Factors Affecting the Organisational Adoption of Blockchain Technology in Australia: A Mixed-Methods Approach

This thesis is submitted in the fulfillment of the requirements of the degree of Doctor of Philosophy

By

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Abstract

Blockchain (BCT) is an emerging technology that promises many benefits for organisations, such as disintermediation, data security, data transparency, a single version of the truth, and trust among trading partners. Despite its multiple benefits, the adoption rate of BCT among organisations has not reached a significantly high level worldwide. The present thesis addresses this issue in the Australian context. There is a knowledge gap in what specific factors, among the plethora of factors reported in the extant scholarly and commercial literature, affect Australian organisations while deciding to adopt BCT. To fill this gap, this thesis uses a mixed-methods approach known as sequential exploratory mixed methods. In this approach, the research starts with a qualitative phase as an initial phase followed by a quantitative phase. During the qualitative phase, data were collected through semi-structured interviews of the BCT experts and decision-makers working with the different Australian organisations that adopted or were in the process of adopting BCT. The Technology, Organisation, Environment (TOE) framework, based on the qualitative interpretative approach, was used as a theoretical lens during the qualitative phase. The qualitative data were analyzed using the thematic analysis technique with the SQR NVivo software. The analysis shows that the different factors, belonging to the technological, organisational, and environmental contexts, affect the organisational decision to adopt BCT in Australia. The technological factors include perceived benefits, perceived computability, perceived complexity, perceived disintermediation, and perceived information transparency; organisational factors are organisational innovativeness, organisational learning capability, top management support; environmental factors consist of government support, standards uncertainty, competition intensity, and trading partners readiness. The qualitative analysis also shows the direct and moderating effect of the perceived risks between the relationship of the identified factors and organisational adoption of BCT. Based on the findings of the qualitative phase, the thesis develops a theoretical conceptual model, which shows the relationship between the factors and the organisational adoption of BCT. To increase the external validity of the developed conceptual model, the thesis started a quantitative phase with the administration of an online survey for data collection. Certain criteria were set to screen out the irrelevant participants in the survey. During this phase, hypotheses were proposed for the relationship of the factors identified in the qualitative phase and the organisational adoption of BCT. The survey data was analyzed

using the PLS Structural Equation Modelling (SEM) technique with the SmartPLS 3 software. The quantitative analysis confirms the findings of the qualitative phase that the perceived benefits, perceived compatibility, perceived information transparency, perceived disintermediation, organisational innovativeness, organisational learning capability, top management support, competitive intensity, government support, and trading partner readiness have a positive effect on the organisational adoption of BCT. Whereas the perceived complexity, standards uncertainty, and perceived risks have a negative effect. The analysis also shows that the moderating effects of perceived risks are significant in the relationship of perceived compatibility, perceived information transparency, perceived disintermediation, organisational innovativeness, organisation innovativeness, competition intensity, and organisational adoption of BCT. Contrary to the qualitative findings, 'perceived risks' has no moderating effects on the relationship of perceived benefits, organisational learning capability, top management support, government support, trading partner readiness, and the adoption of BCT.

The thesis has both theoretical and practical contributions, which are useful both for theory development and decision-making for the adoption of BCT in Australia. Theoretically, this thesis contributes to the existing IT adoption literature in several ways. Firstly, the thesis provides empirical evidence about the factors affecting organisational adoption of BCT in Australia. This is the first in-depth sequential exploratory mixed methods research that bridges this knowledge gap in the extant literature. The identification of such factors is important, particularly for the Australian government and organisations interested in the value creation of BCT. Second, the thesis reports the effect of new factors, namely, perceived information transparency, perceived disintermediation, organisational innovativeness, organisational learning capability, standards uncertainty, trading partner readiness, and competition intensity on BCT adoption that are exclusively identified in this research. Third, this thesis confirms the findings of the past studies that the factors of perceived benefits and perceived compatibility, perceived complexity, and top management support have an effect on the organisational adoption of BCT. Fourth, according to the best of the authors' knowledge, this is the first research that has used the qualitative interpretive research approach to investigate the organisational adoption of BCT. Therefore, the thesis confirms the suitability of the qualitative interpretive research approach for BCT adoption. Lastly, most of the researchers have used the TOE framework in either in qualitative or quantitative research. This thesis proves its validity in mixed methods research as well. The thesis's practical contributions are discussed in chapter 7.

Acknowledgments

All praises are to Allah, the most gracious, who has blessed me with the intellect, strength, and energy to complete this thesis.
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Declaration of Authorship and Originality

Except where otherwise indicated, this thesis by publication is my own original work and has not been submitted for any other degree. This thesis contains no material published elsewhere or extracted in whole or in part from a thesis by which I have qualified for or been awarded another degree or diploma. No other person's work has been relied upon or used without due acknowledgment in the main text and the list of references of the thesis. No editorial assistance has been received in the production of the thesis without due acknowledgment.

Muhammad Saleem Malik
July 09, 2022

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Dedicated to my PhD supervisor Dr. Mehmood Chadhar who is very kind and super supportive

Contents

Abbreviations

ACS	Australian Computer Society
ASX	Australian Security Exchange
BCT	Blockchain Technology
B2B	Business to Business
CEO	Chief Executive Officer
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTO	Chief Technology Officer
DDOS	Distributed Denial-of-Service
DPoS	Delegated Proof of Stake
EDI	Electronic Data Interchange
GDP	Gross Domestic Product
GUI	Graphical User Interface
HRM	Human Resource Management
HREC	Human Research Ethics Committee
IT	Information Technology
NAT	Network Translation Method
PLS	Partial Least Squares
PoW	Proof of Work
PoS	Proof of Stake
R&D	Research and Development
SEM	Structural Equation Modelling
TOE	Technology Organization Environment

List of Figures

N.B. Figures embedded within published and submitted papers do not appear in this list.

List of Tables

N.B. Tables embedded within published and submitted papers do not appear in this list.

List of Publications

The chapters of this thesis contain contents from the different papers that were published/accepted in refereed journals and conferences during the whole candidate's PhD research. The candidate contributed to every research paper between 85% and 90%. The co-authors contributed mainly to concept development and writing up. The following tables present the published and accepted papers and their mapping with the thesis chapters.

Table i List of published papers

Paper No.	Paper title with source	Status
Refereed Journal Papers		
1	**Malik, S.**, Chadhar, M., Chetty, M., & Vatanasakdakul, S. (2022). Adoption of Blockchain Technology: A Study to Identify the Factors Affecting Organisational Decision. *Human Behavior And Emerging Technologies*.	Accepted (first round done)
2	**Malik, S.**, Chadhar, M., Vatanasakdakul, S., & Chetty, M. (2021). Factors affecting the organisational adoption of blockchain technology: extending the technology–organisation–environment (TOE) framework in the Australian context. *Sustainability*, *13*(16).	Published
Referred International Conference Papers		
3	**Malik, S.**, Chadhar, M., & Chetty, M. (2021). Factors Affecting the Organisational Adoption of Blockchain	Published

	Technology: An Australian Perspective. 54th Hawaii International Conference on System Sciences.	
4	**Malik, S.**, Chadhar, M., Chetty, M., & Vatanasakdakul, S. (2020). An exploratory study of the adoption of blockchain technology among Australian organisations: A theoretical model. European, Mediterranean, and Middle Eastern Conference on Information Systems, Dubai.	Published
5	**Malik, S.**, Chadhar, M. A., Chetty, M., & Vatanasakdakul, S. (2020). Adoption of Blockchain Technology among Australian Organisations: A Mixed-Methods Approach. Australasian Conferences on Information Systems, New Zealand.	Published

Table ii Mapping of thesis chapters with the published papers

Chapter No.	Paper No.	Candidates Contribution (%)
Chapter 1: Introduction		90%
Chapter 2: Literature Review	4	90%
Chapter3: Research Methodology	1, 2,5	85%
Chapter 4: Qualitative Data Analysis	1,3,4	90%
Chapter 5: Research Model Development	1-5	85%
Chapter 6: Quantitative Data Analysis	2,5	90%
Chapter 7: Discussion	1,2	90%
Chapter 8: Conclusion	5	90%

Chapter 1: Introduction

1.1 Research background

Blockchain (BCT) is a disruptive technology that provides a novel and unique way of organising distributed and decentralized databases. It offers to organise data as a list of ordered blocks, where each block is connected to its previous block. Recently, BCT has attracted a wide audience of practitioners, policymakers, researchers, and national authorities. Initially, BCT was developed to solve the double-spending problem in the fiat currency through the proposal of a cryptocurrency known as Bitcoin (Nakamoto, 2008). Afterward, researchers proposed its many different use cases for governments, business organisations, and other various institutions. The current use cases of BCT include e-voting (Hsiao, Tso, Chen, & Wu, 2017); network security (Zikratov, Kuzmin, Akimenko, Niculichev, & Yalansky, 2017; Zyskind & Nathan, 2015); healthcare (Azaria, Ekblaw, Vieira, & Lippman, 2016; Engelhardt, 2017; Gordon & Catalini, 2018); HRM (X. Wang et al., 2017); governments (Antipova, 2018); supply chain (Nakasumi, 2017); and industry 4.0 (Pinheiro, Macedo, Barbosa, Santos, & Novais, 2018).

The BCT has significantly been contributing to the global economy (World EconomicForum, 2018; Winter Green Research, 2018) as depicted in Figures 1.1 and 1.2, and has the potential to revolutionize the world (Ganne, 2018). Google reported blockchain as one of its top trends (Google, 2017, 2021). Gartner, Forbes, Economist, and Fortune also include BCT in their top mega trends (Forbes, 2021). Various globally leading organisations including IBM, Walmart, and Microsoft are working with BCT to improve their business process and performance (Blockchain Council, 2018; Winter Green Research, 2018).

1.2 Blockchain technology in Australia

Australia is a BCT-friendly country where both government and private associations promote BCT (Novak, 2019). Australia started working with BCT when Standards Australia submitted a proposal to the International Organisation for Standardization (ISO) to develop BCT standards (Australia, 2016). Later, the Australian government put significant efforts to foster BCT adoption within the country. The most recent initiative of the Australian government is the issuance of the roadmap to increase the adoption of BCT

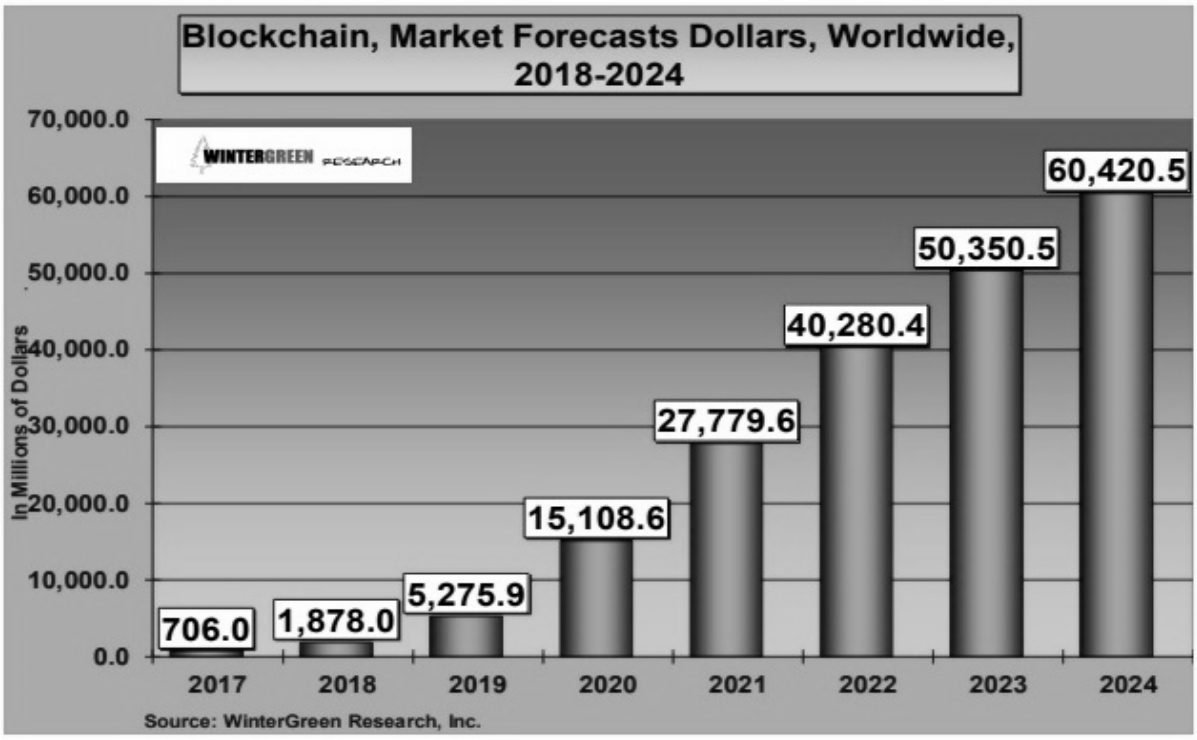

Figure 1. 1 Global growth of BCT (Research, 2018)

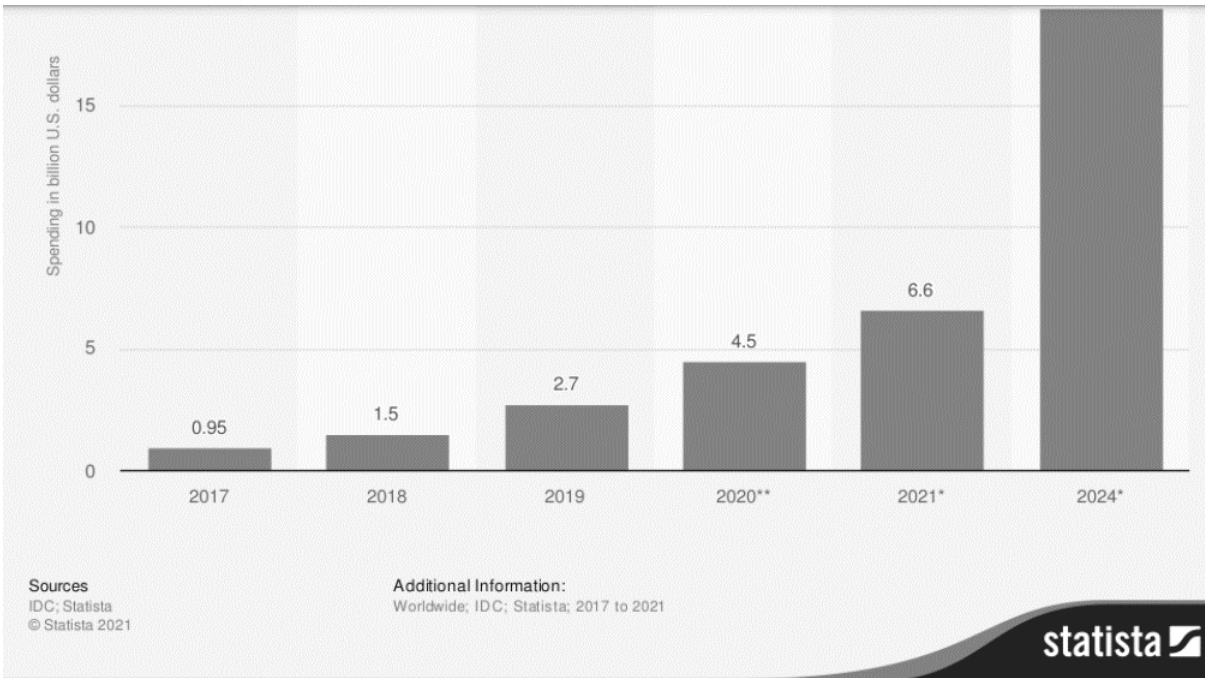

Figure 1. 2 Global growth of BCT (Statista, 2021b)

(DISER, 2020). The CSIRO's Data61, which is an Australian research agency, has been working to develop a national BCT network to enhance coordination among the public

departments (Austrade, 2018). The ASX, Australia's biggest stock exchange, partnered with "Digital Asset Holdings" to develop a private blockchain for the Australian equity market (IP, 2018). Blockchain Australia, a private association, has actively been working to encourage the use of BCT among Australian organisations (BA, 2022). Australia has all the technological infrastructure that organisations require to embrace innovation like BCT (Deloitte, 2016; Economist, 2018). Gunasekera and Valenzuela (2020) and Maroun and Daniel (2019) suggested that the adoption of BCT could enhance the productivity of many Australian industries such as finance, grain, and supply chain by 8-10 percent, resulting in a 2.6% rise in GDP. Garrard and Fielke (2020) and Cao et al. (2020) proposed to implement BCT in the meat industry because the beef sold under the Australian label in different countries is not Australian. They said that BCT could overcome this meat fraud and provide shipment tracking that will protect Australia's reputation. Similarly, Monroe, Hansen, Sorell, and Berglund (2020) recommended the use of BCT to empower consumers for peer-to-peer energy trading. They mentioned that the BCT-enabled energy trading system could enhance the sharing economy in Australia. In another report, it was mentioned that BCT can create many unexpected jobs in regional Australia (Foth & McQueenie, 2019).

1.3 Rationale and motivation

Given the support from the Australian government and private agencies, it appears essential for organisations to consider adopting BCT to enhance their business value and performance. However, the recent reports issued by the Australian government and renowned private firms indicate that Australian organisations have not adopted BCT heavily (ACS, 2019; Deloitte Deloitte, 2016; Ward & Rochemont, 2019). The reports indicate that the adoption of BCT among organisations is still at its initial stage and has not reached a significantly high level. Past studies report several factors that influence organisational adoption of BCT in different countries. However, they have many limitations that lead to knowledge, methodological and theoretical gaps in the information systems literature. A further explanation of these limitations presented in the past studies is given below.

- The past studies examined BCT adoption in the context of non-oceanic countries like Ireland, Malaysia, Germany, etc. (Clohessy & Acton, 2019; Holotiuk & Moormann, 2018; L.-W. Wong, Leong, Hew, Tan, & Ooi, 2019). According to the best of our knowledge, to date, there is a lack of in-depth empirical research that attempts to identify the factors influencing

organisations' intention to adopt BCT in Australia. This knowledge gap has slowed the development of strategies and policies to enhance BCT adoption. According to W. Hong, Chan, Thong, Chasalow, and Dhillon (2013), the findings of a study undertaken in one context e.g. country cannot be generalized to any other context because every context has its unique characteristics, for instance, technology readiness, networked readiness index, uncertainty avoidance index as shown in Table 1.1. Technology readiness and networked readiness indexes represent the level of readiness of a country in terms of the technological infrastructure to adopt new technology whereas uncertainty avoidance refers to how the individuals, groups of people, or organisations of a specific country take decisions in new and risky situations. The higher value of the technology readiness index for Australia indicates that it (Australia) is more ready to adopt new technology as compared to other countries. At the same time, it is a more fearful country due to the higher value of uncertainty avoidance.

Table 1. 1 Comparison of Australia with other countries (W. Hong et al., 2013)

Country	Characteristics		
	Technology Readiness index	Networked readiness index	Uncertainty avoidance index
Germany	9.15625	77.48	65
Ireland	8.03125	72.13	35
Malaysia	7.46875	61.43	36
Australia	9.71875	75.09	51

According to Chandra and Kumar (2018), the findings of a study conducted in one context serve as a starting point for a study in another context. They further stated, "it is imperative to study the specific contexts aligned from a firm's perspective". Therefore, it is imperative to identify the key factors that influence organisational adoption of BCT in the Australian context.

- The past studies extensively used the TOE framework and reported a linear relationship between several technological, organisational, and environmental factors and organisational adoption of BCT. However, they report varying results even for the impact of the same factor on BCT adoption. For example, Clohessy and Acton (2019) and Orji, Kusi-Sarpong, Huang, and Vazquez-Brust (2020) found top management support as a critical factor for the organisational adoption of BCT whereas, L.-W. Wong et al. (2019) reported an insignificant effect of the top management support for BCT adoption. Likewise, De Castro, Tanner, and Johnston (2020) reported the favorable role of government regulations towards the organisational adoption of BCT, whereas, Albrecht et al. (2018) stated that government regulations prevent BCT adoption. This inconstancy in results could be due to the presence of hidden factor (s) that moderate the cause-effect (causal) relationship between the factors (Umrani, Kura, & Ahmed, 2018). This aspect has not been addressed in the previous studies and leads to a theoretical gap. Baron and Kenny (1986) recommend the introduction of a moderating variable(s) when the findings of different studies vary for the same variable. They asserted that the moderating variable enhances the understanding of the problem and prevents any misleading conclusions. Therefore, this study introduces a moderating variable to examine organisational adoption of BCT in Australia.
- The past studies on BCT adoption either use quantitative or qualitative methodology. Quantitative research only focuses on statistical relationships and can overlook broader themes and relationships while developing hypotheses and models. The qualitative research lacks external validity because of using a smaller sample size. Thus, the past studies have an absence of a comprehensive and holistic view of the organisational adoption of BCT due to using quantitative and qualitative methodology separately. The present study overcomes this methodological gap by combining qualitative and quantitative methodologies to identify factors affecting an organisation's intention to adopt BCT.

1.4 Research aims, questions, and objectives

This study aims to enhance our understanding of the organisational adoption of BCT in Australia. To achieve this aim, the study identifies factors and investigates their effect on BCT adoption. The research question is:

What are the key factors that influence the organisational adoption of blockchain technology (BCT) in Australia?

To answer this research question, the study employs a mixed-methods approach based on the Technology-Organisation-Environment (TOE) framework. The study combines qualitative and quantitative methodologies in a sequence. During the qualitative phase, semi-structured interviews with BCT experts and senior IT people will be conducted to identify the influential factors. In the quantitative phase, a research model and hypotheses will be developed based on the findings derived from the qualitative phase. The model will be confirmed with the data collected through an online survey.

The research has the following objectives:

- To conduct a mixed-methods (sequential exploratory) study to investigate the factors influencing organisational adoption of BCT in Australia.
- To conduct interviews of BCT experts and senior IT people to know the factors that influence organisational adoption of BCT in Australia.
- To develop a research model based on the findings drawn from the interview data.
- To empirically confirm and validate the research model with quantitative data obtained through an online survey. This objective contains the following sub-objectives:
    - To examine the impact of technological factors on the organisational adoption of BCT.
    - To examine the impact of organisational factors on the organisational adoption of BCT.
    - To examine the impact of environmental factors on the organisational adoption of BCT.
    - To examine the moderating role of perceived risks in the relationship between the influential factors and the organisational adoption of BCT.

1.5 Significance of the research

This study will contribute to the existing body of knowledge on BCT in several ways. Firstly, the study examines the organisational adoption of BCT and highlights the need to consider technological, organisational, and environmental factors while deciding BCT in Australia. Thus, the study bridges the knowledge gap on the factors relevant to BCT adoption among Australian organisations. Secondly, unlike the past studies on BCT adoption, this study integrates the moderating role of perceived risks into the TOE framework and extends the framework to be used in countries wherein people highly avoid the risks of new technologies like BCT. Thus, the study fills the theoretical gap persisting in the literature on BCT adoption. Thirdly, the study uses the mixed-methods approach to identify the factors influencing the organisational adoption of BCT. By doing this, the study not only fills the methodological gap but also brings out the importance of combining qualitative and quantitative methods when there is a lack of research or limited knowledge available in the existing literature. Fourthly, the decision-makers working with the Australian government and private organisations can use the findings of this study to develop better national policies for the adoption of BCT in Australia. Fifth, the findings of the study can help consulting and marketing companies while developing business strategies for their potential BCT customers. Lastly, the findings can be used by multinational organisations willing to expand their business in Australia.

1.6 Thesis outline

This PhD research is presented as a thesis by incorporating publications, with eight chapters and five original publications enlisted in Table i. Following is the overview of every chapter of the thesis.

Chapter 1: Introduction

This chapter provides background information about the research issues and the rationale for starting this study. It explains the importance and potential of BCT and provides an overview of the adoption of BCT worldwide and in Australia. Furthermore, the chapter describes the research problem, research questions, and overviews the research contributions.

Chapter 2: Literature review

This chapter begins with a review of extant research on BCT, how it works, its characteristics, and its benefits for different industries. It presents a comprehensive review

and identifies knowledge gaps in the BCT technology adoption literature, which highlights the importance of conducting this research in the Australian context. The chapter then explains the theoretical foundation of this research.

Chapter 3: Methodology

This chapter describes the methodology employed in this study. The chapter explains the research design, mixed methods, and their appropriateness for this research. A detailed discussion on the two phases of the mixed methods design is presented. Phase 1 includes the qualitative part whereas phase 2 holds the quantitative part. In addition, data collection and data analysis techniques for each phase are also presented in this chapter. The chapter explains the use of thematic analysis through QSR NVivo software in phase 1 and the use of PLS-SEM with the SmartPLS software in phase 2.

Chapter 4: Qualitative Data Analysis

This chapter presents the results of phase 1 of this study. The chapter shows the interpretations of the respondents for every factor derived from the interview data. The chapter provides findings in the context of the TOE framework.

Chapter 5: Research Model Development

This chapter describes the development of the research model for this study. The chapter explains how the findings derived from the qualitative phase inform the research model. To confirm the model, hypotheses for every factor are also explained in this chapter. Moreover, the moderating role of perceived risks is presented.

Chapter 6: Quantitative Data Analysis

This chapter offers the empirical results of phase 2 of this study. The chapter discusses the analysis of the survey responses. Furthermore, the chapter presents the evaluation of the measurement models. The results for the research model and the hypotheses are examined.

Chapter 7: Discussion

This chapter discusses the research findings and provides a detailed analysis of the structural model and the hypotheses testing. It explains how the research questions outlined in Chapter 1 are answered. The chapter exclusively discusses every context of the TOE framework. In addition, it presents the theoretical and practical contributions of the study. Moreover, a comparison and contrast of the findings of this study with similar previous

studies are discussed. The recommendations and strategies to succeed in the organisational adoption of BCT are presented.

Chapter 8: Conclusion

This chapter provides a summary of the thesis. In addition, the limitations and the direction for the possible future are presented in this chapter.

1.7 Summary

This chapter provides a brief introduction to the research. It presents the research background, research problem, and research questions. The chapter also explains the research objectives and main contributions of the research. Finally, the thesis outlines are presented that describe the content of each chapter of this thesis.

Chapter 2: Literature Review

2.1 Blockchain technology

Unlike traditional databases, blockchain technology (BCT) is a distributed and decentralized database that is organized as a list of ordered blocks, where every block is immutable. BCT provides a distributed peer-to-peer platform where the participating entities can interact and do transactions without the need for a trusted third party like banks (Nakamoto, 2008). According to Beck (2018), "blockchain is a tamper-resistant database of transactions consistent across a large number of nodes and is cryptographically secured against retrospective manipulations, and it uses a consensus mechanism to keep the database consistent whenever new transactions need to be validated". There is no agreed-upon single definition of BCT. Woodside, Augustine Jr, and Giberson (2017) defined BCT as a "digitized decentralized ledger to allow record keeping of all peer-peer transactions without the need for a centralized authority". Another definition is "a blockchain is a database without a central authority and it ensures data reliability by how the data are recorded and organized in the database" (B. S. Tan & Low, 2019). Regardless, BCT is a type of database management system, it is very much different from the existing traditional databases (Chowdhury, Colman, Kabir, Han, & Sarda, 2018). The major difference between BCT and traditional databases is centralization. Contrary to the traditional database where all data is stored at a single centralized point, each participant, individual, or organisation, within the BCT system has the same copy of the entire data and no change within the data is possible without the mutual consensus among the participants. In a centralized database, the data is managed by a central controlling authority and the users never know what is happening in the database. Whereas in the BCT system, any attempt to change data is immediately permanently recorded, time-stamped, and notified to the participants and is rejected if they do not reach a mutual consensus. The other difference between BCT and traditional database is the way data is stored. In a traditional database data is simply organised as rows of a table, whereas, in a BCT system data is stored into blocks (B. S. Tan & Low, 2019).

Figure 2.1 shows the difference between BCT and a traditional database system.

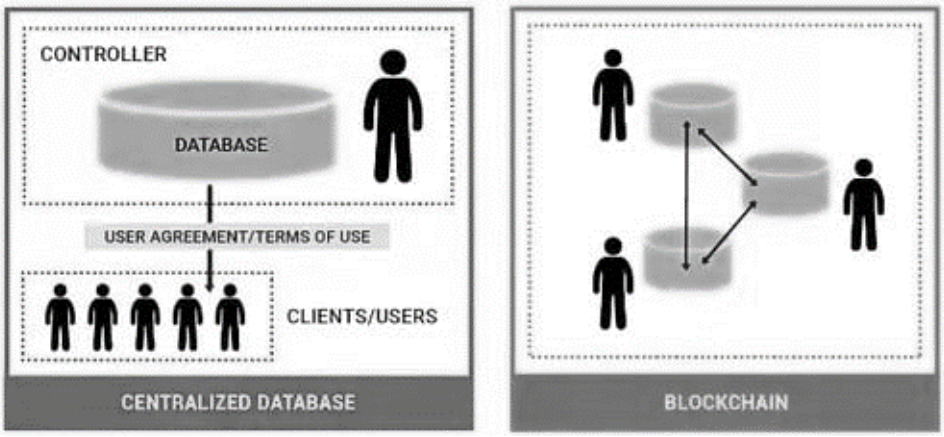

Figure 2. 1 Difference between BCT and traditional database

2.1.2 Types of blockchain technology

BCT has three main types, namely, public, private, and consortium blockchain. These types are based on the access rights of participating nodes. Figure 2.1. summarize the types of BCT (Ganne, 2018; Puthal, Malik, Mohanty, Kougianos, & Das, 2018; Sultan, Ruhi, & Lakhani, 2018).

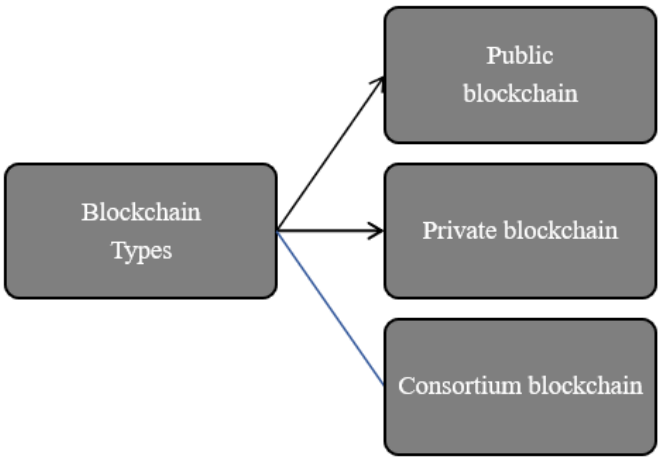

Figure 2. 2 Types of blockchain technology (BCT)

2.1.2.1 Public blockchain

A public blockchain refers to an open platform for anyone to join, transact, or mine the network. There is no prior permission is required to perform any activity that the network offers. The participants have full authority for reading, writing, auditing transactions, or reviewing any part of the ledger. This type of blockchain is open and transparent and does not require any specific validator nodes. Therefore, it is also called a permissionless blockchain. All the participating nodes have equal access control over the network. Since the access is not restricted, everyone can join and leave the network at any time. Every

member within the permissionless blockchain can access the entire copy of the ledger and start mining to earn rewards (de Haro-Olmo, Varela-Vaca, & Álvarez-Bermejo, 2020). However, the ledger copy is synchronized with all the other participating nodes that makes it immutable. Any node, regardless of trusted or untrusted, can join the public blockchain and participate in transaction creation and validation, which puts it to attack. However, with a strong and robust consensus mechanism like proof of work (PoW) such attacks are denied (Puthal et al., 2018). Bitcoin is a famous example of a public blockchain.

2.1.2.2 Private blockchain

A private blockchain is a restrictive network where the access is managed by a single controlling authority e.g., organisation, a selected set of individuals, or rules. This type of blockchain is not open to the public and the user requires prior permission to join the network. Therefore, it is also called permissioned blockchain. In a private blockchain, the controlling authority decides who can join the network and what rights to grant them (Shrivas & Yeboah, 2018). Unknown users can not join the private blockchain resulting in enhanced data privacy and confidentiality. However, this turns a blockchain into a centralized network, which is against the core feature of the "decentralization" of blockchain. In a private blockchain, nodes could have the same copy of the entire ledger, but their writing rights are restricted (Joannou, Kalawsky, Martínez-García, Fowler, & Fowler, 2020). Examples of a private blockchain include Corda and Hyperledger, which are best suited for organisations that are interested to use blockchain for their internal uses only.

