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THEORETICAL ARTICLE

A systematic process for generating new blockchain-service business model ideas

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Abstract
As is the case with other emerging technologies, commercializing blockchain technology via business models can provide radical opportunities for innovation. Existing studies on blockchain-service businesses lack research on how to develop business model ideas systematically; this study proposes a methodical process for generating these new ideas. Blockchain technology features were organized from the perspective of idea generation and leveraged to solve customer requirements. Through workshops, six business ideas were generated and evaluated by 26 experts. The proposed process proved it could generate innovative and qualitative ideas and could, thus, help business planners who are looking to generate new blockchain-service business model ideas.

Keywords Blockchain technology · Blockchain-service business · Business model · Idea generation

1 Introduction

Blockchain technology is an emerging technology (Beck and Müller-Bloch 2017; Chatterjee and Chatterjee 2017; Xu et al. 2018; Kimani et al. 2020); it is innovative and expected to impact business fields (Halaweh 2013; Brey 2017; Schlegel et al. 2018). The characteristics of the block and chain formation process provide blockchain technology the potential to radically innovate businesses and business processes (Weber et al. 2016; Viriyasitavat and Hoonsopon 2019; Morkunas et al. 2019). The blocks contain transaction records verified by everyone in a network, and these blocks are connected into chains according to their creation time and stored distribution (Christidis and Devetsikiotis 2016). The ledger data stored in the blockchain guarantee transparency and integrity as they are stored in separate

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databases and shared by everyone by means of the network (García-Bañuelos et al. 2017; Paliwal et al. 2020). Fraudulent transactions can, thus, be prevented because the data can be saved in blocks only when everyone in a network has verified the transactions (García-Bañuelos et al. 2017). These blockchain advantages can be applied to businesses to alleviate security concerns, improve trust, and lower transaction times or fees (Nguyen 2016; Nowiński and Kozma 2017). Furthermore, by spreading the guaranteed data, it is possible to achieve automation and transparency in business processes (Viriyasitavat and Hoonsopon 2019; Kimani et al. 2020). Blockchain technology has garnered tremendous attention from everyday start-ups and tech-people and has been applied across various industrial fields such as finance, healthcare, energy, and retail (Peck 2017; Lu et al. 2019). The scope of its application will further continue to cover a wide variety of industries and business fields since more than half of the world's largest companies are presently researching ways to integrate blockchain technology into their businesses (Beck et al. 2017; Xu et al. 2018).

As is the case with other emerging technologies, blockchain technology must be commercialized in some way via business ideas for radical innovation in the real world (Chesbrough 2007, 2010). If blockchain technology is not connected to customer requirements, it can wither away from markets even if it is innovative and, thus, potentially a significant factor driving business models (Hall and Khan 2003; Kavadias et al. 2016). Accordingly, it is essential to discover which customer problems can be solved using blockchain technology and generate new blockchain-service business ideas.

However, few studies have been conducted so far on blockchain-service businesses with regards to how to develop business ideas systematically. Factoring in emerging technologies in developing new business ideas is challenging (Risius and Spohrer 2017; Bouncken et al. 2021). On one hand, when one first understands the technology and generates business ideas, one may overlook market needs and develop only technology-based business ideas. On the other hand, when one does not understand technology appropriately, one cannot generate business ideas using those technologies. Moreover, as blockchain technology is inherently decentralized, it is challenging to apply blockchain to existing businesses designed to be centralized (William 2016). Therefore, creating systematic business idea generation processes is vital for integrating blockchain technology into businesses.

In this study, we propose a systematic process for generating innovative blockchain-service business ideas. We attempt to develop a blockchain-service business idea generation process that integrates customer- and technology-driven approaches. This would, thus, help identify customer problems and solve them using blockchain technology. The remainder of this paper is structured as follows: first, it describes the theoretical frameworks of business models and business model idea generation studies. Second, it organizes blockchain technology features from literature reviews from the perspective of idea generation. Next, it discusses developing a structured blockchain-service business idea generation process. Lastly, it describes how the proposed process was experimentally tested.

2 Theoretical frameworks

2.1 Business model definition

The outputs of the proposed process in this study are business model ideas. We focused on designing the output form of the process based on prior research on business models. A business model is the realization of business strategy; it refers to what the company actually does or how it conducts business (Chesbrough 2010; DaSilva and Trkman 2014; Kavadias et al. 2016). It is difficult to concisely define the components of the business model in one sentence (Chesbrough 2007; Runfola et al. 2013); however, previous studies have offered varying yet overlapping definitions. According to Voelpel et al. (2004), new customer value propositions, a value network configuration for value creation, and leadership capabilities that ensure the satisfaction of relevant stakeholders are considered business model components, and Gassmann et al. (2014) enlisted customers, value propositions, value chains, and revenue structures as business model components. Reviewing the literature, commonly described business model components are customers (Magretta 2002; Baden-Fuller and Haefliger 2013; Gassmann et al. 2014), value (Magretta 2002; Voelpel et al. 2004; Doganova and Eyquem-Renault 2009; Zott et al. 2011; Gassmann et al. 2014), architecture of value (Magretta 2002; Zott et al. 2011; Baden-Fuller and Haefliger 2013; Gassmann et al. 2014), and revenue structure (Magretta 2002; Doganova and Eyquem-Renault 2009; Zott et al. 2011; Baden-Fuller and Haefliger 2013; Gassmann et al. 2014). Therefore, this study defines a "business model" as a description of business elements including customers, value, structures of value, and revenue models. Customers are those who use the business. Value is what satisfies the needs of the customers and can vary in a business model (Osterwalder and Pigneur 2010). The architecture of value describes a set of ways to deliver value to customers and includes both the front and back ends (Chesbrough 2007; Doganova and Eyquem-Renault 2009). Lastly, a revenue model refers to the cash flow that occurs in the process of delivering value to the customers (Chesbrough 2007).

