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Article

Exploring the Business Model Innovation of Blockchain Technology

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Abstract: Blockchain is a technological innovation that performs a different paradigm (decentralized protocol) to change the way organizations or societies interact with others. Blockchain adoption evolves into different ecosystems (network of actors adopting BC) along with its development, namely public and private ecosystems. Although previous research has examined the role of BC on the business model, there is little explanation for how BC applies business model innovation (BMI) in different ecosystems. Using a multiple-case study approach, this study seeks to explain the innovation of the business model in different BC ecosystems. The study finds different formulas of BMI among the ecosystems. The potential BMI in the private/consortium BC emphasizes improving the existing business values. In the public BC, BMI potentially disrupts the current business model. The study also proposes a new theoretical model to identify the potential of BMI within an ecosystem. This study contributes to the technology management literature, particularly BC and BMI. Furthermore, the practical implications of this study are presented in this investigation.

Keywords: Blockchain; business model innovation; different ecosystem; case study.

1. Introduction

The paradigm shift leads an essential role in technological innovation development. Blockchain technology (BC) is a decentralized protocol that allows a society to change its interactions with others (Asaf et al., 2020; Gainsbury & Blaszczynski, 2017; Karthikeyyan & Velliangiri, 2019; Lu, 2019). This technology allows distributed data to support peer-to-peer transactions within the business ecosystem and eliminates intermediary parties (Nakamoto, 2008). The inherent characteristics of BC provide many benefits for business, such as transparency, verification, and immutable (Lu, 2019). Furthermore, BC technology can be an innovation platform to improve existing business models and even create a new market (Weking et al., 2019). The future of this technology is promising, marked by the increasing use of the technology in the last several years. BC users have increased significantly in number over time. Statista (2020) states that the average growth of BC users was 78% per year over the last five years (2014-2019). The number of technology users reached 2.67 million in 2014 and grew to 44.69 million in 2019. The growth marked a new era of technology adoption and was transformed into the primary concern for organizations to support strategic decision-making. The same survey also mentioned that BC provides data more securely (39%), reduces transaction costs (36%), and can create new

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revenue streams (24%). Academic research states that the platform can create new economic activities through a disintermediation initiative (Chen, 2018). Another unique characteristic of this technology is that it can adapt to necessities in different market segments.

BC adoption in society is shaped into a unique network in a distinct ecosystem. First, a public BC is a transaction platform that develops within the community. Bitcoin is an example of a successful public BC product today. This platform's success encourages new initiatives within financial transactions and develops into a new venture instrument (Martino & Bellavitis, 2019). The other ecosystem, private BC, is used to support internal organizational needs. This platform aims to help organizations improve their operational performance. Meanwhile, a consortium BC is a BC adaptation that supports coordination between organizations in a limited ecosystem. This ecosystem was created to fulfil the necessity of organizations to collaborate to realize the same objectives (Weking et al., 2019). BC contributes to driving BMI through their respective ecosystems.

BMI is a framework through which organizations adapt to market dynamics. Chesbrough & Rosenbloom (2002) encourage innovation in business models because it has a more significant impact than other innovation modes. The capacity of the BMI has been acknowledged to initiate new value creation through collaboration within the business ecosystem. BC technology as a collaboration platform can support business models more effectively (Morkunas et al., 2019; Nowiński & Kozma, 2017) However, although many scholars study the coexistence of BC and BMI, there is little evidence that explains how BMIs are built based on specific BC ecosystems, as explained in the previous paragraph. Therefore, this research examines BMI in different BC ecosystems. This study attempts to understand the contribution of the BC platform to the BMI in a distinct BC ecosystem. Furthermore, this research strives to explain in-depth the differences between BMIs in each BC ecosystem. Using case studies, this research tries to synthesize empirical evidence to build the theory. The contribution of this research will provide insight into the coexistence of BC and BMI literature. The structure of this study is divided into several parts: the research background, literature review, research methodology, research findings, research analysis, and the conclusions and practical implications.

2. Literature Review

2.1. Business Model and Innovation

The business model is an organizational framework used to support its business activities. Afuah (2003) defines the business model as a framework to determine what organizations deem necessary to improve and accomplish this task to gain economic benefits. According to this researcher, the organization must understand why it is doing business, its objectives, and its customers. Baden-Fuller & Haefliger (2013) explain the business model as a learning system for organizations to generate economic benefits. Teece (2010) understands the business model with a more straightforward definition. He outlined the importance of how organizations can create value or needs that are considered essential for their consumers to produce effective BMIs requires continuous and systematic activity.

BMI is fundamentally changing from the existing business model into a new one. Demil & Lecocq (2010) use the term evolution to explain the changes in the business models. According to him, BMI is an organization search activity that allows changes due to interactions between components in the business model. Another opinion states that BMI is defined as a way to execute business competition through a learning process and the organizational modification that results in a new business model. Aspara et al. (2013) argue that BMI challenges existing business models to produce better value by considering the business's contexts. Furthermore, BMI is a logical change in sequential value creation and systematic activity.

