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Business Use of Blockchain in New Zealand Organisations An Exploratory Study

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Abstract

The purpose of the survey study is to understand the current business use of blockchain technology in New Zealand organisations. Over the past five years or so, an increasing number of organisations have become increasingly interested in blockchain technology. However, very few blockchain studies have been conducted in New Zealand organisations. A survey of New Zealand businesses using blockchain was conducted to look at the use of blockchain in New Zealand. Several propositions have been proposed accordingly. This is an exploratory study to understand the current and expected use of blockchain technology, the main reasons of applying blockchain, and barriers to further investment in blockchain. The results provide insights into the future blockchain research.

Keywords: Blockchain, Technology, Survey, New Zealand.

1 Introduction

Blockchain technology has attract the attention of organizations in different industries. It has enormous potential applications for any enterprise involved in record-keeping, documentation, registrations, and transactions. Blockchain is not only a new type of internet infrastructure based on distributed applications but also a new type of supply chain network [1]. It is also known as distributed ledger technology [2]. It allows participants to secure the settlement of transactions, achieve the transaction, and transfer of assets at a low-cost (Tschorsch and Scheuermann 2016). It is an emerging technology in today's world and a lot of revolution and research has just begun regarding this distributed technology. For example, an important feature of blockchain technology is the security. It is impossible to modify, delete or add information or blocks without being detected by other users [3].

Although blockchain technology is relatively new, there have been three generations of blockchains including Blockchain 1.0, which is the core technology used to create the cryptocurrencies, such as Bitcoin, Litecoin, etc. The first generation blockchain appeared in 2009, as a part of Bitcoin, and provided a technique for an incorruptible digital ledger of economic transactions. In 2015, Ethereum used an improved blockchain 2.0 for validating transactions. Blockchain 2.0 was developed from the decentralised digital ledger, which includes many different categories, such as Blockchain 2.0 protocols, smart contracts and decentralised application. With the development of computer technology, Blockchain 2.0 protocols can be used to manage not just financial transactions but virtually everything of value. Blockchain 2.0 space is still in development, many Blockchain 2.0 projects are mainly applied for the transferring of all kinds of assets beyond currency using blockchain [4]. The primary argument for Blockchain 1.0 and 2.0 transactions is the economic efficiency and cost savings afforded by trustless interactions in decentralized network models. Blockchain 3.0 is still emerging. Yli-Huumo, Ko [5] and Garrod [6] argue that the future research directions for blockchain are not clear.

New Zealand is a small country with 5.12 million population in June 2021. This represents a small domestic market. Many New Zealand organisations need to compete with the overseas companies in the international markets. In addition, the major productions such as dairy, meat and wood heavily relied on export [7]. Based on the technology-organization-environment framework (TOE framework), digital technology offers many opportunities for these entrepreneurs [8]. e.g. new business models, reduce the cost and barriers. Blockchain technology optimises international supply chain operations, such as traceability, visibility and security [3]. Moreover, Blockchain may allow companies to improve their sustainability [9]. This government priorities focus on long-term challenges and opportunities in New Zealand. Blockchain technology is considered as an appropriate technology to support the government's strategic vision. The research project was funded by the Crown Research Institute Scion to explore the use of blockchain technology in New Zealand. This is the first part of study to conduct an exploratory study to understand the current use of blockchain. The following four research questions have been formulated,

- RQ1: What applications for blockchain are currently used in the New Zealand organisations?

- RQ2: What key attributes of blockchain do the New Zealand organisations would like to further develop in the real world?
- RQ3: What are the main reasons for applying blockchain in the New Zealand organisations?
- RQ4: What are the barriers to further investment in blockchain in the New Zealand organisations?

In this study, a short survey is designed based on the research questions to understand the current business use of blockchain in New Zealand organisations. This provides an overview of blockchain for different stakeholders and researchers. This is an exploratory study, and no specific hypothesis or theory was being tested. It is important to remember that since a self-selected sample was used, the survey results may be not necessarily representative of all New Zealand organisations using the blockchain. Having said that, according to findings, we proposed several propositions for further research.