2.2 Idea generation approaches

Business success depends on innovative business model ideas. Prior studies on the generation of business model ideas are found to discuss three different strategies: (1) a technology-driven approach, (2) a (potential) customer-driven approach, and (3) a joint integration of approaches (1) and (2).

2.2.1 Technology-driven approach

A technology-driven approach is one that begins with the development of specific technologies (Chidamber and Kon 1994). Technology is an objective of no value because it hardly affects peoples' lives until it is widely adopted (Hall and Khan 2003; Chesbrough 2010). Business model ideas are required to enable users to adopt

such technology and, interestingly, technology can produce different outcomes through different business model ideas (Chesbrough 2010). Typically, a technology-driven approach generates business model ideas by searching specific markets for technologies; however, researchers rarely address systematic methodologies for identifying market opportunities (Henkel and Jung 2009; Platzek et al. 2012). Terzidis and Vogel (2018) developed a workshop-style methodology to enhance the understanding of a technology-driven approach and incorporate its initial steps into a practical methodological framework (Terzidis and Vogel 2018). Group ideation as a workshop-style methodology is found to be more creative as compared to individual ideation, helping participants reach optimal solutions; it also produces the most results per time unit and is, thus, markedly productive (Chan et al. 2016; Terzidis and Vogel 2018; Lundqvist et al. 2018). Lee et al. (2021) considered commercial businesses in a domain technologically related to concept generation and described technology and its implementation or integration into business. These examples act as stimuli for brainstorming in the creation of concepts.

A technology-driven approach is frequently considered as an innovative idea; however, it can lead to generation of ideas that are more likely to fail because the technology lacks a market and its application is yet unknown (Kuo et al. 2011; Platzek et al. 2012). The technology-driven approach commonly overlooks real customers, even though customers are the key drivers in developing new business ideas. Indeed, they participate in developing new service business models (Geum et al. 2016; Szymańska 2017). Therefore, researching a customer-driven approach is useful for ensuring the considerations of the customer.

2.2.2 Customer-driven approach

A customer-driven approach mainly comprises a problem-solving process. Harlim and Belski (2013) suggested a process that consists of: (1) problem identification and understanding, (2) solution planning and idea generation, (3) implementation, and (4) evaluation (Harlim and Belski 2013; Belski et al. 2014). This process is effective when participants from various fields gather in groups and perform the process together, as the ideas are communally modified during the process (Szymańska 2017).

Most innovations seem to come from customers' needs (Szymańska 2017; Terzidis and Vogel 2018), so a customer-driven approach begins by defining the customers' requirements—namely, the problem (Slegers et al. 2013; Lee 2015). Defining the problem is the first step in creating ideas (Lee et al. 2017), and many researchers have emphasized the importance of investing enough time in constructing problems adequately (Henkel and Jung 2009), as well as constructing multiple problems in different ways, thus increasing the success of generating innovative ideas. Therefore, the problem is also expressed as an opportunity (Girotra et al. 2010; Moon and Han 2016).

The concerns that arise from the definition of the problem step need to be analyzed from various perspectives (Slegers et al. 2013). After selecting a problem that needs to be solved from among various problems, the selected problem is analyzed in terms of people, resources, and environments. Some questions to analyze

the problem include "who is experiencing this problem?" "What does this person want (requirements) in the problem?" "How do you want the problem resolved?" and "What is needed to solve the problem?".

Various techniques are adopted to solve this problem; brainstorming and scenario methodologies are the representative techniques. Chan et al. (2016) created a scenario with blank spaces to obtain an idea for a unique solution. Moon and Han (2016) organized 41 techniques for idea generation and induced ideation participants to find a solution to the problem. However, potential customers generally lack an understanding of technology, so it is difficult to use specialized technology to solve problems in a customer-driven approach (Geum et al. 2016).

2.2.3 Jointly integrate technology and customer-driven approaches

New business model ideas are no longer generated by considering only one approach—technology or the customer (Geum et al. 2016). New ideas must be generated by combining the two approaches (Terzidis and Vogel 2018). Design thinking, which is typical of human-centered design, is a methodology that creates an idea by considering customer needs and available technology, simultaneously (Tschimmel 2012). This methodology consists of (1) inspiration, (2) ideation, and (3) implementation (Brown 2008). In inspiration, the researchers profoundly empathize with the customers and proceed with user research to discover and interpret the users' needs. In ideation, they generate problem-solving ideas and develop or evaluate prototypes in implementation (Fixson and Rao 2014; Foster 2021). Furthermore, all these steps are interactive, to refine and modify the ideas. The methodology relies on the researchers' capacity or knowledge of the technology and examines technical feasibility (Brown 2008; Tschimmel 2012). In the case of the process to generate service ideas proposed by Geum et al. (2016), this method considers both the technology dimension and customers, using morphological analysis. Researchers have considered technology from the viewpoint of customer contexts, created combinations of user contexts and technology options to address customer needs, and generated service ideas (Geum et al. 2016). They have also considered customers from the viewpoint of technology and combined the technology competency dimensions and customer dimensions to search for, and to create, service ideas available for specific technology contexts (Geum et al. 2016). Unlike researchers who create service ideas themselves, customers can directly participate in the ideation process. Henkel and Jung (2009) proposed a process using an approach with potential customers. First, researchers investigate the technology features, and the trends or markets promoted by the technology. Next, potential customers who lead the trends are engaged, and they conduct ideation for new services. Technology can provide a specific path to potential solutions (Ross 2006); therefore, in the next step, researchers inform the customers of the technology to generate ideas that can solve problem situations with the technology's features.