A value system is a series of activities to implement the BMI using a systematic approach. The BMI process captures opportunities and goals ((Bocken et al., 2015; Zott & Amit, 2010). The value system is classified into value capture, value creation and delivery, and value proposition. This process occurs through a logic-based, mutually reinforcing interaction (Aspara et al., 2013). Therefore, a sequential and iterative process must ensure a more effective business model. The activity sequence begins the value capture activity. Bocken et al. (2015) elaborate that value capture is an activity that benefits all stakeholders to perform more sustainably, while Baden-Fuller & Haefliger (2013) explain value capture from an economic perspective. Therefore, value capture is the economic benefit that an organization can produce.

Value creation is an activity that involves producing value for customers (Demil & Lecocq, 2010). These activities are represented in the organization's main activities in creating a value proposition. Bocken et al. (2015) use three main components to explain creating value for consumers: key activities, key resources, and key partners. Value creation requires specific organizational capabilities and competencies. Therefore, a strategy is needed to realize the value proposition through partnerships with other parties (Osterwalder & Pigneur, 2010). Partnerships will eliminate organizational boundaries to realize a compelling value proposition. Creating opportunities based not only on value creation but also on delivering those values also must consider the design of a business model. Value delivery is an opportunity created by organizations to establish relationships and deliver value propositions to consumers (Baden-Fuller & Haefliger, 2013).

A value proposition is the organization's purpose in designing a new business model. Boons & Lüdeke-Freund (2013) and Teece (2010) define a value proposition as a manifestation of value capture and creation activities. Osterwalder & Pigneur (2010) use the rules of customer experiences to help organize value propositions. Customer experience uses two main approaches, namely, customer expectations and needs. The terminology customer gain is a representation of customer expectations on the basis of consumers' expectations of a product. Customer pain represents customer needs that have disadvantages or disappointment toward existing products.

Table 1. Value System and Its Rationale.

Activity	Value System	Rationale
Capture	Value capture	Capture the value that benefits consumers (Bocken et al., 2015), including capital owners, communities, and other stakeholders. Monetization of values (Baden-Fuller and Haefliger, 2013).
Opportunity	Value creation	Realizing value creation to consumers (Demil and Lecocq, 2010) and business opportunities (Afuah, 2003; Bocken et al., 2015)
	Value delivery	Communication and relationships with consumers (Baden-Fuller and Haefliger, 2013; Chesbrough and Rosenbloom, 2002)
Purpose	Value proposition	The value inherent in the products offered by the company as an action of value capture and value creation (Boons and Lüdeke-Freund, 2013; Chesbrough and Rosenbloom, 2002; Teece, 2010)

2.2. Blockchain Overview

BC is a decentralized technology that allows society to establish peer-to-peer relationships. In this technology, data stored and disseminated requires adequate supervision. BC involves a distributed ledger controlled by many nodes to perform the transaction, a consensus. This consensus is essential in maintaining data validity before a transaction is made. When a consensus is reached, it is impossible to roll back the transaction or irreversible action. The decentralized principle operates as a supervisory and witness function. The principle of decentralization is data distributed and secured by all nodes in the BC ecosystem. All transactions are recorded, distributed, and accessed through different nodes (Hughes et al., 2019). Consensus mechanisms drive the transactions that can only be made when the protocol is operated correctly. Therefore, all nodes must contribute to verifying the transaction before a transaction can be executed. This mechanism allows each transaction to be accessed and tracked to improve dispute transactions and avoid transaction risk. In addition, the BC secures its nodes by using unique codes rather than public identities to mitigate potential fraud.

BC protocol begins with making code an identity in the system (Nakamoto, 2008). The code functions as the official identity of each node. This code rationale is to maintain the nodes' privacy since they involve in the system. All transactions are recorded and sealed using a BC before being distributed to the platform. When several nodes engage in transactions, other nodes record and participate in verifying the transaction that has been approved will be marked using a security seal that cannot be changed (Martino & Bellavitis, 2019) and encrypted with unique codes. The seal code provides data security and references subsequent transactions (Lee, 2019). The seal relationship between transactions is known as a BC.

2.2.1. Blockchain for Business

The BC platform allows organizations to change or improve their business models. Morkunas et al. (2019) studied the implications of using BC on business model activities using a Business Model Canvas (BMC). His finding indicates that BC is a potential instrument that plays a significant role in BMIs. Nowiński & Kozma (2017) identified a similar finding through the integrated business model framework. Several findings confirmed the significant role of BC in business models, but it remained to understand how BC works. Therefore, effective BMI can be achieved and create values for the organization. To perform effective innovation, organizations must identify their environment. The adoption of BC needs to be synchronized within the organizational condition. BC is a pointless tool in case organizations cannot understand their necessity. A smart contract, for example, is only effective for problems when the transaction process involves several entities (Chang et al., 2019).

