder contributions using blockchain software. Mining companies must handle blockchain data privacy, security, interoperability, legal, and regulatory issues to realise these advantages.

Blockchain mining research informs business model innovation. We suggested blockchain-based business models that address network and corporate value. We explore mining blockchain adoption, blockchain-based business models, and responsible mining's social and environmental impacts.

Profitable blockchain mining. Blockchain networks may improve mining efficiency, sustainability, and competitiveness. Adopting blockchain-based business models requires technical, organisational, and institutional ties. Digital mining will alter with blockchain.

Blockchain solutions for resource firms work. Innovative blockchain businesses improve supply chain efficiency, transaction security, and value. Case examples highlight blockchain's potential and app issues and solutions. This project may aid mineral resources enterprises' blockchain-based business model development and assessment.

Although it admits practical obstacles, this report says blockchain technology may alter the natural resources business. Blockchain might provide natural resources corporations new business models, but it confronts technological, organisational, and institutional challenges. Long-term blockchain effects on minerals may be studied. Knowing blockchain may help you manage its fast growth.

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