Artifacts are often used to describe pieces of technology to customers participating in the idea generation process (Eppler and Hoffmann 2012). In particular, the card-based methodology is useful for finding a solution to a problem that incorporates technology (Halskov and Dalsgård 2006; Biskjaer et al. 2010; Wölfel and

Merritt 2013; Chung and Liang 2015; Mora et al. 2017). If the pieces of technology are described on cards, the cards can explain the relevant complex concepts to participants and serve as a trigger or guide for idea generation. Mora et al. (2017) created a new idea generation methodology related to the Internet of Things in which potential customers participated and used cards. In this case, the card indicates the features of the technology and is used as a communication tool for enrichment in the ideation process (Halskov and Dalsgård 2006). Furthermore, as cards are simple and easy to handle, this helps participants visualize the ideation process better (Wölfel and Merritt 2013), which provides the advantage of encouraging participation and helping generate ideas quickly (Eppler et al. 2011). According to Halskov and Dalsgård (2006), cards can have a direct or indirect influence on ideas, and they must be made so that participants can understand them. One clear concept is displayed on each card. The concept is briefly written on the card, along with an image and description. Explaining each card before creating an idea can increase the participants' understanding.

The question then arises as to whether it is possible to generate innovative ideas from this process. Many studies have created new ideas by integrating technology and customer-driven approaches (Halskov and Dalsgård 2006; Ross 2006; Biskjaer et al. 2010; Geum et al. 2016; Mora et al. 2017). However, the understanding of business model idea generation is limited (Eppler and Hoffmann 2012). Further, business ideas must be evaluated by several experts, such as those who evaluate or rank ideas using multiple criteria (Soukhoroukova et al. 2012; Cui et al. 2019); however, most of the studies were found to be completed only through the ideation process and omitted the evaluation process (Biskjaer et al. 2010; Slegers et al. 2013; Geum et al. 2016; Lee et al. 2017; Lundqvist et al. 2018). By evaluating business model ideas, this study tries to prove that innovative and high-quality ideas can be generated by integrating technology- and customer-driven approaches.

3 Method

3.1 Process for blockchain-service business model idea generation

Our process for investigating blockchain technology uses a technology-driven approach. According to Daniel (2018), blockchain exists in the non-functional aspect of the implementation layer, not the functional aspect of its application. Therefore, blockchain is used in the implementation of the technology, not the interface, and is not visible to business customers. The implementation layer and non-functional aspects, however, are important because these aspects involve solving fundamental customer problems and transforming how the business is operated (Daniel 2018). In this paper, we, thus, explore how blockchain technology can be used to solve customer problems.

Blockchain technology is used differently to solve customer problems. In some business fields, like agricultural industry, it is used by customers to purchase high-quality products and view their transaction histories (Tiscini et al. 2020). This is because blockchain technology organizes transaction histories in chronological

order and maintains these histories indefinitely without deleting them (Fanning and Centers 2016; Kosba et al. 2016; Lo et al. 2018; Seebacher and Schüritz 2017; Treleaven et al. 2017; Schlegel et al. 2018; Scriber 2018). In media services, blockchain enables customers—such as contents creators—to verify ownership of online content and spread this content to more users while receiving cryptocurrency rewards (Nowiński and Kozma 2017). This is because blockchain technology ensures the integrity of data and allows assets to be managed without storing them directly (Crosby et al. 2016; Chanson et al. 2017; Seebacher and Schüritz 2017; Hofmann et al. 2017; Bucovetchi et al. 2018; Lo et al. 2018; Schlegel et al. 2018; Scriber 2018). In the medical business field, blockchain technology is used to prevent duplicate treatment of customers—that is, patients—and helps to activate patient-centered medical functions by allowing patients to manage their medical data themselves (Gordon and Catalini 2018). This is because blockchain technology is highly secure and transparent, and when data are recorded on a blockchain, they cannot be modified (Seebacher and Schüritz 2017; Lo et al. 2018; Scriber 2018; Bucovetchi et al. 2018). In addition, regardless of business areas, blockchain enables customers to provide financial rewards to all anonymous members who have contributed to the success of the platform (Crosby et al. 2016; Foth 2017; Hofmann et al. 2017; Sas and Khairuddin 2017; Bucovetchi et al. 2018), and it helps liquidate illiquid assets that are difficult to convert into cash (Hacker and Thomale 2018). Lastly, blockchain technology is useful in fields that rely on smart contracts, which are automated contracts useful for managing personalized product demand when selling products, and allows parties to directly transact without an intermediary (Abetratbe and Monfared 2016; Hofmann et al. 2017; Halaburda 2018; Schlegel et al. 2018). Customers in these fields can receive greater returns from businesses, due to the lower transaction costs and the greater profits derived from transaction efficiency.