2.1.2.3 Consortium blockchain

A consortium or federated blockchain is a network that is governed by multiple controlling authorities. However, this is a permissioned blockchain and not public. In this blockchain, predetermined organisations, a consortium, decide the consensus protocol and rules for block validation. The consortium also decides whether the permissions to read and write would be public or limited to the selected participants (Puthal et al., 2018). Regardless of a permissioned blockchain, a consortium blockchain provides more decentralization due to many organisations involved in the consensus mechanism, unlike the private blockchain, which is operated by one organisation and is more centralized. TradeLens and IBM Food Trust are examples of consortium BCT.

2.1.3 Characteristics of blockchain technology

Following are the key characteristics that are common across all types of BCT (Atlam, Alenezi, Alassafi, & Wills, 2018; Clohessy & Acton, 2019; L. Hughes et al., 2019).

2.1.3.1 Decentralization/disintermediation

Decentralization refers to the elimination of central authority to validate and process transactions on a BCT network (Sarmah, 2018; Zheng, Xie, Dai, Chen, & Wang, 2018). Due to having access to the entire database, every participant can verify transactions within the BCT network without the need for any intermediary. The decentralization allows participants nodes to run data flow by integrating cryptographic hash, digital signature, and distributed consensus mechanism, which in turn significantly reduces the development and operational costs of the servers that exist in the centralized networks. Decentralization removes the single point of failure that can be vulnerable and at the risk of security attacks (Ølnes, Ubacht, & Janssen, 2017).

2.1.3.2 Immutability

Immutability is one of the key characteristics of BCT that refers to unchangeable data. Transactions over BCT are permanent and can be altered (Puthal et al., 2018). Once the participants within the BCT network are agreed on a transaction and it is recorded, it can not be reversed or changed. Although a new transaction can be created to record the state of the original transaction, it can not be removed or hidden from the BCT network. Immutability makes the BCT data irreversible.

2.1.3.3 Transparency

Transparency is one of the main features of BCT that refers to the availability and visibility of data to every participant (Khan & Salah, 2018). Technically, this transparency in BCT is achieved when every participant has the same copy of data, which is immutable, open, and irreversible (Apte & Petrovsky, 2016). Due to the complete visibility, every member of the BCT network has equal access to a single version of the truth (Tijan, Aksentijević, Ivanić, & Jardas, 2019).

2.1.3.4 Anonymity/pseudonymity

Anonymity refers to the ability of the participating entities within the BCT network to keep their identities private. It ensures the privacy of all the entities participating in BCT. Anonymisation is provided by cryptographic functions making the true identity of the participants not known. A combination of public-private key cryptography is used to

achieve anonymity within BCT. The level of anonymization depends on the cryptographic functions used (de Haro-Olmo et al., 2020).

2.1.3.5 Smart contract

The smart contract describes the feature of the BCT that enables to development of algorithms and rules that are automatically triggered when certain conditions are met (Cong & He, 2019). This feature brings significant benefits including regulation of intellectual property, access control, and privileges, or even fraud-proof voting. With smart contracts, the transactions are executed and validated within BCT without needing any third party to intervene (de Haro-Olmo et al., 2020).

2.1.3.6 Consensus

Consensus refers to the mutual agreement on common terms and conditions among the participants. In order to run a BCT network effectively and smoothly, a consensus among participants is important to verify the transactions without the involvement of any central authority or an external trust-granting agent. This feature is also referred to as the mining process in the BCT network.

2.1.4 How blockchain technology works

Blockchain as its name implies consists of a series of blocks connected to form a chain. These blocks are kept together with the help of using complex computational algorithms. Every block within the BCT network contained several transactions and a hash value of its previous block, which goes on to the parent block (Puthal et al., 2018). New transactions are added to the blocks when the BCT participants, called nodes, agree on their validity. Every transaction and block is timestamped (Bashir, 2017; Nakamoto, 2008). Figures 2.1 and 2.2 show the basic architecture of a BCT system and how it works.

Following are the core components of BCT (de Haro-Olmo et al., 2020; Puthal et al., 2018; Sarmah, 2018).

Ledger: It is distributed database that contains all the data of a BCT system. All the participating members have the same copy of the ledger.

Transaction: Transaction is the smallest and core component of a BCT system that serves its purpose. It is a piece of information broadcasted over a BCT network from a participating node. A transaction holds multiple information e.g. sender, receiver, hash value.

Block: A block is a container that keeps a set of transactions. Every block has an address of its own and the previous block. However, the genesis block, the first block of BCT, has

no previous block. Transactions are added to a block when the participating nodes reach a consensus. In the case of Bitcoin, a new block is created every after 10 minutes.

Node: A node is a machine connected to a BCT network. Every node has a complete and same copy of the whole BCT database. A BCT network is made up of several nodes that communicate, exchange data, validate transactions, and create new blocks.

Miner: Miner is a special node that performs the transactions validation process before they are added to a block. To validate transactions, miners compete with other nodes to solve a complex mathematical problem, a node that first solves the problem has the right to create a block. This whole transaction validating process requires a high processing power and energy consumption. Therefore, the successful node is rewarded for its contribution. They are responsible to create blocks and keep data flow.

Consensus Protocol: These are the set of rules to carry out BCT operations. The addition of a new block into the BCT network requires validation from the participating nodes that is done with the consensus protocol. There are different consensus protocols such as Proof of Work (PoW), Proof of Stake (PoS), and Delegated Proof of Stake (DPoS) (Debus, 2017; Zhang & Lee, 2020).

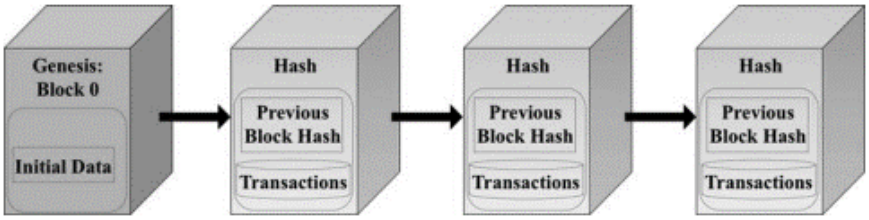

Figure 2. 3 A basic representation of a BCT network (Puthal et al., 2018)

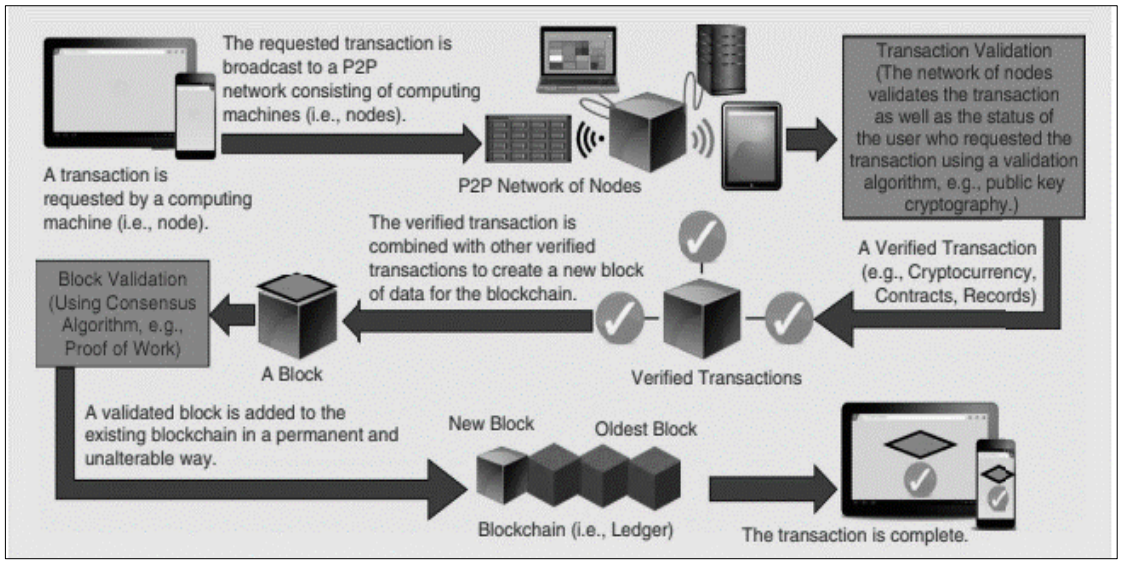

Figure 2. 4 How a BCT network works (Puthal et al., 2018)

2.1.5 Potential benefits and promises of blockchain technology

The literature indicates many benefits of BCT across different industries that are perceived to be the main motivation for organisations to its adoption. Some of the major benefits include reduced cost, reduced systemic risks, enhanced security, new business models, improved traceability, and improved business efficiency. These benefits are further explained in the following sections.

2.1.5.1 Reduced cost

In the existing traditional business model, the involvement of a trusted third party is the main cost that is incurred for the verification of transactions and value exchange of goods and services. In a BCT business model, there is no need for third parties or middlemen like banks to make guarantees for the verification of transactions (Swan, 2017). In a BCT-based system, the value of goods and services is exchanged in a peer-peer and distributed manner. Ultimately, the removal of the intermediary not only reduces the fee for transaction verification but also minimizes other expenses like the hiring of operational and administrative staff to review and handle so much documentation to run a trade. The benefits of BCT in terms of reducing cost become apparent are specifically apparent in cross-border payment where the banks charge a heavy fee for their services. This is supported by a report published by McKinsey (2019), which estimates that BCT could save $4 billion per year in cross-border payment space. Although the BCT fundamentally changes the nature of intermediaries, they will still be able to add value to the transactions (Catalini, 2017).

2.1.5.2 Reduced systemic risk

Systemic risk refers to an event or situation that could cause severe instability or collapse of an entire industry or economy. In a current centralized business model where a third party or an intermediary controls the data and transaction, there arise risks of a single point of failure and data privacy. The entire value chain of a business turns at risk if there is any cyber-attack on the centralized system. With disintermediation, BCT removes the risk of a single point of failure and enhances the system's resilience by providing a decentralized and distributed ledger for data management (Swan, 2019). In a centralized business environment, big companies get control and monopoly over the market and create barriers and inequality for small organisations. On the other hand, BCT provides a trustless and equal opportunity business environment wherein all the stakeholders have equal control over the information that contributes to more transparency and a sustainable economy. According to Mselmi (2020), BCT significantly reduces the level systemic risk level.

2.1.5.3 Enhanced security

BCT does not rely on middle or trusted intermediaries for the processing of transactions, and thus provides more security than any other database solution (Ølnes et al., 2017). The intermediaries, being a single point of failure, make the whole system vulnerable to security attacks. Security in BCT is achieved in several ways including consensus mechanism, immutability, and anonymity. Every transaction is only allowed to become part of the BCT system when the participants approve it. After the approval, the transaction is encrypted and linked to its previous transaction. Since the same copy of all transactions is stored and synchronized on a network of computers rather than a single server, it is almost impossible for hackers to compromise all the computers connected to the BCT network (Zheng et al., 2018). Thus, the BCT is an opportunity for organisation, such as financial institutions, healthcare providers, and governments, those struggling to protect their sensitive data from fraud and unauthorized access. The availability of the same historical data to every participant within the BCT system increases the predictability of any malicious attack (Atlam et al., 2018).

2.1.5.4 New business models

Due to its innovative architecture of decentralization, BCT can alter the current business practices and creates new business opportunities for individuals and organisations (Nowiński & Kozma, 2017). Unlike the conventional financial system wherein all the money matters are dealt by banks or other financial institutions, BCT enables the direct transfer of funds among business entities. The transformational power of BCT is not limited

to the financial sector, it also enables a disruptive change in a shared economy where the companies like Uber and Airbnb have control and monopoly over the current ecosystem and charge a high fee for their services. Another example of monopolization and centralization is the electricity and renewable energy companies. BCT can remove inefficiencies in the energy sector by introducing a new decentralized marketplace where participants can generate revenue by selling their locally generated surplus renewable energy directly to people instead of selling it back to the owner company. This idea has been successfully implemented by an Australian company named PowerLedger (Rutkin, 2016). The number of other potential business models of BCT are still under-estimated and under-investigated e.g. new way of digital identity management, e-voting, a new way of land registration, and compensation models for artists (Schinckus, 2020).

2.1.5.5 Improved traceability

In the BCT network, every transaction is connected to its previous transaction, which enables easier traceability of data, for instance where it is and where it has been (Sultan et al., 2018). With the help of this interconnected transactional data, the reliability and authenticity of data can be verified quickly. Since the transactions within BCT are time-stamped in sequential order, any participating entity can perform their audit. The traceability encapsulated in BCT allows quicker data provenance (Lu & Xu, 2017). It makes the origin of information easily accessible that enhances the quality and safety of data. The BCT-enabled traceability has various positive purposes. For example, in the traditional supply chain network, it is challenging to trace back the origin of an item. However, when the information about the goods is stored on BCT, every party involved can access an audit trail that shows the complete history of an item in the supply chain. Based on this, quick decision-making is achieved and the fast delivery of products to end customers becomes possible. Traceability eliminates the errors that occur due to missing and incomplete information within the multiparty business environment (Francisco & Swanson, 2018).

2.1.5.6 Improved business efficiency

BCT provides a high level of effectiveness and speedy processing in a multiparty business environment (Catalini & Gans, 2020). Currently, the participating organisations manage their data in silos, which causes sharing of information to be a time-consuming activity. Maintaining multiple copies of the same data at different organisations brings redundancy and inconsistency in information and causes delays in business decision-making (Chang, Chen, & Wu, 2019). Whereas in the BCT business model, the same information is

accessible to every participating organisation through a shared digital ledger, and organisations are not required to manage multiple databases. This reduces time delays and enables a speedy exchange of information among the participating organisation, which ultimately enhances the quality of processes and overall effectiveness of a business. With the use of a single shared digital ledger, organisations face less clutter, and the trading clearing and settlement occur very quickly (Frizzo-Barker et al., 2020).

Ølnes et al. (2017) presented a comprehensive list of the potential benefits and promises of the BCT as shown in Table 2.1. They classified the benefits into four categories, namely, strategic, organisational, economical, informational, and technological.

Table 2. 1 Potential benefits and promises of BCT (Ølnes et al., 2017)

Category	Benefits and promises	Explanation
Strategic	Transparency	Democratizing access to data. The history of transactions remains visible, and every node has a complete overview of transactions.
	Avoiding fraud and manipulation	Hacks or unauthorized changes are difficult to make without being unnoticed, as information is stored in multiple ledgers that are distributed.
	Reducing corruption	Storage in distributed ledgers allows for preventing corruption. For example, by storing land ownership in a BT and having clear rules for changing ownership that cannot be manipulated.
Organisational	Increased trust	Trust in the process by increased control due to immutable recordkeeping and by verification of the data by multiple nodes.
	Transparency and audibility	Being able to track transaction history and create an audit trail. Also, by having multiple ledgers which can be accessed for consistency.

Category	Benefits and promises	Explanation
	Increase predictive capability	As history information can be traced back, this availability of historic information increased the predictive capability.
	Increased control	Increased control by needing consensus to add transactions.
	Clear ownerships	Governance needs clearly defined and how information can be changed.
Economical	Reduced costs	The costs of conducting and validating a transaction can be reduced as no human involvement is needed.
	Increased resilience to spam and DDOS attacks	Higher levels of resilience and security reduce the costs of measures to prevent attacks.
Informational	Data integrity and higher data quality	Information stored in a system corresponds to what is being represented in reality due to the need for consensus voting when transacting and distributed nature. This results in higher data quality.
	Reducing human errors	Automatic transactions and controls reduce the making of errors by humans.
	Access to information	Information is stored at multiple places which can enhance the ease the access and speed of access.
	Privacy	Users can be anonymous by providing encryption keys or access can be ensured to avoid others to view the information.

Category	Benefits and promises	Explanation
	Reliability	Data is stored in multiple places. Consensus mechanisms ensure that only information is changed when all relevant parties agree.
Technological	Resilience	Resilient to malicious behavior.
	Security	As data is stored in multiple databases using encryption manipulation is more difficult. Hacking them all at the same time is less likely.
	Persistency and irreversibility (immutable)	Once data has been written to a BC it is hard to change or delete it without notice. Furthermore, the same data is stored in multiple ledgers.
	Reduced energy consumption	Energy consumption of the network is reduced by increased efficiency and transaction mechanisms.

2.1.6 Challenges of blockchain technology

Despite the several benefits offered by the BCT, organisations still face many challenges and issues while they decide its adoption (Zheng et al., 2018).

2.1.6.1 Scalability

Scalability refers to the stability of a system when the number of users grows. in terms of BCT, scalability is the ability of a system to process the transactions when there are more nodes connected to the network. currently, most of the BCT networks handle transactions at a very low processing rate (Kaur & Gandhi, 2020). For example, Bitcoin can handle 3-7 transactions per second and takes on average 60 minutes to confirm the transaction. Similarly, Ethereum process 15-20 transactions per second, and its average confirmation time is 6 minutes. On the other hand, the majority of the traditional transaction processors have far better processing rates such as the Visa can handle 10,547 transactions per second (Shahriar Hazari & Mahmoud, 2020). The scalability is considered one of the big issues for the large-scale adoption of BCT (Conoscenti, Vetro, & De Martin, 2016).

2.1.6.2 Interoperability

Interoperability means the ability of different disparate BCT networks to perform tasks such as easy exchange of information, integration with the other existing systems, and initiation of transactions with other networks without the need for an intermediary (Perrons & Cosby, 2020). However, most of the recent BCT-based systems lack interoperability and are incapable to communicate with other peer networks. Technically, they can not send or receive data from each other. The major challenge in interoperability is each BCT network works with its own parameters e.g. consensus protocol, smart contract, hashing algorithm, and transaction processing rate (Lafourcade & Lombard-Platet, 2020). For example, Bitcoin works on a proof-of-work (PoW) protocol with a transaction processing speed of 3-7 transactions/second. On the other hand, Ethereum uses proof-of-stake (PoS) with a transaction speed of 15-25 transactions/second. Due to these technical differences, both Bitcoin and Ethereum work completely unconnected and lack interoperability. Although there are plenty of BCT projects in the market, all of them are siloed from each other (Akram, Malik, Singh, Anita, & Tanwar, 2020).

2.1.6.3 Privacy

It is believed that the data over a BCT network is safe and private as the users make transactions with a combination of public and private cryptographic keys instead of using their real identities. However, some researchers suggest that transactional privacy is compromised when the public key is visible to everyone within the BCT network (Henry, Herzberg, & Kate, 2018). Although the transactions remain anonymous in the BCT network, some recent studies claimed that the true identity of a user can be revealed by analyzing the transaction history (Smith & Khovratovich, 2016). Another scenario of privacy leakage in some BCT networks like Bitcoin is mapping the peers' pseudonyms with the IP addresses through the network translation method (NAT) (Biryukov & Pustogarov, 2015). Further, a user can also be identified by analyzing his connected set of nodes within the BCT network. This privacy vulnerability makes the use of BCT unviable for the organisations that store sensitive data and where privacy protection is the main concern (Mohanta, Jena, Panda, & Sobhanayak, 2019).

2.1.6.4 "51% attack"

Regardless, the value of the BCT platform is driven by its security, it is not free from the possible risks of security vulnerability and breaches. Although no instance of the hacking of the entire BCT network is reported, few private crypto exchanges and wallets are being hacked with the help of viruses and scams (Yli-Huumo, Ko, Choi, Park, & Smolander,

2016). Accessibility of data to everyone is also considered a security risk, however, the most possible technical threat to BCT reported in the literature is the "51% attack" (Shi, 2016). The BCT is assumed to be run and managed by the honest node, but there is still a possibility of gaining more collective control of computational power of the network by the dishonest nodes than the good ones, which is called hypothetically 51% Attack (Sayeed & Marco-Gisbert, 2019). However, this is a hypothetical and potential attack and no real incident of 51% attack has been reported (Mohanta et al., 2019).

2.1.6.5 Energy consumption

The consensus protocols, specifically proof of work (PoW) used in the BCT require a lot of computational power to solve complex mathematical puzzles for the validation of transactions. In doing this, a huge amount of electrical energy is consumed by the miners' computers. According to the International Energy Agency, the overall energy consumed by the Bitcoin network is higher than the energy usage of many countries (Sedlmeir, Buhl, Fridgen, & Keller, 2020). Although the other consensus protocols like proof-of-stake (PoS) consumed less energy than the PoW, energy consumption is still a big challenge for the organisational adoption of BCT (Nair, Gupta, Soni, Shukla, & Dhiman, 2020). Most of the energy in the BCT network is consumed during the mining process when each connected computer uses its resources to compete with the other computers over the network. High consumption of energy by the BCT network, particularly cryptocurrencies, brings many other challenges including the rise in CO2 gas emission that is harmful to our environment (Ghosh & Das, 2019).

2.1.6.6 Waste of storage

The data volume of a BCT network grows endlessly because a new block is added almost every 3-10 minutes, depending on the type of the consensus protocol. Due to the inherited architecture of the BCT, every participating node keeps the same copy of the entire ledger that not only requires high computational power, but also needs a vast amount of data storage (Zhao, Niu, Li, & Fan, 2019). In terms of Bitcoin, up to April 13, 2021, the entire ledger has a volume of 331.05 GB, and every 10 minutes a new block of 1MB is added (Statista, 2021a). Similarly, the Ethereum full chain data size is more than Terabyte. Every time a new block is added, it must be stored in the storage media e.g. hard drives of every connected user in the BCT network. At first glance, it seems good that everyone has the same copy of data and no cheating and fraud is possible, as time progress it becomes a challenging task to manage such a huge amount of data (Dai, Zhang, Wang,

& Jin, 2018). From an organisational perspective, such a data storage mechanism is not only a wastage of resources but also an expensive activity.

2.1.7 Adoption of blockchain technology

Similar to any IT innovation, the adoption of BCT can bring a significant change to an organisation's internal and external operations (Gunasekera & Valenzuela, 2020). This has led researchers mainly to investigate the adoption of BCT at the organisational level (Clohessy & Acton, 2019). While studying the adoption of BCT, most of the existing studies took the deterministic approach, which assumes that the adoption of technology is determined by a certain number of factors. For example, De Castro et al. (2020) investigated the adoption of BCT in the asset and wealth management industry in South Africa. They found that the relative advantages, computability, complexity, supportive technological environment, characteristics of the industry, and regulations are the main deterministic factors that influence the organisational adoption of BCT; Orji et al. (2020), Dobrovnik, Herold, Fürst, and Kummer (2018), Barnes III and Xiao (2019b), and Kühn, Jacob, and Schüller (2019) evaluated the factors that influence BCT adoption in the logistics industry. They identified the availability of specific BCT tools, infrastructural facilities, and government policy and support are the main significant factors in BCT adoption; L.-W. Wong, Tan, Lee, Ooi, and Sohal (2020), L.-W. Wong et al. (2019), Bai and Sarkis (2020), Kouhizadeh, Saberi, and Sarkis (2020), Ghode, Yadav, Jain, and Soni (2020), Kalaitzi, Jesus, and Campelos (2019a) investigated BCT adoption for the supply chain industry. They found relative advantages, complexity, upper management support, cost, market dynamics, competitive pressure, and regulatory support as the influencing factors; Clohessy and Acton (2019) found BCT awareness, top management support, and organisation size influence BCT adoption in Ireland. Loklindt, Moeller, and Kinra (2018), Mohammed, Potdar, and Yang (2019), Post, Smit, and Zoet (2018), Hoxha and Sadiku (2019), and Holotiuk and Moormann (2018) investigated BCT adoption for the different industries including shipping and land record management. They showed that easy verification of transactions, data accuracy and reliability, and cost reduction influence organisations to adopt BCT; Kulkarni and Patil (2020) and Koster and Borgman (2020) claimed that the firm scope, learning culture, top management, customer readiness, competitive pressure, and government policies influence BCT adoption in banking and public sector. Moreover, Albrecht et al. (2018) studied the post-decision stage of the BCT adoption. They found that market power, regulation, transaction speed, transparency, and

costs, confidentiality, and interoperability were the prominent factors that influence BCT implementation in the energy sector.

By reviewing the literature, it was noted that the factors influencing the organisational adoption of BCT can be grouped into technological, organisational, and environmental factors. Table 2.2 provides a summary of the factors reported in the extant literature.

Table 2. 2 Factors affecting the organisational adoption of BCT

Technology	Organisation	Environment	Context	Source
Perceived novelty, complexity, cost, and disintermediation	Top management support, top management knowledge	Government support, customer pressure, trading partner readiness, and consensus among trading partners	Australia	(M. S. Malik, Chadhar, & Chetty, 2021)
Relative advantages, Computability, Complexity	Supportive technological environment	characteristics of industry, regulations	Wealth Management Industry in South Africa	(De Castro et al., 2020)
Availability of specific BCT tool, Infrastructural facility, complexity, ease of being tried and observed, perceived benefits, compatibility, security, and privacy	Presence of training facilities, top management support, firm size, capability of human resources, perceived costs of investment, organisational culture	Government policy and support, competitive pressure, institutional-based trust, market turbulence, stakeholders' pressure	Freight logistics industry	(Orji et al., 2020)
cost, efficiency, trust	Awareness	-	-	(Mohammed et al., 2019)

Technology	Organisation	Environment	Context	Source
Increase of data availability, reduction of information, asymmetry, easy verification of transactions, comprehensibility of the transaction, data accuracy and reliability, data inalterability, exclusion of false information from contractual information, hacking attempts system denials, high-security encryption, cost reduction through the exclusion of intermediaries, contract conclusion with A reasonable fee, cost reduction due to process efficiency	-	-	Real estate industry in Kosovo	(Hoxha & Sadiku, 2019)
transactions speed, transparency, transactions costs, integrity, confidentiality, availability, interoperability	-	Market power, regulation,	Energy sector	(Albrecht et al., 2018)
-	Top management support, organisation size	-	Ireland	(Clohessy & Acton, 2019)
Relative advantages, complexity, cost	Upper management support	Market dynamics, competitive pressure, and regulatory support	Supply chain industry in Malaysia	(L.-W. Wong et al., 2019)

Technology	Organisation	Environment	Context	Source
Technology	Organisation, people	-	-	(Holotiuk & Moormann, 2018)
Compatibility, cost, relative advantage, security	Firm scope, learning culture, top management	Customer readiness, competitive pressure, government policies	Banking services	(Kulkarni & Patil, 2020)
Blockchain characteristics	Existing infrastructure, awareness, organisation culture, financial resources, IT governance, High need for process harmonization	Customer pressure, competitive pressure, partner pressure, legal uncertainties, technology progress in the industry	Supply chain	(Kühn et al., 2019)
Relative advantage, perceived challenges, compatibility	Firm size, top management support, existing technical skills	Competitive pressure, trading partner pressure, regulatory environment, and customer pressure	Food supply chain	(Kalaitzi et al., 2019a)
Hype, trust	Top management support	regulations	Public sector	(Koster & Borgman, 2020)
Prompt and speedy payment, reduction in transaction costs, scalability, storage capacity	-	Regulation	Grains trade	(Gunasekera & Valenzuela, 2020)
Relative advantage, compatibility, complexity, trialability, observability	-	-	Logistics	(Dobrovnik et al., 2018)

Technology	Organisation	Environment	Context	Source
immutability, decentralization, Security, Privacy, compatibility, scalability, inclusiveness, and territoriality	-	-	Shipping industry	(Loklindt et al., 2018)
complexity, maturity, compatibility, scalability, security and privacy concerns, cost	Technology awareness, technical knowledge and expertise, perceived risk of vendor lock-in, perceived efforts in collaboration	Perceived constraint of government supports, perceived constraint of poor regulations, perceived constraint of infrastructure	Supply networks	(Choi, Chung, Seyha, & Young, 2020)
Perceived benefits, compatibility, complexity	Organisation innovativeness, organisation learning capability, top management support	Competitive pressure, government support, trading partner readiness, standards uncertainty	Australia	(S. Malik, Chadhar, Chetty, & Vatanasakdakul, 2020)
-	Sufficient capital, staff training, support from the senior management	Ease of local legislation, support from the shipping community, professional consultation and assistance	Maritime industry, Singapore	(Zhou, Soh, Loh, & Yuen, 2020)
Complexity, ease of use, lack of interoperability & standardization, lack of scalability and system speed	Huge resource (energy, infrastructure), initial capital requirement	Lack of government regulation, lack of trust among agro-stakeholder	Agriulture industry, India	(Yadav, Singh, Raut, & Govindarajan, 2020)

2.2 Gaps in the literature on BCT adoption

The review of the literature suggests that past studies mainly focus the BCT adoption in the context of industry e.g., logistics, supply chain, banking, shipping, or the country e.g. South Africa, Kosovo, Ireland, Malaysia, and Germany. The studies have asserted that the adoption of a new technology emerges differently in different contexts because every industry per se and the way BCT is implemented in the industry are different. For example, the business processes in the supply chain industry are not the same as land record management; the purpose of applying BCT in the supply chain is different from that of land record management. A careful analysis of the literature reveals that most of the BCT adoption research has been conducted in non-Oceania countries and there is very little research in the Oceania region, particularly in Australia. Since the countries differ from each other due to their contextual and demographic characteristics like GDP, union density, trade laws, and gender, the factors motivating or hindering technology adoption in one county may not be influential in another country. This provides rationale and justification to research organisational adoption of BCT in the Australian context.

The past studies on BCT adoption show inconsistent results for the relationship between the influencing factors and BCT adoption. For example, Clohessy and Acton (2019) and Orji et al. (2020) found top management support as a critical factor for the organisational BCT. Whereas, L.-W. Wong et al. (2019) reported the insignificant effect of upper management support on BCT adoption. Similarly, De Castro et al. (2020) reported government regulations positive toward the organisational adoption of BCT, whereas, Albrecht et al. (2018) stated that government regulations prevent BCT adoption. However, regardless of the inconsistent results, the past studies only focus on a linear relationship between the influencing factors and BCT adoption and ignore the impact of any intervening variable causing that inconsistency. According to Baron and Kenny (1986), the inconsistent relationship between a predictor and the criterion variable is caused by a hidden factor (s), which is scarce in the existing studies on BCT adoption. This suggests the inclusion of a moderator while studying the organisational adoption of BCT in the Australian context.

2.3 Theoretical Foundation

This thesis uses the Technology-Organisation-Environment (TOE) framework as a theoretical lens. The framework is widely used to study the organisational adoption of different technologies. Figure 2.5 depicts the technology, organisation, and environmental contexts of the original TOE framework. Every context consists of different factors that influence an organisation's decision to adopt a technology.

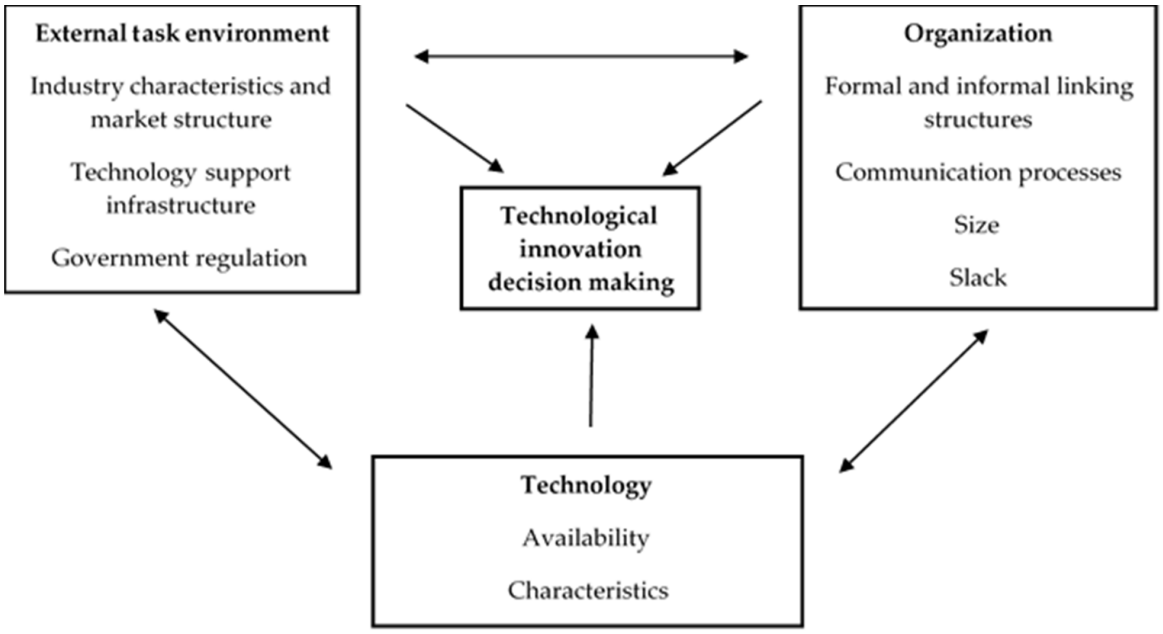

Figure 2. 5 The TOE framework

The research paper, “An Exploratory Study of the Adoption of Blockchain Technology Among Australian Organisations: A Theoretical Model” on the next page explains the TOE framework in more detail. The paper also explains the rationale for using the framework in this research. This paper was accepted in a peer-reviewed conference, “European Mediterranean & Middle Eastern Conference on Information Systems” that was held in 2020. The paper can be accessed via the following link.

https://link.springer.com/chapter/10.1007/978-3-030-63396-7_14

An Exploratory Study of the Adoption of Blockchain Technology Among Australian Organizations: A Theoretical Model

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Abstract. Scholarly and commercial literature indicates several applications of Blockchain Technology (BCT) in different industries e.g. health, finance, supply chain, government, and energy. Despite abundant benefits reported and growing prominence, BCT has been facing various challenges across the globe, including low adoption by organizations. There is a dearth of studies that examined the organizational adoption of blockchain technology, particularly in Australia. This lack of uptake provides the rationale to initiate this research to identify the factors influencing the Australian organizations to adopt BCT. To achieve this, we conducted a qualitative study based on the Technology, Organization, Environment (TOE) framework. The study proposes a theoretical model grounded on the findings of semi-structured interviews of blockchain experts in Australia. The proposed model shows that the organizational adoption of blockchain is influenced by perceived benefits, compatibility, and complexity, organization innovativeness, organizational learning capability, competitive intensity, government support, trading partner readiness, and standards uncertainty.