Therefore, smart contract applications fit the supply chain area, requiring precise information and transaction speed and involving several business entities incorporated in the specific business ecosystem, such as the logistics industry (Queiroz & Wamba, 2019). A decentralized system embedded in the BC protocol improves information transparency and helps maintain data validity without burdening transaction costs (Schmidt & Wagner, 2019). With its unique characteristics, BC can serve as a problem-solving technique for sequential data and information difficult for many people to access (Zhao et al., 2016). The existence of this platform can provide economic opportunities to the

community through the initiation of new venture creations and potentially disrupt the existing market (Chalmers et al., 2019; Chen, 2018; Martino and Bellavitis, 2019). Through Initial Coin Offering (ICO) or tokenization, investment through the platform can perform and allow all token holders equal opportunities to create new ventures.

2.2.2. Blockchain Adoption in the Ecosystem

BC adoption in society evolved the network into two different ecosystems, public and private. This classification is based on the interests and objectives of each entity. A public BC is an open system that allows anyone to access the platform at any time without permission (Martino & Bellavitis, 2019). This ecosystem seeks to use BC to support business activities and access public information needed by society. Security is the primary value for nodes that want to be part of this ecosystem (Chen, 2018). However, the characteristics of this ecosystem are not suitable to be applied to organizations with limited scope and are used to support existing businesses. To support those needs, the private BC platform is more appropriate to be adopted.

A private BC is a type of BC that utilizes a semi-decentralized protocol. The uniqueness of this protocol relies on a modified consensus and has limited access. This platform only allows certain entities to join the ecosystem. The purpose of this ecosystem is more oriented toward improving organizational operations, both within the organization and between business entities. The BC protocol can accommodate inter-organizational needs that are difficult to realize, facilitate transparency, and validate data (Weking et al., 2019). Distributed data can eliminate intermediaries so that transaction costs can be reduced. The legally binding BC has the potential to reduce disputes in business interactions. Moreover, because of its distributed ownership, BC can help realize equality in the ecosystem.

Market dynamics drive the private BC protocol to be customized according to the ecosystem needed. A private BC platform is currently divided into two groups of ecosystems: private and consortium (Mendling et al., 2018). A private BC results from a modified BC in which specific attributes are changed to support organization interaction systems. Whilst, a consortium BC enables support interaction among organizations' different entities. Both ecosystems aim to strengthen collaboration to improve ecosystem performance (Schmidt & Wagner, 2019).

3. Materials and Methods

This study uses abductive reasoning through a case study approach. This study promotes abductive reasoning of the limited references and empirical evidence. The case study approach is the most suitable method for understanding the BC advantage for developing BMI in different ecosystems (Yin, 2014). To obtain credible data sources, we use experts who implemented their business within the scope of BC. The Indonesian Blockchain Association (ABI) mentioned that there are currently 17 organizations officially engaged in the BC association, five of which serve as BC providers. In Indonesia, although BC is developing, the technology penetration is still in its initial stages.

Data collection uses semi-structured interviews involving five people representing distinct ecosystems with in-depth interviews and public and private consortia from the organizations mentioned in Table 2. In determining the target interviewees, this study uses several four main criteria experience in related function (five years in a related field and a high-level position in an organization), capacity and willingness to contribute (experienced sharing their knowledge in a public meeting), dedicated time (able to provide at least 45 minutes as an interviewee) and communication skills (conducts the preliminary meeting before deciding as a capable interviewee).

This study collaborated with ABI since they can provide information and promote access to the key informants in a network ecosystem. Then, the interview was followed by private/consortium BC systems. The public BC closed the interview series because the platform's structure is the most complicated among all BC ecosystems. This study utilizes secondary data that supports academic and practical research to produce effective questions. Before conducting interviews, researchers used the protocol form as research guidance. The interviews were recorded using a representative recording device and then translated into documents for analysis, classification, and conceptualization. The data analysis process used inductive coding (Corbin & Strauss, 1990) and theoretical development (Eisenhardt & Graebner, 2007). The coding results from the interview were confirmed to the interviewees and experts to justify them.

Table 2. Key Informants Profile

Organization	Ecosystem	Informants*)	Implementation Area	Interview Duration
Private Block1	Private	Donald	Financial service	1:05:21
Private Block2		Pandora	Logistic service	0:56:37
Consort Block3	Consortium	Gilbert	Airport service	0:48:27
Consort Block4		Daniel	Supply chain	0:53:45
Public Block5	Public	Edward	Crypto assets	0:49:33
Public Block6		Rheino	Document storage	0:50:31

Note: *) All the names are pseudonyms since the key informants requested confidentiality.