Technology features are defined differently according to different contexts (Harrison and Datta 2007; Kim et al. 2009). In some studies, the features are the characteristics, functions, or attributes of the technology. For the purpose of this paper, however, we defined blockchain technology features as the way that blockchain technology is used to solve customer problems in the service industry.

To catalogue existing blockchain technology features, we found articles on Google Scholar in a search conducted in August 2018. This resulted in a collection of 20 articles. After deriving 90 blockchain keywords from these studies, we organized them into 21 items, excluding duplicates. Among them, we deleted 7 items that did not meet the following criteria:

1. Only direct ways that can solve customer problems should be considered features. For example, the technology being characterized as "trustworthy," a belief that "the system is stable because there is no single point of failure," or "reduced transaction costs or fee" were deleted. These are secondary benefits that customers can get by applying blockchain technology to service businesses, rather than a way to directly solve customer problems.
2. Keywords with similar meanings to "integrity" or "confidentiality" were grouped under the technology features of "encryption" or "data immutability," respectively. Integrity and confidentiality of data are guaranteed when they are stored in

a way that is highly secure and in a system that does not allow for their modification.
3. The features were also grouped together by recognizing hierarchical relationships between the keywords.

The final list of features was then edited to include descriptions for customers who were not blockchain experts, so that it would be easier to understand. Through this process, a list of 14 blockchain technology features was derived, as Table 1 shows.

Figure 1 depicts this study's proposed overall process. We considered prior studies on customer-driven approaches for this; therefore, the process starts by defining and analyzing problems. We also considered the joint integration of technology and customer-driven approaches. In the idea generation phase, technology and blockchain could be solutions for the problems defined in the previous phase. In the first phase, the participants select a field, such as medical care, finance, or beauty; this is necessary because problem finding becomes broader when no field is selected. By first selecting a field, the participants can focus on addressing field-specific problems that they perceive.

The second phase, problem definition, finds problems within the selected field. To make finding problems easier, researchers constructed an organized list with each field's characteristics and delivered it to the participants. This study recommends a

Table 1 Blockchain technology features and their descriptions

Blockchain technology feature	Description
Data permanence	Transaction histories are kept forever
Data immutability	Stored data is difficult to forge
Data transparency	All participants have access to the data
Connect all participants	All participants are interconnected. The entire system is maintained by the participants
Equal rights	All participants are treated the same within the system They can perform activities to maintain it
Audit trail	All information from past to present is linked like a chain
Everyone has the same data	Participants synchronize information by copying each other
Time stamp	The time the transaction was concluded is saved
Anonymous	Users' actual information is unknown to others Users do not have to authenticate themselves to others
Asset ownership controllability	Ownership of assets can be controlled without having to store them directly
Encryption	High level of security is guaranteed through encryption when storing data
Reward	Participants can give or receive rewards through activities
Direct transaction	All participants can provide services to or receive them from each other. There is no central authority to manage participants
Smart contract	When the contract conditions are satisfied, the saved contract content is automatically executed

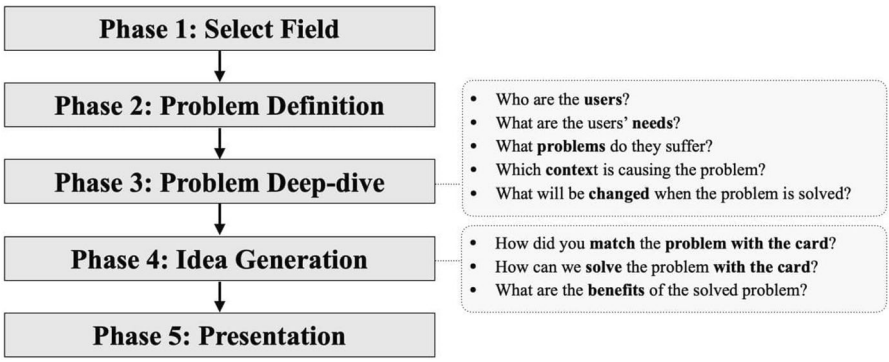

Fig. 1 Blockchain-service business model idea generation process

wording change to lists of advantages in specific fields, using words that describe disadvantages instead. In the case of sharing business fields, the advantages are cost reduction and prevention of overconsumption, while the wording change will be waste or excess consumption. The wording change list will allow participants to think of the problems they experience.

The third phase, problem deep-dive, selects and analyzes one of the identified problems. In an attempt to deeply analyze the problem from various perspectives, several items are suggested: "Who are the users?" "What are the users' needs?" "What problems do they suffer?" "Which context is causing the problem?" and "What will be changed when the problem is solved?".

The fourth phase is idea generation. In this phase, 14 blockchain technology features are assessed through the cards. Each card has a title, the blockchain technology feature, related illustrations, and an explanation written on the other side of the card (see Fig. 2). The cards help the participants understand the blockchain easily. Participants chose three or more cards that they consider as solutions for the problem. After choosing cards, they described the following items to generate ideas for problem-solving: "How did you match the problem with the card?" "How can we solve the problem with the card?" and "What are the benefits of the solved problem?".