Keywords: Blockchain · Theoretical · Adoption · TOE · Australia

1 Introduction

Blockchain (BCT), widely known for Bitcoin and other cryptocurrencies, is a technology that works as a platform for decentralized transactions and data management. Transaction systems such as those found in banks are centralized, while the BCT is a decentralized system that provides secure, immutable, and timestamped data transmission over a peer to peer network without the involvement of any controlling intermediary [1]. BCT provides solutions to overcome many issues in today's digital business world, for example, lack of trusted partnership, security breaches, cybercrimes, and frauds, which are the main hurdles in flourishing the digital industries. BCT paves the path for a paradigm shift from central control to distributed and decentralized authority by decomposing the governance structure and thus enables better decision

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making [2]. There are several benefits of BCT reported for different industries such as finance, healthcare, supply chains, government, and energy [3, 4]. The BCT has also been contributing to the global trade volume [5, 6] and has the potential to revolutionize the world [7]. Google reported BCT among its top trends [8]. The Gartner, Forbes, Economist, and Fortune have also included BCT in its megatrends. Various global leading organizations, for example, IBM, Walmart, Microsoft have been finding ways to utilize BCT to enhance their business process and value [6, 9]. Despite all this, the review of scholarly and commercial literature reveals that blockchain is not adopted heavily by organizations all over the globe, and there exists a research gap to find the rationale for its low adoption [10–14]. This gap motivated us to investigate the factors that influence the adoption of BCT, particularly in Australia.

1.1 Why Did We Choose Australia?

Australia has been working with BCT for a long time and has highly invested to find ways to utilize BCT to offer e-services. One of its research agencies, CSIRO's Data61, has been developing national blockchain through which the Australian government has plans to integrate its different departments to coordinate and share their data. [15, 16]. The Australian government has recently started a BCT pilot project for trading water rights [17]. Recently it has developed a roadmap for BCT adoption. According to this roadmap, "the Australian government has provided support and funding for the government, private sector, and researchers, to foster innovation and collaboration around blockchain, through programs such as Austrade business missions to international markets; the Entrepreneur's Programme; Australian Research Council Grants; and Business Research and Innovation Initiative pilots" [18].

There is great support for BCT at the private level. Blockchain Australia, formerly known as the Australian Digital Commerce Association (ADCA), has actively been promoting the adoption of BCT among Australian organizations [19].

The Economist Intelligence Unit (EIU), a world reliable body, ranked Australia first in its technology readiness index [20], indicating that it has all the required infrastructure to embrace new technology like BCT. However, having all this support from the government and private sector, the Australian organizations have not adopted BCT heavily [21–23]. In other words, there is a definite need to address the key research question:

"What are the factors that influence the adoption of BCT among Australian organizations?"

The rest of the paper is as follows. Section 2 reports the literature review. Section 3 explains the theoretical foundations. Section 4 demonstrates the research methodology of this paper. Divided further into three subsections, the Sect. 5 elaborates the proposed research model and the impact of factors related to technological, organizational, and environmental contexts of the TOE framework. Section 6 concludes the paper, reports theoretical and practical contributions, and mentions the limitations of the research.

2 Literature Review

Most of the studies that explored BCT adoption are either conceptual or address the issue from an individual perspective and lack empirical evidence. For example, Streng [24], Duy, Hien [25], Parino, Beiró [26], and Batubara, Ubacht [27] proposed BCT use cases for organizations and governments. Kokina, Mancha [28] presented an overview of the BCT practices adopted by different accounting firms. A similar study was conducted by Taufiq, Hidayanto [29]. Wang, Chen [30] proposed a maturity model. However, their model is not derived from empirical evidence. Kamble, Gunasekaran [31] investigated factors influencing individuals to BCT adoption in the supply chain industry. Supranee and Rotchanakitumnuai [32] conducted a similar study in the Thai automotive industry. Another conceptual study in the supply chain was conducted by Kshetri and Loukoianova [33]. Few studies that investigated BCT adoption from an organizational perspective include: Holotiuk and Moormann [34] investigated the factors influencing organizational adoption of BCT in the finance industry of Germany. However, they did not include BCT-specific aspects and developed a general framework, based on the existing knowledge of adoption. Wong, Leong [10] conducted a similar study for the adoption of BCT among Malaysian SMEs in the supply chain business. Clohessy and Acton [35] explored the impact of top management support, organization size, and organizational readiness on the adoption of BCT in Ireland. Their study is limited to three selective factors only. Albrecht, Reichert [36] investigated the implementation of BCT in the energy sector. However, they do not provide any information about how the factors mentioned in their study influence the organizations to adopt BCT.

From the above literature review, it has become apparent that there exists no study that explores the factors influencing BCT adoption among Australian organizations.

3 Theoretical Foundations

The present study uses a theoretical lens approach suggested by Creswell and Creswell [37] and Strauss and Corbin [38]. They recommend the use of this approach when the phenomenon under investigation is unknown and unarticulated, and literature is scarce on the topic. This is very relevant to the adoption of BCT in Australia. The theoretical lens approach requires using a well-established theory as a starting point for further investigation of the phenomenon, but the researchers are encouraged to go beyond and do not confined with the starting theory only. They should be open to accepting any of the new findings coming out of the whole inquiry process. This approach, also known as theory elaboration [39], helps researchers to extract new insights that further extend the theory. This approach helps to shape the type of questions being asked, provides directions on how to collect and analyze the data, and gives information about the issues. Many of the past studies have utilized this approach to investigate the adoption of different technologies e.g. e-commerce [40], ICT [41], and business analytics [42].

To find an appropriate theory for exploring BCT adoption, we conducted an extensive literature review and observe that the adoption of technology occurs either at the individual level or at the organizational level. For the individual level adoption,

researchers use various theories and models including the Theory of Reasoned Action (TRA), the Theory of Planned Behaviour (TBA), the Technology Acceptance Model (TAM), and Unified Theory of Acceptance and Use of Technology (UTAUT) enlisted in [43, 44]. The organizational level theories include the Technology-Organizational-Environment (TOE) framework [45], Diffusion of Innovation (DoI) [46], and the Institutional Theory [47].

The institutional theory emphasizes the role of the inter-organizational relationship in the organizational decision to adopt new technology; the DoI theory demonstrates that technology adoption is a linear process and the organizational decision to adopt new technology is influenced by the technological and organizational characteristics; the TOE framework states that the organizational decision to adopt new technology is influenced by the three contextual factors, namely, technology, organization, and environment. Compared to the other organizational theories, the TOE framework provides a better foundation to explain the organizational adoption of new technology because it overcomes or supplements the shortcomings of those theories [48]. Most of the organizational theories are considered as a variant of the TOE framework that further divide or extend dimensions of the TOE framework [49]. For example, the TOE framework comprises the technological and organizational contexts, which are part of the DoI theory. In addition, it contains the inter-organizational aspect of the Institutional Theory into its "Environment Context". Due to the robustness and comprehensiveness, many researchers used the TOE framework to explore the adoption of different technologies such as ERP [50], IoT [51], e-business [52]. Oliveira and Martins [48] and Baker [53] provided a review of the studies that utilized the TOE framework to examine the adoption technologies e.g. EDI, Open Systems, and RFID, etc. These empirical pieces of evidence provided us the rationale to select the TOE framework as a starting point to explore the factors influencing the adoption of BCT among Australian organizations.

4 Research Methodology

The study uses a qualitative research approach by conducted the semi-structured interviews of BCT experts and decision-makers working with different organizations in Australia. Considering the novelty of BCT and scarcity of literature on the organizational adoption of BCT among Australian organizations, we find qualitative research very appropriate to find the answer of the research question, as advised by Yin [54]. Soja, Themistocleous [55] suggests to carry out this kind of research by conducting the interviews of 'experts' in the subjects. We employed semi-structured interviews because of they provide flexibility and power to extract rich insights, identifying, and understanding viewpoints, making clarifications, and collecting supplementary information [54]. The interviewees for this study were selected very carefully based on the following predefined qualifying criteria: (1) they should be expert of BCT and have a minimum of three-five years of knowledge/experience, and (2) they should be working as decision-making position such as CEO, CTO etc. with organizations, which had adopted BCT or in the process of BCT adoption. We reached the potential participants through using multiple online platforms such as LinkedIn, Google, BCT related groups

on Facebook, and snowball sampling methods. We also used our professional network. Although, the interviews were the main source of the primary data collection, however, the findings of this study were strengthened with the secondary data that were either provided by the participants or were collected through different online sources including websites of participants' organizations, government reports, white papers, literature. This triangulation of data enhances the reliability and validity of the findings [54]. We kept continuing to conduct interviews until the data saturation arrived i.e. new insight stopped coming out from the interviews. We conducted 23 online interviews. Every interview: lasted 30–60 min; recorded with the consent of the interviewees; conducted by a team of two persons, authors of this research who having extensive BCT knowledge, to remove intrinsic biases; transcribed and analyzed after its completion. After every interview, the participants were requested to confirm the major findings of the interview. later, they were provided a transcribed copy of the interview. An interview guide was prepared to ask specific questions. The guide comprised the interview questions that were mainly derived from the TOE framework. However, the participants were encouraged to report any of the factors pertinent to the organizational adoption of BCT in Australia. Organization-specific questions were also included in the interview guide. Table 1 shows the details of the participants and their organizations.

Table 1. Summary of the participants and organizations

Organizations	Participants	Interviews
IT	CEOs, Founders, Software Engineer, System Analyst, CTO, Project Manager	8
Finance	CEO, Founder, CTO	3
Travel	CEO, Technical Analyst	2
Education	Director	1
Government	Senior Computer Forensics Officer	1
Consulting	CEOs, Project Manager, Solution Architect	4
Legal	CEOs, Director	4
Total		23

We followed the guidelines of Strauss and Corbin [38] for the analysis of interview data using QSR NVivo tool. We performed multiple iterations of data analysis to extract relevant and valid findings. The underlying concepts were drawn by examining the transcribed interviews line-by-line. The identified concepts were grouped into different categories based on their similarity and differences. Finally, the categories were mapped with the TOE framework.

5 Proposed Theoretical Model

Based on the findings derived from the interview data, the study proposes a theoretical model (Fig. 1) that describes the factors affecting the organizational adoption of BCT in Australia. The model shows that the organizational adoption of BCT is influenced by the technological context, organizational contexts, and the environmental context. The technology context includes perceived benefits, perceived compatibility, and perceived complexity; organizational context consists of organization innovativeness, organizational learning capability, and top management support; environmental context contains competition intensity, government support, trading partner readiness, and standards uncertainty.

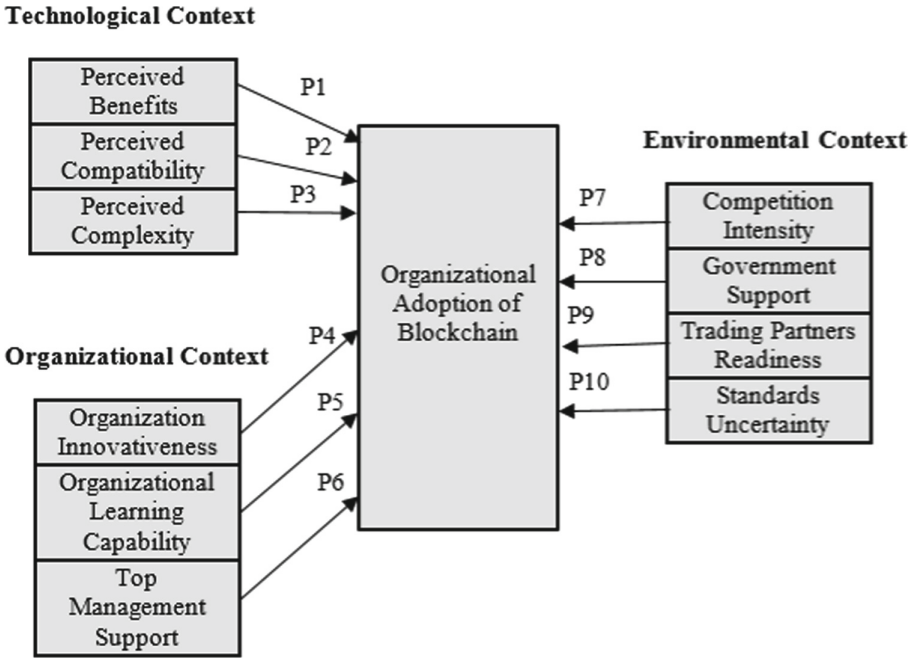

Fig. 1. Proposed theoretical model for the organizational adoption of BCT

The following sub-sections further explain the relationship of the TOE factors with the organizational adoption of BCT.

5.1 Technology Context

Perceived Benefits. Perceived benefits refer to the degree to which an organization perceives benefits from the use of technology. Many of the past studies consistently reported the positive influence of perceived benefits of different new technologies on their adoption among organizations. For example, Chwelos, Benbasat [56] and [57–59]

studied the impact of perceived benefits on EDI, SCM, and B2B-commerce. AlBar and Hoque [60] reported a positive role of ERP advantages on its adoption. Barnes III and Xiao [61] say that an organization adopts BCT when it perceives that BCT will bring improvements to its business. Wong, Leong [10] says that organizations adopt BCT when they expect increased transparency and security in their business. Many benefits of using BCT are reported in the recent IS literature, for instance, transparency among transactions, improved accountability, fraud reduction, security, auditability, and traceability [62]. Therefore, we propose that:

P1. *The more benefits of BCT are perceived, the more likely an organization will adopt BCT.*

Perceived Compatibility. Perceived compatibility of technology refers to the perception of an organization towards its suitability with its values and technological infrastructure. It is considered an important factor for the adoption of new technology. If technology is more compatible with the existing needs of an organization, it has more likelihood of being adopted [63]. Kühn, Jacob [64] state that if BCT is not compatible with the organization's IT infrastructure, there are fewer chances of its adoption. Sadhya and Sadhya [65] state that the adoption of BCT requires organizations to procure or develop BCT related solutions that interoperate with their present legacy systems or transform their existing systems to be BCT compatible. They further mentioned that the use of BCT requires the consumption of extra energy, extra storage capacity, and skilled professional. Therefore, an organization, willing to adopt BCT, should make its existing infrastructure compatible with the aforementioned requirements of BCT. If BCT is not fit with the existing business processes, organizations will be unwilling to adopt [66]. We put forward the following proposition:

P2. *The more compatibility of BCT with the existing system is perceived, the more likely an organization will adopt BCT.*

Perceived Complexity. Perceived complexity refers to the degree to which organizations perceive technology is difficult in using and understanding. The adoption of technology is affected by the extent of simplicity or difficulty of using a particular technology [67]. If more complex a technology appears, organizations are unlikely to adopt it. For instance, Huang, Janz [57] found that the complexity of EDI negatively influenced organizations' intention to adopt I-EDI technology. The perceived complexity of technology makes organizations anxious about whether their employees would be able to understand and use a particular technology. Since the BCT appears analogous to inter-organizational systems like EDI, the past studies report the similar impact of perceived complexity on BCT adoption among organizations. Wong, Leong [10] found that the technical complexity of BCT was a challenge to Malaysian organizations to understand that adversely affected their decision to the adoption of BCT. The use of BCT requires public and private keys, hashing of blocks, and obscure addresses etc., which are considered complex processes by organizations [65]. Clohessy and Acton [35] reported the perceived complexity of BCT a barrier that negatively affects the organizational adoption of BCT. This leads to proposing the following:

P3. *The more complex BCT is perceived, the less likely an organization will adopt BCT.*

5.2 Organizational Context

Organizational Innovativeness. Innovativeness refers to the willingness and ability of an organization to adopt new technology for continuous improvement in its services [68]. Thong and Yap [69] relate organizational innovativeness to the management's acceptance of new ideas and technology. Newby, Nguyen [70] state that the innovativeness of an organization plays a significant role in its decision to adopt an innovation. In the case of BCT, we noted the organization that adopted it has a culture of openness to new ideas as stated by Venkatesh and Bala [71]. They further indicate that if there is a culture of innovativeness, an organization is more likely to adopt the inter-organizational system. Since BCT is an inter-organizational system, hence, we can hypothesize that:

P4. The more *innovative an organization is, the more likely it will adopt BCT.*

Organizational Learning Capability. Organizational Learning Capability (OLC) refers to an organization's ability to acquire new knowledge from its internal and external environment, and then store, disseminate, and implement that knowledge into its business decisions [72]. Organizational learning and information technology supplement each other [73]. Woiceshyn [74] states that the adoption of new technology depends on the capability of an organization to learn. Organizational learning provides an environment wherein organizations create new ideas, new knowledge is shared and applied that consequently leads to the adoption of an innovation [75] and Berta, Teare [76]. Takian, Sheikh [77] and [78] report the enabling role of organizational learning in the adoption of HER and ERP systems. Svetlik, Stavrou-Costea [79] demonstrates that OLC comes through the experimentation, risk-taking that is closely related to BCT. Kulkarni and Patil [80] state that the learning culture of an organization significantly influences the adoption of BCT. Therefore, we propose that:

P5. *The more capable an organization to learn, the more likely it will adopt BCT.*

Top Management Support. Top management is considered essential to the adoption of new technology. Haneem, Kama [81] show an influential role in the adoption of Master Data Management System adoption among Malaysian organizations. Koster and Borgman [82] indicate how management support positively influences the adoption of BCT in the Netherland. Similar results of the leadership support in organizational adoption of big data, ERP systems were found by [83, 84]. Hughes, Park [85] report that if the management is not supportive, BCT adoption within an organization is not possible. This is further supported by Houston, Acton [86] and Clohessy, Acton [87] regarding BCT adoption in Ireland. One of our interviewees reported, "*our organization adopted BCT because our management was very supportive and actively involved BCT related activities*". Based on this piece of evidence, we propose that:

P6. *The more support top management provides, the more likely an organization will adopt BCT.*

5.3 Environment Context

Competition Intensity. Competition intensity (also called competitive or external pressure) refers to the degree that an organization feels pressure from its competitors in the market [88]. It forces organizations to adopt new technology quickly to perform their business better and gain a competitive advantage over their competitors. Sun, Cegielski [89] showed a significant role of competitive pressure in the organizational adoption of big data technologies. Zhu, Kraemer [90] mentions that technologies like BCT that provide information transparency and operational efficiency help organizations to maintain a competitive edge. Therefore, organizations tend to adopt those technologies. Competition intensity has long been recognized in the past studies on the adoption of inter-organizational systems like BCT, e-business, and EDI as an important driver [91, 92]. Wong, Leong [10] showed that competitive pressure played an important role in the adoption of BCT among Malaysian organizations. Barnes III and Xiao [61] postulated that when a business invests in BCT, competitors might follow suit and adopt BCT to maintain their competitive position. Kulkarni and Patil [80] reported competition intensity as a strong positive factor in the adoption of BCT among Indian organizations. Therefore, it is reasonable to propose:

P7. *The greater the intensity of competition, the more likely an organization will adopt BCT.*

Government Support. Government support is considered a major driving force in the organizational adoption of new technology [93]. Governments develop policies, regulations, and set up facilities that encourage organizations to adopt new technology. Lack of government regulations about new technology like BCT impedes organizations to adopt it [94]. Mills and Newbold [95] showed the positive influence of government support in the adoption of HER technology. Chong, Man [96] and Ilin, Ivetić [97] reported that the organizational adoption of big data technologies and ERP systems is not possible without the support of the government. Government positive and legitimate environment for new technology persuade organizations to its adoption. Koster and Borgman [82] state that government support speeds up the adoption of BCT among organizations. Some other studies [10, 80] have also reported government support a significant indicator for the successful adoption of BCT. This leads to propose:

P8. *The more support government provides, the more likely an organization will adopt BCT.*

Trading Partner Readiness. BCT, similar to any inter-organizational system like EDI requires strong collaboration and interaction among the trading partners [98]. The value of such inter-organizational systems is achieved at its fullest when all the trading partners have adopted it [91]. An organization alone can not decide the adoption of an inter-organizational system until its trading partners are financially and technologically

ready for it [91]. Chang and Chen [99] states that the actions of an organization to adopt an inter-organizational system are dependent on the actions of its trading partners. Many studies have reported that trading partners play an important role in the adoption of inter-organizational systems, for instance, EDI, SCM, and e-commerce [100–102]. Since every organization has a different level of its financial resources and IT skills, therefore, when an organization is motivated to adopt an inter-organizational system can not adopt it due to the un-readiness of its trading partners [56]. Zhu, Kraemer [103] reports that a lack of trading partner readiness significantly inhabits organizations to adopt an inter-organizational system. Kühn, Jacob [64] state that an organization adopts BCT when its trading partners are ready to share their data over the BCT network. Hence, considering the positive impact of trading partner readiness on the organizational adoption of inter-organizational systems like BCT, we propose that:

P9. *The more technically and financially trading partners are ready, the more likely an organization will adopt BCT.*

Standards Uncertainty. Standards uncertainty has a substantial impact on the adoption of new technology like BCT because organizations feel reluctant to adopt a technology for which there exist no established standards in the market [71]. Organizations feel confident to adopt new technology when standards related to that technology become de-facto standards in the market [104]. To be compliant with the standards specification, organizations require substantial changes in their business processes. Standards uncertainty obstruct organizations to accurately predict whether the standards associated with new technology would become stable overtime or not. Venkatesh and Bala [71] state that the technologies that are still evolving significantly like BCT and their use vary from industry to industry; it is hard to estimate the certainty pertinent to their relevant standards. Consequently, it creates fear, among organizations, of losing investments due to adopting an uncertain technology. In the case of BCT, there are no clear standards regarding data privacy, funds transfer, smart contracts that impede organizations to its adoptions. Kühn, Jacob [64] found that standards uncertainty prohibit organizations to adopt BCT. This is further supported by Clohessy and Acton [35]. Sadhya and Sadhya [65] reports standards uncertainty a barrier inhibiting large-scale adoption of BCT. They further state that industry standards increase network effects that ultimately result in speedy adoption of BCT among organizations. These perspectives lead to the following proposition:

P10. *The more uncertainty of BCT standards, the less likely an organization will adopt BCT.*

6 Discussion and Conclusion

The study explores the factors affecting the adoption of BCT among Australian organizations and proposes a theoretical model. To achieve this, we employ a qualitative approach by using the theoretical lens of the TOE framework and conduct interviews of BCT experts and the decision-makers working with the organizations that

had adopted BCT or in the process of adopting BCT. The proposed model conceptualizes and articulates all the relevant factors, which influence the adoption of BCT by organizations in Australia. The model shows that the adoption of BCT is influenced by the technological context (perceived benefits, compatibility, and complexity), organizational context (organization innovativeness, organizational learning capability, top management support), and environmental context (competition intensity, government support, trading partners readiness, and standards uncertainty) of an organization. The model validates the findings of the past studies, reports some new insights, and contributes to the existing body of knowledge both theoretically and practically.

From the theoretical perspective, the study extends the TOE framework by adding the BCT-related variables into its three main contexts from an Australian perspective. The theory-driven and data grounded model reported in this study describes the factors; most of them, for example, organization innovativeness, organization learning capability, trading partner readiness, and standards uncertainty, which were not reported in the prior studies of BCT adoption. Most of the past research on IT adoption used the TOE framework quantitatively; this study validates the TOE framework qualitatively. From the practical perspective, the model would help not only the Australian government and the organizations to address issues pertinent to the adoption of BCT in Australia. It would also provide guidelines to the multinational organizations, willing to expand their BCT products and services in Australia, to understand the adoption of BCT in Australia. The model would also provide valuable insights to the organizations when they decide to supplement their existing technologies with the BCT. The marketing and consulting firms could use the proposed model to understand the factors, which are important to reaching their audiences more efficiently. Although the research model is developed for identifying the factors in BCT adoption by the organizations in Australia, the model can be applied in BCT adoption in other countries having similar characteristics to Australia like New Zealand.

Despite the above-mentioned theoretical and practical contributions, the study has some limitations that create opportunities for future research. First, the proposed model is derived from the interviews of a small number of experts. Second, the study focuses on the Australian perspective only. In the future, a quantitative study will be conducted with a larger sample size to validate the proposed model and increase its external validity.

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2.4 Summary

This chapter provides a comprehensive evaluation of the relevant literature relating to BCT. It mainly focuses on blockchain technology, its types, characteristics, and how it works; potential benefits and promises and challenges associated with blockchain; application of blockchain technology; gaps in the existing literature on the organisational adoption of BCT. The chapter also discusses the theoretical foundation of this research.

Chapter 3: Research Methodology

3.1 Research paradigm

A research paradigm refers to assumptions or beliefs to understand and solve a problem (Denzin & Lincoln, 2008). According to Kuhn (1970, p. 175), a paradigm is "a set of beliefs, values and techniques which is shared by members of a scientific community, and which acts as a guide or map, dictating the kinds of problems scientists should address and the types of explanations that are acceptable to them". There are three main mutually dependent components, namely, ontology, epistemology, and methodology of a research paradigm (Crotty & Crotty, 1998; Guba & Lincoln, 1994; Healy & Perry, 2000; R. B. Johnson & Onwuegbuzie, 2004; Lincoln, Lynham, & Guba, 2011). Ontology refers to the existence of reality in the social world. Epistemology refers to the nature of knowledge, and methodology refers to how knowledge about social reality is acquired (Sale, Lohfeld, & Brazil, 2002; Shah & Corley, 2006). Thus, ontology and epistemology define the selection of research methodology.

From an ontology and epistemology perspective, a research paradigm is classified into interpretivism/constructivism, positivism, and post-positivism (Guba & Lincoln, 1994; Healy & Perry, 2000; Parkhe, 1993). An interpretive paradigm allows the researcher to conduct an inquiry in a naturalistic way. In this paradigm, qualitative data from research participants is collected in its social context, and the research findings are interpreted through a theoretical lens (Creswell & Clark, 2017). Therefore, a research design in an interpretive paradigm depends on a priori theory. A positivism paradigm is based on an objective, numerical research design, and the quantitative data is collected and analyzed through formal statistical methods. Contrary to interpretivism, the positivism paradigm uses accurate and structured techniques to conduct an inquiry and does not consider the social context wherein the research is conducted. Further, the positivistic approach requires hypotheses based on prior research on an issue. The selection of a correct paradigm for a study is essential when seeking possible answers to a specific research question (Bryman, 2016). A proper research paradigm allows the researcher to ensure the trustworthiness of research findings. In this research, it was established that no previous similar research on the organisational adoption of BCT had been conducted in the context of Australia.

Therefore, it was decided to use a combination of interpretivism and positivism paradigms resulting in a mixture of qualitative and quantitative methodology. The qualitative methodology is considered appropriate when limited prior research on the issue under investigation has been done. Therefore, this methodology was used in the first phase. The quantitative methodology was used in the second phase to confirm the findings of phase one with larger sample size.

3.2 Research design

A research design helps researchers to collect, analyze and interpret the data about an issue under investigation and make relevant and appropriate conclusions (Churchill & Iacobucci, 2006; Zikmund, Carr, & Griffin, 2013). This study used a mixed-methods research design known as exploratory sequential mixed methods design. This research design starts with a qualitative phase as an initial phase followed by a quantitative phase (Creswell & Clark, 2017; Venkatesh, Brown, & Sullivan, 2016). The qualitative step is an exploratory stage to identify the current status of the problem under investigation. In-depth interviews are the most commonly used technique for primary data collection in this method, whereas secondary data is collected from journals, websites, books, reports, and newspapers (Hox & Boeije, 2005).

On the other hand, the quantitative phase is the confirmatory stage, where the findings drawn from the qualitative phase are confirmed. Primarily, surveys are used for the data collection in quantitative research (Sekaran & Bougie, 2016). Given the lack of research on BCT adoption in the Australian context, there is a need first to explore how the relevant organisations interpret the phenomenon and then confirm those interpretations for a larger population to generalize the findings. Venkatesh et al. (2016) stated that the mixed-method design can address exploration and confirmation research questions. They asserted that the mixed-methods design provides more robust inferences, which is not possible with a single method. This is further supported by R. B. Johnson and Onwuegbuzie (2004). They alluded that when both the qualitative and quantitative approaches are combined, they produce complete knowledge about the phenomenon under consideration. Therefore, a mix-methods design was found more suitable for our study.

3.3 Phase 1: Qualitative

The methodology for the qualitative phase is explained in the below research paper, "Factors Affecting the Organisational Adoption of Blockchain Technology: An Australian Perspective". This paper was accepted in the Core "A" ranked peer-reviewed conference "Hawaii International Conference on System Sciences" that was held in 2020. The paper can be accessed via the following link.

https://scholarspace.manoa.hawaii.edu/items/fc3a02ce-7379-4e70-a16b-fa56e097a447

Factors Affecting the Organizational Adoption of Blockchain Technology: An Australian Perspective

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Abstract

Blockchain Technology (BCT) is a novel innovation that has the potential to transform industries, for instance, supply chain, energy, finance, and healthcare. However, despite the potential and the wide range of benefits reported, organizational adoption of BCT is low in several countries including Australia. Some studies investigated the adoption of BCT in different countries, however, there is a lack of research that examines the organizational adoption of BCT in Australia. This study fills this gap by exploring the factors, which influence BCT adoption among Australian organizations. To achieve this, we used an interpretative qualitative research approach based on the Technology, Organization, and Environment (TOE) framework and the Institutional Theory. The findings show that organizational adoption of BCT in Australia is influenced by perceived novelty, complexity, cost, and disintermediation feature of BCT; top management knowledge and support; government support, customer pressure, trading partner readiness, and consensus among trading partners.

1. Introduction

Blockchain Technology (BCT) is a digital ledger that manages data over a distributed, decentralized, and peer-peer network through smart contracts without the need of any intermediary [1]. Every node over the BCT network has the same copy of data, and any change in the data is made through a mutual consensus among the nodes. The transactions over the BCT network are timestamped, immutable, and back traceable. Therefore, BCT offers better transparency, fraud detection, improved security, data provenance, and authenticity in businesses. Initially, the BCT was designed for cryptocurrencies like Bitcoin. However, recently multiple uses of BCT are proposed in finance, healthcare, supply chains, energy, and many other sectors [2]. BCT has significantly contributed to the global trade volume [3, 4]. For many years, BCT has been in Google's top trends. Gartner, Forbes, the Economist, and Fortune also reported BCT among its top megatrends. Big companies like IBM, Walmart, and Microsoft explored possible uses of BCT for their businesses [3, 5]. Despite all this, the review of scholarly and commercial literature reveals that BCT has not reached its heavy adoption among organizations all over the globe [6-10]. This lack of uptake of BCT by organizations necessitates us to investigate the rationale for its low adoption among Australian organizations. The following section provides a review of the studies that tried to investigate the adoption of BCT.