The remainder of the paper is organised as follows. Section 2 describes the relevant literature review. Section 3 briefly introduces the research methods. Then, the descriptive analysis and survey results are presented in section 4. The last section discusses propositions and concludes the paper with limitations and further research directions.

2 Literature Review

Blockchain is considered a powerful tool to improve the efficiency and effectiveness of business processes and transactions [4, 10, 11]. It is therefore essential to understand the attributes and/or functions which may be used to strengthen the capabilities in the business.

Digital ledgers offer some important attributes, which can be adopted in the business supply chain [11-14]. In previous studies, Zheng, Xie [15] state that the key characteristics of a blockchain include decentralisation, persistency, anonymity, and auditability, and the important properties of a blockchain are decentralized, verified, and immutable. Sultan and Lakhani [16] stress four core characteristics of blockchain: immutable, decentralised, consensus driven, and transparent. Chen, Xu [1] identify four features: decentralization, traceability, immutability, and currency properties from the technical point of view and advantages of blockchain technology including reliability, trust, security, and efficiency. Zyskind, Nathan [17] stress that blockchain, which is a trusted, auditable and decentralized system, can be used to manage personal data. Mansfield-Devine [18] emphasises that trust is important for a business network, for which blockchain provides a kind of assurance that is cheaper and a standardised service for companies. Conte de Leon, Stalick [19] argue that blockchain could offer higher service availability at much lower costs for some types of business and enterprise applications. In the literature, despite previous studies may have different names for an attribute, some attributes with similar names have been merged and summarised as the key attributes of a blockchain [3] as follows in Table 1.

Table 1 Important attributes of a blockchain [3]

Attributes of a Blockchain	Explanation	Studies
Immutable	It also knowns as irreversibility. The data can hardly be modified or deleted after the data has been approved by all nodes in blockchain.	Chen, Xu [1], Swan [4], Hackius and Petersen [11], Tapscott and Tapscott [12], Sultan and Lakhani [16], Zheng, Xie [20]
Decentralised	Blockchain is a decentralized managing technique of Bitcoin. There is no central storage. This may minimise the disruption risks. It supports a decentralized decision-making.	Chen, Xu [1], Wang, Wu [3], Swan [4], Yli-Huumo, Ko [5], Hackius and Petersen [11], Tapscott and Tapscott [12], Dobrovnik, Herold [14], Zyskind, Nathan [17], Mansfield-Devine [18], Pereira, Tavalaei [21]
Trust	The trust is different from conventional trust. Blockchain creates trustless network by using sophisticated math. Business partners can trade together without knowing each other.	Chen, Xu [1], Wang, Wu [3], Underwood [10], Tapscott and Tapscott [12], Dobrovnik, Herold [14], Sultan and Lakhani [16], Mansfield-Devine [18], Beck, Stenum Czepluch [22], Kosba, Miller [23], Christidis and Devetsikiotis [24]
Transparency and visibility	The data is almost simultaneously validated and broadcasted to all nodes in blockchains. The transactions or records cannot be hidden so this creates more trust and adds value to the business system.	Wang, Wu [3], Underwood [10], Tapscott and Tapscott [12], Dobrovnik, Herold [14], Sultan and Lakhani [16], Zyskind, Nathan [17], Caro, Ali [25]
Security	Advanced computational logic, cryptographic technology and a	

	distributed decentralized network offer a secure environment. Moreover, it provides not only confidentiality, but also authenticity and nonrepudiation to all activity.	Yli-Huumo, Ko [5], Underwood [10], Tapscott and Tapscott [12], Mansfield-Devine [18], Kosba, Miller [23], Caro, Ali [25], Wang [26]
Global Network	Blockchain technologies rely on shared information. It can be extended globally. It is a standardised global network.	Wang, Wu [3], Underwood [10], Tapscott and Tapscott [12], Swan [13], Sultan and Lakhani [16]

3 Research Method

This is an exploratory study. In this study, a short survey was used to collect the responses from blockchain specialists and management (e.g. CEO, director, managers). We only invited the New Zealand organisations, which had already applied blockchain technology in their operations. The short survey consists of nine questions related to the experience and knowledge of Blockchain in the New Zealand organisations. The short survey lead to less fatigue and consequently better data quality, this reduces fieldwork cost, and are likely to increase response rates, thus reducing response bias [27].