In the final phase, the participants organized their ideas generated above into a presentation and presented them to the other participants. This session modifies and

Fig. 2 Examples of blockchain technology feature cards. The right pane of each image represents the back of that card

develops the ideas because it allows the participants scope for meaningful discussion (Szymańska 2017). Details focused on users, requirements (how to build infrastructure or earn money), solutions, and necessary resources. Researchers can suggest that participants use pictures or diagrams in their presentations to clearly communicate their ideas. Previously, the business model definition described business elements such as the customer, value, structure of value, and revenue model, so this final phase generates the business model idea with the customers as users, values as solutions, and structure of value as necessary resources, while revenue models are described in the requirements.

3.2 Participants

The participants who performed the ideation were 12 graduate students from the authors' institute, majoring in industrial and management engineering. The workshop was held for students belonging to the on-campus "Blockchain research center," and only students who received confirmation of participation participated in the workshop. They verbally confirmed their participation in business model ideas before the workshop. The participants were 9 males and 3 females, with an average age of 27.1 years (SD = 4.35). The participants were all students who worked on a blockchain-themed project and had basic blockchain technology knowledge. Six of the 12 participants were familiar with the idea generation process. These participants encouraged their team members to join the idea process (Halskov and Dalsgård 2006; Biskjaer et al. 2010). We divided the participants into three teams of four, each including one female participant.

3.3 Experimental design

The experiment was designed in two stages: generating business model ideas from two different business fields, sharing—people can share their tangible assets, documents with other people in these business fields— and healthcare, and evaluating them. The type of business model acted as the independent variable. This included ideas generated from the blockchain-service business model idea generation process (group name: New) and existing business model ideas (group name: Exis.). Therefore, we reviewed existing blockchain businesses for comparative evaluation. We explored 521 blockchain businesses and DApps from December 2019 to January 2020. Of these, 86 businesses belonged to the sharing and health care business fields; we selected currently operating businesses (as of July 2020) and described blockchain technology as their central technology. Further, businesses with similar business models were consolidated as unidentifiable business companies. Accordingly, six existing businesses were selected, and the researchers rewrote the business model titles.

Idea generation processes or methodologies are generally evaluated in two ways: the usability of the process (Moon and Han 2016) or the evaluation of generated ideas on various scales (Dean et al. 2006; Magnusson et al. 2014; Cui et al. 2019). This study attempted to score the effectiveness of the blockchain-service

business model idea generation process using the latter method (Cui et al. 2019). "Novelty" and "feasibility" became dependent variables for identifying innovative ideas (Baregheh et al. 2009; Ferioli et al. 2010; Dziallas 2020). The variable, "relevance," was used to identify whether an idea can solve customer problems with blockchain technology, or to identify the quality of ideas jointly considered with the novelty and feasibility variables (Dean et al. 2006; Moon and Han 2016). Moreover, "intention to use" was added as an evaluation scale to determine the potential for customers to be attracted to new ideas, that is, to describe marketability (Kim and Mauborgne 2000; Scott et al. 2015; Choi and Ji 2015). Table 2 shows the evaluation scales and items from Dean et al. (2006) and Choi and Ji (2015). The items were evaluated on a 101-point scale from 0 to 100 to measure the evaluators' subjective impression on the business model idea (Preston and Colman 2000).

The idea evaluation data led to four hypotheses, which were then tested:

- H1: The mean idea novelty score is significantly higher for the ideas generated from the process than for the existing business model ideas.
- H2: The mean idea feasibility score is significantly higher for the ideas generated from the process than for the existing business model ideas.
- H3: The mean idea relevance score is significantly higher for ideas generated from the process than for existing business model ideas.
- H4: The mean idea intention to use score is significantly higher for the ideas generated from the process than for the existing business model ideas.

Documents were produced to explain the business model ideas to the evaluators in a non-face-to-face context. When evaluating business model ideas, a universally formatted single-page document is needed for each model (Cui et al. 2019) to ensure that the ideas are consistently described to the evaluators. The documents include a business model title, a short description of the business model idea, problems related to the ideas that are currently experienced by customers, an illustration of solutions, and the business's significance. Illustration of solutions show the business owner, the customer, and the flow of goods, data, and

Table 2 Evaluation scales and items

Evaluation scales	Evaluation items	
Novelty (Dean et al. 2006)	1	This idea solves the present problem and is described in an original way
	2	This idea solves the present problem and is described in a better way than previous attempts
Feasibility (Dean et al. 2006)	1	This idea is socially acceptable
	2	This idea can be easily implemented
Relevance (Dean et al. 2006)	1	This idea can be clearly applied to the present problem
	2	This idea can completely solve the present problem
Intention to use (Choi and Ji 2015)	1	I hope this idea will be implemented and used
	2	I am willing to use this idea once it is implemented

money to represent components of a business model, along with how the business structures values to the customer, and the revenue model.

3.4 Experiment procedure

The first experiment, generating business model ideas, was conducted over two days. On the first day, ideation participants in a particular business field looked for problems related to that field, and on the second day, they found solutions to the problems.