1.1. Studies on Blockchain adoption

Streng [11], Duy et al. [12], Parino et al. [13], and Batubara et al. [14] proposed BCT use cases for organizations and governments. Kokina et al. [15] presented an overview of the BCT practices adopted by different accounting firms. A similar study was conducted by Taufiq et al. [16]. Wang et al. [17] proposed a maturity model. However, their model was not derived from empirical evidence. Kamble et al. [18] investigated factors influencing individuals to adopt BCT in the supply chain industry. Supranee and Rotchanakitumnuai [19] conducted a similar study in the Thai automotive industry. Another study in the supply chain was conducted by Kshetri and Loukoianova [20]. Holotiuk and Moormann [21] investigated the factors influencing BCT adoption in the finance industry of Germany. They developed a general framework and ignored the BCT-specific factors. Wong et al. [6] conducted a similar study for Malaysian SMEs in the supply chain business. Kulkarni and Patil [22], Koster and Borgman [23], and Kühn, et al. [24] investigated the adoption of BCT in India, Netherland, and Germany respectively. Clohessy and Acton [25] explored the impact of top management support, organization size, and organizational readiness on the adoption of BCT in Ireland. They studied the impact of few selective factors only. Albrecht et al. [26] investigated the

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implementation of BCT in the energy sector. They studied the implementation stage of the adoption process of BCT. Werner et al. [27] investigated the potential influence of BCT adoption on a company's competitive performance.

From the above review, it is apparent that there is a lack of study that explores the organizational adoption of BCT in Australia. Therefore, we aim to find the answer of:

"What factors are influencing the adoption of blockchain technology (BCT) among Australian organizations?"

The rest of the paper is as follows: Section 2 provides an overview of the BCT in Australia. Section 3 explains the theoretical foundations of the study. Section 4 describes the methodology part of the paper and elaborates on the information related to the sample selection, sample size, data collection, and interview process. Section 5 elucidates the interview data analysis and findings. Section 6 is devoted to the discussions and contributions of the study. Section 7 concludes the paper, explains limitations, and the directions for future research.

2. Blockchain in Australia

Australia considers the emergence of new and exciting technologies like BCT as far-reaching opportunities. The Australian government started working with BCT in 2016 when Standards Australia submitted a New Field of Technical Activity (NFTA) proposal on behalf of the Australian government to the International Organization for Standardization (ISO) to develop standards to support BCT [28]. Since then, the Australian government has put significant efforts to promote BCT. Following are the recent BCT projects of the Australian government:

- The Australian government has issued a roadmap for BCT, which states that "the Australian government has provided support and funding for the government, private sector, and researchers, to foster innovation and collaboration around BCT, through programs such as Austrade business missions to international markets; the Entrepreneur's Program; Australian Research Council Grants; and Business Research and Innovation Initiative pilots" [29].
- Another recent project of the Australian government is the trading of water rights using BCT [30].
- One of its research agencies, CSIRO's Data61, has been working to develop a national blockchain through which the Australian government has plans to integrate its different departments for better coordination and data sharing among them [31, 32].
- The Australian Stock Exchange (ASX) and the Australian National Bank (NAB) have been exploring BCT to find its possible uses for their business operations [33].
- The Australian government has a partnership with IBM to accelerate the uptake of BCT [34].

There is also a great support for BCT at the private level in Australia. Blockchain Australia, formerly known as the Australian Digital Commerce Association (ADCA), has actively been promoting the adoption of BCT among Australian organizations [35]. According to a report from Deloitte [36], Australia has the potential to become a global BCT leader. The Economist Intelligence Unit (EIU), a world reliable organization, ranked Australia to be the first in its technology readiness index [37], indicating that Australia has all the required infrastructure to embrace new technology like BCT. Despite having supports from the government and private sector, BCT has not been adopted by Australian organizations heavily [36, 38].

3. Theoretical Preliminaries

Technology adoption occurs at both individual and organizational levels and there are a large number of studies in this regard [43]. Researchers have developed and used several theories and models at both levels separately. This study focuses on BCT adoption and relevant theories at the organizational level.

Oliveira and Martins [39] reviewed the literature and reported that the majority of the studies on IT adoption at the organizational level use the Diffusion of Innovation (DoI) theory [40] and the Technology, Environment, and Environment (TOE) framework [41].

The DoI theory states that the organization's decision to adopt new technology is influenced by the characteristics of the technology and the organization per se that is going to adopt that technology. The TOE framework describes that the organization's decision to adopt new technology is not only influenced by the technology and organization, but it is also affected by the environment in which the organization runs its business. Thus, the TOE framework complements the DoI theory by adding the environment context and provides a better solid theoretical basis for the investigation of an IT adoption. Therefore, the authors of this study selected the TOE framework as a theoretical lens to explore BCT adoption. The TOE framework has widely been used to study the adoption of various technologies such as ERP systems, FRID, big data, cloud computing, website, etc. [39, 42]. However, Verma and Bhattacharyya [43] stated that the TOE

framework alone is incapable of understanding the IT adoption of interactive and complex technologies like BCT. This is because, the BCT is an inter-organizational technology and the decision to its adoption requires cooperation, collaboration, and interdependency among the organizations working together [27], which is not addressed by the TOE framework [26]. The TOE framework is static, in that, it overlooks the complex interactions between or among the organizations [44]. To supplement this shortcoming of the TOE framework, we integrated the Institutional Theory [45], which is known to explain the interactions among organizations, to its environmental context. Oliveira and Martins [39] reported the review of studies that integrated the TOE framework and Institutional Theory to explore the adoption of different inter-organizational technologies such as e-commerce and EDI.

The following sub-sections further explains the TOE framework and the Institutional Theory.

3.1. TOE Framework

The TOE framework, originally developed by Tornatsky and Fleischer [41], consists of three contexts, namely, technological, organizational, and environmental that influence the organization's decision to adopt new technology.

Technological Contexts. Technological context refers to how the characteristics of technology per se influence its adoption. Examples of technology contexts include relative advantage, complexity, compatibility, observability, trialability, cost, and risk associated with technology [42].

Organizational Contexts. Organizational context refers to the organization's characteristics and resources, which influence the adoption of new technology such as organization size, top management support, organization culture, organization readiness, and organization structure [42].

Environmental Context. Environment context refers to the environment in which an organization runs its business. This includes the external factors that create opportunities and uncertainties for organizations to adopt new technology. Competitive pressure and government support and regulations are prominent examples of the environmental context [42].

3.2. Institutional Theory

Institutional Theory explains how organizations influence each other while deciding the adoption of new technology. According to DiMaggio and Powell [45], the authors of the Institutional Theory, organizations can not make a purely internally driven decision in an institutionalized environment. They are likely to be dependent on each other while making any decision such as the adoption of an inter-organizational system like BCT. They further assert that coercive, normative, and mimetic pressures make organizations isomorphic.

4. Methodology

To find the answer of the research question, an interpretive qualitative research approach, proposed by Klein and Myers [46], was considered appropriate for this study. This approach helps to explore new issues when there is inadequate or little research available to understand it; the issue cannot be understood without the context and the meanings people assigned to it [47]. This is particularly relevant to our study because there is a lack of research that examines the organizational adoption of BCT in the Australian context. Therefore, the interpretive research approach was selected and utilized.

We conducted in-depth semi-structured interviews of the key persons from the organizations that either adopted BCT or were in the adoption process.

Selection of Organizations. To search the relevant organizations and their information e.g. contact person, industry type, adoption status of BCT, we used the following strategies: (1) search with Google and LinkedIn, (2) use of our professional network, and snowball sampling technique, (3) examination of various industry reports and organizations' press releases, and (4) scanning of the BCT related workshops and conferences. After collecting the required information, we sent an invitational email to the organizations, containing information concerning the research as well as the consent form. The organizations, willing to participate in the research, indicated their consent by returning the signed consent form and by nominating a person (informant) able to give the required information on BCT adoption. As recommended by Hill et al. [48], we sent tentative questions to the nominated informant one week before the interview which gave him ample time to get familiar and prepare for the interview. Table 1 shows the details of participating organizations and their informants.

Table 1. Organizations and their informants

Type of Organization	Informant	Identifiers	No. of Interviews
IT	Founder	A1	1

	Software Engineer	A2	1
	System Analyst	A3	1
	CTO	A4	1
	Project Manager	A5	1
	CEO	A6-8	3
Finance	Co-Founder	A9	1
	CTO	A10	1
	CEO	A11	1
Travel	CEO	A12	1
	Technical Analyst	A13	1
Education	Co-Founder	A14	1
Government	Senior Computer Forensics Officer	A15	1
Consulting	CEO	A16-17	2
	Project Manager	A18	1
	Solution Architect	A19	1
Legal	CEO	A20-22	3
	Director	A23	1
Total			**23**

Informants Selection. To gather reliable information, the informants were selected very carefully. Only those informants were selected that fulfilled the following criteria:

- They should able to demonstrate extensive knowledge/expertise in BCT.
- They should involved with the actions/decisions of the organization to adopt BCT.

Sample Method. We used theoretical sampling for the data collection. We selected organizations and informants that fit with the purpose of our study.

Data Collection and Interview Process. The primary data was collected through the semi-structured interviews that were carried out until the data saturation was achieved as suggested by Glaser and Strauss [49]. It took seven months (June 2019-December 2019) to conduct the interviews. We conducted 23 interviews. The semi-structured interviews provide the flexibility to cover all the information related to the phenomena under investigation [50]. Out of 23 interviews, 20 were conducted over Skype, and for the remaining three, we visited the organization's premises. Every interview lasted for 30-60 minutes. An interview guide was developed to ask relevant and specific questions. An expert opinion was sought from the senior academics and researchers to remove flaws within the interview guide. Every interview was transcribed and analyzed after its completion. The interview guide was updated according to the findings of every interview. Organization-specific questions were also asked in addition to the initial questions that were mainly derived from the TOE framework and the Institutional Theory. To remove the different types of biases such as intrinsic and methodological, and to maintain the validity of the research, the following measures were taken:

- Every activity involved in the data collection was properly documented.
- In addition to the interviews, secondary data were collected by reviewing existing literature on BCT, white papers, Australian government reports, and organizations' websites to get further insights into the phenomenon and to corroborate the findings. Some documents were provided by the interviewees.
- Interviewees were selected from diverse business functions and IT backgrounds.
- Instead of structuring the interviews around the TOE framework and the Institutional Theory, the interviewees were encouraged to mention those factors that they thought were important while deciding BCT adoption in their organizations.
- The interviewees were free to ask any questions about the research.
- The interviews were administered by a team of two persons, i.e. authors of this paper, who had extensive knowledge of BCT, as suggested by Eisenhardt [51]. One team member handled the interview questions, while the other recorded the interview and took notes.
- At the end of the interview, the interviewees were asked to verify the summary of the major findings. Later, they were provided a transcribed copy of the interview.

Every interview was audio recorded with the written/verbal consent of the interviewee. To maintain confidentiality, the interviewees were assured that their names would be replaced with pseudonyms.

5. Interview Data Analysis and Findings

To analyse the interview data, the study followed the guidelines of Corbin and Strauss [52] using QSR NVivo software. The data were analyzed in multiple iterations. The steps involved in the analysis are given below.

Examination. All the transcribed interviews were thoroughly examined, line-by-line.

Open Coding. Underlying concepts were identified.

Axial Coding. The identified concepts were grouped, based on their similarities and differences, into categories.

Mapping. The categories were mapped with the corresponding contexts of the TOE framework as shown in Figure 1.

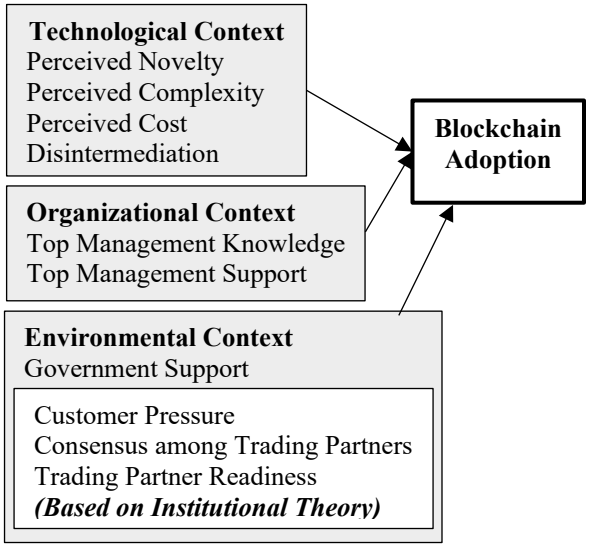

Figure 1. Factors influencing BCT adoption

Table 2 shows a frequency analysis of responses of the informants for every factor, adapted from [53].

Table 2. Frequency analysis of the response

Factors	Frequency of Responses		
	Positive	Negative	Not Sure
Perceived Novelty	15	6	2
Perceived Complexity	0	20	3
Perceived Cost	0	19	4
Disintermediation	11	10	2
Top Management Knowledge	18	0	5
Top Management Support	23	0	0
Government Support	10	12	1
Customer Pressure	14	0	9
Consensus among Trading Partners	5	15	3
Trading Partner Readiness	4	18	1

The following sub-sections explain the findings of this study in the contexts of the TOE framework.

5.1. Technological Context

This section reports the influence of BCT characteristics on its adoption.

Perceived BCT Novelty. The perceived novelty of BCT refers to the beliefs about its newness or freshness in the eyes of its potential adopters. Rogers [40] and Wells et al. [54] reported novelty as a fundamental characteristic that determines an organization's reaction to the adoption of new technology. Most of the informants commented that the novelty of BCT was an important factor while deciding the adoption of BCT in their organizations.

"The main motivation for me to adopt BCT is its newness. I think blockchain and its applications like Bitcoin will become day-to-day usage in the future. So for me, I saw it as an opportunity to get in while the industry is still developing on an early level and being able to participate in it." said the CEO of a crypto exchange (A11).

Some respondents reported perceived novelty as a demotivating factor for BCT adoption due to its limited number of trials in the market, and its benefits are not widely observable.

Perceived Complexity. Perceived complexity is the degree to which organizations perceive an innovation to be relatively difficult to understand and use [40]. There was consensus among the informants that BCT is a complex technology that hinders an organization from its adoption. One of the informants said:

"The other thing that is causing slow adoption of BCT among Australian organization is probably people are used to GUIs of the existing data structures and data warehouses, and these are well-developed and people understand how to use those GUIs, whereas, with the BCT at the moment, has not been done a lot of development to make it easy for users to use it as a data structure and database type of solution" (A7)

Perceived Cost: The informants were consistently agreed that the perceived cost inhibits the organizational adoption of BCT. One of them stated (A13):

"Adoption of BCT involves a significant switching cost of changing fundamentally how a business is interacting with its stakeholders and customers and suppliers. There is substantial integration cost that demotivates organizations to adopt BCT".

BCT Disintermediation. BCT enables peer-peer data transfer without the need of any third party over a decentralized network [1]. Most of the informants considered disintermediation as a motivational factor. As said by one of them (A12):

"We adopted BCT because it provides the freedom to our customers to make a payment without any bank.

Now we have customers beyond the borders. If you are paying from countries like where there is like very little banking infrastructure, BCT makes it possible and easier to pay for anything."

The disintermediation was not a source of motivation for every informant to adopt BCT. For some, this was a threat to their business. As stated by one of them (A18):

"As the BCT removes the intermediaries, so the organizations such as banks, distributors, brokers that are doing their business as middleman do feel insecure to adopt it. Adoption of BCT has no meaning to them because they are earning money because of working as an intermediary. If BCT removes them, this makes no sense for them to be part of this technology."

5.2. Organizational Context

In this sub-section, we include the factors that are internally related to organizations and influence their decision to adopt BCT.

Top Management Knowledge. The decision to adopt new technology is influenced by the knowledge, which an organization acquired about that technology to remove its uncertainties. Since top management e.g. CEO are the main decision-makers in an organization, therefore, their knowledge about new technology determines the attitude towards its adoption [55]. The informants were agreed that the majority of the recent top management at different organizations do not have sufficient knowledge about BCT and thus they feel reluctant about its adoption. One of them commented (A14):

"So basically, there is a need for the top management to acquire BCT knowledge. It is a pre-requisite for its adoption. Currently, top management does not have a good understanding of how the BCT is going to give value to their businesses. Low BCT knowledge is causing uncertainties and doubts about its adoption."

Top Management Support. The informants were agreed that without the recognition and support of the top leadership, adoption of BCT was not possible within an organization. *"we adopted BCT because our top management was supportive for it."*, said a CTO of an organization (A10). The clear strategic direction and enthusiasm of the top management were reported influential on BCT adoption. A project manager explained it by saying (A5):

"Our CEO acknowledged that the adoption of BCT would bring an increase in the gross profit of our company. Our leadership was very certain about the benefits of BCT" He further added, *"Successful adoption of BCT in our company was not possible without the support of our leadership."*

5.3. Environmental Context

This sub-section includes the factors, external to an organization, which were reported influential on the organizational adoption of BCT.

Government Support. Government support and regulations drafted for new technology play an important role in its adoption [56]. Informants showed a mixed response about the government support and the regulations formulated for BCT. A formerly senior computer forensic officer of a government department said (A15):

"I think that for blockchain as a technology, the Australian government is quite supportive of in some aspects when it is going to lead to greater transparency and potentially better border processes and things like blockchain as a data warehousing, data architecture solution. I think where the regulations are pertinent to the cryptocurrency or finance-related matters; it is obviously where I see a lack of regulations by the Australian government at the moment, which may be causing uncertainty about the BCT and its adoption"

Customer Pressure. Customers are considered an important part of an organization's environment. They have the power to influence an organization's decision to initiate and implement certain business practices [57]. Customer pressure played a pivotal role in the adoption of BCT, reported by many informants. They mentioned that customer-oriented organizations adopt BCT because of their customer demands and needs. A solution architect opined on this by saying (A19):

"There are many customers who have the requirement of data provenance, which we think can be achieved through the BCT"

It was further supplemented by the CEO of an organization (A20):

"BCT is kind of considering the customer's future needs. We provide technology solutions to businesses. So, for us, the key incentive to adopt BCT is if our customers are coming asking for that"

Consensus among Trading Partners. Since the BCT is a network technology that is maintained by the participating organizations. Therefore, mutual consensus on common terms and conditions among the trading partners was reported very important to adopt BCT. The informants pointed out that the need for consensus among trading partners as a potential barrier to BCT adoption. One of them said (A23):

"BCT adoption requires all the organizations over the network to reach a single mutual consensus over the validation of transaction, monitoring of all records and

validating or certifying the possession of assets digitally, and confirmation of the settlements. Organizations struggle to agree upon common terms and conditions to participate in the BCT network. Due to be an inter-organizational system, the interdependencies, power of the BCT initiator, and trust toward the organizations become critical issues that impede to reach a mutual consensus among the organizations."

Trading Partner Readiness. The informants stated that the adoption of BCT requires the readiness of all trading partners, which is measured in terms of their IT sophistication and financial resources [58]. The respondents were agreed that the decision to adopt BCT depends on the willingness and ability of potential partners. One of them stated (A2):

"Since the BCT is a cross-organization technology, you can get its value when all the organizations are ready to adopt it. If an organization is motivated and ready to adopt BCT but its partner organizations are unready due to not having sufficient technical skills or finance would be unable to adapt."

6. Discussion and Contributions

Our study finds that the adoption of BCT among Australian organization is influenced by the TOE framework and Institutional Theory factors. The TOE factors include perceived novelty, complexity, cost, disintermediation, top management knowledge and support, and government support whereas the Institutional Theory factors comprise customer pressure, trading partner readiness, and consensus among trading partners. The findings indicate that despite the positive influence of the factors derived from the TOE framework, the organizations still cannot decide BCT adoption alone unless they consider the Institutional Theory factors. The findings not only confirm the impact of the factors i.e. complexity, cost, top management support and knowledge, and government support that reported in the existing studies on BCT adoption [6, 22-25, 59], but they also introduce some new factors such as novelty and disintermediation of BCT, consensus among trading partners, trading partners readiness, which were not reported in the earlier literature to best of our knowledge.

The perceived novelty has been found as an enabler and an inhibitor in BCT adoption. There is a need to minimize the negative impact of BCT novelty. We suggest that adopter organizations should demonstrate the benefits that BCT brought into their business. If BCT has more trials and observability in the market, there will be fewer adverse effects of BCT novelty on its adoption [40].

Perceived complexity is found as a negative factor in BCT adoption. This finding is in line with Wong, et al. [6]. He discovered that the adoption of BCT lowers if organizations perceive the use of BCT is complex. Complexity to integrate BCT with the existing IT infrastructure, consensus algorithms, cryptography, and data storage redundancy impediment BCT adoption. Therefore, the organizations preparing to adopt BCT must properly address these issues, failing which may cause serious problems of undesirable outcomes of this technology.

Perceived cost is found to be a hindering factor for BCT adoption. Kulkarni and Patil [22] also stated perceived cost as an inhibitor for the adoption of BCT in India. We suggest that organizations should carefully analyze the cost involved in BCT before deciding its adoption. Nevertheless, the use of BCT is considered a cost-effective solution in terms of funds transfer [26], however, the costs involved in its adoption, for instance, change of internal systems, hiring of highly paid technical staff, energy consumption, and installation of additional hardware to store data that organizations should accurately estimate to avoid any future losses and unwanted consequences [6].

Disintermediation is one of the main features of BCT that is considered a breakthrough in today's digital business world [60]. Our findings report some negative impacts of disintermediation on organizations, which are working as intermediaries, to adopt BCT. They are not convinced to adopt BCT because of the disintermediation feature of BCT. This insight intrigues BCT developers, proponents, and practitioners to find ways to make BCT usable for intermediary organizations.

Our findings show that BCT adoption is significantly dependant on the discretion of the organization's management because they are the persons who have the final say to adopt or do not adopt a technology [59]. The top management provides funds and takes risks to adopt BCT. However, if the top management lack BCT knowledge, there are fewer chances that an organization would go for BCT adoption. The handling of probable change that BCT causes and the employees' acceptance towards BCT are not possible without the active and positive involvement of top management. Therefore, it is important to obtain the support of top management for the successful adoption of BCT within an organization.

Australian government support is seen as essential to BCT adoption. Organizations especially those providing financial services are actively seeking the government to develop more clear policies and legal frameworks to enhance their trust in BCT. The findings demonstrate that the legal uncertainties in handling

privacy in BCT are depicting barriers towards BCT adoption. This finding is consistent with Kühn, et al. [24] that reported the similar effects of government support on BCT adoption in Germany. It urges the Australian government to develop more clear guidelines and support for the adoption of BCT.

Most of the extant studies explore the BCT adoption from a standalone technology perspective and ignore its inter-organizational aspect, which requires the involvement of the trading partners and customers. Our findings provide new valuable insight on the influence of the trading partners on BCT adoption. The consensus among trading partners and their readiness are found to be salient factors for the successful adoption of BCT. Therefore, organizations need to know that BCT is like an inter-organizational system [27] and it has different requirements and protocols for its adoption as compared to the standalone technologies like ERP, RFID, etc.

The following sections explain the theoretical and practical contributions of the study.

6.1. Theoretical Contribution

Our study contributes to the existing body of knowledge in the following ways: (1) preliminarily identifies the factors influencing Australian organizations to adopt BCT, (2) discovers new factors: BCT novelty and disintermediation, and consensus among trading partners in Australian perspective that were not considered in previous IT adoption research in general, and BCT adoption in particular, (3) integrates the TOE framework and the Institutional Theory, which were not combined by any of the past studies on BCT adoption, and (4) validates the impact of different factors, mentioned in the prior studies on BCT adoption, for example, top management support, government support, cost, and complexity [6, 25, 26].

6.2. Practical Contribution

The practical relevance of this study is that its findings would help: (1) BCT consultants and service providers to better understand the influence of different factors on BCT adoption in Australia and consequently formulate better strategies and informed decisions, (2) managers and decision-makers to carefully evaluate the BCT complexity and cost concerns as well as the other factors before deciding the adoption of BCT in their organizations, (3) service providers in deciding to expand their BCT related services into other countries having characteristics similar to Australia e.g. New Zealand, (4) Australian government and private organizations like Blockchain Australia to address the major issues in the adoption of BCT and develop policies and actions to remove uncertainties of potential BCT-adopter organizations.

Further, the findings reflect the importance of top management knowledge in the adoption of BCT. Therefore, the organizations could equip their staff with the knowledge and skills necessary for BCT adoption. The study reports the shortage of BCT related technical skills in Australia. The educational institutions could take this finding as a business opportunity to plan and develop suitable BCT training programs and courses.

7. Conclusion

The study investigates the factors influencing organizational adoption of BCT in Australia by applying an interpretive qualitative research approach; using the integrated theoretical lens of the TOE framework and the Institutional Theory. The data was collected through semi-structured interviews.

The findings of the study show that the organizational adoption of BCT is influenced by the factors related to the technological context (novelty, complexity, cost, and disintermediation of BCT), organizational context (top management knowledge and support), and environmental context (government support, customer pressure, consensus among trading partners, and trading partner readiness) of the TOE framework. The study provides both theoretical and practical contributions.

The scope of the study is limited to cover BCT adoption from the Australian perspective only. Therefore, the external validity of the findings cannot be assured. Extension of the current work will expand it further to generalize the findings through a quantitative study. Future work can also focus on investigating BCT adoption by considering public, private, and consortium BCT separately in Australia.

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3.3.1 Validity and reliability of the qualitative phase

Qualitative methods such as in-depth interviews come with some biases such as intrinsic and methodological and should be carefully assessed to maintain reliability) and validity of the findings (Silverman, 2013). The guidelines outlined by Yin (2017) were followed to achieve the reliability and validity of our research. The quality of research was evaluated with the following tests.

3.3.1.1 Construct validity

Triangulating the interview questions helps to maintain the construct validity (Rao & Perry, 2003). A question with alternative wordings was asked to understand the same issue from multiple perspectives, for instance, "*What is the effect of the organisational factors (such as innovativeness, learning capability, top management support) on the decision to adopt BCT? Please explain*. An alternative version of this question was, "*How do the factors related to an organisation (such as innovativeness, learning capability, top management support) have a positive or negative influence on its decision to adopt BCT?*". This method is considered effective and permits a refined construct validity approach (Carson et al., 2001). In addition to this, the interviewee was requested to confirm the significant findings when the interview had finished. Later, they were provided a complete transcribed copy of the interview and asked if they wanted to add or remove anything from it.

3.3.1.2 Internal validity

Internal validity refers to the degree to which extraneous factors that could affect results are controlled or eliminated successfully (Silverman, 2013). The internal validity was achieved by following several measures, including substantiating the interview questions; piloting the interview schedule; removing extraneous data from the analysis, and keeping an ethical procedure for the whole study, as Yin (2017) suggested. Moreover, the interviewees were selected carefully. In-depth interviews of the people were conducted who were either decision-maker of their organisation or were experts in the area of BCT. This helped us to capture the information that was purely related to the research aim. The secondary data e.g., existing literature on BCT, white papers, Australian government reports, and organisations' websites were consulted to corroborate the findings.

3.3.1.3 External validity

External validity refers to the degree to which the findings of a study can be generalized and transferred into other settings e.g. industry, country, population, etc. (Silverman, 2013).

The participants were selected from a diverse range of industries and roles to achieve external validity. They had extensive BCT knowledge, expertise, and leadership. Because of their profile, the participants had a strong influence on many people and industries in Australia. Therefore, the findings derived from their in-depth interviews would be convincing for the organisations and people working in similar industries and roles (Carson et al., 2001).

3.3.1.4 Reliability

Reliability refers to consistency in the findings if the analysis of the interview data is repeated or reproduced (Sekaran & Bougie, 2016). Reliability is achieved if a study generates consistent results. To obtain research reliability and avoid researcher bias, every data collection activity was properly documented. Interviewees were selected from a diverse range of industries and roles. Although the TOE framework was used to formulate the interview questions, the interviewees were encouraged to report the factors that actually motivated them to adopt BCT or the factors that they consider essential for the organisational adoption of BCT. All the questions that the interviewers asked about the research were entertained to remove their doubts and enhance their understanding. Every interview was recorded with the written or verbal consent of the interviewee. Every interview was conducted with a team of two researchers, who have extensive knowledge of BCT. One team member asked the interview questions, while the other took notes and recorded the interview. These records can be accessed, and the data can be easily retrieved for re-checking or re-analysis. In addition to this, the research process was consulted with senior researchers, peers, and colleagues in terms of the research design, methods, interpretation, themes, and findings of the research.

3.4 Phase 2: Quantitative

3.4.1 Data collection method

An online survey method is employed for the confirmatory stage of this study. Researchers frequently use the survey method in the quantitative research domain (Joseph F Hair, 2007). This method was considered appropriate because of its ability to reach a large population for the data collection (Sekaran & Bougie, 2016). Further, this method is time and cost-saving (Bell, Bryman, & Harley, 2018).

3.4.2 Target population and sample

A survey population refers to an entire group of elements that exhibit a particular set of common characteristics (Joseph F Hair, 2009). Quantitative research requires researchers to choose a sample that reflects the attributes of a whole population. A more representative sample allows more generalisability of the findings and enhances research quality. This research considered Australian organisations that had adopted or were adopting BCT as the primary target population. Initially, using different online sources such as Google, LinkedIn, BCT-related conferences, and websites like "VentureRadar", "Crunchbase", "Coindesk", and "blockchain Australia", nearly 300 organisations were identified that qualified for our study. Later, a third party was used to recruit more organisations. Many studies on IT adoption have used the third party for speedy data collection implying its usefulness for our study (L.-W. Wong et al., 2019; Wunderlich, Veit, & Sarker, 2019). The third-party helped to find more than 617 organisations. Resultantly, a total of 917 Australian organisations were found that qualified for our study. For the quantitative part of this study, the same unit of analysis and observation of the qualitative part of this study was used.

For the sampling, the probability random sampling method was used (Joseph F Hair, 2009). A bigger sample size is always considered better in survey research. The higher sample size reduces the estimation error (Iacobucci, 2010). In PLS-SEM, an adequate sample size is recommended (Joe F Hair, Ringle, & Sarstedt, 2011; Marcoulides & Saunders, 2006; VanVoorhis & Morgan, 2007). To calculate the right sample size for this study, Qualtrics online application was used (Qualtrics, 2020). A sample size of 500 was obtained with a 95% "confidence level" and a 3% "margin of error". In social science research, a 3%-5% "margin of error" is acceptable (Dillman, Smyth, & Christian, 2014). Further, Sekaran and Bougie (2016) stated that the ideal sample size should be between 30 and 500. Hence, adequate sample size was chosen for this study.

3.4.3 Survey instrument

A valid and reliable survey instrument is considered essential to minimize the errors in research findings (MacKenzie, Podsakoff, & Podsakoff, 2011). Many aspects, e.g. type of questions, the survey wording, layout, and structure, require careful consideration while developing the survey instrument (Cavana, Delahaye, & Sekeran, 2001). The following steps were performed to establish a quality survey instrument (Bell et al., 2018; Cooper, Schindler, & Sun, 2006; Zikmund et al., 2013).

- ✓ The construct measures except the "perceived disintermediation" were developed based on the comprehensive and systematic peer-reviewed literature on IT/IS adoption. However, some of the measures for some constructs were developed from the interview data of the qualitative phase of this study. The measuring items of perceived disintermediation were not available in the IS literature, hence developed for this study by following the guidelines of MacKenzie et al. (2011).
- ✓ Use of duplicate and long questions, technical and specialized terms were avoided.
- ✓ Feedback from the senior academic and researchers working in the IS domain was sought to evaluate the instrument relevance and content clarity to avoid any difficulty or non-response that the respondents may face while filling the survey. Further, the instrument was sent to the language experts for proof-read, grammatical errors, and wordings.
- ✓ A pilot study was conducted to confirm the instrument aligns with the research question and aims.

Table 3.1 shows all the constructs and their codes and source. Operational definitions and the relevant measuring items of every construct are given in Appendix A.