4. Results

4.1. Value Capture

The encoding from the Value Capture dimension produces four subcategories, of which two represent different types of BC ecosystems. A brief description of the coding can be seen in Table 3.

Table 3. Value Capture Coding in Different Blockchain Ecosystems.

Ecosystem	Subcategory	Rationale
Private Blockchain	Reduce costs	Economic implications of the loss of intermediary parties
Public Blockchain	New revenue	Opportunities from new markets or new businesses creation
	Recurring income	Sustainable returns from investment activities that are formed as dividends or any other forms

4.1.1. Reduce Cost

BC protocol allows entities to interact peer-to-peer. In effect, the path of interaction and communication no longer uses an intermediary. The implications of implementing this protocol can reduce transaction costs such as transaction and insurance costs. These costs are replaced by the costs of implementing the system, which is more efficient. In addition, the use of the system provides more benefits to the organization than a centralized system. Cost efficiency shall lead to an increase in corporate profits. With a fixed revenue assumption, lower costs may increase profit margins. Cost is the primary factor in determining the success of organizational performance, particularly for established business value. Cost efficiency can be classified by mapping how high the incurred costs are. The use of costs must be as efficient as possible to provide more significant profit margins for the organization. There are two approaches to pursuing higher profits. First, by raising the sales target, increasing the number of sales can be formulated by increasing the number of goods or increasing their prices. The strategy of increasing sales is an initiative that has higher uncertainty and risk. Second, profits can be achieved by reducing production costs. A cost-efficient strategy is more relevant for organizations with business value to increase corporate profit.

4.1.2. New Revenue

The public BC ecosystem enables new value creation to initiate a new market. The public BC platform allows people to connect for the exchange of data. The presence of a smart contract provides interaction among nodes and can be implemented legally through a contract. This product is an instrument to invite the public to contribute to funding a new business. Because the contract uses a programming language, transactions can be automated. The BC protocol raises unique characters that can create new business initiatives. Also, this protocol encourages data integrity and more transparent information. This character can fulfil the data security and data accessibility needed by society. With this platform, public problems can be solved and created as an initiative for new businesses. This initiation proves that BC can appear as an innovation platform and potentially generate new revenue streams.

4.1.3. Recurring Income

Public BC enables the creation of new venture opportunities by connecting entrepreneurs and their investors. The new ventures allow investors to generate recurring income like dividends. Recurring income is a form of sustained expected return generated from investment activities. Investments using the tokenization mechanism enable society to have equal opportunities in investing, as mentioned by Rheino:

"The public BC allows investment in previously difficult sectors to distribute. This platform allows everyone to invest and generate returns built upon their contribution."

Recurring income is an incentive form as a passive contribution to venture activities. Limited knowledge and experience do not enable anyone to operate a venture. The venture mechanism provides instruments for investors who want to contribute without involving the business directly. On the other hand, entrepreneurs who have an idea but contend limited funding require outsiders to fund the idea. Therefore, a collaboration platform such as the BC is relevant to unite them.

4.2. Value Creation

Value creation in BC ecosystems has different patterns of interaction and consensus models, as shown in Table 4. The private BC ecosystem has a more flexible consensus model than the public BC ecosystem.

Table 4. Value Creation Coding in Different Blockchain Ecosystems.

Ecosystem	Subcategory	Rationale
Private blockchain	Exclusive interaction	The relationship pattern between entities within the organization
	Service level agreement	The form of agreement that is approved among nodes and incorporated into the agreement in the system
Public blockchain	Equality	All nodes have an equal position to access data and information
	Social inclusivity	Community involvement in supporting the oversight function and transaction verifier

4.2.1. Exclusive Interaction

The BC platform is an instrument for interacting within an ecosystem. The platform makes those activities easier for business entities to exchange information and data quickly and precisely. Organizational interaction patterns can be classified into two groups, inter-organizations and intra-organizations. An inter-organization is an interaction with different business entities, while another is an interaction among entities. There is a fundamental difference between public and private BCs in their interaction patterns. In the public BC ecosystem, the interaction between nodes adopts an inter-organization pattern because the nodes in the ecosystem connect to society or peer-to-peer networks. The private/consortium BC allows for more varied patterns of interaction but with a narrower scope. First, the intra-organization system is used by organizations to support operational activities such as recording transactions and audits among sections. Second, inter-organization uses interaction patterns in different organizations still in the distinct business ecosystem.