On the first day of the experiment—March 14, 2019, for participants in the sharing business field, and July 3, 2019, for those in the health care business field—ideation participants shared problems related to their field for 60 min and described these problems. To facilitate the sharing of problems related to the sharing business field, the researchers explained the definition of the sharing business field and the six advantages of sharing. After the explanation, keywords were conveyed to the participants which are antonyms of the described advantages. Participants imagined the problems they were currently experiencing while focusing on these keywords. In the healthcare business field, we explained the benefits, and the antonyms were conveyed to the participants. All the advantages or benefits and their antonyms are shown in Appendix Table 4.

On the second day—May 13, 2019, for sharing participants and July 17, 2019, for health care participants—the participants searched for solutions to the problems using the blockchain-service business model idea generation process for 80 min. Specifically, they were given 5 min to select a problem to solve from among the problems identified on the first day, 20 min to deepen the problem, 30 min to construct the problem-solving process using the blockchain technology feature cards, and 20 min to then prepare their presentation, which they presented over 5 min.

A total of 26 IT-related start-up experts were recruited to evaluate the process's outputs and the blockchain-service business model ideas because evaluations by several experts improve accuracy (Soukhoroukova et al. 2012). The experts were founders or entrepreneurs experienced in the IT field. All evaluators were male, with an average age of 28.3 years (SD = 4.1) and an average entrepreneurship experience of 2.2 years (SD = 2.1, minimum 1 year and maximum 10 years). The evaluators rated each question on a 101-point scale from 0 (strongly disagree) to 100 (strongly agree).

The evaluators conducted business model evaluations through a non-face-to-face Google survey. They received documents describing business models and evaluation scales and items. These documents did not mention whether the business model ideas to be evaluated were new ideas or existing businesses; they listed the business in a random order and requested an evaluation. Evaluators scored the business model ideas on the four evaluation scales (eight evaluation items) presented in Table 2. They communicated their overall impressions of the business model ideas to the researchers in writing.

4 Results

The card usage rates in the workshops differed for each card. Specifically, the anonymous card was used four times, while the data transparency card was used three times. Direct transactions, smart contracts, data immutability, and reward cards were used twice; data permanence, encryption, and connecting all participant cards were used once. The other cards were not used.

The set of all ideas resulting from the idea generation process revealed that the participants generated 3 ideas for sharing businesses to overcome 22 related problems and 3 ideas for health care businesses to overcome 22 related problems. Table 3 describes the business model idea titles.

The 26 evaluators independently scored each business model idea on the four scales of novelty, feasibility, relevance, and intention to use. To measure the internal consistency of multiple items on the same scale, we calculated Cronbach's α as an index of reliability. All evaluation scales except feasibility had an acceptable Cronbach's α of >0.8 (Bland and Altman 1997; Tavakol and Dennick 2011). Thus, novelty, relevance, and intention to use were analyzed by combining their evaluation items. Regarding feasibility, each scale had low internal consistency, so each item could not confirm the uni-dimensionality (Tavakol and Dennick 2011). We, thus, considered the analysis of each item separately as feasibility1 and feasibility2, and the score for each idea was the mean of the rating given by the evaluators. The data did not satisfy normality or homogeneity of variance, so the Mann–Whitney U test was used to statistically analyze whether the ratings were significantly higher in the New group than in the Exis. group, and significance was set at $\alpha = 0.05$ (Mcknight and Najab 2010). The proposed process affected novelty, feasibility2, and relevance ($p < 0.001$) but did not affect feasibility1 ($p = 0.062$) or intention to use ($p = 0.053$) (Fig. 3). Mean values and standard deviation in parentheses were described in Fig. 3. Thus, these results support hypotheses H1 and H3, but not H2 and H4.

Table 3 Blockchain-service business model ideas titles with two groups

No	Blockchain-service business model ideas title	Group
1	Translation request and verification service	New
2	Service for a community pet insurance platform	New
3	Hospital-cost limited beneficiary–donor matching platform service	New
4	Travel companion matching service	New
5	Doctors' service quality evaluation application	New
6	Over the counter drug personal review application	New
7	Patient health behavior management service based on doctor's prescription	Exis
8	Ride sharing service	Exis
9	Cryptocurrency rewarded knowledge sharing service	Exis
10	Beauty item review information sharing service	Exis
11	Blockchain-based social network service	Exis
12	Cryptocurrency rewarded physical activity promotion service	Exis

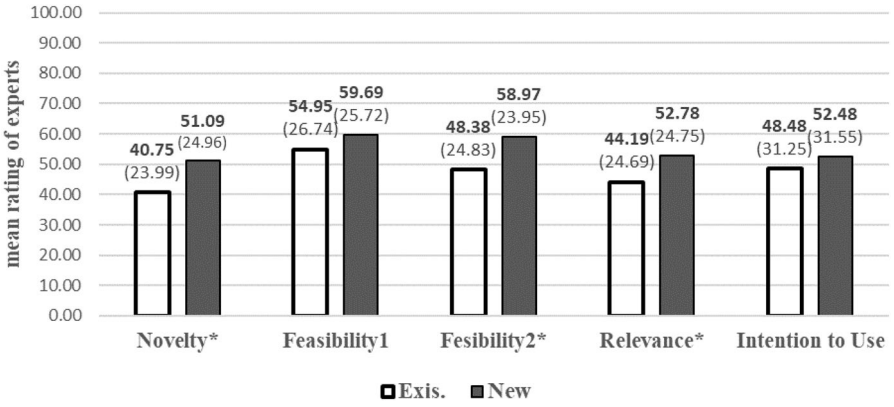

Fig. 3 Mean value of scales (*$p < 0.05$)

The threshold approach methodology is used to evaluate the idea development process by measuring the generated idea rating score threshold. This methodology assumes that an idea must meet certain thresholds for each scale (Dean et al. 2006). At all scales, the cumulative rate of ideas was found to be consistently more outstanding in the New group than in the Exis. group (Fig. 4). This means that at all scales, ideas from the New group were more likely to score higher than those from the Exis. group. At the threshold of approximately 60 points—that is, the maximum mean value of the scales (a feasibility1 of 59.69)—the new group ideas had a ratio of over 50%.