Table 3. 1 Constructs and their respective sources

Construct	Code	Source
Perceived benefits	PB	Rawashdeh and Al-namlah (2017)
Perceived compatibility	PC	Moore and Benbasat (1991)
Perceived complexity	PCM	
Perceived information transparency	PIT	Terry Anthony Byrd (2000)
Perceived disintermediation	PD	Authors
Top management support	TMS	Soliman and Janz (2004)
Organisation innovativeness	OI	Newby, Nguyen, and Waring (2014)
Organisational learning capability	OLC	Muñoz-Pascual, Curado, and Galende (2019)
Government support	GS	Rawashdeh and Al-namlah (2017)
Trading partner readiness	TPR	Zhu, Dong, Xu, and Kraemer (2006)
Competition intensity	CI	

Standards uncertainty	SU	Venkatesh and Bala (2012)
Perceived risks	PR	M. S. Featherman and Pavlou (2003)
Intention to adopt	INT	Kim and Ammeter (2014)

3.4.4 Survey measurement scale

It is vital to facilitate respondents with an appropriate scale to answer survey questions. Researchers use different response measurement scales, including the Thurston scale, Guttmann scaling, and Likert scale (DeVellis, 2016). The Likert scale (Likert, 1932) was used in this study. This scale is more adaptable, reliable, and easier to develop (Babbie, 2013). The 5-point and 7-point are the two main versions of the Likert scale frequently used in information systems research. However, the 7-point scale outperforms the 5-point scale in terms of more flexibility and options for the respondents, which are essential for the reliability and accuracy of the research findings (Cox III, 1980; Lewis, 1993). Therefore, the 7-point Likert scale was considered more appropriate for the present study. The response options ranging from "1-strongly disagree" to "7-strongly agree" were used. Many researchers have used the 7-point Likert scale in their studies to examine the adoption of different technologies. For instance, Nam, Kang, and Kim (2015) used a 7-point Likert scale to study the adoption of big data. Kuan and Chau (2001) utilized 7-point Likert to understand the adoption of Electronic Data Interchange (EDI) systems in small businesses using the TOE framework. The questionnaire along with the Likert scale is given in Appendix B.

3.4.5 Survey pre-testing

A pre-test is carried out to identify any improvements in the survey instrument before its launch with the actual unit of analysis. The pre-test helps to refine the instrument further and enhances its validity (Cavana et al., 2001). The pre-test was conducted with a group of 20 academic staff and PhD candidates at the IT department of FedUni (Bell et al., 2018; M. Saunders, Lewis, & Thornhill, 2009). Participants were asked to provide their feedback about the survey instrument in terms of the difficulty they faced, survey completion time, clarity and simplicity of the questions and instructions given in the survey. They were also asked to share any additional thoughts, suggestions, or remarks. Most of the respondents provided positive feedback and they did not encounter any major difficulty in answering the survey questions. However, few questions were rephrased, based on the suggestions of

the participants, to improve their clarity. The average survey completion time was reported between 10 and 15 minutes.

3.4.6 Survey pilot study

A pilot study is the actual launch of a survey with a smaller sample size. The unit of analysis and observation in a pilot study are similar to those used in the final launch of the survey. The sample for the pilot study should be the same that is used for the main study (Shaughnessey, Zechmeister, & Zechmeister, 2012). A pilot study is considered important to test the questions in the survey instrument (Kothari, 2004). This helps to explore, identify, and remove issues in the survey design; to evaluate the validity and reliability of the survey; identify any weakness in the survey, and increase its accuracy (L. Cohen, Manion, & Morrison, 2017; Cooper et al., 2006; Waters & Waters, 2008).

The pilot study for this study was conducted with a sample size of 35. A sample size of 10-30 for a pilot study is considered appropriate (Fink, 2003; M. Saunders et al., 2009). Thirty (30) out of 35 completed surveys were received with a response rate of 85%. The remaining five incomplete surveys were not included in the pilot study. The individuals who participated in the pilot study were IT directors and CEO of the Australian organisations that had adopted or were in the process (not adopted yet) to adopt BCT. In other words, the sample population for the pilot study and the main study were the same.

3.4.6.1 Pilot study reliability

The reliability of a survey instrument depends upon its consistency, which is commonly measured with the value of Cronbach's alpha. Accepted values of Cronbach's alpha for a reliable survey instrument range from 0.7 to 0.8. (Drost, 2011; Joe F Hair et al., 2011; Shaughnessey et al., 2012). Following this acceptance criteria, the measuring items showing lower values for Cronbach's alpha were eliminated. There was only one item of "perceived disintermediation" that was eliminated. The rest of the items for every construct showed values between 0.810 and 0.903.

3.4.7 Main survey administration

In this study, a licensed version of the Qualtrics online survey tool was used for the data collection. This is a popular survey platform that does not require any installation or programming skills (Molnar, 2019). It offers a simple and convenient interactive editor to design a survey. The survey remained active for 3 months i.e., June 2020 to -August 2020. All the 500 (sample) oorganisations were sent an invitation email along with an anonymous

survey link. Every organisation was requested to submit only one survey. Qualtrics saves the IP addresses of every participant, which helped us to monitor the replication of submitted surveys. At the start of the survey, the screening questions enabled us to exclude the organisations and respondents that do not fit the research objective. Out of 494 organisations, 409 responded to the survey, yielding a response rate of 82%, which is considered good in online survey research (Cavana et al., 2001). Since the survey was anonymous, it was not possible to identify the non-respondent organisations. However, follow-up emails were sent to the organisations to increase the maximum response rate. Out of 409 responses, 50 were automatically screened out due to a mismatch with the qualifying criteria for the study. Among the remaining 359 responses, 10 were found incomplete and not included in the data analysis. Finally, 349 surveys were found appropriate for the statistical analysis.

3.4.8 Quantitative data analysis technique

This research used PLS Structural Equation Modelling (SEM) technique with SmartPLS 3 software to perform the statistical analysis of the data. This technique is widely used for quantitative data analysis in social science research (Hoyle, 1995; MacCallum & Austin, 2000). Although this research uses a reflective measurement model, researchers could use the SEM technique for both the reflective and formative measures to perform several tests to estimate the reliability and validity of the data (Joe F Hair et al., 2011; K. K.-K. Wong, 2013). Many researchers have recommended PLS-SEM as one of the best statistical tools for multivariate data analysis (Joe F Hair et al., 2011; Kline, 2015; Ullman & Bentler, 2003). Due to the usefulness of the quantitative data, many researchers have used the PLS-SEM to examine the organisational adoption of different technologies (Gangwar, Date, & Ramaswamy, 2015; Oliveira, Thomas, & Espadanal, 2014).

As a first step of the quantitative data analysis, a descriptive analysis was performed to get some background information e.g., demographic and behavior of the survey respondents. In addition, response rate, missing value, and multicollinearity were evaluated to ensure clean and error-free data. For the second step, the validity and reliability of the survey data were conducted. Further details are provided in chapter seven of this thesis.

3.5 Ethical Considerations

According to the national statement on ethical conduct in human research (Ethics, 2019), involved human research must undergo a review to ensure the study is following ethical

standards and guidelines. Therefore, an application for approval through the ethics assessment process was lodged with the Human Research Ethics Committee (HREC) at the Federation University, and approval was obtained (Appendix C). The data collection activity was not started unless the HREC approved the ethics application.

3.6 Summary

This chapter describes the research methodology used in the current research. The chapter explains the research paradigm and research design that is sequential exploratory, completed in two phases. Discussion on the unit of analysis and observation, data collection, and analysis techniques for qualitative and quantitative phases is presented in this chapter. The unit of analysis is BCT adopters and potential adopter organisations working in Australia whereas the unit of observation is the decision-makers and senior IT staff having extensive knowledge in BCT. During the qualitative phase, the data was collected through semi-structured interviews and was analyzed through the thematic analysis technique with SQR NVivo software. In the quantitative phase, the data was collected through an online survey and was analyzed with the PLS-SEM technique using SmartPLS software. The pre-testing and pilot study were conducted to evaluate the measuring instrument for the survey. A 7-point Likert scale was used to capture the survey responses.

Chapter 4: Qualitative Data Analysis

4.1 Frequency Analysis

This chapter presents the findings of the study for the qualitative phase. The purpose of this phase was to identify the factors that organisations perceive while making their intention to adopt BCT in Australia. To fulfill this purpose, 23 Skype and face-to-face interviews with BCT consultants, experts, and decision-makers working with the Australian organisations and government were conducted. After the analysis of the interview data, it was found that certain technological, organisational, and environmental factors affect an organisation's intention for adopting the BCT. The factors every participant reported with their knowledge and experience are presented in Table 4.1.

Table 4. 1 Frequency analysis of the qualitative data

Factors	Participants																							Frequency
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	
PB	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	22/23
PR	*		*	*	*	*	*	*	*		*	*	*	*	*	*	*		*	*	*	*	*	21/23
PC	*	*			*	*	*	*	*	*	*	*	*	*		*	*	*	*	*	*	*		20/23
CMP		*	*	*	*	*		*	*	*	*	*	*	*		*	*	*	*		*	*	*	20/23
PIT	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		22/23
PD	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	21/23
OI		*	*	*	*	*	*	*	*	*	*		*	*	*	*	*	*		*	*	*	*	20/23
OLC	*		*	*	*	*	*	*	*			*	*	*	*	*	*	*	*	*	*	*	*	21/23
TMS	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	23/23
GS	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*		*	*	19/23
SU	*	*	*	*		*	*	*	*		*		*	*	*	*	*		*		*	*	*	18/23
TPR	*	*	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	22/23
CI	*	*	*		*	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*		*	20/23

PB: Perceived Benefits, PR: Perceived Risks, PC: Perceived Compatibility, CMP: Perceived Complexity, PIT: Perceived Information Transparency, PD: Perceived Disintermediation, OI: Organisation Innovativeness, OLC: Organisation Learning Capability, TMS: Top Management Support, GS: Government Support, SU: Standards Uncertainty, TPR: Trading Partner Readiness, CI: Competition Intensity

Figure 4. 1 Schematic diagram for the identified factors

4.2 Impact of the technological factors

The findings derived from analysis of the responses of the participants shows that the technological factors, namely, benefits, compatibility, information transparency, and disintermediation were perceived to have a positive impact on the organisation's intention to adopt BCT. However, the factors perceived risks and complexity have a negative impact. Table 4.2 summarises the impact of these technological factors.

Table 4. 2 Impact of technological factors

Factor	Impact	Frequency	Reason
Perceived benefits	Positive	22	Positive impact because of time-saving, reduction in cost and expense, fast transactions
	Negative	0	-
	Not sure	1	Not sure about the impact of perceived benefits on the organisation's intention to adopt BCT
Perceived risks	Positive	0	-
	Negative	21	Negative impact of due to security and privacy breaches, benefits uncertainty
	Not sure	2	Not sure about the impact of perceived risks on the organisation's intention to adopt BCT
Perceived compatibility	Positive	20	Positive impact of compatibility with business processes, technical infrastructure, and skills
	Negative	0	
	Not sure	3	Not sure about the impact of compatibility on the organisation's intention to adopt BCT
Perceived complexity	Positive	0	-
	Negative	20	Negative impact because of being much technical and hard to understand
	Not sure	3	Not sure about the impact of complexity on the organisation's intention to adopt BCT
	Positive	19	Positive impact due to easy access and visibility of the information

Factor	Impact	Frequency	Reason
Perceived information transparency	Negative	3	Negative impact due to lack of privacy
	Not sure	1	Not sure about the impact of information transparency on the organisation's intention to adopt BCT
Perceived disintermediation	Positive	11	Positive impact due to direct and peer-peer data management
	Negative	10	Negative impact due to losing control over business
	Not sure	2	Not sure about the impact of information transparency on the organisation's intention to adopt BCT

4.2.1 Perceived benefits (PB)

Perceived benefits of technology are considered a major factor that influences its organisational adoption. For BCT, perceived benefits have also been reported significant factor in its adoption among organisations (Kalaitzi, Jesus, & Campelos, 2019b). Most of the interviewees agree that the perceived benefits of BCT play an important role to influence organisations to its adoption. They said that the benefits such as a reduction in expenses, time savings, peer-peer transactions, security, and disintermediation motivated them to adopt BCT.

An interview with a technical analyst (A13) working at a traveling agency.

Interviewer: *What benefits did you perceive before deciding to adopt blockchain?*

Interviewee: *Blockchain has certain benefits for our business. We have customers all over the world. Before adopting blockchain, we used the conventional banking system to receive payments from our customers. It takes a couple of days to receive payment in our bank account in Australia. It was not only time-consuming but also expensive to us and our customers due to the different*

service charges imposed by the banks. Now we receive payments in cryptocurrency, which is fast and cost savings.

In an interview with a founder (A14) at an educational institution, he said, "*We use blockchain solution for the verification of the documents. Any employer can directly verify the student's credentials without contacting us. It saves our expenses to engage staff to entertain verification queries. It also saves time for the employer*"

4.2.2 Perceived risks (PR)

New technologies come with certain risks that hinder organisations to adopt them. Similarly, the BCT is also with risks and challenges that make organisations reluctant to its adoption. For instance scalability, privacy, slow transaction processing speed, need for miners to run the network (Duy, Hien, Hien, & Pham, 2018; Y. Wang, Han, & Beynon-Davies, 2019). Since the data over the BCT network is immutable, organisations also consider this a risk if anything goes wrong and they do not have control to reverse it (Makridakis & Christodoulou, 2019).

Respondent A20 argued that "*usually, the big organisations control the industry, and they dictate how the processes should work, and how the vendors and suppliers and other small peer organisations should deal with them. These big players perceive fear of losing control after adopting blockchain*". Another point that was highlighted by A14 is "*blockchain is relatively new technology and there is a lack of well-established blockchain systems in the market. Organisations cannot observe the real benefits of blockchain that cause worried about the value proposition, the return on their investment in blockchain*".

4.2.3 Perceived compatibility (PC)

Compatibility can be defined as the degree to which the new technology fits with the potential adopter's existing values and technological systems (Rogers, 2003). Most of the studies on IT adoption report that if a technology is incompatible with the organisations existing infrastructure, they will unlikely to adopt it. Therefore, for the adoption of BCT, its smooth integration with the organisation's existing businesses is very important (De Castro et al., 2020). One of the CEO (A8) providing enterprise BCT solutions supported this by saying, "*if blockchain is compatible, for example, if an organisation is providing IT solutions such as AI or database and it has all the technical staff, then it would surely adopt BCT because it aligns with its business aims and objectives*". He further added that "*now*

suppose if an organisation requires to install a completely new technological infrastructure, it will think twice to adopt blockchain because of its incompatibility. For example, the organisation currently has an ERP system, which is a centralized system, it would be hard for him to replace a centralized system with a blockchain system because it will require a lot of modification into its existing system".

The CTO (A4) expressed similar thoughts about the compatibility of BCT for their business. He stated "*We already had a team of IT professionals. So, it is normal for us to start working with any new technology like blockchain*"

4.2.4 Perceived complexity (CMP)

Perceived complexity is the degree to which organisations perceive innovation as relatively difficult to understand and use (Rogers, 2010). According to the informants, Australian organisations consider blockchain a complex technology compare to traditional database technologies in the market and is their main concern for its adoption. One of them stated:

"The other thing that is causing slow adoption of blockchain among Australian organisation is probably people are used to GUIs of the existing data structures and data warehouses, and these are well-developed and people understand how to use those GUIs, whereas, with the blockchain at the moment, it has not been done a lot of development to make it easy for users to use it as a data structure and database type of solution. It is still, you have to have a high level of technical expertise to use it on an ongoing basis. Organisations consider blockchain technology a complex architecture, and I think they are still grappling with those decisions of how to fit or replace their existing technology infrastructure with the blockchain". Although complexity is found to be negatively associated with the adoption of BCT in organisations, however, the informants agreed that it can be minimized by having BCT knowledge and skills.

4.2.5 Perceived information transparency (PIT)

Information transparency is the openness, clarity, free access, and sharing of information when it is required (Dapko, 2012) Today, a vast amount of information is exchanged among different businesses, individuals, sellers, buyers, competitors, and stakeholders that enhance the value of information transparency. Information transparency increases the overall performance of an organisation. For example, the availability of transparent information to customers enhances their trust in a company, which ultimately increases sales and services. Information transparency is one of the major features of BCT that

attracts organisations to its adoption (Sunny, Undralla, & Pillai, 2020). A solution architect (A19) emphasized this by stating, "*our clients wish to adopt blockchain because of the transparency of information it provides. The clients want a solution to facilitate their consumers to track the products they are buying is authentic*". He further stated, "*We recommend blockchain solutions to our clients who demand openness and visibility within and outside of their organisation*".

The organisations that perceive information transparency offered by BCT as an advantage for their business operations are more induced towards its adoption. During an interview, a project manager (A5) said, "*over a blockchain network, every participating organisation knows the flow of information. This free and easy access to information enables speedy decision making among stakeholders, which ultimately increases the productivity of business*"

4.2.6 Perceived disintermediation (PD)

Blockchain is a technology that enables peer-peer data transfer without the need of any third party over a decentralized network (Nakamoto, 2019). Removal of intermediaries through BCT is considered a breakthrough in today's digital world. One of the respondents, working with a travel agency and accepting payments in cryptocurrencies, reported disintermediation as the main motivational factor to adopt BCT for his organisation. He stated:

"We adopted blockchain because it provides the freedom to our customers to make a payment without any bank. Now we have customers beyond the borders. If you are paying from countries where there is very little banking infrastructure, blockchain technology makes it possible and easier to pay for anything. After adopting blockchain, we do not need any bank to handle our financial matters. Previously, it took days to receive payments through banks from overseas, and it was expensive as well. Now our customers can pay really fast and secure payments for our travel products."

However, disintermediation is not a source of motivation for every organisation. For some, it is a threat to their business as stated by one of the informants:

"As the blockchain technology removes the intermediaries, so the organisations such as banks, distributors, brokers that are doing their business as middleman do feel insecure to adopt blockchain technology. The adoption of blockchain has no meaning to them because

they are earning money because of working as an intermediary. If blockchain removes them, this makes no sense for them to be part of this technology."

4.3 Impact of the organisational factors

This research suggests that the organisational factors of BCT adoption: organisation innovativeness, organisational learning capability, and top management support have a positive impact. Table 4.3 illustrates the findings upon analysis of the responses of the participants.

Table 4. 3 Impact of organisational factors

Factor	Impact	Frequency	Reason
Organisation innovativeness	Positive	20	Positive impact if an organisation is open to new ideas and accepts the risks associated with them.
	Negative	0	-
	Not sure	3	Not sure about the impact of organisation innovativeness on the organisation's intention to adopt BCT
Organisation learning capability	Positive	21	Positive impact if organisation keep their employees up to date about contemporary technologies and it has a mechanism to store, and share new knowledge.
	Negative	0	-
	Not sure	2	Not sure about the impact of organisational learning capability on the organisation's intention to adopt BCT
Top management support	Positive	23	Positive impact if top management is active to support BCT and considers it important for an organisation
	Negative	0	-

	Not sure	0	Not sure about the impact of top management support on the organisation's intention to adopt BCT

4.3.1 Organisation innovativeness (OI)

The innovativeness of an organisation relates to its openness to new ideas, seeking to work innovatively, and willingness to take risks (Venkatesh & Bala, 2012). These features of an organisation are very much pertinent to its decision to adopt new technology. New technologies like BCT come with a novel idea that has very limited trials and successful evidence. Therefore, the risk-taking and openness of an organisation have a substantial relationship with the adoption of an innovation (Subramanian & Nilakanta, 1996). This was also reflected during our interview with a project manager (A5) of a leading IT organisation. He said, "*We are the pioneer in Australia working with blockchain technology. When we started, there were no success stories about blockchain in Australia. However, we decided to take the risk and invested to develop blockchain solutions for our clients*". According to Grover, Kar, and Janssen (2019), innovativeness has a significant effect on an organisation's decision to adopt BCT relatively quickly as compared to others in the industry. A similar thought was shared by A17, "*since the blockchain is totally a novel idea, it requires organisations to change their legacy systems. which is a massive process for many organisations. Therefore, only those organisations will adopt blockchain that are creative and contemporary in doing business*".

4.3.2 Organisation learning capability (OLC)

Organisation learning capability refers to an organisation's ability to learn from its internal and external environment (Jerez-Gómez et al. 2007). Organisations learn when they attain new knowledge through different sources, share it with their employees, and the employees implement that knowledge into their business decisions. The adoption process of technology starts when an organisation acquires knowledge about that technology via a learning system (Gomes & Wojahn, 2017; Rogers, 2003). A learning system could be a formal knowledge management system, R&D department, organizing informational seminars and workshops within the organisation, or sending employees to attend external conferences to gain new knowledge. Adoption of BCT takes place inside organisations through influences such as their own capabilities like learning (Kulkarni & Patil, 2020).

Most of the interviewees endorsed the role of an organisation's capability to learn about new technology emerging in the industry. They stated that many organisations in Australia do not know what a BCT is and how it could be used for. Further, they mentioned that the first step to adopting BCT is organisations must get the knowledge to understand BCT (A14 & A17). "*We have a dedicated R&D department that floated the idea of blockchain to work with. We shared this idea with our employees through a newsletter and ask them to provide their feedback. Then, we analyzed the opportunities and risks associated with blockchain for our business, and finally decided to develop blockchain solutions for our clients",* said A12.

4.3.3 Top management support (TMS)

All the informants agreed that without the recognition and support of the top leadership, adoption of BCT is not possible in the organisation. One of the CEO of an organisation said that they adopted BCT because they were in a position to support the idea of BCT. The informants agreed that the clear strategic direction and enthusiasm of the top management are the primary ingredients of the adoption of BCT in any organisation. One of the informants at a travel agency stated:

"Our CEO acknowledged that the adoption of BCT would bring an increase in the gross profit of our company. Our leadership was very certain about the benefits of blockchain." He further added, *"Successful adoption of BCT in our company was not possible without the support of our leadership."*

4.4 Impact of the environmental factors

The analysis of the responses of the interviewed participants suggests that the environmental factors, namely, government support, trading partner readiness, and competition intensity have a positive impact, whereas the standards uncertainty has a negative impact on the organisational adoption of BCT. Table 4.4 explains the impact of every organisational factor on an organisation's intention to adopt BCT.

Table 4. 4 Impact of environmental factors

Factor	Impact	Frequency	Reason
Government support	Positive	19	Positive impact if proper and effective

			policies and regulations are implemented
	Negative	2	Negative impact if the government is not active to support organisations to adopt BCT
	Not sure	2	Not sure about the impact of government support on the organisation's intention to adopt BCT
Standards uncertainty	Positive	0	-
	Negative	18	Negative impact due to the immaturity of BCT and lack of industry standards
	Not sure	5	Not sure about the impact of standards uncertainty on the organisation's intention to adopt BCT
Trading partner readiness	Positive	21	Positive impact due to the financial and technological readiness of the partner organisations
	Negative	1	Negative if partner organisations are not willing to adopt BCT
	Not sure	1	Not sure about the impact of trading partner readiness on the organisation's intention to adopt BCT
Competition intensity	Positive	20	Positive impact because organisations feel motivated and pressurized to adopt BCT before their competitors and gain competitive advantages over them
	Negative	0	Negative impact because of being much technical and hard to understand

	Not sure	3	Not sure about the impact of competition intensity on the organisation's intention to adopt BCT

4.4.1 Government support (GS)

Government support and the regulations drafted for a new technology play an important role in its adoption. Some believe that the regulations stifle innovation and organisations feel reluctant about its adoption (Cetindamar, 2001; Jaffe & Palmer, 1997) while others believe that the regulations have a positive relationship with technology adoption (Lanjouw & Mody, 1996). while knowing the effect of external factors on the adoption of BCT, informants showed a mixed response about the government support and its formulated regulations for BCT. One of the CEO of a cryptocurrency exchange mentioned:

"I think that for blockchain as a technology, the Australian government is quite supportive of in some aspects when it is going to lead to greater transparency and potentially better border processes and things like blockchain as a data warehousing, data architecture solution. I think where the regulations are pertinent to the cryptocurrency or finance-related matters; it is obviously where I see a lack of regulations by the Australian government at the moment, which is contributing uncertainty about the blockchain and its adoption." The informants agreed that the Australian government should develop sufficient policy, regulations, and legal frameworks to guide and prevent the misuse of technology for financial matters.

4.4.2 Standards uncertainty (SU)

Standards uncertainty refers to the unavailability and instability of formal standards for technology (Venkatesh & Bala, 2012). Though organisations seek to adopt BCT for their business models, the uncertainty about the BCT standards is the primary reason stymying its organisational adoption (Hileman & Rauchs, 2017). As stated by one of the legal experts (A21), "*organisations aren't likely to invest if they're not sure what the standards are going to be set for blockchain. They have been waiting until the formal standards are developed*". Most of the respondents agreed that BCT is at its early stage and still evolving. They said that there are many changes expected in BCT over time to reach a certain maturity level. According to PwC (2018) survey, these uncertainties cause organisations to distrust BCT, which ultimately impedes its adoption. "*Organisations are slow to adopt blockchain-based*

solutions because they have been waiting for the potential blockchain standards. They fear if the blockchain standards change over time, it might require them to make expensive investments in the future", stated A20, a legal advisor. Thus, the standards uncertainty is predominantly relevant to the adoption of BCT because an organisation may be reluctant to adopt it until its standards are matured in the industry (Shaikh, 2020).

4.4.3 Trading partner readiness (TPR)

BCT, similar to any inter-organisational system like EDI requires strong collaboration and interaction among the trading partners (Werner, Basalla, Schneider, Hayes, & Vom Brocke, 2020). The value of such inter-organisational systems is achieved at its fullest when all the trading partners have adopted it (Iacovou, Benbasat, & Dexter, 1995). An organisation alone cannot decide the adoption of an inter-organisational system until its trading partners are financially and technologically ready for it (Iacovou et al., 1995). Since every organisation has a different level of financial resources and IT skills, therefore, when an organisation is motivated to adopt an inter-organisational system cannot adopt it due to the un-readiness of its trading partners (Chwelos, Benbasat, & Dexter, 2001). This was supported by a project manager, "*We are a part of a business wherein many partner organisations like suppliers, vendors, manufacturers are involved. Although we understand and acknowledge the benefits of adopting blockchain for our business, but our partners are hesitant due to lack of funds and skills*"

Zhu, Kraemer, and Xu (2003) found that the lack of willingness of the trading partner readiness inhabits organisations to adopt an inter-organisational system. The respondents agreed that the decision to adopt BCT depends on the willingness and ability of potential partners. One of them stated (A2):

"Since the BCT is a cross-organisation technology, you can get its value when all the organisations are ready to adopt it. If an organisation is motivated and ready to adopt BCT but its partner organisations are unready due to not having sufficient technical skills or finance would be unable to adapt"

4.4.4 Competition intensity (CI)

The likelihood of the adoption of new technologies among organisations increases due to the competition and intensity of rivalry (Thong, 1999). The organisations feel the fear of losing their competitiveness if their competitors have adopted new technology. This was endorsed by A21, "*We adopted blockchain solution because our competitors started to*

accept payments in digital currencies. We felt the pressure of losing our customers if we do not offer them that service". According to a survey conducted by Deloitte (2018), most of the CEOs of leading organisations mentioned that they feel if they do not consider how the BCT can impact their business now, they would not be able to capture any growth opportunities offered by this revolutionary technology in the future. According to Zhu, Kraemer, and Xu (2006), if similar organisations do things in a certain way in the industry, others will follow suit to avoid being perceived as less innovative or responsive. In the context of BCT, its adoption might help organisations to alter the rules of competition,

affect the industry structure, increase operational efficiencies, and leverage new ways to outperform rivals (L.-W. Wong et al., 2019). These initiatives are considered essential for organisations to preserve a competitive edge. Thus, competition intensity is likely to drive organisations to adopt BCT. According to A9, "*whenever there is new technology coming out everyone starts doing the same thing to become the first to develop a product and defeat others in the industry. For example, Facebook has started working with blockchain. I certainly think that the other IT giants like Google, Microsoft, and Amazon are not going to be far behind and will be doing something similar*"

4.5 Summary

This chapter discusses the analysis of qualitative data that was collected through the semi-structured interviews of the BCT experts and decision-makers working in Australian organisations. The chapter presents excerpts from the responses of the interviewees for every factor. The factors are organized in the context of the TOE framework. perceived benefits, perceived risks, perceived compatibility, perceived complexity, perceived information transparency, and perceived disintermediation are covered in the technology context, organisation innovativeness, organisation learning capability, and top management support are presented in the organisational context; government support, standards uncertainty, trading partner readiness, and competition intensity are discussed in the environmental context. The chapter also summarises the findings derived from the qualitative data in tabular form. A schematic diagram showing the relationship between the TOE factors and an organisation's intention to adopt BCT.

Chapter 5: Research Model Development

5.1 Research Model

The published literature reports many factors to influence organisational adoption of BCT worldwide. However, the factors that are particularly relevant to the adoption of BCT among Australian organisations are still unknown. There is a lack of research addressing this issue in depth. To overcome this issue, interviews with BCT experts and decision-makers, from the organisations that had adopted or were in the decision process to adopt BCT, were conducted. Based on the findings drawn from the qualitative data, a conceptual model was developed as shown in Figure 4.1.

To increase the generalisability of the conceptual model, the qualitative findings were further evaluated from the past studies on the adoption of BCT and other information systems like EDI, and B2B e-commerce having similar characteristics to BCT. This led to the development of the theoretical model shown in Figure 5.1. Hypotheses were developed for every factor of the conceptual model to see its validity with larger sample size.

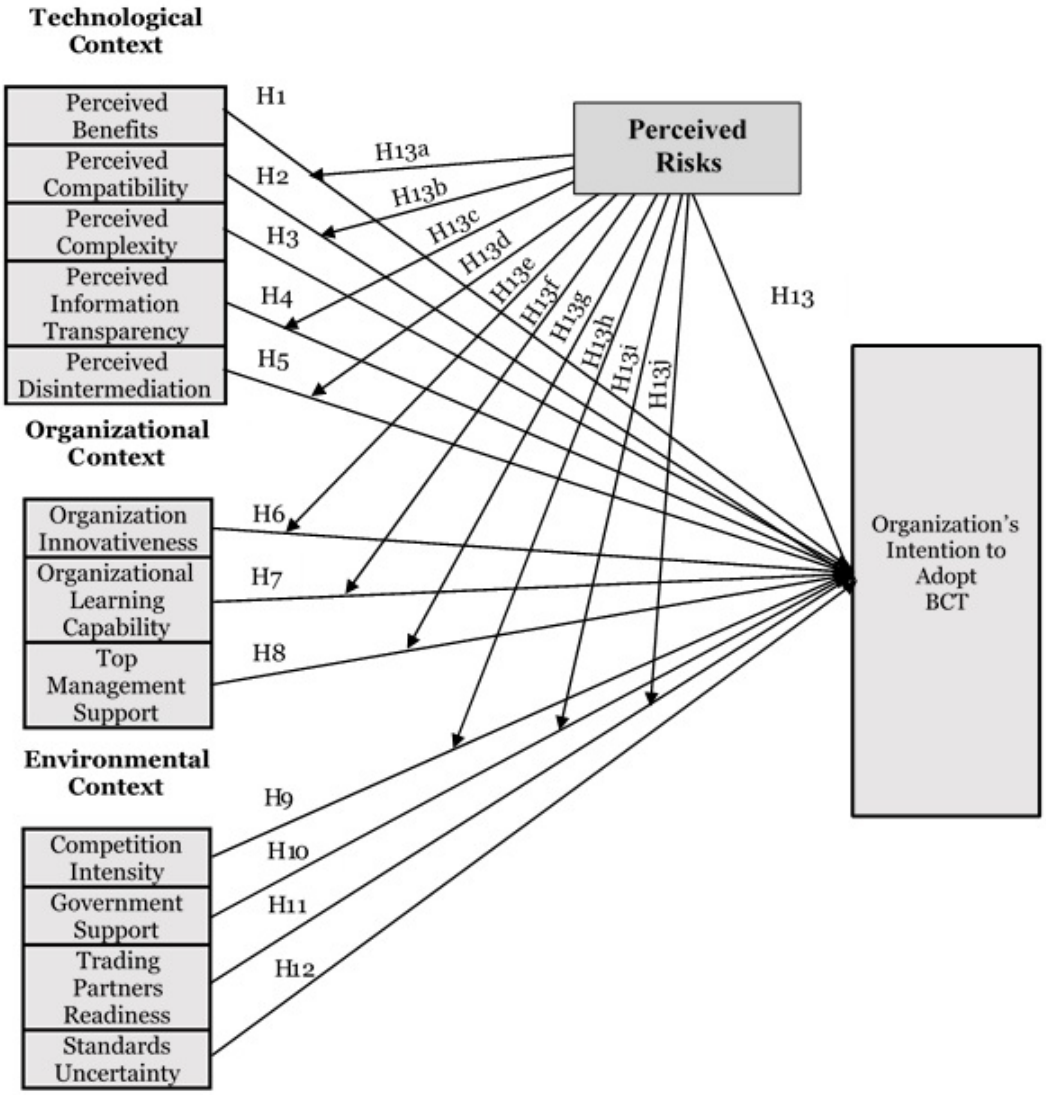

Figure 5. 1 Research theoretical model for the adoption of BCT in Australia

5.2 Research hypotheses

Following is the detail of how a hypothesis was developed for every factor reported in the theoretical model.