4.2.2. Service Level Agreement

The consensus scheme can be modified to suit the forms of the ecosystem, like the private/consortium BC. In contrast, the public BC requires the full-consensus scheme to verify the transaction before implementation. The consensus scheme on a BC can be adjusted following the market characteristics. In private BC, consensus values adjust to support the organizational business values. The limitation of entities in the ecosystem circle is also a consideration for adjusting the consensus model. The modified consensus model on a private/consortium BC requires an agreement among all nodes. They have an equal position in determining the consensus model due to the distributed protocol. The plain vanilla BC protocol does not allow any modification of its attributes. If a misdirected transaction is conducted due to human failure, then the transaction should not preference cancelled or reversal. Unlike the public BC, the ate BC modification of these platforms refers to service-level agreements that support the business value of the organization/ecosystem. This service-level agreement is a resource for the BC platform to support organizations, allowing them to reverse the transaction performed by the banking industry or logistics. Financial transactions such as banking or logistics allow reversible action.

4.2.3. Equality

A decentralized BC platform enables equal values among all nodes. A distributed server provides a position for nodes to have an equal position in the ecosystem. They also have equal access to the data and an obligation to respond to and support the transactions made by other nodes. Equality values are more prominent in the public BC because the entire community can access the platform without hurdles. Registering and generating the identity number is the main requirement to enter this ecosystem. At the same time, this platform maintains node privacy by using unique and well-encrypted code. This platform allows everyone to access investment activities as long as they have tokens as investment instruments. A decentralized system has the consequence of equality between nodes. The BC protocol does not allow this system to be controlled only by different parties. Node members of this ecosystem should understand the importance of a decentralized system.

4.2.4. Social Inclusivity

The decentralized model can eliminate intermediaries in a peer-to-peer network. Peer-to-peer interaction among nodes through this platform provides valid information benefits. The source inputted data and verified it correctly before the transaction is made. The more nodes are involved in this platform, the more valid the data will be. In public BC, community involvement is needed to support an open-access system. Communication protocols, particularly in a public BC, emphasize the importance of community involvement. With this involvement, this protocol facilitates the elimination of the intermediaries and information management replaced by decentralized nodes. Furthermore, community

involvement allows collaboration in which every node has equal access to data on the platform. Equality can be performed because the transaction authority is delegated as decentralized among nodes. They interact among others to perform transactions.

4.3. Value Delivery

The public or private BC ecosystem has a similar value delivery, as shown in Table 5. The BC platform has legal procedures inherent in the algorithm and supports an interaction form among nodes. The implication and disintermediation can be performed by using the platform.

Table 5. Value Delivery Coding in Different Blockchain Ecosystems.

Ecosystem	Subcategory	Rationale
Private and Public Blockchain	Legal procedure	The law inherent in the platform embedded in the system through an algorithm
	Multi-actor interaction	Receive and respond to activities because of supporting the de-centralized system. This mechanism forces the node to monitor data and information at the same time.
	Disintermediation	Relationships receive and respond to data. This mechanism forces the node to monitor and verify transactions simultaneously.

4.3.1. Legal Procedure

The BC platform is delivered to nodes through a legal procedure that is inherent in the platform algorithm. A smart contract is a product that allows legal-based interactions within the platform. This contract is systematically designed to operate without trespassing on the transaction agreement. In private BC, this legal procedure is designed according to the inter-node transaction model. This legal procedure is difficult to intervene in without approval from nodes in the ecosystem. This modification or change can be solely made if the nodes agree. Agreements among the nodes determine the customization of agreements in the BC ecosystem. Agreements on a public BC usually use the generic model of a decentralized system. In private BC, legal procedures adjust to the transaction model among entities in distinct BC ecosystems. The BC system that promotes equality closes the opportunity controlled by a specific entity. This procedure aims to help secure transactions from disputed circumstances. The code develops as a legal basis to perform a business model agreement and can reduce transaction failures. BC is developed based on specific programming algorithms. The algorithm is a systematic procedure to help solve problems. With this approach, BC can accomplish business problems in a logical and structured way. A smart contract becomes a BC product that can support the platform in public and private ecosystems. The algorithm functions as a legal procedure attached to the BC platform, as mentioned by Pandora:

> *"When using a private blockchain, the consensus of the algorithm can avoid 51% of attacks because the mechanism can be modified using only 70% or 90% of the nodes. It can be adjusted to the ecosystem's needs."*

4.3.2. Multi-Actor Interaction

A decentralized system requires a platform as an instrument to enable multi-actor interaction. The communication relationship among nodes is not limited to receiving data but also requires nodes to respond to transactions through verification and approval action. Because of its decentralized nature, information is distributed to all nodes and accessed directly to support the system. Although all nodes have equal access to data, they cannot intervene or even change them. Using BC protocol, data should pass the layered encryption procedure. Layered security and distributed databases reduce the data manipulation risks in the system. Decentralized protocol drives all nodes in receiving the data and responding to the transaction process. The consensus model on this technology requires transaction approval through agreement from all nodes. Transactions made must be relevant to the existing data to execute the transaction. All nodes must verify the data based on the previous block to declare the information validity. Two-way communication makes the decentralized system more secure and transparent.