We used the SurveyMonkey to manage the data collection. To ensure the study is meeting ethical requirements, the anonymous research survey was used in the project. After initial search, a small number of New Zealand companies have used Blockchain in their business operations. We searched the organisations via LinkedIn and relevant Blockchain conferences in New Zealand. Total 50 companies have been identified and invited to this study in New Zealand. We send an invitation letter with web link via email in early July 2019. Total 24 valid responses have been received. The response rate is 48% in this survey study. Considering the small population using Blockchain in New Zealand, the sample size can be satisfied [28]. Descriptive statistics is used for the data analysis in the study. As this was an exploratory study, descriptive statistics were considered appropriate for presenting the survey results [29]. Then, according to the survey results and discussion, we proposed several propositions for future research.

3.1 Reliability and Validity

Reliability, and validity are criteria for assessing the quality of business research. Reliability is concerned with the question of whether the results of a study are repeatable. Validity is concerned with the integrity of the conclusions generated from a piece of research [27]. The short questionnaire was designed by several researchers to ensure objectivity, reliability and validity [28, 29]. The questions derived from the literature review. We used multiple-choice questions with “other” answer. The multiple choice questions are effective when respondents were asked to pick their favourite or least-favourite option from a predetermined list, and adding an “other” answer option or comment field can solve a common drawback and reduce the response bias [29].

4 Descriptive Analysis and Results

In this section, the survey results are presented. A questionnaire survey was undertaken in New Zealand organisations. Based on the TOE, in this study, the technological context may include blockchain technology as well as the relevant business processes, the organisational and environmental context refers to the companies in New Zealand. The first four survey questions indicate the demographic information. Then the following four questions were designed to answer the research questions. A summary of the results from the survey in each of the areas addressed follows.

4.1 Descriptive results

Company size

A large proportion of responses came from small and medium-sized enterprises (SME). The result is not surprising as almost all New Zealand businesses fall into this SME category, according to the OECD report, SME defined as businesses with 0-49 employees, made up 99% of New Zealand businesses in 2020. This result could be interpreted as small companies may be more flexible and willing to experiment with new technology in their business. Table 1 indicates the company size in the survey.

Table 2. Company size

Companies size	Responses	
1-19 employees	58.33%	14
20-199 employees	37.50%	9
>200 employees	4.17%	1
Total	100%	24

Location of organizations

All responses were from Auckland and Wellington except one organisation was in Northland. This also in line with the demographic characteristics in New Zealand. Auckland and Wellington are New Zealand's major cities, this shows that the companies using blockchain concentrated in major cities in New Zealand. In other words, companies are in major cities in New Zealand more likely to adopt blockchain technologies.

Industry

The Australian and New Zealand Standard Industrial Classification (ANZSIC) 2006 is used to analyse industry statistics in the study. Not all the industries have been covered in this survey. Over 70% of organisations came from industries including the Information Media and Telecommunications, and Financial and Insurance Services. Table 3 illustrates the current use of blockchain in different sectors.

Table 3. Current use of blockchain in industries

Industry	Responses	
Construction	4.17%	1
Information Media and Telecommunications	37.50%	9
Financial and Insurance Services	41.67%	10
Professional, Scientific and Technical Services	4.17%	1
Health Care and Social Assistance	4.17%	1
Other Services	8.33%	2
TOTAL	100%	24

Respondents' position

Table 4 shows the respondents' position in the survey. About 70% respondents were CEO and senior managers in the companies. This indicates the accuracy of the results in this exploratory study.

Table 4. Respondents' position

Positions	Responses	
Chief Executive Officer / Senior management	70.83%	17
Department / Functional managers / Intermediate management	12.50%	3
Team leader / Supervisor / Line management	4.17%	1
Staff / Employee	12.50%	3
TOTAL	100%	24

4.2 Research Questions Answers

RQ1: Applications for the current use of blockchain

Zheng, Xie [15] argue that blockchain can be applied into diverse applications far beyond cryptocurrencies, particularly in the next generation of internet interaction systems. Mansfield-Devine [18] asserts that blockchain provides a kind of chain of trust in the commercial world. So far, most studies focus on the utilization of blockchain to facilitate the information flow and financial flow [2, 5, 20]. Blockchain is a smart network [13, 30], which can interact with the different technologies e.g. smart contracts, Artificial Intelligence (AI), internet of things (IoT), Automation, etc. to change the traditional business model globally [4, 5, 11, 23].