5 Discussion

5.1 Characteristics of the generated blockchain-service business model ideas

The business model ideas generated in this study have similar aims. The business model ideas' customers evaluate subjects and share their evaluation rates with other customers. The evaluation subjects included travel companions, doctors' service quality, or over the counter drugs, which were not considered to be significantly evaluated in former days. In these businesses, the evaluators (customers) need personal anonymity, and all users want to view the evaluation results with no barriers; therefore, the anonymous and data transparency cards were used. Further, smart contracts and rewards cards appear to have been used frequently to automatically deliver legitimate rewards for activities on the network (for example, cryptocurrency rewards could be given for evaluating subjects).

5.2 Innovation and quality of the generated blockchain-service business model ideas

The New group achieved higher scores on all scales than the Exis. group. Since new ideas that also had a positive evaluation for the initial idea are much more likely to

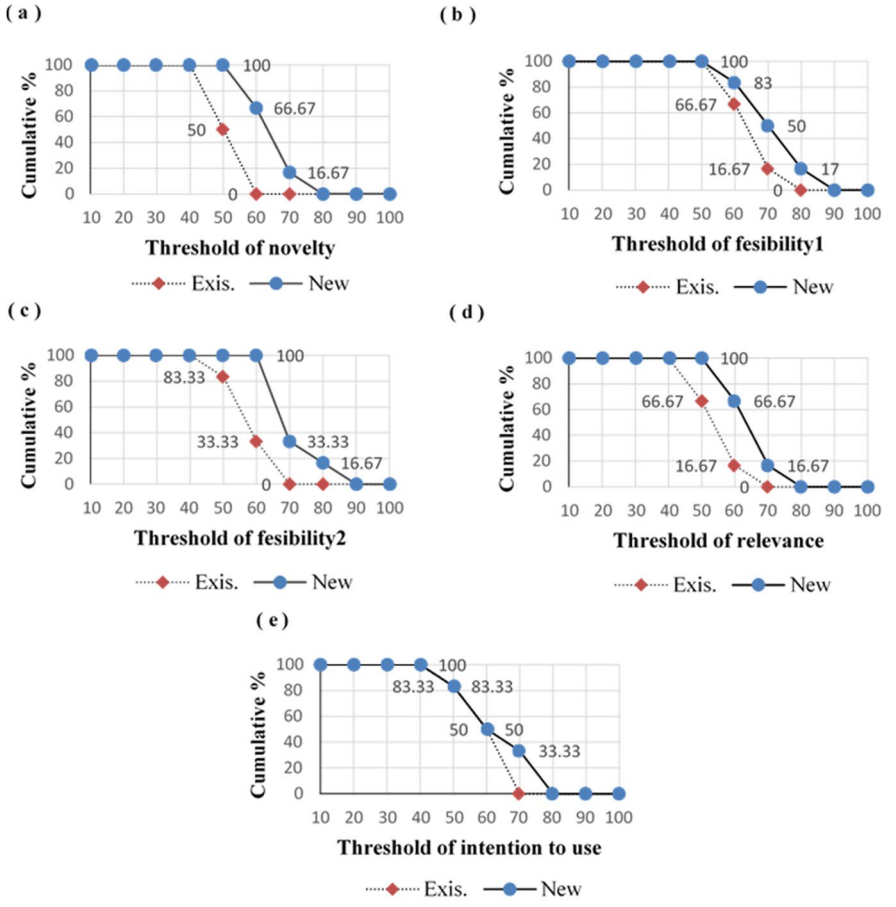

Fig. 4 Percent of cumulative ideas for each scale: **a** novelty, **b** feasibility1, **c** feasibility2, **d** relevance, **e** intention to use

reach commercialization (Scott et al. 2015), the proposed process can generate ideas with high commercialization potential. The following paragraphs further analyze the statistical results.

The items of the feasibility scale were analyzed separately because of their low reliability. Although there was no significant difference in social acceptability, there was a significant difference in implementation, which is remarkable. People generate ideas that can be implemented with current technology to the extent of their knowledge (Moon and Han 2016). Although the ideation participants participated in the blockchain-themed project and had basic knowledge about blockchain technology, they did not have expert knowledge about blockchain technology implementation. Nevertheless, they used the latest technology to develop ideas that are more feasible than the existing services. This suggests that with blockchain technology feature

cards, even people without expert knowledge of blockchain technology can understand it and generate ideas that can be implemented with the technology (Mora et al. 2017).