4.3.3. Disintermediation

Disintermediation is a logical implication for implementing a decentralized system. The system performs the data distribution to all nodes in the ecosystem. Therefore, the intermediary parties are no longer needed. Data is distributed to all nodes using the same system. The system allows counteracting system adjustment or system synchronization to perform system integration. Disintermediation enables the improvement of transaction guarantees because it is

supervised and performed by all nodes. The value of disintermediation can perform economic redistribution. The existence of an adverse mediator has an impact on improper economic distribution. In addition, the flow of data is controlled by the intermediary. This situation interferes with the business entities and their activity, as mentioned by Danie:

> *"…the centralized system is held by a single party. Then, it is possible to control the system. We were forced to trust the third party in a centralized system, which is difficult to do. Most cases are often encountered in which the organization with immense financial power or position is the actual owner of the system."*

4.4. Value Proposition

There are differences in the value propositions in a different ecosystems. Those values are defined by each ecosystem's different activities and objectives (Table 6). The values of the private BC are built to support the organizational business values to improve performance, whilst the public BC emphasizes the value of data security that involves all nodes in the ecosystem.

Table 6. Value Proposition Coding in Different Blockchain Ecosystems.

Ecosystem	Subcategory	Rationale
Private Blockchain	Value transfer	Perform the value transfer through the distributed data, and the transactions can perform more quickly.
	Consensus	The mechanism of agreement among nodes supports the decentralized system.
	Transparency	Distributed data allows each node equally to access the data.
Public Blockchain	Privacy	The system offers authority to each node to perform the transaction using a consensus scheme.
	Traceability	BC uses a chain system to perform subsequent blocks. A unique seal on the previous block guarantees transactions on each block.
	Security	Data in each block is secured by rewriting the data and secured by software before being distributed.

4.4.1. Value Transfer

The private/consortium BC benefits can improve the value transfer of transactions. The system performs transactions faster because the data is distributed to all nodes. Thus, the process can be shortened. Moreover, the transactions operate with smart contracts that can help the process run automatically. Smart contracts perform as verifiers and communication instruments to support the transaction process. Decentralized platforms benefit organizations by eliminating inefficient costs such as transaction costs. These costs are replaced by a BC system that works more efficiently and benefit organizational operations. The initial form of the BC, the distributed ledger, makes this platform suitable for service and trust-oriented organizations such as the logistics and banking sectors.

4.4.2. Consensus and Transparency

The BC system invites society to interact through consensus oversight. Those modes can secure data and maintain the validity of transactions. The consensus mechanism can suit the different needs of distinct ecosystems. Due to the full-consensus model, public BC results in slower transaction performance. This consequence occurs because the public BC requires all nodes to approve the transactions. The consensus mechanism can be modified with all nodes' agreements to perform the transaction process in the private BC. The BC system is designed to support society's involvement. Node involvement is explicitly required to secure the data. Because the node involvement model represents a consensus, transactions will only be made when all nodes agree with the transactions. After the approval procedure is conducted, the consensus results are entered into the platform for implementation. The BC system is a collaboration platform, allowing all nodes to supervise the data and verify the transactions, as mentioned by Donald:

> *"The uniqueness of the blockchain technology is the consensus model in determining which data is correct and which nodes are correct."*

4.4.3. Traceability and Security

The adoption of BC can guarantee data traceability. The BC system has a model following the value chain concept. The concept can perform the information connected sequentially. Data updated on the platform can only be made if the

previous data is closed and sealed using random code. The code or number serves as a reference to perform the subsequent block. Simply put, this system uses a sequential approach, and the previous block guarantees the information on the new block. This oversight mechanism reduces the risk of transaction failures and uses a consensus mechanism. The BC system records the data, which is encrypted before being distributed on the platform. Encryption is performed on all nodes to ensure that data security is guaranteed. The software on the BC platform will help the node to be encrypted with a unique password. Those codes also serve as a key to open the block. After the data is encrypted, the system adds security through additional encryption. Then, data is distributed to all of the servers or nodes and can access with different devices, as mentioned by Gilbert:

> "*Traceability is a unique value provided by the blockchain platform. This platform records all events or transactions made sequentially. This uniqueness makes the transaction traceability more efficient by using blockchain."*

5. Discussion

Organizational objectives and their interaction patterns drive BMI in a BC ecosystem. BMI is a private/consortium of BC support organizations to improve their business value or can be classified as low innovativeness. The public BC can change the current value system or create a high level of innovativeness.