5.2.1 Technological factors

5.2.1.1 Perceived benefits (PB)

Perceived benefits relate to the extent to which organisations perceive an innovation that would be beneficial to their business (Rogers, 2003). In past studies on IT adoption, perceived benefits of an innovation are reported influential on its adoption decision (Huang, Janz, & Frolick, 2008; Kuan & Chau, 2001; C. S. Saunders & Clark, 1992). Similarly, there are many benefits of BCT adoption such as improved auditing, cost reduction, improved data provenance, trust, etc. (Kshetri, 2017; Lombard, 2018). De Castro et al. (2020)

mentioned that the perceived benefits of BCT influenced the organisation working in South Africa to adopt BCT. While studying the adoption of BCT in the logistics industry, Orji et al. (2020) reported that the benefits of adopting BCT can motivate organisations to acquire such digital innovations. Therefore, it can be hypothesized that:

H1. *Perceived benefits of BCT positively influence the organisation's intention to adopt BCT.*

5.2.1.2 Perceived compatibility (PC)

Perceived compatibility refers to the organisations' perception of how technology is aligned with their requirements as well as with the existing IT infrastructure (Rogers, 2003). De Castro et al. (2020) pointed out that organisations become more inclined to adopt BCT when they perceive its compatibility with their IT infrastructure. On the other hand, organisations feel anxious about adopting BCT when they do not find it compatible with their business processes (L.-W. Wong et al., 2019). Clohessy, Acton, and Rogers (2019) reported that the organisations that found BCT compatible with their business are more likely to adopt it. They further stated that the compatibility of BCT with an organisation's resources in terms of finances, infrastructure, and skilled employees plays an important role while deciding the adoption of BCT. Therefore, it can be hypothesized that:

H2. *Perceived compatibility of BCT positively influences the organisation's intention to adopt BCT.*

5.2.1.3 Perceived complexity (CMP)

Perceived complexity can be defined as the degree to which organisations perceive technology as difficult to use and understand (De Castro et al. (2020). Past studies on IT adoption literature found perceived complexity negatively associated with the adoption of an innovation (Huang et al., 2008). For the BCT adoption, researchers also found a similar impact of perceived complexity. For instance, L.-W. Wong et al. (2019) reported that the technical complexity of BCT is a barrier to its adoption among Malaysian organisations. Organisations consider technicalities such as the use of public and private keys, and hashing of blocks involved in BCT a complex process. Consequently, organisations become reluctant to adopt BCT (Sadhya & Sadhya, 2018). Clohessy and Acton (2019)reported the perceived complexity of BCT as a barrier that hinders organisations from its adoption. Therefore, it can be hypothesized that:

H3. *Perceived complexity of BCT negatively influences the 'organisation's intention to adopt BCT.*

5.2.1.4 Perceived information transparency (PIT)

Perceived information transparency refers to the extent to which organisations perceive an increase in data availability, reduction of information asymmetry, and easy verification of information (Hoxha & Sadiku, 2019). BCT provides a transparent and trusted single source of information, which motivates organisations to adopt it (Francisco & Swanson, 2018). Information transparency obtained through the BCT significantly reduces organisational interdependency and the expenses caused by information irregularity (V. Johnson, 2019a). Wamba, Queiroz, and Trinchera (2020) found the significant influence of perceived information on organisational adoption of BCT in the USA. Sander, Semeijn, and Mahr (2018) also consider transparency and visibility of information as important determinants of BCT adoption. Hoxha and Sadiku (2019) indicated the highest influence of the perceived information transparency on organisational intention to adopt BCT in the real estate industry of Kosovo. Therefore, it can be hypothesized that:

H4: *Perceived information transparency positively influences the 'organisation's intention to adopt BCT.*

5.2.1.5 Perceived disintermediation (PD)

Perceived disintermediation refers to the extent to which organisations perceive that they could run their business without the involvement of any third party. Disintermediation through BCT is considered a breakthrough in the contemporary digital world. Elimination of the intermediaries reduces the operational costs (Larios-Hernández 2017). Hoxha and Sadiku (2019) reported a positive role of perceived disintermediation in the adoption of BCT among real estate organisations in Kosovo. They stated that BCT disintermediation enabled every stakeholder to have access to the required information which was not possible with the traditional land record system. The removal of third parties like notaries and lawyers reduced the different costs and improved the process efficiency that motivated the organisations to adopt BCT. O'Dair (2017) also found the positive impact of BCT disintermediation in the music industry. They found that 12.7% of royalties that the third parties were receiving as an operating cost, through the BCT disintermediation, be made available directly to artists. Therefore, it can be hypothesized that:

H5: *Perceived disintermediation positively influences the 'organisation's intention to adopt BCT.*

5.2.2 Organisational factors

5.2.2.1 Organisational innovativeness (OI)

Organisational innovativeness is the willingness and openness of an organisation to adopt innovation regardless of the risks associated with it (Tajeddini, Trueman, & Larsen, 2006). It also refers to the organisation's acceptance of the new ideas before they get adopted by others (Thong & Yap, 1995). Organisational innovativeness has been reported important while deciding to adopt new technology, idea, or bring contemporary practices into the business (Newby et al., 2014; Nuryyev et al., 2020). Venkatesh and Bala (2012)indicated that if there is a culture of innovativeness, an organisation is more likely to adopt an inter-organisational system like BCT. Nuryyev et al. (2020) found a statistically significant effect of innovativeness on the adoption of BCT among the tourism and hospitality SMEs in Taiwan. Therefore, it can be hypothesized that:

H6. Organisation*al innovativeness positively influences the 'organisation's intention to adopt BCT.*

5.2.2.2 Organisational learning capability (OLC)

Organisational Learning Capability (OLC) is the organisation's ability to acquire new knowledge from its internal and external environment, store, disseminate, and implement that knowledge into its business decisions (Jerez-Gómez, Céspedes-Lorente, & Valle-Cabrera, 2007). S. Malik, Chetty, and Chadhar (2018) mentioned that organisational learning and information technology supplement each other. Woiceshyn (2000) stated when organisations acquire new knowledge from their environment, it leads them to adopt innovations. Organisational change and innovation come through organisational learning (Chadhar & Daneshgar, 2018). Kulkarni and Patil (2020) said that the organisation's learning culture significantly influenced the adoption of BCT. V. Johnson (2019b) considered organisational learning essential for the adoption of BCT. Therefore, it can be hypothesized that:

H7. *Organisational Learning Capability (OLC) positively influences the 'organisation's intention to adopt BCT.*

5.2.2.3 Top management support (TMS)

Top management support is an integral part of any decision to adopt new technology (Haneem, Kama, Taskin, Pauleen, & Bakar, 2019). Hughes, Park, Kietzmann, and Archer-Brown (2019) say that if the top management is not supportive, adoption of innovation like BCT is not possible within an organisation. Koster and Borgman (2020) found the positive

role of top management support in the adoption of BCT in the Netherland. De Castro et al. (2020) stated that the lack of leadership support reduced the likelihood of the adoption of BCT. Houston, Acton, Clohessy, and Godfrey (2018) and Clohessy et al. (2019) also found that top management support was essential for the adoption of BCT. Therefore, it can be hypothesized that:

H8. *Top management support positively influences the 'organisation's intention to adopt BCT.*

5.2.3 Environmental factors

5.2.3.1 Competition intensity (CI)

Competition intensity, also known as competitive or external pressure, is the extent to which organisations feel fear their competitors to lose competitive advantage. Competition intensity has long been recognized as an important factor in the organisational adoption of innovation (Zhu & Kraemer, 2005). (L.-W. Wong et al., 2020) says that organisations believe if they do not adopt BCT eventually, they will lose their competitive advantage. Barnes III and Xiao (2019a) also argued that when an organisation adopts BCT, competitors follow the suit to maintain their competitive position. L.-W. Wong et al. (2019) said that competitive pressure catalyses an organisation's decision to adopt BCT. Therefore, it can be hypothesized that:

H9. *Competitive intensity positively influences the 'organisation's intention to adopt BCT.*

5.2.3.2 Government support (GS)

Organisations consider government support an important element when deciding to adopt new technology (M. Tan & Teo, 2000). In the case of BCT, Koster and Borgman (2020) consider government support as the major driving force that speeds up the adoption of BCT among organisations. De Castro et al. (2020) stated that if the government does not provide proper support such as establishing the regulations, the widespread adoption of BCT among organisations will remain hindered. Kulkarni and Patil (2020) also L.-W. Wong et al. (2019) reported government support as a critical factor in the adoption of BCT. Therefore, it can be hypothesized:

H10. *Government support positively influences the organisation's intention to adopt BCT.*

5.2.3.3 Trading partner readiness (TPR)

Trading partner readiness refers to the preparedness of the partners of an organisation to embrace new technology. Similar to any inter-organisational system, BCT requires strong

collaboration and interaction among the trading partners (Werner et al., 2020). If the trading partners do not have technical and financial resources, an organisation alone can not decide the adoption of an inter-organisational system (Chwelos et al., 2001). Kühn et al. (2019) stated that the adoption of BCT among the collaborating organisations occurs when everyone trusts and is ready to share their data over the BCT network. Bai and Sarkis (2020) said that the willingness of the trading partners is essential to adopt BCT. Therefore, it can be hypothesized:

H11. *Trading partner readiness positively influences the 'organisation's intention to adopt BCT.*

5.2.3.4 Standards uncertainty (SU)

Standards uncertainty refers to the unpredictability that organisations feel to forecasting that BCT will be stable over time and become a standard. The BCT projects are built on different protocols, consensus, privacy measures, and there is a lack of standardization of BCT architectures (Morkunas, Paschen, & Boon, 2019). Orji et al. (2020) said that there is an overall lack of BCT electronic data interchange standards, which causes interoperability issues among the BCT projects resultantly discouraging organisations from adopting BCT. Organisations feel reluctant to adopt a technology with no established standards in the market (Venkatesh & Bala, 2012). Standards uncertainty creates fear of losing investments when the organisations decide to adopt BCT (Kühn et al., 2019). Due to the non-existence of clear standards of BCT regarding data privacy, funds transfer, and smart contracts, it is hard to reach the large-scale organisational adoption of BCT (Sadhya & Sadhya, 2018). Therefore, it can be hypothesized that:

H12. *Standards uncertainty negatively influences the organisation's intention to adopt BCT.*

5.2.4 Moderating effect of perceived risks

Perceived risks refer to the extent to which organisations perceive the negative consequences of adopting BCT. In the IT adoption literature, perceived risks are negatively associated with the adoption of new technology. Although there are many benefits of BCT reported, it is not free from the risks such as privacy, high data storage, and a 51% attack that hinder organisations to adopt it (Sadhya & Sadhya, 2018). Yoo, Bae, Park, and Yang (2019) stated perceived risks as a barrier to the organisational adoption of BCT. Erturk, Lopez, and Yu (2019) and Abramova and Böhme (2016) mentioned that the risks of using

BCT contribute to the greater uncertainty of its adoption. Therefore, it can be hypothesized that:

H13. *Perceived risks of BCT negatively influence the 'organisation's intention to adopt BCT.*

The past literature shows inconsistent results for the relationship between the influencing factors and BCT adoption. For example, Clohessy and Acton (2019) and Orji et al. (2020) found top management support as a critical factor for the organisational BCT. Whereas, (L.-W. Wong et al., 2019) reported the insignificant effect of upper management support on BCT adoption. Similarly, De Castro et al. (2020) reported government regulations positive toward the organisational adoption of BCT, whereas, Albrecht et al. (2018) stated that government regulations prevent BCT adoption. In addition to that, Hoxha and Sadiku (2019) and L.-W. Wong et al. (2019) found varying results for the influence of cost on BCT adoption. Baron and Kenny (1986) recommended the introduction of the moderating variable when there is found a weak or inconsistent relationship between a predictor and the criterion variable. The present study proposed perceived risks as a potential moderating variable influencing the relationship between the factors found influential on BCT adoption among Australian organisations.

The moderating role of perceived risks has yet to gain attention while applying the TOE framework to examine the organisational adoption of BCT. The reasons for choosing perceived risks as a moderating variable in this study are given below:

- During the qualitative phase of this study, BCT experts highlighted the moderating role of perceived risks in BCT adoption.
- The past literature reports the moderating role of perceived risks in the adoption of different technological innovations (M. Featherman & Fuller, 2003; Khaksar, Khosla, Singaraju, & Slade, 2019; Martins, Oliveira, Thomas, & Tomás, 2019; Shen & Chiou, 2010; Yang & Lin, 2015). Shen and Chiou (2010) found that perceived risks moderates the relationship between perceived ease of use and intention towards using internet services. Khaksar et al. (2019) reported moderating role of perceived risks in the adoption of social assistive technology.
- Given the higher value of the “uncertainty avoidance index” for Australia in Table 1.1, anecdotally it can be assumed that the perceived risks would moderate the

relationship between the influential factors and organisation' intention to adopt BCT.

Since the perceived risks per se had a negative impact on BCT adoption, its moderating effects were proposed for only those factors having a positive influence on BCT adoption. The following hypotheses were developed:

H13a. Perceived risks moderate the relationship between perceived benefits and intention to adopt BCT.

H13b. Perceived risks moderate the relationship between perceived compatibility and intention to adopt BCT.

H13c. Perceived risks moderate the relationship between perceived information transparency and intention to adopt BCT.

H13d. Perceived risks moderate the relationship between perceived disintermediation and intention to adopt BCT.

H13e. Perceived risks moderate the relationship between organisation innovativeness and intention to adopt BCT.

H13f. Perceived risks moderate the relationship between organisational learning capability and intention to adopt BCT.

H13g. Perceived risks moderate the relationship between top management support and intention to adopt BCT.

H13h. Perceived risks moderate the relationship between competitive intensity and intention to adopt BCT.

H13i. Perceived risks moderate the relationship between government support and intention to adopt BCT.

H13j. Perceived risks moderate the relationship between trading partner readiness and intention to adopt BCT.

5.3 Summary

This chapter explains the development of the research model and relevant hypotheses. The research framework was developed on the basis of the findings of the qualitative phase of this study and the extensive literature review. The framework has factors belonging to the

technology, organisation, and environment contexts. These factors have a direct relationship with an organisation's intention to adopt BCT. The chapter also describes the moderating effect of perceived risks between the independent and dependent variables. The technology factors include perceived benefits, perceived compatibility, perceived complexity, perceived information transparency, and perceived disintermediation; organisational factors comprise organisation innovativeness, organisation learning capability, and top management support, and environment factors contain government support, competition intensity, trading partner readiness, and standards uncertainty. The framework has 13 hypotheses for the direct factors. However, the moderating factor 'perceived risks' has further 10 hypotheses.

Chapter 6: Quantitative Data Analysis

6.1 Analysis of survey responses

6.1.1 Response rate

The data through an online survey were collected from June 2020 to August 2020. A total of 500 target organisations across Australia were sent an email to participate in the research. The organisations that had adopted or were in the process to adopt BCT were chosen for the survey. They were recruited by using online sources and a third party. Every organisation was requested to forward the survey to the employee who was responsible and took part in the decision-making process for the adoption of BCT. Over three months, 200 completed responses were received from the company that was hired for the data collection. Among the 200 responses, 4 were found duplicated and therefore removed. Consequently, 196 valid and unique responses were obtained, yielding a response rate of 39.2%, which is considered acceptable in online survey research (Baruch & Holtom, 2008; Cavana et al., 2001; Cobanoglu, Moreo, & Warde, 2001; Cook, Heath, & Thompson, 2000). The response rate is also aligned with the study of Khemthong (2007) who studied IT adoption in Australia.

6.1.2 Characteristics of participating organisations

The section explains the summary of the characteristics of the participating organisations, which include the type of organisation, size of the organisation in terms of the number of employees, and annual budget as shown in Table 6.1.

Table 6. 1 Descriptive information about the participating organisations

Characteristics	Frequency	Percentage (%)
Type of Organisation		
Automotive	3	1.5
Construction	3	1.5
Consultancy	12	6.1
Education	25	12.7
Electronics	6	3.1
Finance/Banking	17	8.7

Characteristics	Frequency	Percentage (%)
Government	5	2.6
Information technology	47	24.0
Insurance	12	6.1
Manufacturing	8	4.1
Pharmaceutical	10	5.1
Retail	2	1.0
Supply chain	31	15.8
Telecommunication	5	2.6
Transport	7	3.6
Legal	3	1.5
Size		
Micro (1-4 employees)	19	9.7
Small (5-19 employees)	55	28.1
Medium (20-199 employees)	98	50.0
Large (>200 employees)	24	12.2
Annual Revenue (AUD)		
Less than $1 million	19	9.7
Between $1-$5 million	55	28.1
Between $5-$50 million	98	50.0
Above $50 million	24	12.2

All the participating organisation had been working in Australia. They were from different industries including automotive, construction, consultancy, education, electronics, finance/banking, government, information technology, insurance, manufacturing, pharmaceutical, retail, supply chain, telecommunication, transport, and legal. Most of the organisations were from the banking/finance (15.8%), education (12.7%), information technology (24%), and supply chain (15.8%) industries. These industries seem to be most appropriate for BCT.

In this research, the organisations were classified according to the definition set by the Australian Bureau of Statistics (ABS). According to the bureau, micro-organisation has less than five employees; a small organisation has 5-19 employees, medium organisation has 20-199 employees, whereas in a large organisation there works more than 200 employees.

The demographic data shows that most of the organisations were medium (50%). The micro organisations were found 9.7%, small 28.1%, and large organisation 12.2%. The micro-organisations have annual revenue of less than AU$ 1 million; small organisations have between AU$1-AU$5 million, and medium organisations have between AU$5-AU$50 million. Large organisations have annual revenue above AU$50 million.

The level of BCT adoption by the organisations was also investigated. Organisations were asked to mention their BCT adoption status by (i) currently interested in BCT and actively seeking related information, (ii) currently in the process of deciding adoption of BCT, (iii) currently implemented BCT, and (iv) previously implemented BCT, but not using now. This information helped to classify organisation between adopters (iii and iv) and potential adopters (i and ii) of BCT. The result indicated that 55.90% organisations were adopters while 44.10% of them were potential adopters).

6.1.3 Characteristics of individual respondents

In this section, the demographic profile of the individual respondents is summarised. This includes age, gender, education, and role of the respondents as exhibited in Table 6. 2.

Table 6. 2 Descriptive information about individual respondents

Characteristics	Frequency	Percentage (%)
Age		
18-25 Years	11	5.6
26-40 Years	92	46.9
41-50 Years	73	37.3
51-60 Years	20	10.2
Gender		
Male	112	57.1
Female	84	42.9
Education		
College Certificate	34	17.3
Undergraduate Degree	45	23
Postgraduate Degree or Higher	80	40.8
Professional Certificate/Diploma	37	18.9
Role		

Chief Executive Officer (CEO)	30	15.3
Chief Technology Officer (CTO)	45	23
IT Director	33	16.8
IT Manager	20	10.2
Technology Strategy Manager	17	8.7
Database Administrator	11	5.6
Supply Chain Manager	25	12.7
Finance Director/Manager	15	7.7

The demographic data shows that there were 42.9% female (n=84) and 57.1% male (n=112) respondents in the sample.

The respondents were asked to mention their job titles. The majority of them reported themselves as chief technology officer (23%), chief executive officer (15.3%), and IT director (16.8%). The rest of them include the IT manager, technology strategy manager, database administrator, supply chain manager, and finance director/manager.

The level of BCT experience of respondents was also captured in the survey. Over 83% of the respondents have an experience between 5 and 7 years. The respondents having experience of fewer than 3 years were screened out from the survey. In addition, respondents were asked to rate their knowledge as novice, good, or expert about BCT. Overall, they indicated them as good (74.7) in BCT. The novice respondents were removed from the survey.

In addition, respondents were asked to mention their level of education. The majority of the respondents were post-graduate degree holders (40.80%). The minimum qualification, which had 18.90% of the respondents, was a professional diploma/certificate.

6.2 Preliminary analyses

The preliminary data analysis helps to identify any possible violations, assure data quality, and assist in a better understanding of the data while performing the multivariate data analysis, especially with the SEM technique (Joe F Hair et al., 2011). The following preliminary analyses were performed in this study (Joe F Hair et al., 2011; Tabachnick, Fidell, & Ullman, 2007).

- Missing Value Analysis
- Descriptive Analysis
- Multicollinearity Analysis

6.2.1 Missing value analysis

To produce clean data for the analysis, an examination of the missing values in the collected data is important. However, this study does not require the missing value analysis because the respondents were forced to answer each question before moving to the next question in the online survey as suggested by Gosling, Vazire, Srivastava, and John (2004). In other words, a respondent was only able to answer the last question of the online survey if he had answered all the previous questions. As a result, all the downloaded surveys were complete and had no missing values implying no need to perform the missing value analysis (Gefen, Rigdon, & Straub, 2011; Joseph F Hair, Sarstedt, Pieper, & Ringle, 2012).

The input data matrix comprises 196 cases. There are 45 indicators for each case and 8820 data points in total.

6.2.2 Non-Response Bias

Bias: Nonresponse bias occurs when some respondents of the chosen sample are unable or unwilling to participate in the survey (Cavana et al., 2001). The respondents who fail to respond may be different from the rest of the population. Consequently, the true representation of the target population is not reflected in the survey data. The inferences derived from the collected data may be false and the validity of the research is compromised (Urbach & Ahlemann, 2010). The nonresponse bias is introduced when the recruitment of the respondents is based on self-selection. The participants voluntarily decide to participate in a survey. To assure that the collected data is free from self-selection bias, and it truly represents the target population, the comparison of the sample population and the respondents who completed the survey was performed. From the comparison, no selection bias was found in the collected data. Furthermore, the non-response bias was checked with Levene's test for equality of variances (Cuddeback, Wilson, Orme, & Combs-Orme, 2004) and independent-samples t-test, for all the factors. The respondents were divided between early respondents (who responded before the reminder, 45.5%) and late respondents (who responded after the reminder, 54.5%). The equal variance significance values for all the factors were found to be higher than the significance level of 0.05, which implies that both groups, early and late respondents, have the same variance. Thus, non-response bias was not found in the data.

6.2.3 Descriptive analysis

The descriptive analysis including the values of mean, standard deviation, variance, minimum value, and maximum for each indicator of the latent variables was performed. Another important issue in the data analysis is considered the normality test i.e. normal data distribution assumptions (Gefen et al., 2011). However, many researchers believe that the normality test is not required while using the PLS-SEM for data analysis (Cassel, Hackl, & Westlund, 1999; Chin, 1998; Gefen et al., 2011; Reinartz, Haenlein, & Henseler, 2009; Wetzels, Odekerken-Schröder, & Van Oppen, 2009). They stated that an accurate model estimation can be obtained using the PLS-SEM even if the data are non-normally distributed.

6.2.4 Multicollinearity analysis

Before assessing the fitness of the measurement model, the collinearity test was performed. Multicollinearity refers to the condition of a high correlation among the exogenous latent variables (Tabachnick et al., 2007). The high level of collinearity among the independent variables results in biased results for the path coefficient (Hair Jr, Hult, Ringle, & Sarstedt, 2016). The collinearity was assessed through the value of Variance Inflation Factor (VIF), recommended by Hair Jr et al. (2016). The VIF value of 5 is considered high collinearity. Table 6.3 shows the results of the multicollinearity test for our study.

Table 6. 3 Multicollinearity Test

Construct	VIF
Competitive Intensity	1.707
Perceived Complexity	1.192
Government Support	1.123
Organisation Innovativeness	1.493
Organisation Learning Capability	1.324
Perceived Benefits	1.059
Perceived Compatibility	1.903
Perceived Disintermediation	1.440
Perceived Information Transparency	1.953
Perceived Risks	1.299
Standards Uncertainty	1.606

Construct	VIF
Top Management Support	1.354
Trading Partner Readiness	1.210

From the test values, it is clear that the factors have VIF value of less than 5, which implies that the factors are not highly correlated. The factor 'perceived benefits' has the lowest VIF value i.e., 1.059 whereas perceived information transparency has the highest value i.e., 1.953 that are less than 2 indicating no multicollinearity (Senaviratna & Cooray, 2019).

6.3 Common method variance (CMV)

Common method variance, a subset of common method bias, is the amount of spurious variance that is shared among the variables because of using a common method for data collection (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). The CMV is considered a major concern in self-reporting surveys because it creates serious problems while evaluating the construct validity and reliability (Hufnagel & Conca, 1994; Lindell & Whitney, 2001; Podsakoff et al., 2003; Spector, 2006). According to Conway and Lance (2010, p. 325), "common method bias inflates relationships between variables measured by self-reports"

To examine the CMV, the *Harman one-factor* test was performed through the SPSS software. All the variables of the study were loaded for a principal component analysis selecting the unrotated factor solution (Podsakoff et al., 2003). The analysis yielded fourteen factors, and the largest factor showed 29.313% of the total variance, which is less than 50% and implies that CMV is not an issue for the study (Podsakoff, MacKenzie, & Podsakoff, 2012; Woszczynski & Whitman, 2004).

Apart from the *Harman one-factor test,* the full collinearity assessment approach was also followed to examine the CMV (Kock, 2015; Kock & Lynn, 2012). According to Kock (2015), "if all VIFs resulting from a full collinearity test are equal to or lower than 3.3, the model can be considered free of common method bias". Table 6.3 shows that all the VIFs values are lower than 3.3 that indicating the model under study is free from the common method bias.

6.4 Models evaluation

The study uses the Structural Equation Model (SEM) to analyze the survey data to confirm the proposed theoretical model. There are two models involved in the SEM analysis that

are the measurement model and the structural model (Hair Jr et al., 2016). The measurement model shows the relationship between manifest variables, also known as measuring items or indicators, and their corresponding construct (latent variable). Whereas, the structural model shows the relationship among the latent variables (both the exogenous and endogenous), which is developed through the research hypotheses. It is important to assess the fitness of the measurement model before proceeding to the evaluation of the structural model to test the hypotheses.

6.4.1 Assessment of the measurement model

The study assesses the measurement model by examining the construct validity and reliability, as shown in Figures 6.1 and 6.2.

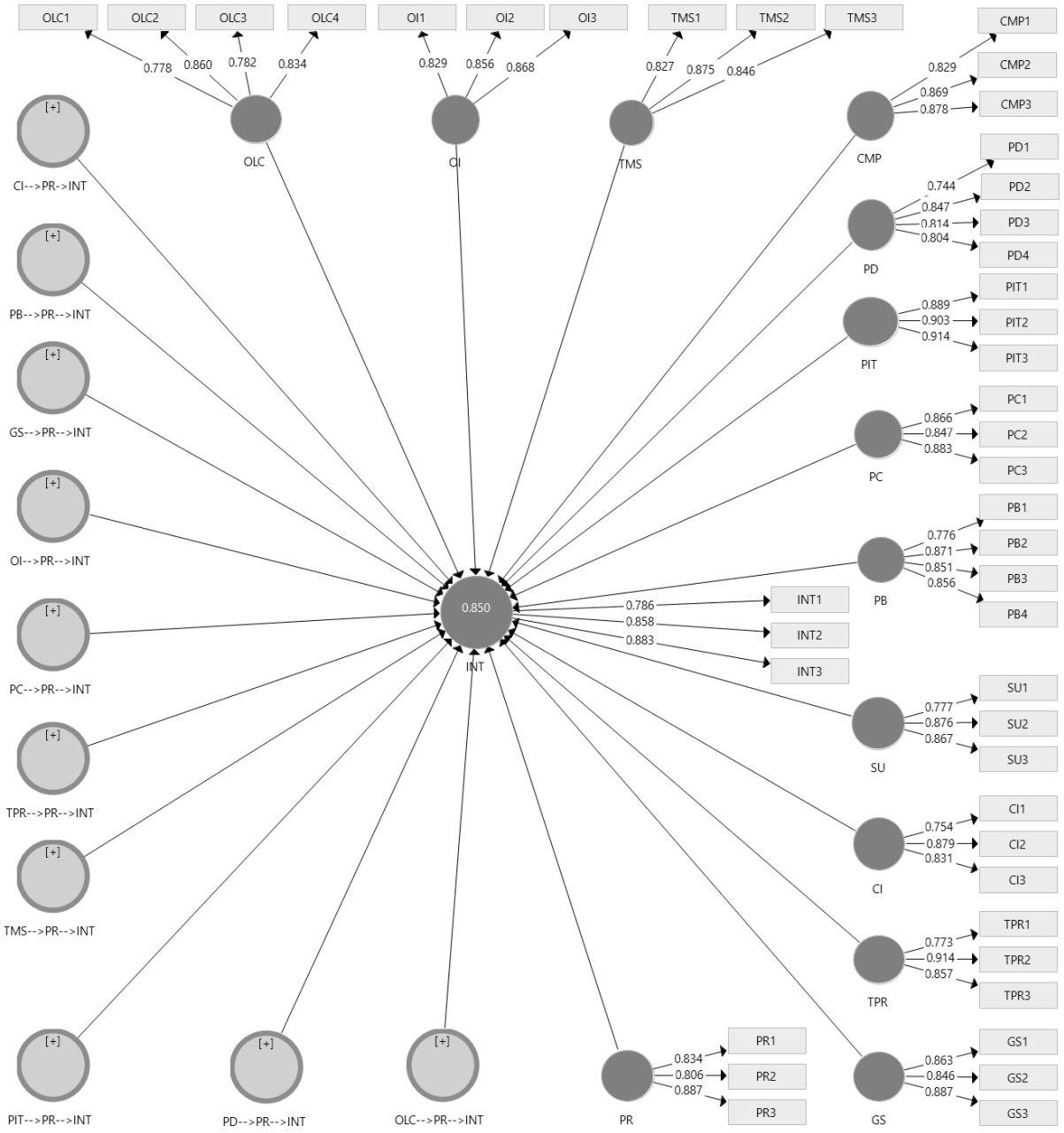

Figure 6. 1 Measurement Model with PLS Loadings

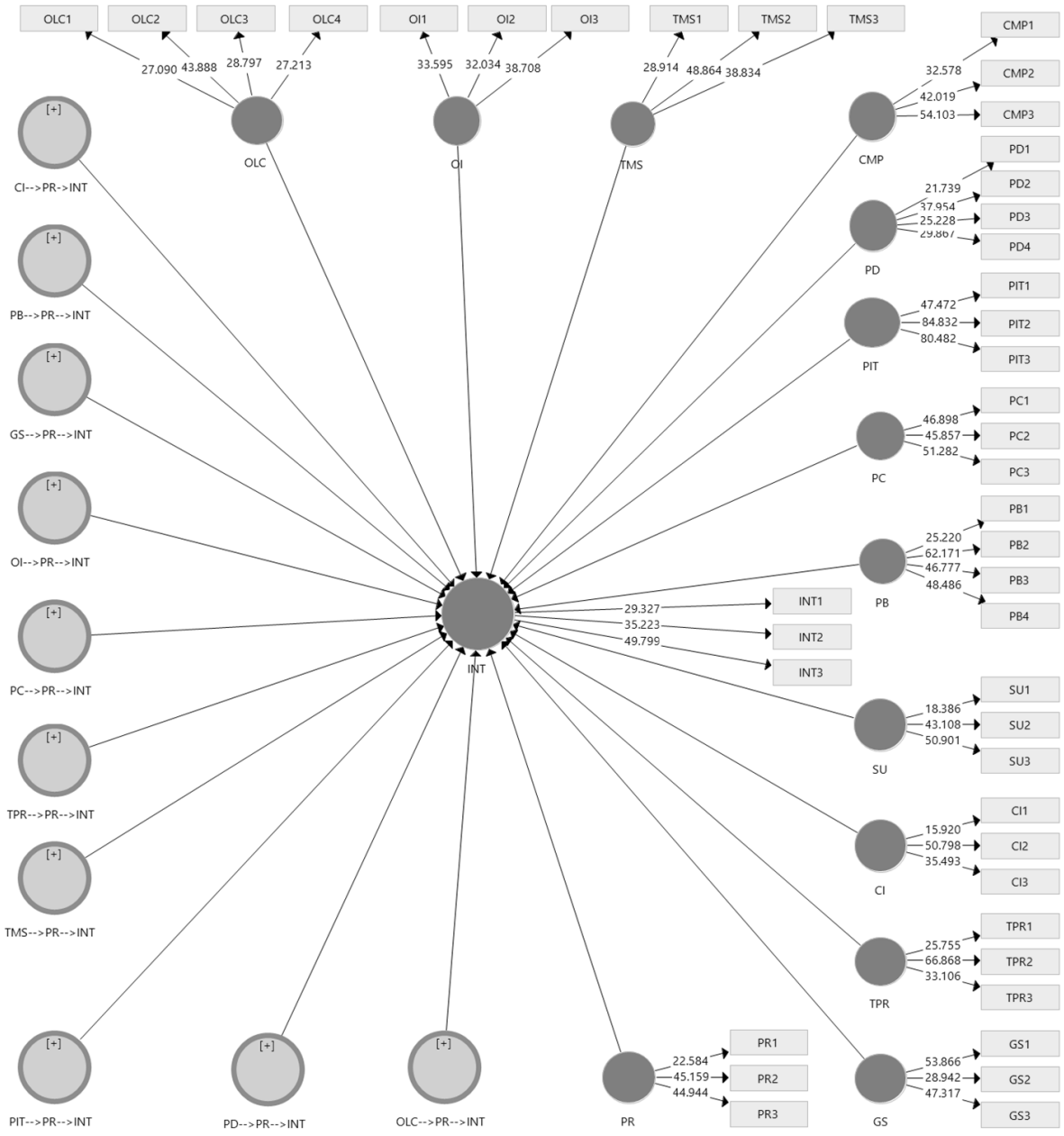

Figure 6. 2 Measurement Model with T-Statistics

6.4.1.1 Constructs validity

Construct validity refers to the degree to which the chosen measuring items measure the constructs they are supposed to measure in theory (Bagozzi, Yi, & Phillips, 1991). A construct is considered valid if its corresponding measuring items have high correlations (Peter, 1981). The construct validity is assessed in two major ways, namely, convergent validity and discriminant validity.