To understand the current use of blockchain, respondents were asked to indicate the applications in their organisations. The most popular blockchain applications are smart contracts and payments in New Zealand. 14 companies are currently using blockchain for payments and smart contracts. Blockchain applications for digital currency, traceability and supply chain are frequently found in the survey. 9 companies mentioned other uses including transportation, travel, tokenisation, international trade, communications, financial markets, identity and venture capital. Table 5 summarised the survey results of the current use of blockchain in New Zealand organisations.

Table 5. Applications for the current use of blockchain

Applications	Responses	
Smart Contracts	58.33%	14

Payments	58.33%	14
Digital Currency	54.17%	13
Traceability	50.00%	12
Supply Chain	45.83%	11
AI Technologies	37.50%	9
Internet of Things	33.33%	8
Automation	25.00%	6
Cloud Storage	16.67%	4
Electronic Voting	8.33%	2
Robotics	0.00%	0
Other (please specify)	37.50%	9

RQ 2: Key attributes of blockchain for future development

Blockchain is a highly decentralised network, which is different from traditional centralised database, all the different users can almost simultaneously receive update information in the network. Transparency and visibility is an important attribute of blockchain [30]. And the hashing and cryptography are used to create data stored in the blockchain, all the transactions or records are almost immutable [12, 24]. This provides a new trust mechanism, which relies on cryptographic technology and a distributed decentralized network [12]. Potential new applications of blockchain is unknow, thus we focus on the key attributes of blockchain, which were used in the questionnaire, to look at the expected use of blockchain for future.

To understand the expected use of blockchain, respondents were asked to indicate the key attributes of blockchain that their organisation would like to promote in the real world. 87% respondents expected the transparency and visibility, following attributes include decentralised, trust, security and authenticity. 7 companies indicate other expected use including permissionless, digitization of value, programmability of value, open data and open platforms, privacy of data, economic participation of users. Table 6 summarised the expected use of blockchain in this survey.

Table 6. Expected use of blockchain for future

Attributes	Responses	
Transparency and visibility	87.50%	21
Decentralised	70.83%	17
Trust	70.83%	17
Security and authenticity	66.67%	16
Global Network	62.50%	15
Immutable	50.00%	12
Other (please specify)	29.17%	7

RQ3: Main reasons/motivations for applying blockchain

The third research question is used to understand the main reasons / motivations for applying blockchain in the organisations. For example, why the companies would like to use blockchain in their business. According to the survey results, we identified the main reasons including competitive advantages, new business models, and improving effectiveness of current business. Other reasons mentioned in the survey are assured compliance, new products, multiple companies' platform, providing choice to consumers, public good, the future of money, open source, open data. Table 7 summarised the main reasons for applying blockchain in this survey. Technologies play an important role to drive the competitive advantages and innovation [8].

Table 7. Main reasons / motivations for applying blockchain

Reasons	Responses	
Competitive advantages	58.33%	14
New business models	54.17%	13
Improving effectiveness of current business	41.67%	10
Cost savings	33.33%	8
Risk management	33.33%	8
Stakeholder's requirements	16.67%	4
Other (please specify)	37.50%	9

RQ4: Barriers to further investment in blockchain

In this survey, we asked the respondents, who have already used blockchain in their organisations, to think about the barriers to further invest the technology. The top barrier was regulatory issues. This indicates that government needs to pay attention to support the new technologies development. One company suggested that “adoption was happening on its own pace, but regulators need to be more proactive”. Thus, further policy and regulation studies on blockchain may be required in New Zealand. Another respondent emphasised that “finding talent, the demand globally for highly skilled technology people is high and the supply is low.” some companies “viewed blockchain as “new” tech and therefore not mainstream.” Table 8 summarised the barriers to further investment in blockchain.