5.1. Business Model Innovation in Private Blockchain

The private BC platform effectively helps the organization improve its current business model to support its business value (Table A1). The value system framework analyses the private BC ecosystem, focusing on innovating business models to improve organizational performance. BC is a tool to leverage corporate profits in the value capture dimension. This platform helps to reduce ineffective costs such as transaction and insurance costs. Therefore, it improves a higher profit margin. Private BC assists the interaction system among all permissioned entities. Based on this concern, modification of several attributes in the BC is required. Some attributes attached to the technology can potentially adjust the number of nodes, service level agreement, and transaction consensus model. This system allows organizations to limit the number of nodes and provide access to specific nodes. Service-level agreement modification leads a significant role in the private/consortium BC ecosystem. All nodes must agree upon the modification before being applied to the platform. Value delivery on the private BC ecosystem is performed using smart contracts to serve its stakeholders. A smart contract is a series of codes to pursue service-level agreements among all nodes. In practice, this smart contract will help transactions run automatically with specific algorithmic codes. Although it runs automatically, transaction supervision and verification are still performed by all nodes. Because of its decentralized nature, involvement among all nodes on this platform forces them to accomplish the activities.

Moreover, data and transaction authority are granted to all nodes to deliver value. The values offered by the private BC enhance existing business performance. Organizations can improve customer value transfer through this platform with faster performance, greater precision, and lower cost. The value transfers can be shortened due to the decentralized system design through distributed data. Therefore, the value transfer process only requires a verification and approval process. These transactions are verified by all nodes and then proceed to the consensus approval process. Consensus agreement is the final process using a BC protocol. If consensus is reached, then the transaction can be performed. BMI in the private BC ecosystem enhances existing business performance (Queiroz & Wamba, 2019). Profitability can perform through cost orientation by eliminating ineffective costs (Schmidt & Wagner, 2019), and profit performance can increase (Morkunas et al., 2019; Nowiński and Kozma, 2017). To create this value, a private BC is a compatible platform by modifying several attributes of the BC protocol. This modification should be performed to support the ecosystem value transaction. Organizational interaction is run through applications that allow all nodes to interact among them. Private BC delivers a smart contract based on ecosystem activities (Chang et al., 2019).

5.2. Business Model Innovation in the Public Blockchain

BMIs in the public BC ecosystem emphasize societal collaboration and create new business opportunities (Table A2). In the value capture dimension, the identification of economic value refers to the new market development. Simply put, the adoption of this platform is a revenue-based orientation. Revenue recognition possibilities can be performed from an existing business and new business portfolio to perform new revenue streams. Investors can generate sustainable income, such as dividends, in an existing business portfolio. It needs partnership support from the public BC ecosystem to release the economic potential. Value creation on the public BC platform is conducted through public partnerships. Partnerships allow the creation of new values through the platform. The platform is designed to open up the possibility to perform economic collaboration. This platform also allows all nodes equal opportunity to participate in the ecosystem. A greater of nodes participating will make this platform more secure. Collaboration among all nodes is provided through decentralized applications (DApp).

DApp is a procedure for the public BC to deliver its value to society. The application operates using a smart contract with legal procedure attached. By using specific algorithms, the contract is attached to a code. Systematized codes work to perform automation transactions. The process runs systematically to eliminate transaction failure. The node involvement is needed to maintain the reliability of information and verify transactions that constitute the primary value driver of a public BC. The public BC can solve market-based problems. Indeed, the benefit of public BC refers to the transparency of data/information transactions. A decentralized system allows all nodes or societies to access equal data sources. This system protocol also adopts the sequential pattern and layered encryption to perform immutability.

The public BC platform encourages market-oriented BMI and creates the possibility of initiating new markets or new ventures (Chalmers et al., 2019; Chen, 2018). Value capture on this platform allows new markets to develop that can generate new revenue streams or recurring income (Martino & Bellavitis, 2019). This system design supports collaboration among all nodes or communities. The more nodes that are available enable, the security performance increases. Every node can access the platform through DApps, which use smart contracts to perform the applications. Smart contracts run based on legal procedures embedded in their algorithms or code series. Although its operation is automated, all nodes still play the data verifier and transaction approver. Public BC demonstrates slower value transfer because the system applies a full-consensus model.

5.3. Business Model Innovation in Different Blockchain Ecosystems

The BC platform has high adaptability in responding to market dynamics. BC is a collaboration platform that enables BMI and adapts to distinct ecosystems. Private BC enables BMIs to perform within the organization ecosystem. The adoption objective is to optimize the interaction among the parties in a specific organization to improve the business value performance. Along with the private BC, the consortium also focuses on operational performance by involving other entities outside the organization. Unlike the others, public BC has a unique value in BMI. The public BC identified enables BMI to create new markets or new ventures. The public BC platform allows collaboration among societies without intermediaries.