The mean relevance of the ideas was found to be significantly greater in the New group than in the Exis. group. A business model's success begins with finding a solution that satisfies customer problems (Johnson et al. 2008). However, the transition from problem understanding to solution is difficult (Slegers et al. 2013), and several solutions may arise due to the lack of a definitive solution (Moon and Han 2016). In fact, here, several solutions were generated from one problem, and various problems were solved with one idea in the workshops. Through the proposed process, new service developers can analyze customer problems more clearly and then generate business model ideas to solve them.

Novelty and feasibility are indicators for evaluating innovative ideas (Dean et al. 2006; Baregheh et al. 2009; Ferioli et al. 2010; Dziallas 2020). Novelty, feasibility, and relevance are jointly considered to identify the quality of ideas (Dean et al. 2006). When designing new technologies, it is challenging to create an idea that considers both novelty and feasibility indicators (Bauer and Kientz 2013). Generating novel business model ideas is an essential and challenging task (Eppler et al. 2011). Nevertheless, here, the mean novelty, feasibility2, and relevance of the ideas were significantly higher in the New group than in the Exis. group. The proposed process proved that it could generate innovative and qualitative ideas.

5.3 Quality of the process

In this process, it is possible to find and select multiple solutions through examining customers' problems, but the process does not generate multiple ideas at once. According to Girotra et al. (2010), it is more important to choose high-quality ideas over a high quantity of ideas. In the case of the blockchain-service business model ideas generated through this process, this study proved that high-quality ideas could be generated and selected through the process. At all scales, ideas from the New group average scores were higher than those for the Exis. group. Moreover, as the percentage of ideas that meet a higher threshold increases, the ratio of useless ideas decreases and there is less need to discard obsolete ideas. At all scales, the cumulative rate of ideas was consistently more outstanding in the New group than in the Exis. group. Therefore, this process is considered adequate because there is less need to discard obsolete ideas (Moon and Han 2016). Currently, methodological support for the development of business model ideas lacks scholarship (Seidenstricker et al. 2014), so the results of this study markedly contribute to a better understanding of the customers and make business model ideas for them.

5.4 Study limitations and guidelines for a better blockchain-service business model idea generation process

The process proposed in this study has been proven to generate better business model ideas than the process of existing businesses. Due to certain limitations,

however, refinement phases may be necessary to improve the process and ideas further. Specifically, we recommend several guidelines for better idea generation processes, based on expert opinions collected during the evaluations, as well as our review of the relevant literature.

First, we find it is necessary to evaluate the necessity of blockchain technology when ideation participants select their ideas. The experts raised the question of whether blockchain is a must in their business model. When we presented descriptions of the ideas, we did not precisely convey how the blockchain is used or at what stage of the business process it is used, and the blockchain is expressed as it could be used as just a database. Since proving that blockchain is essential for business innovation is crucial, it is necessary to evaluate its necessity. Second, we suggest that the revenue structure be considered more deeply in this process. The experts raised questions on the simplicity of the revenue structure; it is essential to derive a unique profit structure or consider a profit structure in detail for a successful service business. However, for most generated ideas, advertising fees were chosen as revenue structures. Therefore, to generate ideas for successful business models, an additional phase is needed to consider the revenue structure. Lastly, we suggest that legal issues be considered, whether with participants from various backgrounds or at the end of the process. The experts commented that the ideas did not consider legal aspects. In this process, it is difficult for the participant to consider areas about which they have little background knowledge since only the problems they currently experience are chosen. Therefore, one problem is that the business ideas generated may have legal issues. Participants can generate better ideas if they are chosen for diverse majors (Siangliulue et al. 2015). In our experiments, we did not consider diverse participants; consequently, all participants with the same major participated. Moreover, we did not consider gender balancing. If participants are more diverse and have background knowledge of legal issues, especially, this problem could be overcome. Alternatively, since the results generated through this process are in the idea stage, it is possible to correct the ideas in consideration of legal issues at the end of the ideation process.

6 Conclusion

This study proposes a blockchain-service business model idea generation process that identifies customer problems and solves them with blockchain technology features using jointly considered technology- and customer-driven approaches. The proposed process makes it difficult to establish scale reliability due to the small number of generated ideas or lack of diversity in ideation participants' majors. However, the process has been proven to generate innovative and qualitative business model ideas because the process outputs are found to score significantly higher in novelty, feasibility2, and relevance as compared to existing business models. The proposed process is accessible for novice users and may help business model planners who are looking to generate blockchain-service business model ideas. Furthermore, this study contributes to a better understanding of customers and designing of business model ideas to solve their problems. Therefore, with the proposed process

Table 4 Advantages and antonyms of the advantage in each business field

Business Field	Advantages	Antonyms of these advantages
Sharing	Cost reduction Personal profit creation Prevention of overconsumption Maximization of resource utilization Increased individual transactions Expansion of collaboration opportunities Promotion of community activities	(a) Waste or excess consumption (b) The complexity or expenditure of procedures (c) The absence of opportunities for personal production
Healthcare	Improving the quality of medical services Reducing costs Continuous medical services Personalized treatment Medical data integration	(a) Disclosure of personal health information (b) Discontinuous health services (c) Uniformed or static treatment (d) Distributed personal health information in each hospital (e) Limitations of data access and exchange (f) Poor service quality and high cost

better blockchain-service business models can be generated, and help businesses encourage many customers to adopt blockchain technology.

Appendix

See Table 4.

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Declarations

Conflict of interest The authors have no conflicts of interest to declare that are relevant to the content of this article.

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