Table 8. Barriers to further investment in blockchain

Barriers	Responses	
Regulatory issues	47.83%	11
Lack of in-house skills/understanding	34.78%	8
Implementation—replacing or adapting to legacy system	13.04%	3
Concerns over sensitivity of competitive information	8.70%	2
Uncertain ROI	8.70%	2
Technology is unproven	8.70%	2
Potential security threats	4.35%	1
No barriers	13.04%	3
Other (please specify)	26.09%	6

5 Discussion, Propositions and Conclusion

This paper presents a survey study on blockchain applications in New Zealand organisations. We focused on the New Zealand companies using the blockchain. There were some interesting results, very few industries indicated the use of blockchain in their operations from this survey, and the most popular blockchain applications were smart contracts and payments. This may provide evidence that blockchain can facilitate the goods, information, and cash flows in the supply chains. This may imply the potential opportunities to expand the current use of blockchain in New Zealand industries. The expected use of blockchain was studied based on the key attributes of blockchain for future development. Transparency and visibility are the top expected use of blockchain in this survey. Some respondents mentioned that applying blockchain for “open communities”. Having said that, a caution must be considered for type of information sharing, privacy, duration etc. The adoption of digital technologies improves virtuality and can facilitate the information sharing and collaboration among the supply chain partners [3]. Blockchain technology may represent the sharing of information, collaboration, and trust among the stakeholders, and it can help remove barriers in supply chains. Thus, the following propositions are put forward.

- **Proposition 1.** Blockchain technology may improve the transparency and visibility in companies.
- **Proposition 2.** Blockchain technology may improve the supply chain relationship between companies.

The top main reason for applying blockchain is a competitive advantage, which is an attribute/advantage that allows a business to outperform its competitors and deliver greater value to consumers. New business model is the second main reason of applying blockchain, this supports that the SMEs have a high level of business innovation in New Zealand. Furthermore, blockchain technology offers several unique advantages, which allows companies to create value and gain competitive advantages [3]. As mentioned before, due to international competition, higher customer expectations and supply chain complexity, the New Zealand organisations need to continue to gain and enhance the competitive advantages and business innovation to compete in the international markets. The survey results are in line with the characteristics of New Zealand business trading. Digital technologies play a vital role in digital transformation processes. It has a positive influence on innovation activities [31]. Digital technologies afford more information, computing, and connectivity, they enable new forms of collaboration, this offers tremendous potential for firm innovation [8]. Thus, the following propositions are proposed.

- **Proposition 3.** Blockchain technology may improve the competitive advantage in companies.
- **Proposition 4.** Blockchain technology may facilitate the innovation in companies.

The top two barriers to further investment in blockchain were from outside New Zealand organisations, they were regulatory issues and lack of in-house skills/understanding. This may ring a bell for further policy and regulatory studies. The effective integration of technological considerations into business is an important aspect of business planning. The results may provide some useful strategies for implementing blockchain in New Zealand business. Blockchain is a relatively new technology, not many New Zealand companies are using blockchain yet, some respondents viewed blockchain as “new” tech and therefore not mainstream, and there have been questions around implementing blockchain.

In this paper, we present the survey results from the NZ companies and provide several propositions for future research. Technologies alone cannot improve business performance. It is important to understand the underlying mechanism for the digitalisation in organisations. This study is part of larger blockchain research project at Scion, we did not expect to answer all the questions regarding blockchain. However, this paper may inspire more practitioners and researchers to consider the new tech in their businesses and research.

The following limitations of the study include that a small number of companies have been studied in New Zealand, the findings from the survey are not necessarily representative of all New Zealand businesses, this may be difficult to generalise the results to all New Zealand organisations. The study did not specific the future applications of blockchain. The practitioners need to consider the attributes of blockchain in the different use cases.

Overall, the survey study draws a big picture about the current and expected use of blockchain, the main reasons of applying blockchain, and barriers to further blockchain investment in New Zealand organisations. Future work could support the organisations to utilise blockchain for specific purposes and overcome the barriers.

Note: The questionnaire is supplied for a review process, it is available on request from the first author of this article.

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