Differences among BC ecosystems can be analyzed using two main axes: level of innovation and multi-actor interaction, as shown in Figure 1. A private BC focuses on improving its existing business (Beck & Müller-bloch, 2017). While the consortium BC involves more actor interaction than the private BC, it has a similar objective. The primary focus of the consortium BC is to integrate different entities with similar objectives (Mendling et al., 2018). Then, the public BC has the characteristics and opportunities to disrupt the markets. Broad community involvement and a full-consensus model support this ecosystem's opportunities to create new markets or businesses (Chalmers et al., 2019). The BC ecosystem matrix classification in Figure A1 can explain the BMI in a different BC ecosystem.

An excellent example of BMI in a private/consortium BC is found in value creation. In value creation, BC is a tool to align information on business activity to perform better. The technology encourages the delivery of information to the actors involved in a limited (permission less) ecosystem. Transaction costs can be more efficient (Schmidt & Wagner, 2019), and production quality improves. On the other hand, public BC encourages a different business method than the current system. These changes can create a new market that could not be reached with previous technologies. DeFI, or "Decentralized Finance", is a great example that describes the public BC ecosystem. Through this system, financing can be channeled to previously difficult parties to achieve equality for a large society (Chen, 2018; Martino & Bellavitis, 2019).

6. Conclusions

In conclusion, this study indicated that BC could change all elements of the value system (capture, creation, delivery, and proposition). However, it is the intensity of BMI that differentiates between these ecosystems. BMI intensity in the private/consortium ecosystem is lower than in the public ecosystem. This sense is performed since the BC adoption is aimed to improve the current business performance. Empirical evidence states that in this ecosystem, the most noticeable changes perform in value creation. While in the public ecosystem, empirical evidence mentions a higher intensity of BMI. Empirical evidence states that BC affects the entire value system of the organization. A business can be conducted through BC with a different approach, allowing new markets. From these arguments, this study creates a model that describes the relationship between multi-actor complexity and the intensity of the business model. The private BC is presented in quadrant I, which means narrow multi-actor interaction and low intensity of BMI. In the second quadrant is the consortium BC, which has broad multi-actor interaction and low intensity of BMI. In contrast, quadrant IV is a public BC described as narrow and broad multi-actor complexity and high intensity of BMI. This study contribution reinforces the prior discussions that focused on BC and the business models (Morkunas et al., 2019; Nowiński and Kozma, 2017; Weking et al., 2019). In addition, this study explores BC adoption's BMI, which has not been discussed in prior research through empirical evidence. This study proposes a particular model to explain the BMI in different ecosystems from the findings. This model can assist practitioners with BMI possibility when they decide to adopt BC technology.

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Appendix A

Table A1. BMI in Private Blockchain.

Dimension	Super Category	Category	Subcategory
Value capture	Profitability	Cost orientation	Reduce cost
Value creation	Limited partnership	Permission	Exclusive Interaction
			Service-level agreement
Value delivery	Smart contract	Automation	Legal algorithm
		Decentralized platform	Multi-actor interaction
			Disintermediation
Value proposition	Enhancement	Value transfer	Value transfer
		Verifiability	Consensus
			Transparency

Table A2. BMI in Public Blockchain.

Dimension	Super Category	Category	Subcategory
Value capture	Market Development	Revenue orientation	New revenue
			Recurring income
Value creation	Limited partnership	Permission-less	Equality
			Social inclusivity
Value delivery	Smart contract	Automation	Legal algorithm
		Decentralized platform	Multi-actor interaction
			Disintermediation
Value proposition	Transparency	Auditability	Traceability
		Immutability	Privacy
			Security

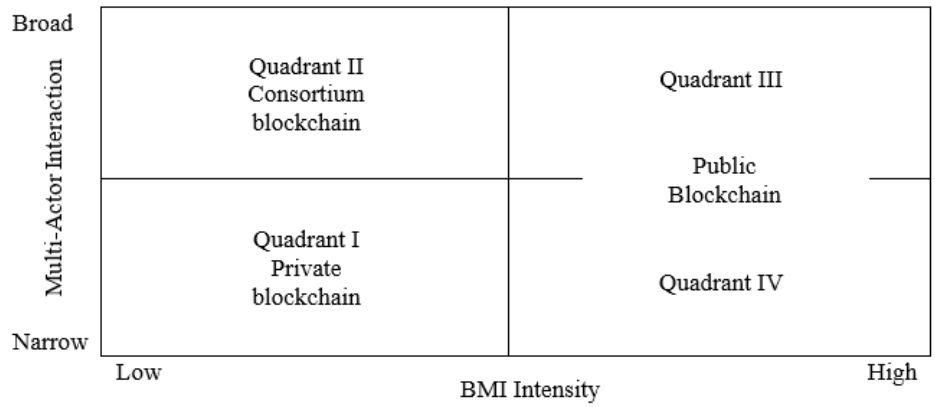

Figure A1. Blockchain for BMI Ecosystem Model

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