Convergent validity is the extent to which the chosen measures capture a common construct (Carlson & Herdman, 2012). Similarly, Campbell and Fiske (1959) stated that convergent

validity is established when two or more indicators correlate with each other for the same concept. According to Nunnally (1994), the convergence of a construct is represented by its highly correlated measures. In addition, he asserts that the magnitude and interpretability of research findings will be adversely affected if the convergent validity is managed poorly at any point. Carlson and Herdman (2012) reported that when there is a weak or poor correspondence between the measuring items and their constructs, the meanings of the observed data become ambiguous.

Discriminant validity refers to the degree to which the measuring items of one construct do not highly correlate with the measuring items of any other constructs under study (Hair Jr et al., 2016; Hulland, 1999). Theoretically, discriminant validity ensures that "a test does not correlate too highly with measures from which it is supposed to differ" (Campbell, 1960, p. 548). According to Farrell (2010, p. 324), if the discriminant validity is not addressed, "constructs [have] influence on the variation of more than just the observed variables to which they are theoretically related" and, consequently, "researchers cannot be certain results confirming hypothesized structural paths are real or whether they are a result of statistical discrepancies".

To ensure construct validity, confirmatory factor analysis was performed by using PLS-SEM through the SmartPLS 3 software. According to Hair Jr et al. (2016) and Chin (1998), convergent validity is achieved by calculating the values of "Outer Loadings", while the discriminant validity is established through the "Cross-Loadings" and "Average Variance Extracted (AVE)". All the constructs used in this study are reflective. The PLS Algorithm procedure was generated to obtain the values of outer loadings, cross-loadings, and AVE.

6.4.1.1.1 Outer loadings

The statistical results for the outer loadings are shown in Table 6.4. K. K.-K. Wong (2013) and Hulland (1999), Barclay, Higgins, and Thompson (1995) suggest that the values of the outer loadings should be greater than 0.5, whilst Chin (1998) recommends that the loadings should be greater than 0.707. Also, he states that the value of T-statistics for their path coefficient should be greater than 1.645 at $p \leq 0.05$ and more than 2 at $p \leq 0.01$.

According to the statistical results shown in Table 6.4, the result of this study meets the recommended values for convergent validity. All of the loadings are above 0.707 and the T-statistics are more than 2.

Table 6. 4 Loadings for the measurement model

Construct	Items	PLS Loadings	T-Statistics
Competitive Intensity	CI1	0.754	15.920
	CI2	0.879	50.798
	CI3	0.831	35.493
Perceived Complexity	CMP1	0.829	32.578
	CMP2	0.869	42.019
	CMP3	0.878	54.103
Government Support	GS1	0.863	53.866
	GS2	0.846	28.942
	GS3	0.887	47.317
Intention	INT1	0.786	29.327
	INT2	0.858	35.223
	INT3	0.883	49.799
Organisation Innovativeness	OI1	0.829	33.595
	OI2	0.856	32.034
	OI3	0.868	38.708
Organisation Learning Capability	OLC1	0.778	27.090
	OLC2	0.860	43.888
	OLC3	0.782	28.797
	OLC4	0.834	27.213
Perceived Benefits	PB1	0.776	25.220
	PB2	0.871	62.171
	PB3	0.851	46.777
	PB4	0.856	48.486
Perceived Compatibility	PC1	0.866	46.898
	PC2	0.847	45.857
	PC3	0.883	51.282
Perceived Disintermediation	PD1	0.744	21.739
	PD2	0.847	37.954
	PD3	0.814	25.228
	PD4	0.804	29.867
Perceived Information Transparency	PIT1	0.889	47.472
	PIT2	0.903	84.832
	PIT3	0.914	80.482
Perceived Risks	PR1	0.834	22.584
	PR2	0.806	45.159
	PR3	0.887	44.944
Standards Uncertainty	SU1	0.777	18.386
	SU2	0.876	43.108
	SU3	0.867	50.901
Top Management Support	TMS1	0.827	28.914
	TMS2	0.875	48.864
	TMS3	0.846	38.834
Trading Partner Readiness	TPR1	0.773	25.755
	TPR2	0.914	66.868
	TPR3	0.857	33.106

6.4.1.1.2 Cross-loadings

The values of the cross-loadings were obtained to ensure the dissimilarity of constructs under the study, as suggested by Hulland (1999). According to Chin (1998), each indicator of every latent variable should be loaded higher than the indicators of any other off-diagonal variable. The results of the cross-loadings are shown in Table 6.5. The results indicate that the loadings of the measuring items of every construct were loaded higher than the loadings of the measuring items of any other construct in the same block, which implies that the loadings clearly separate each latent variable.

Table 6. 5 Cross-loadings test

Items	Competitive Intensity	Perceived Complexity	Government Support	Intention	Organisation Innovativeness	Organisation Learning Capability	Perceived Benefits	Perceived Compatibility	Perceived Disintermediation	Perceived Information Transparency	Perceived Risks	Standards Uncertainty	Top Management Support	Trading Partner Readiness
CI1	**0.754**	0.636	0.328	0.597	0.438	0.504	0.527	0.450	0.403	0.423	0.491	0.482	0.462	0.431
CI2	**0.879**	0.560	0.512	0.616	0.552	0.638	0.616	0.633	0.522	0.480	0.644	0.619	0.543	0.671
CI3	**0.831**	0.505	0.484	0.619	0.603	0.589	0.646	0.448	0.464	0.461	0.536	0.557	0.447	0.616
CMP1	0.569	**0.829**	0.328	0.456	0.421	0.424	0.475	0.324	0.326	0.466	0.412	0.392	0.450	0.347
CMP2	0.533	**0.869**	0.348	0.502	0.387	0.430	0.462	0.432	0.389	0.698	0.431	0.395	0.550	0.482
CMP3	0.651	**0.878**	0.381	0.535	0.434	0.488	0.562	0.616	0.411	0.634	0.567	0.471	0.588	0.600
GS1	0.470	0.365	**0.863**	0.545	0.446	0.489	0.579	0.466	0.471	0.311	0.522	0.452	0.367	0.512
GS2	0.412	0.345	**0.846**	0.440	0.417	0.406	0.480	0.361	0.406	0.309	0.399	0.422	0.261	0.430
GS3	0.518	0.358	**0.887**	0.531	0.470	0.456	0.554	0.413	0.393	0.327	0.444	0.437	0.319	0.514
INT1	0.635	0.516	0.469	**0.786**	0.583	0.528	0.687	0.549	0.484	0.451	0.518	0.470	0.462	0.586
INT2	0.621	0.468	0.497	**0.858**	0.678	0.606	0.611	0.561	0.593	0.464	0.561	0.641	0.538	0.635
INT3	0.631	0.492	0.521	**0.883**	0.569	0.619	0.603	0.654	0.594	0.508	0.645	0.535	0.519	0.681
OI1	0.581	0.419	0.426	0.664	**0.829**	0.550	0.598	0.483	0.541	0.439	0.587	0.649	0.412	0.515
OI2	0.511	0.430	0.459	0.562	**0.856**	0.537	0.569	0.533	0.637	0.464	0.697	0.680	0.484	0.606
OI3	0.559	0.380	0.429	0.609	**0.868**	0.538	0.547	0.459	0.532	0.419	0.660	0.632	0.415	0.536
OLC1	0.566	0.467	0.376	0.533	0.492	**0.778**	0.504	0.373	0.499	0.345	0.450	0.500	0.330	0.346
OLC2	0.672	0.455	0.504	0.636	0.594	**0.860**	0.601	0.576	0.606	0.431	0.640	0.667	0.400	0.552
OLC3	0.480	0.324	0.344	0.465	0.447	**0.782**	0.464	0.357	0.514	0.258	0.470	0.485	0.292	0.386
OLC4	0.556	0.440	0.457	0.605	0.528	**0.834**	0.594	0.569	0.632	0.454	0.601	0.553	0.417	0.553
PB1	0.615	0.528	0.484	0.582	0.553	0.596	**0.776**	0.445	0.609	0.331	0.562	0.508	0.429	0.534
PB2	0.664	0.464	0.536	0.690	0.547	0.568	**0.871**	0.618	0.516	0.356	0.668	0.520	0.433	0.668
PB3	0.640	0.514	0.560	0.635	0.502	0.540	**0.851**	0.606	0.520	0.423	0.605	0.478	0.421	0.648

Items	Competitive Intensity	Perceived Complexity	Government Support	Intention	Organisation Innovativeness	Organisation Learning Capability	Perceived Benefits	Perceived Compatibility	Perceived Disintermediation	Perceived Information Transparency	Perceived Risks	Standards Uncertainty	Top Management Support	Trading Partner Readiness
PB4	0.664	0.465	0.519	0.629	0.650	0.552	**0.856**	0.547	0.531	0.421	0.597	0.626	0.493	0.600
PC1	0.582	0.565	0.442	0.655	0.564	0.545	0.633	**0.866**	0.641	0.517	0.636	0.613	0.540	0.602
PC2	0.538	0.440	0.430	0.595	0.441	0.509	0.538	**0.847**	0.519	0.392	0.599	0.469	0.440	0.530
PC3	0.487	0.383	0.370	0.554	0.483	0.465	0.541	**0.883**	0.566	0.334	0.619	0.545	0.446	0.546
PD1	0.445	0.327	0.420	0.515	0.595	0.560	0.581	0.559	**0.744**	0.222	0.598	0.596	0.367	0.484
PD2	0.521	0.419	0.422	0.606	0.579	0.641	0.517	0.563	**0.847**	0.310	0.642	0.629	0.410	0.514
PD3	0.456	0.330	0.359	0.484	0.503	0.579	0.515	0.494	**0.814**	0.327	0.613	0.577	0.373	0.478
PD4	0.385	0.324	0.367	0.511	0.459	0.553	0.459	0.526	**0.804**	0.258	0.608	0.483	0.367	0.439
PIT1	0.403	0.571	0.306	0.406	0.421	0.357	0.334	0.340	0.282	**0.889**	0.383	0.418	0.459	0.418
PIT2	0.540	0.670	0.331	0.583	0.506	0.492	0.453	0.463	0.360	**0.903**	0.546	0.426	0.548	0.485
PIT3	0.529	0.644	0.347	0.503	0.459	0.389	0.430	0.488	0.287	**0.914**	0.446	0.410	0.526	0.535
PR1	0.569	0.472	0.419	0.585	0.680	0.587	0.558	0.486	0.654	0.424	**0.834**	0.608	0.422	0.520
PR2	0.527	0.468	0.397	0.495	0.492	0.554	0.612	0.656	0.544	0.395	**0.806**	0.551	0.412	0.524
PR3	0.616	0.460	0.513	0.636	0.630	0.637	0.666	0.673	0.624	0.486	**0.887**	0.634	0.477	0.654
SU1	0.508	0.445	0.396	0.473	0.568	0.473	0.475	0.416	0.571	0.339	0.565	**0.777**	0.490	0.472
SU2	0.617	0.421	0.397	0.570	0.653	0.597	0.534	0.559	0.574	0.422	0.677	**0.876**	0.521	0.506
SU3	0.573	0.381	0.479	0.594	0.609	0.641	0.594	0.597	0.654	0.404	0.648	**0.867**	0.502	0.554
TMS1	0.489	0.573	0.257	0.465	0.353	0.320	0.412	0.409	0.338	0.470	0.377	0.383	**0.827**	0.382
TMS2	0.529	0.568	0.360	0.545	0.484	0.436	0.524	0.544	0.471	0.503	0.512	0.584	**0.875**	0.522
TMS3	0.479	0.442	0.315	0.518	0.458	0.375	0.408	0.447	0.389	0.483	0.426	0.543	**0.846**	0.444
TPR1	0.597	0.526	0.429	0.586	0.477	0.460	0.600	0.433	0.473	0.437	0.471	0.426	0.401	**0.773**
TPR2	0.635	0.482	0.468	0.662	0.567	0.482	0.637	0.575	0.483	0.440	0.596	0.496	0.478	**0.914**
TPR3	0.566	0.431	0.536	0.668	0.598	0.518	0.626	0.634	0.564	0.488	0.643	0.620	0.475	**0.857**

6.4.1.1.3 Average variance extracted (AVE)

Average Variance Extracted (AVE) refers to the amount of variance among the measuring items of a construct (Fornell & Larcker, 1981). To measure the discriminant validity, it is recommended that for each construct, the square root of its AVE should exceed all the correlations among the constructs in the same block of the factor correlation matrix (Chin, 1998; Fornell & Larcker, 1981; Gefen et al., 2011). Table 6.6 shows the correlation matrix of the constructs under study. It is indicated in the table that the square root of all the AVE is greater than all the elements within their corresponding block, which confirms the discriminant validity.

Table 6. 6 Latent factors correlation Matrix

Construct	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Competitive Intensity	**0.823***													
Perceived Complexity	0.682	**0.859***												
Government Support	0.543	0.411	**0.866***											
Intention	0.627	0.581	0.588	**0.843***										
Organisation Innovativeness	0.650	0.482	0.515	0.623	**0.851***									
Organisation Learning Capability	0.604	0.522	0.523	0.695	0.638	**0.814***								
Perceived Benefits	0.670	0.583	0.625	0.689	0.673	0.670	**0.839***							
Perceived Compatibility	0.623	0.541	0.481	0.698	0.577	0.588	0.663	**0.865***						

Construct	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Perceived Disintermediation	0.565	0.439	0.490	0.663	0.667	0.629	0.644	0.668	**0.803***					
Perceived Information Transparency	0.553	0.603	0.365	0.563	0.517	0.466	0.457	0.485	0.348	**0.902***				
Perceived Risks	0.679	0.551	0.529	0.684	0.659	0.605	0.626	0.615	0.667	0.518	**0.843***			
Standards Uncertainty	0.675	0.490	0.505	0.652	0.668	0.683	0.638	0.630	0.614	0.463	0.651	**0.841***		
Top Management Support	0.588	0.620	0.369	0.601	0.512	0.447	0.530	0.553	0.473	0.572	0.520	0.598	**0.850***	
Trading Partner Readiness	0.604	0.561	0.564	0.654	0.647	0.573	0.631	0.648	0.597	0.536	0.675	0.608	0.533	**0.850***

*Square root of AVE

6.4.1.2 Construct reliability

Construct reliability refers to the consistency and accuracy of the measuring items of a given construct (D. W. Straub, 1989). In other words, reliability is "the extent to which the respondent can answer the same questions or close approximations the same way each time" (D. Straub, Boudreau, & Gefen, 2004, p. 400). Mainly the reliability of a construct is measured through the internal consistency of its measuring items. There are suggested different standards in the literature to measure the construct reliability. However, the researchers agree to use the values of *Cronbach's alpha coefficient*, *Composite Reliability* (CR), and AVE to measure internal consistency (Chin, 1998; Cronbach, 1971; Fornell & Larcker, 1981; D. Straub et al., 2004). The values of PLS loadings can also be used to measure the internal consistency of the reflective indicators of a construct (Chin, 1998). Table 6.7 shows the acceptable values of PLS loadings, CR, AVE, and Cronbach's alpha for the construct reliability.

Table 6. 7 Acceptable values for PLS loadings, CR, AVE, and Cronbach's alpha

Test	Acceptable Value	Source (s)
Outer loadings	equal to or greater than 0.7	(Chin, 1998)
Composite Reliability (CR)	equal to or greater than 0.7	(Chin, 1998), (Nunnally, 1994), (Bagozzi et al., 1991)
Average Variance Extracted (AVE)	greater than 0.5	(Fornell & Larcker, 1981)
Cronbach's alpha	equal to or greater than 0.7	(Cronbach, 1971), (MacKenzie et al., 2011)

Table 6.8 shows the results of the reliability of the constructs and their relevant measuring items.

Table 6. 8 Reliability of constructs and their measuring items

Construct	Items	Outer loadings	CR	AVE	Cronbach's alpha
Competitive Intensity	CI1	0.754	0.863	0.678	0.761
	CI2	0.879			
	CI3	0.831			

Construct	Items	Outer loadings	CR	AVE	Cronbach's alpha
Perceived Complexity	CMP1	0.829	0.894	0.738	0.823
	CMP2	0.869			
	CMP3	0.878			
Government Support	GS1	0.863	0.900	0.749	0.833
	GS2	0.846			
	GS3	0.887			
Intention	INT1	0.786	0.881	0.711	0.796
	INT2	0.858			
	INT3	0.883			
Organisation Innovativeness	OI1	0.829	0.887	0.724	0.810
	OI2	0.856			
	OI3	0.868			
Organisation Learning Capability	OLC1	0.778	0.887	0.663	0.831
	OLC2	0.860			
	OLC3	0.782			
	OLC4	0.834			
Perceived Benefits	PB1	0.776	0.905	0.704	0.859
	PB2	0.871			
	PB3	0.851			
	PB4	0.856			
Perceived Compatibility	PC1	0.866	0.899	0.749	0.833
	PC2	0.847			
	PC3	0.883			
Perceived Disintermediation	PD1	0.744	0.879	0.645	0.816
	PD2	0.847			
	PD3	0.814			
	PD4	0.804			
Perceived Information Transparency	PIT1	0.889	0.929	0.814	0.887
	PIT2	0.903			
	PIT3	0.914			
Perceived Risks	PR1	0.834	0.880	0.711	0.797
	PR2	0.806			
	PR3	0.887			
Standards Uncertainty	SU1	0.777	0.879	0.708	0.793
	SU2	0.876			
	SU3	0.867			
Top Management Support	TMS1	0.827	0.886	0.722	0.807
	TMS2	0.875			
	TMS3	0.846			
Trading Partner Readiness	TPR1	0.773	0.886	0.722	0.805
	TPR2	0.914			
	TPR3	0.857			

From the statistical results shown in Table 6.8, it is clear that the values of PLS loadings for the measuring items, CR, AVE, and Cronbach's alpha for the constructs met the accepted threshold, which implies that construct reliability is satisfied.

Since the results of construct validity and reliability are satisfactory, therefore, the evaluation of the structural model can proceed.

6.4.2 Evaluation of the structural model

The structural model represents the relationship between the exogenous and endogenous variables (Joseph F Hair, Black, Babin, Anderson, & Tatham, 1998). The Bootstrapping procedure with 5000 sub-sampling iterations was performed to test the structural model. According to the recommendation of Joseph F Hair et al. (2012), "the number of bootstrap samples should be high but must be at least equal to the number of valid observations in the data set". Figure 6.3 shows the results of the bootstrapping. The structural model was evaluated through the assessment of the coefficients of determination (R^2), effect size (f^2), and the significance of path coefficients as suggested by Hair Jr et al. (2016).

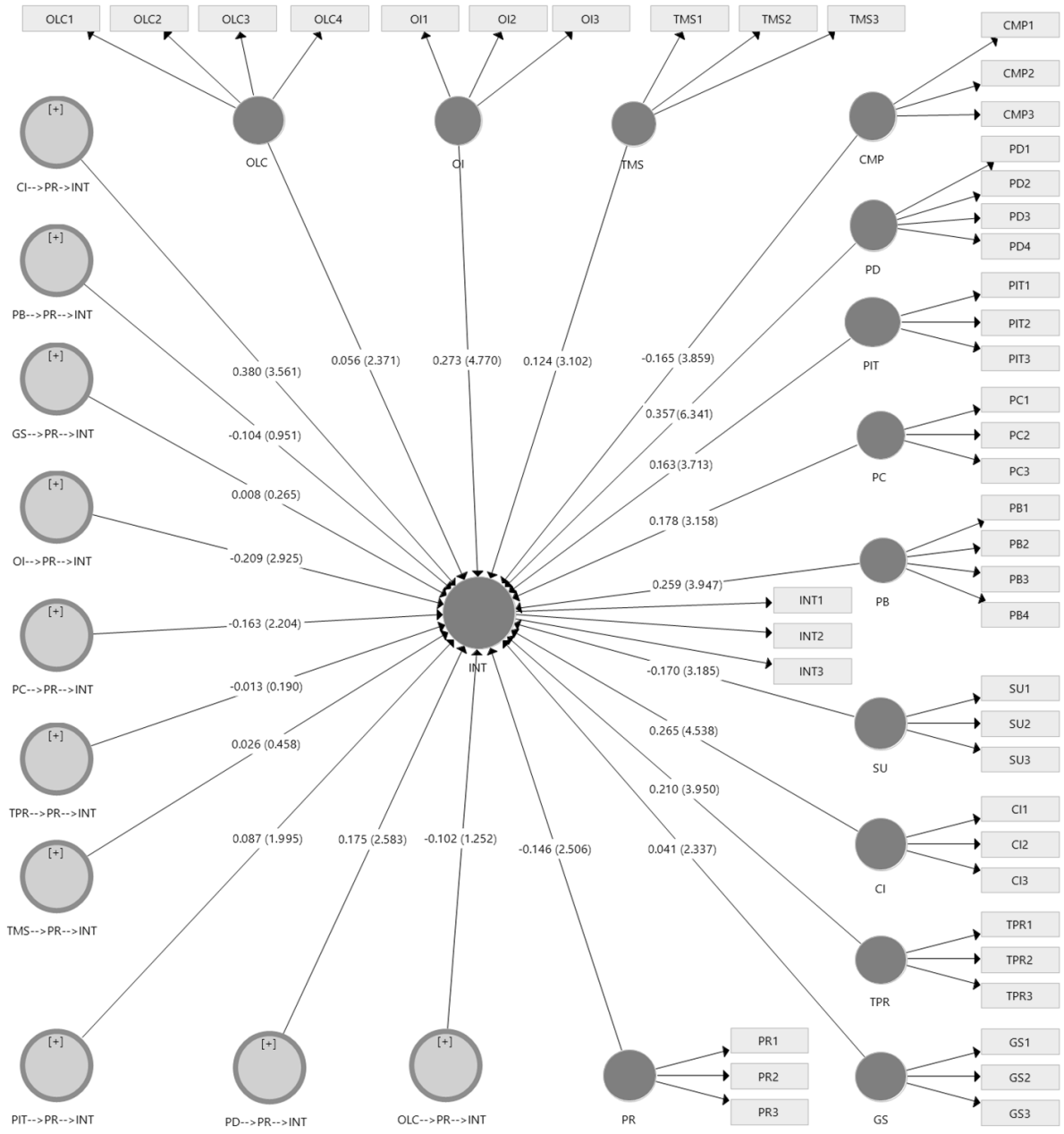

Figure 6. 3 Structural Model

6.4.2.1 R-square (R^2)

The R^2, also known as coefficient determination, explains the predictiveness of the model. Its value is the extent to which the independent constructs could explain the variance in the dependent constructs (Hair Jr et al., 2016; Henseler, Ringle, & Sinkovics, 2009). If the value of R^2 is 1, the model has a perfect prediction. On the other hand, R^2=0 represents the unexplained predictiveness of the model. Thus, a bigger R^2 implies more predictive power of the model. The acceptance value of R^2 varies according to the nature of the research and the model under study (Hair Jr et al., 2016). Falk and Miller (1992) recommend that 0.10

is the lowest acceptable value of R^2 in social science research. Whereas Chin (1998) classifies 0.67, 0.33, and 0.19 are classified as "substantial", "moderate", and "weak" levels of R-Square respectively. According to the bootstrapping results, the R-Square value of the endogenous latent variable "Intention to adopt BCT (INT)." is 0.822, which falls in the "substantial" classification of Chin (1998). The reported value of R2 indicates that the exogenous variables: Perceived Benefits (PB), Perceived Compatibility (PC), Perceived Complexity (CMX), Perceived Information Transparency (PIT), Perceived Disintermediation (PD), Top Management Support (TMS), Organisation Innovativeness (OI), Organisation Learning Capability (OLC), Government Support (GS), Competitive Intensity (CI), Trading Partner Readiness (TPR), Standard Uncertainty (SU), Perceived Risk (PR), accounted for 88.2% variance of the "Intention to adopt BCT (INT)".

6.4.2.2 Effect size (f^2)

The value of f^2 represents the strength of the effect of a particular independent construct on the dependent construct in the structural model (Chin, 1998; J. Cohen, 2013; Selya, Rose, Dierker, Hedeker, & Mermelstein, 2012). J. Cohen, Cohen, West, and Aiken (2013) declared the values of $f^2 = 0.02$; $f^2 = 0.15$, and $f^2 = 0.35$ as Small, Medium and Large effect respectively. Table 6.9 shows the results of f^2. It can be observed that the perceived benefits, perceived information transparency, perceived disintermediation, and trading partner readiness have a large effect; perceived compatibility, perceived risks, organisation innovativeness, organisation learning capability, top management support, competitive intensity, and standards uncertainty have medium effect; perceived complexity have government support have small effects. According to Chin, Marcolin, and Newsted (2003), even the smallest value of f^2 of a latent variable is important because that has at least some effect on the endogenous variable(s).

Table 6. 9 Effect Size of exogenous variables on the endogenous variable

Latent Variables Relationship	f^2	Degree of Effect
PB -> INT	0.433	Large
PC -> INT	0.254	Medium
CMP -> INT	0.057	Small
PIT -> INT	0.309	Medium
PD -> INT	0.608	Large
OI -> INT	0.111	Small
OLC -> INT	0.016	Small
TMS -> INT	0.144	Small
CI -> INT	0.276	Medium
GS -> INT	0.105	Small
TPR -> INT	0.425	Large
SU -> INT	0.142	Small
PR -> INT	0.227	Medium

6.4.2.3 Path coefficients

The path coefficients show the strength of the relationship between the latent variables. They were obtained through the PLS Algorithm procedure. To estimate the significance of path coefficients, their *t*-values and *p*-values were obtained. According to Chin et al. (2003), the path coefficients should have a *t*-value of more than 1.645 for a significance level at 0.05 and more than 2 for a significance level at 0.01. Table 6.10 presents the relationship between the latent variables, their actual effect, and results for the path coefficients, their corresponding *t*-values, and *p*-values.

Table 6. 10 Path coefficient analysis

Hypothesis	Latent Variables Relationship	Path Coefficient	T Statistics	Decision
H1	PB -> INT	0.259	3.947*	Supported
H2	PC -> INT	0.178	3.158**	Supported

Hypothesis	Latent Variables Relationship	Path Coefficient	T Statistics	Decision
H3	CMP -> INT	-0.165	3.859**	Supported
H4	PIT -> INT	0.163	3.713*	Supported
H5	PD -> INT	0.357	6.341*	Supported
H6	OI -> INT	0.273	4.770*	Supported
H7	OLC -> INT	0.056	2.371**	Supported
H8	TMS -> INT	0.124	3.102*	Supported
H9	CI -> INT	0.265	4.538*	Supported
H10	GS -> INT	0.041	2.337*	Supported
H11	TPR -> INT	0.210	3.950*	Supported
H12	SU -> INT	-0.170	3.185*	Supported
H13	PR -> INT	-0.146	2.506*	Supported
H13a	PB->PR->INT	-0.104	0.951	Not Supported
H13b	PC->PR->INT	-0.163	2.204**	Supported
H13c	PIT->PR->INT	0.087	1.995**	Supported
H13d	PD->PR->INT	0.175	2.583**	Supported
H13e	OI->PR->INT	-0.209	2.925*	Supported
H13f	OLC->PR->INT	-0.102	1.252	Not Supported
H13g	TMS->PR->INT	0.026	0.458	Not Supported
H13h	CI->PR->INT	0.380	3.561*	Supported
H13i	GS->PR->INT	0.008	0.265	Not Supported
H13j	TPR->PR->INT	-0.013	0.190	Not Supported

*p<0.01, **p<0.05

The results in Table 6.10 implies that the majority of the hypotheses are accepted, and the exogenous variables have a significant effect on the endogenous variable. The hypotheses H1-H13 possess more than the accepted threshold of the t-value of 1.645 at p<0.05 (Chin et al., 2003). The path coefficient of perceived benefits, perceived compatibility, perceived information transparency, perceived disintermediation, organisation innovativeness, organisation learning capability, top management support, competitive intensity, government support, and trading partner readiness has a positive value, which implies that they have a positive relationship with the intention to adopt BCT. Whereas, perceived

complexity, standards uncertainty, and perceived risks have a negative value, which means they have a negative relationship with the intention to adopt BCT. In other words, the more the complexity, risks, and uncertainty of BCT are, the lower will be the intention to adopt BCT.

6.5 Moderating effects

To examine the moderating effects of PR on the relationship of the exogenous variables (PB, PC, PIT, PD, OI, OLC, TMS, CI, GS, TPR) and the endogenous variable (INT), the product indicator approach was used through the PLS-SEM (Chin et al., 2003; Henseler & Chin, 2010). The study uses the product indicator approach because it provides better estimates over the other techniques e.g. group comparison used to measure the interaction effects (Henseler & Fassott, 2010). The product indicator approach requires creating product terms between the indicators of exogenous variables and the indicators of the latent moderating variable (Kenny & Judd, 1984). Table 6.11 shows the results of the moderating effects. The PR has no moderating effects on the relationship of PB, OLC, TMS, GS, TRP and INT, which implies that the proposed hypotheses H13a, H13f, H13g, H13i, and H13j are not supported. However, the moderating effects of PR are significant in the relationship of PC, PIT, PD, OI, CI and INT that confirms the hypotheses H13b, H13d, H13e, and H13h. Table 6.11 also shows the strength of the moderating effects. According to J. Cohen (2013) and Henseler and Fassott (2010), values 0.02, 0.15, 0.35 of f^2 are considered as weak, medium, and strong effects respectively. All the moderating effects were reported weak. Figure 6.4, 6.5, 6.6, 6.7 and 6.8 show the plots for the moderating effects as suggested by Aiken, West, and Reno (1991).

Table 6. 11 Strength of the moderating effects

Constructs Relationship	f^2	Degree of Effect
PC-->PR-->INT	0.022	Weak
PIT-->PR-->INT	0.011	Weak
PD-->PR-->INT	0.028	Weak
OI-->PR-->INT	0.036	Weak
CI-->PR->INT	0.068	Weak

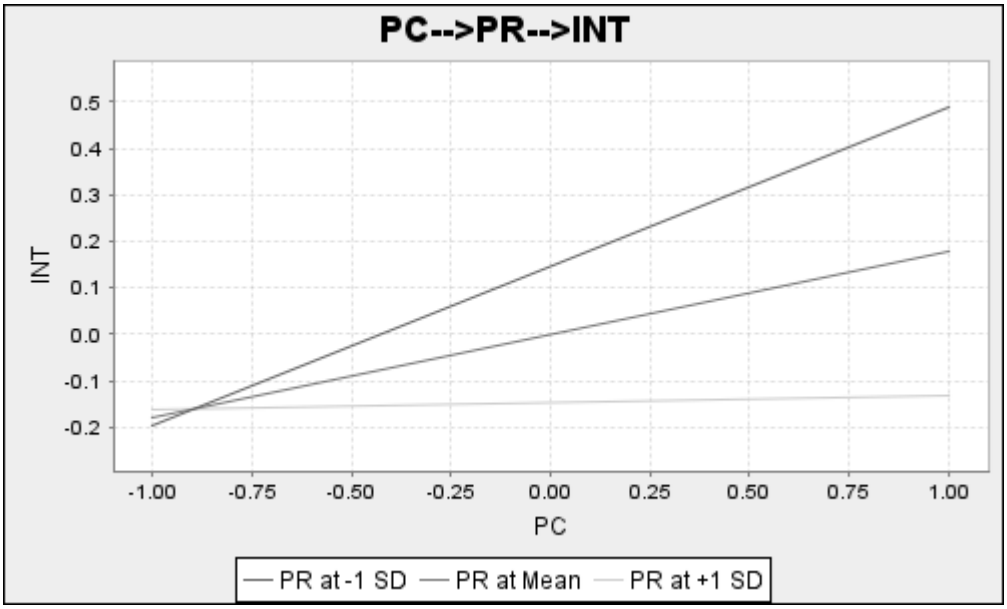

Figure 6. 4 Moderating effects of Perceived Risks (PR) on the relationship between Perceived Compatibility (PC) and Intention to Adopt BCT (INT)

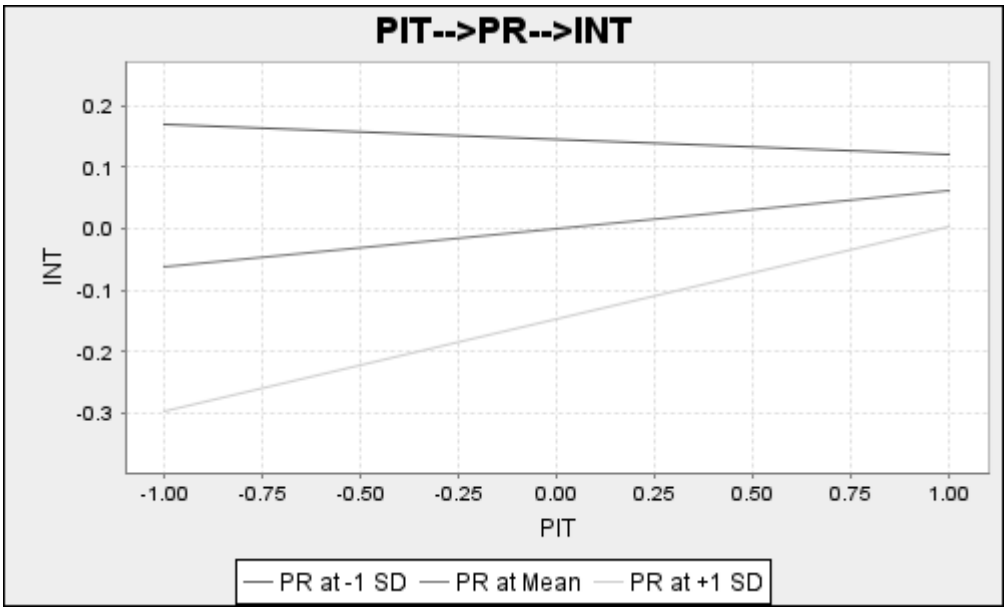

Figure 6. 5 Moderating effects of Perceived Risks (PR) on the relationship between Perceived Information Transparency (PIT) and Intention to Adopt BCT (INT)

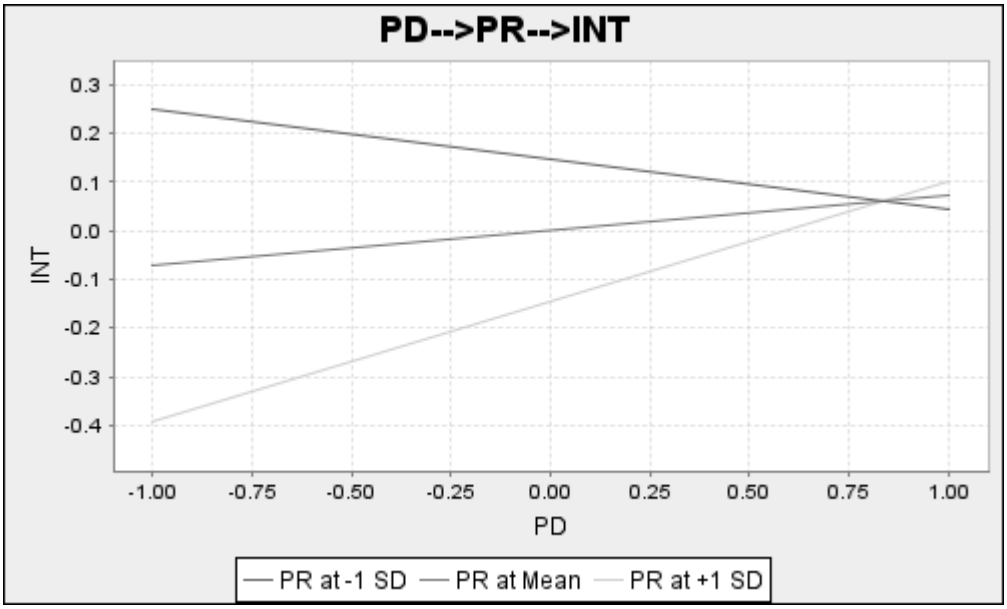

Figure 6. 6 Moderating effects of Perceived Risks (PR) on the relationship between Perceived Disintermediation (PD) and Intention to Adopt BCT (INT)

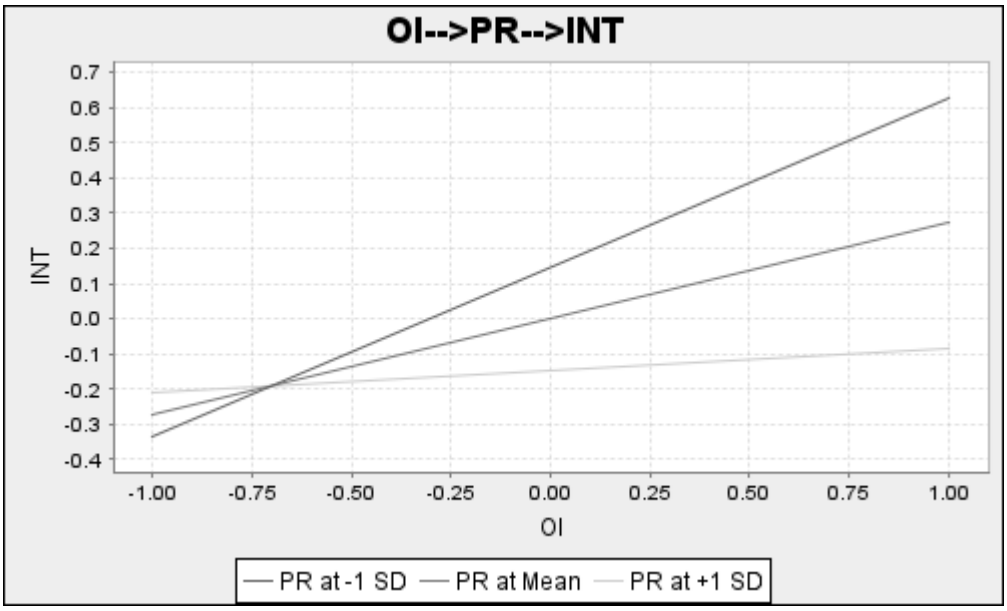

Figure 6. 7 Moderating effects of Perceived Risks (PR) on the relationship between Organisation Innovativeness (OI) and Intention to Adopt BCT (INT)

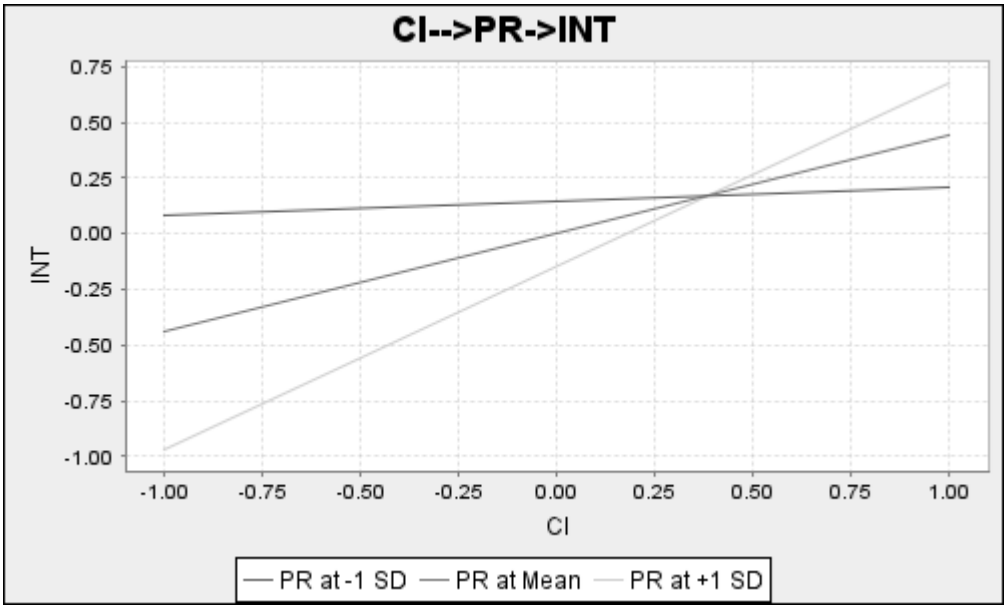

Figure 6. 8 Moderating effects of Perceived Risks (PR) on the relationship between Competitive Intensity (CI) and Intention to Adopt BCT (INT)

6.6 Summary

This chapter explains the analysis of the quantitative data. The analysis includes response rate, demographic, missing value, non-response bias, common method variance (CMV), and multicollinearity. Further, the chapter discusses the evaluation of the measurement and structural models. The measurement model was evaluated with the constructs' validity and reliability. The constructs' validity was assessed with the values of outer loadings, cross-loadings, and average variance extracted (AVE). The constructs' reliability was confirmed with the values of composite reliability (CR), average variance extracted (AVE), and Cronbach's alpha. All the values were found satisfactory. The structural model was evaluated with the values of R-square (R^2), effect size (f^2), and path coefficients. All the proposed hypotheses were found supportive. The moderating effects of perceived risks are also discussed in this chapter. It is found that the perceived risks moderates the relationship between perceived compatibility, perceived information transparency, perceived disintermediation, organisation innovativeness, competition intensity, and an organisation's intensity to adopt BCT.

Chapter 7: Discussion

The study aims to find the factors that influence BCT adoption among Australian organisations. To achieve this, the study used a mixed-methods approach having qualitative and quantitative phases. The discussions on the findings of both phases are presented in the research articles, "Adoption of Blockchain Technology: A Study to Identify the Factors Affecting Organisational Decision" and "Factors Affecting the Organisational Adoption of Blockchain Technology: Extending the Technology–Organisation– Environment (TOE) Framework in the Australian Context". The first article explains the qualitative phase, whereas the quantitative phase is discussed in the second article, which is accessible via https://www.mdpi.com/2071-1050/13/16/9404. The first article has been accepted in a Q1 journal, "Human Behavior And Emerging Technologies". Preparation for the second round is in progress.

Overall, findings of both phases complement each other. Hypotheses of the quantitative phase were developed from the findings drawn in the qualitative phase. The results of this study extend the TOE framework by adding the new factors: perceived information transparency (PIT), perceived disintermediation (PD), organisation innovativeness (OI), organisation learning capability, competition intensity (CI), trading partner readiness (TPR), and standards uncertainty (SU) under its technological, organisational, and environmental contexts. Furthermore, the TOE framework has been extended with the inclusion of perceived risks (PR) as a moderating variable.

In the context of the TOE framework, the results and their interpretation and comparison with the past studies are presented in the following articles. Theoretical and practical contributions of the research are also explained in the articles.

Adoption of Blockchain Technology: A Study to Identify the Factors Affecting Organizational Decision

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Abstract: In recent times**,** Blockchain (BCT) is an emerging technology that promises many benefits for organizations, such as disintermediation, data security, data transparency, a single version of the truth, and trust among trading partners. Despite its multiple benefits, the adoption rate of BCT among organizations has not reached a significantly high level worldwide. The present study addresses this issue in the Australian context. There is a knowledge gap in what specific factors, among the plethora of factors reported in the extant literature, affect Australian organizations while deciding to adopt BCT. To fill this gap, the study uses the qualitative interpretative research approach along with the Technology-Organization-Environment (TOE) framework as a theoretical lens. Data were mainly drawn from the literature review and semi-structured interviews of the decision-makers and senior IT people from the BCT adopter and potential adopter organizations in Australia. The findings show that an organization's perception towards information transparency and associated risks, innovativeness and learning capability, standards uncertainty, and competition intensity are the factors that mainly affect the organizational decision to adopt BCT in Australia. These factors are exclusively identified in this exploratory study. The study also validates the effect of perceived benefits and compatibility on BCT adoption, reported in past studies. Practically, these findings would be helpful for the Australian government and public and private organizations to develop better policies and make informed decisions regarding the organizational adoption of BCT. The findings would also guide decision-makers to think about the adoption of BCT strategically. The study also has theoretical implications explained in the discussion section.

Keywords: blockchain, adoption, TOE, organization, Australia, diffusion

Background

Blockchain (BCT) is a novel way of storing and managing a database. In the BCT, the data is distributed, decentralized, and organized as a list of ordered blocks, where each block is connected to its previous block. The technology has attracted a broad audience of practitioners, policymakers, researchers, and national authorities after a few years of its inception in 2008. Initially, BCT was applied in the cryptocurrency known as bitcoin to solve the double-spending problem (Nakamoto, 2008). Later, researchers proposed many different applications of BCT, for instance, e-voting, management of human resources and healthcare, network security, e-governments, supply chain, industry 4.0 (Balasubramanian, Shukla, Sethi, Islam, & Saloum, 2021; Callinan, Vega, Clohessy, & Heaslip, 2022; Frizzo-Barker et al., 2020; Hasan, Ayub, Ellahi, & Saleem, 2022; Hughes et al., 2019). Moreover, BCT has been reported as a significant contributor to the global economy. For example, in the reports published by Gartner and PwC, the BCT market is expected to reach more than US$176 billion by 2025 and US$3.1 trillion by 2030 (Gartner, 2018; PwC, 2018). In another report by Wintergreen (Research, 2018), the BCT market value is estimated to be reached US$60.7 billion by 2024. Similarly, Statista (Statista, 2020) and International Data Corporation (IDC, 2019) estimated that the BCT could drive the worldwide market size to US15.9-$39.7 billion by 2023-2025. It is expected that the BCT will revolutionize the world in the future through its operational and strategic advantages for organizations (Mane & Ainapure, 2022; Underwood, 2016). The researchers also hope that the BCT would underpin the majority of the current digital services in the future (Clohessy & Acton, 2019). Tapscott and Tapscott (2017) and Mohammed, Potdar, and Yang (2019) stated that BCT has promising benefits such as data security, information transparency, a single version of the truth, and trust among organizations. However, despite the benefits and proposed applications, surprisingly, the worldwide adoption of BCT among organizations is slow (Appelbaum, Cohen, Kinory, & Smith, 2022; Woodside, Augustine Jr, & Giberson, 2017). Consequently, this calls for research to investigate the factors causing this low uptake among organizations (Mohammed et al., 2019; Toufaily, Zalan, & Dhaou, 2021). In responding to this call, the study seeks to identify the factors affecting BCT adoption among organizations. The study has specifically been conducted in the Australian context. Although past studies investigated the factors that affect the BCT adoption among organizations, they focused non-oceanic countries like Germany, UAE, Ireland, Kosovo, Malaysia, Brazil (Clohessy & Acton, 2019; Holotiuk & Moormann, 2018; Hoxha & Sadiku, 2019; Queiroz, Fosso Wamba, De Bourmont, & Telles, 2021; Wong, Leong, Hew, Tan, & Ooi, 2019). Moreover, their findings

vary from country to country. According to Troshani and Doolin (2005), the determinants of adoption of a technological innovation differ as the context wherein the research is conducted differs. Since the properties of the countries differ in terms of population, economy, literacy, uncertainty avoidance index, technology readiness index from Australia (Du, Jia, & Zhu, 2021; Malik, Chadhar, Vatanasakdakul, & Chetty, 2021), therefore the findings of similar studies on BCT adoption conducted in the context of other countries cannot be generalized to the Australian context.

Additionally, the past studies reported inconsistent influencing results of the same factors in BCT adoption. For example, Clohessy and Acton (2019) and Orji, Kusi-Sarpong, Huang, and Vazquez-Brust (2020) stated that the top management support played a critical role in the organizational adoption of BCT. In contrast, Wong et al. (2019) found an insignificant effect of upper management support. Similarly, De Castro, Tanner, and Johnston (2020) reported a positive impact of government regulations on BCT adoption, whereas Albrecht et al. (2018) identified its hindering effect on BCT adoption. This inconsistency in the findings of past studies makes it unclear what specific factors influence BCT adoption among Australian organizations. According to the best of our knowledge, the extant literature lacks any in-depth exploratory study to address this issue. Therefore, this study aims to fill this knowledge gap by finding the answer of the below research question.

"*What factors influence the organizational decision to adopt blockchain technology in Australia?"*

The rest of the paper reviews published literature on BCT adoption, provides a theoretical foundation, explains the methodology, and describes the empirical results. Later, findings and their theoretical and practical contributions are discussed. In the end, a conclusion on the key findings, limitations of the research, and directions for future research are presented.

Blockchain technology in Australia

The Australian government has put significant efforts to promote the organizational adoption of BCT within the country. It has launched several BCT initiatives, which include the release of a blockchain roadmap (DISER, 2020), national blockchain, water trading (CRCNA, 2020), Australian security exchange project (NAB, 2020), pilot grants (Government, 2022; Porter, 2021), and private partnership (IBM, 2018). BCT also has significant support at the private level. A private association, Blockchain Australia, has actively been working to promote the organizational adoption of BCT adoption in Australia (BA, 2022). According to the reports

issued by Deloitte (Deloitte, 2016, 2022), Australia has the potential to become a global leader for BCT. Statistics from the Economist Intelligence Unit (EIU), a world reliable organization, showed Australia at the first rank in its technology readiness index (Economist, 2018; Malik, Chadhar, Chetty, & Vatanasakdakul, 2020). This indicator signifies that Australia has all the required infrastructure to embrace innovation like BCT. However, despite having government and private sector support, BCT has not been adopted heavily by Australian organizations (ACS, 2019; Deloitte, 2016; DISER, 2020).

Adoption of blockchain technology

Researchers made tremendous efforts to understand the organizational adoption of BCT in the context of different countries and industries. The past research on BCT adoption is mainly factorial in nature, where researchers examined the effect of different factors on BCT adoption. For example, De Castro et al. (2020) explored how the South African asset and wealth industry adopts BCT. Their findings show that the relative advantage of BCT over the other technologies, BCT complexity, technological environment and nature of the industry wherein an organization works, and government regulations influence BCT adoption; Orji et al. (2020), Dobrovnik, Herold, Fürst, and Kummer (2018), Barnes III and Xiao (2019), and Kühn, Jacob, and Schüller (2019) examined the effect of different factors on BCT adoption in the logistics industry. They found that the availability of BCT tools, government support, and infrastructural facility are critical for BCT adoption; Wong, Tan, Lee, Ooi, and Sohal (2020), Wong et al. (2019), Bai and Sarkis (2020), Kouhizadeh, Saberi, and Sarkis (2020), Ghode, Yadav, Jain, and Soni (2020), Kalaitzi, Jesus, and Campelos (2019), Queiroz et al. (2021), and Agi and Jha (2022) explored the adoption of BCT in supply chain. Their findings revealed that the support provided by the upper management, market, cost, competitive pressure, and regulations play important role; Clohessy and Acton (2019) investigated BCT adoption in Ireland. They found that awareness of BCT, size of an organization, and top management support influence BCT adoption. Loklindt, Moeller, and Kinra (2018), Mohammed et al. (2019), Post, Smit, and Zoet (2018), Hoxha and Sadiku (2019), and Holotiuk and Moormann (2018), Sharma and Joshi (2021) explained the adoption of BCT for different industries including land record management, fashion, and shipping. They mentioned that the easy verification process for transactions, accuracy and reliability of data, and reduction in cost influence organisational decision to adopt BCT; Kulkarni and Patil (2020) and Koster and Borgman (2020) stated that the factors learning culture, customer readiness, top management and government support, and

competitive pressure affect the organizational adoption of BCT in the public and banking sector. Furthermore, Albrecht et al. (2018) examined BCT adoption in the energy sector. They concluded that the transaction speed, market power, government regulations, data transparency and confidentiality, inter-operability, and costs were the main factors that influence BCT adoption.

The above review of the literature reveals that there are a plethora of factors that affect the adoption of BCT among organizations. However, the factors that are highly relevant to the organizational adoption of BCT in Australia are still unclear. There is a lack of qualitative research that demonstrates the effect of the factors identified from the data directly drawn from the opinion or experience of people working in Australian organizations. Thus, there exists a knowledge gap in an in-depth exploratory study to investigate the organizational adoption of BCT in Australia. The study accomplished this gap by using a qualitative interpretative research approach based on the Technology-Organisation-Environment (TOE) framework (Tornatsky & Fleischer, 1990) as a theoretical lens.

3. Theoretical foundation

Since the study aims to explore BCT adoption at the organizational level, theories explaining technology adoption at the individual level, for instance, the Technology Acceptance Model (TAM), Theory of Planned Behaviour (TPB), Unified Theory of Technology Acceptance and Use of Technology (UTAUT) are out of the scope of this study. While reviewing the literature, it was found that the TOE framework is the widely used theory to study technology adoption at an organizational level. The framework provides multiple perspectives that are not present in other theories. The TOE framework states that an organizations' decision to adopt a technological innovation is affected by three types of contextual factors, namely, technology, organization, and environment. The technology factors comprise the factors related to the technology under investigation; organizational factors are associated with the effect of an organization's characteristics such as size, culture, top management on its decisions, and environmental factors describe the effect of the environment wherein an organization operates its business.

Although there are other organizational level theories like Institutional Theory (DiMaggio & Powell, 1983) and Diffusion of Innovation (DoI) (Rogers, 2003), they either hold shortcomings or are partially covered in the TOE framework as explained below:

- The environmental context of the TOE framework is missing in the DoI theory.

- Institutional theory lacks the impact of technological factors, which are included in the TOE framework.
- DoI theory addresses the impact of technology characteristics on an IT adoption process. This aspect is already covered in the technology context of the TOE framework.
- Institutional Theory explains the impact of environmental factors on an IT adoption, which is already covered in the TOE framework.

Therefore, the TOE framework has more explanatory power over the other technology adoption theories reported in the literature. Due to its strong explanatory power, the TOE framework has extensively been used by researchers to understand the organizational adoption of different technological innovations, such as EDI and ERP systems, e-commerce, and RFID (Baker, 2012; Oliveira & Martins, 2011; Satar & Alarifi, 2022). Therefore, we consider the TOE framework an appropriate theoretical for our study.

4. Research Methodology

The study aims to identify the factors influencing the organizational decision to adopt BCT in Australia. A qualitative interpretive research approach was opted to achieve the study aim. This approach is considered appropriate when inadequate or little research is available on an issue. In such a case, it becomes essential to understand the phenomenon within the given social context and the meanings people assign to it (Yin, 2017). Since the existing literature on the organizational adoption of BCT in Australia is limited, the qualitative interpretive approach was found appropriate. This study followed the principles set by Klein and Myers (1999) for the qualitative interpretative research. An explanation of these principles and how they were incorporated into this study is given in Table 1.

Principle	**Description**	**How used in this study**
Principle of the hermeneutic circle	This fundamental principle explains how human meanings are socially constructed. It describes the nature of the interdependent meaning of the parts and the whole that they form.	This study investigates the experts' interpretations (the parts) having experience/knowledge about the BCT adoption among organizations in the Australian context (the whole).

Principle of contextualization	This principle explains the social and historical context to understand the views of potential audiences about the emergence of the phenomenon under investigation.	This study uses the Australian context to explain the effect of different factors on the organizational decision to adopt BCT.
Principle of interaction between the researchers and the subjects	This principle asserts that the social facts are better understood when a researcher socially interacts with the participants involved in the phenomenon.	Data collection was done through semi-structured interviews (face-to-face and online).
Principle of abstraction and generalization	This principle explains the importance of using a particular theoretical lens to derive insights from the participants' interpretations.	In this study, the TOE framework has been used as a starting point to understand the organizational adoption of BCT.
Principle of dialogical reasoning	This principle requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings (the story which the data tell) with subsequent cycles of revision.	This study introduces country-related issues found in the interviews, which cannot be explained through the original TOE framework.
Principle of multiple interpretations	This principle explains the possibility of variations among participants' interpretations. Therefore, the researcher should use multiple interpretations to reach a final analysis.	In this study, multiple viewpoints from interviewees are used to form the analysis. The key findings are supported by more than one interview.
Principle of suspicion	This principle explains the bias in interpretations due to preconceptions, which leads to the misinterpretation of the viewpoints.	To avoid this, the viewpoints from the respondents of the same industry were cross-examined.

Table 1: Principles for the interpretative qualitative research (Klein & Myers, 1999)

4.1. Data collection

The primary data was collected by interviewing key persons from the Australian organizations that had either adopted or were in the process of adopting BCT (potential adopters). To collect accurate and valid data, every interviewee was chosen carefully by observing the following criteria:

- An interviewee should demonstrate extensive knowledge/expertise in both IT and BCT.
- An interviewee should hold a decision-making position in organization, such as chief technology officer (CTO), chief executive officer (CEO), director, project manager etc. These individuals were selected because of their presumed level of knowledge about the organizational adoption of BCT in Australia.

The target organizations and their relevant information, such as contact details, which industry they are working in, and their adoption status with BCT, were collected through (i) search engines and social media websites, for example, LinkedIn, Google (ii) professional network, and snowball sampling technique (iii) reviewing BCT scholarly and commercial literature, industry reports and press releases, and (iv) examination of the BCT related workshops and conferences.

An invitation email along with the description of the research project and consent form were sent to the target organizations. They were requested to nominate a person with extensive BCT knowledge/expertise or involved in BCT-related actions/decisions in the organization. The participating organizations showed their willingness by returning the signed consent form and nominating a person chiefly responsible for their BCT project (s). Finally, a mutually agreed time was set for the interview, and a tentative questionnaire was provided to the nominated person. By following the recommendations of Hill, Thompson, and Williams (1997), the questionnaire was emailed one week before the interview date giving the respondent ample time to get familiar with the research and prepare the answers.

Before the start of the actual data collection, an interview guide and protocol were prepared to ask relevant and specific questions. Senior academics and researchers were consulted while preparing the interview guide and protocol. The guide was kept updated after the analysis of every interview. Details about the participating organizations and their respondents are presented in Table 2.

Industry	**Designation**	**Identifier**	**BCT adoption status**
	Founder	A1	Adopted

Information technology (IT)	Software Engineer	A2	Potential adopter
	System Analyst	A3	Adopted
	CTO	A4	Adopted
	Project Manager	A5	Adopted
	CEO	A6	Adopted
	CEO	A7	Adopted
	CEO	A8	Adopted
Finance	Co-Founder	A9	Adopted
	CEO	A10	Adopted
	CTO	A11	Potential adopter
Travel	CEO	A12	Adopted
	Technical Analyst	A13	Adopted
Education	Founder	A14	Adopted
Government	Senior Computer Forensics Officer	A15	Potential adopter
Services	CEO	A16	Adopted
	CEO	A17	Adopted
	Project Manager	A18	Potential adopter
	Solution Architect	A19	Adopted
Legal	Advisor	A20	Potential adopter
	Director	A21	Adopted
	Director	A22	Potential adopter
	Advisor	A23	Potential adopter

Table 2: Profile of the participating organizations and their respondents

Purposive theoretical sampling was employed for the data collection. Those organizations were chosen that fit the purpose of our research. We carried out the interview process until the saturation of data was reached (Glaser & Strauss, 2017). A total of 23 interviews were conducted within the seven months of the period. Twenty participants were interviewed over Skype, and the remaining three were interviewed face-to-face. The duration of every interview was between 30 and 60 minutes. After finishing every interview, data was transcribed and analyzed. The whole data collection process followed an ethical code of conduct.

4.2. Reliability and validity

Qualitative methods such as in-depth interviews come with some biases like intrinsic and methodological that should be carefully assessed to maintain the reliability and validity of the research. We followed the guidelines outlined by Yin (2017) to achieve the reliability and validity of our research.

4.2.1. Construct validity

Triangulating the interview questions helps to maintain the construct validity. We asked a question with alternative wordings to understand the same issue from multiple perspectives. This method is considered effective that permits a refined approach for construct validity. In addition to this, the interviewee was requested to confirm the major findings when the interview had finished. Later, we provided them a complete transcribed copy of the interview and asked if they wanted to add or remove anything from the interview.

4.2.2. Internal validity

Internal validity refers to the degree to which extraneous factors that could affect results are controlled or eliminated. We draw the internal validity by following several measures including substantiating the interview questions, piloting the interview schedule, removing extraneous data from the analysis, and keeping an ethical procedure for the study. Moreover, the interviewees were selected carefully. We conducted in-depth interviews of the people that were either decision-makers or senior IT people that were experts in the area of BCT. This helped us to capture the information that was purely relevant to the study. We also examined the secondary data for BCT, including published literature, white papers, Australian government reports, and organizations' websites to corroborate the findings. Furthermore, the data analysis was done by the authors of this paper, who have extensive experience in analyzing and doing qualitative research.

4.2.3. External validity

External validity refers to the degree to which findings of a study can be generalized and transferred into other settings, e.g., industry, country, population, etc. To attain the external validity for this study, participants were selected from a diverse range of industries and roles and had extensive BCT knowledge, expertise, and leadership, as reflected in Table 3. Because of their profile, the participants had a strong influence on many people and industries in Australia. Therefore, the findings derived from their in-depth interviews would be convincing for the organizations and people working in similar industries and roles. However, the study still has limited external validity.

4.2.4. Reliability

To obtain research reliability and avoid researcher bias, every activity of the data collection was properly documented. We selected interviewees from a diverse range of industries and roles. Although we used the TOE framework to formulate initial questions, we encouraged interviewees to freely mention the factors that actually influence their decision or consider them important while deciding BCT adoption. We asked if the interviewees had any questions or concerns about the research. We answered every question that the interviewees asked to remove their doubts and to enhance their confidence and trust in the research. We recorded every interview with the written or verbal consent of the interviewee. A team of two persons, authors of this paper, conducted every interview. One member asked the interview questions, while the other took notes and recorded the interview. In addition to this, we discussed the research process with senior peers and colleagues in terms of the research design, methods, interpretation, themes, and findings of the research.

5. Data analysis and findings

The interview data were analyzed by using the thematic analysis technique offered by Braun and Clarke (2006) and Strauss and Corbin (1990). We used QSR NVivo software for the qualitative data analysis. The steps performed for this analysis are enlisted in Table 3. How the steps were incorporated for this study is also explained in the table. Since the TOE framework was used as a theoretical lens, the analysis is a theoretical thematic analysis rather than an inductive one. Given this, we coded that segment of data that was relevant and interesting to our research question. To improve the reliability of the findings, the data analysis was conducted by a team of two persons (authors of this paper).

Step	How used in this study?
Step 1: Familiarizing with the data	Interview data were transcribed and read line-by-line multiple times. After each read, we made notes and wrote down the early impression of the data to develop some idea about the codes.
Step 2: Generating initial codes/ open coding	All the transcribed data was organized in a meaningful and systematic way and reduced into small chunks of concepts related to our research question. When we finished the initial coding, we compared the codes, discussed them, and modified them before moving to the next step.
Step 3: Search for themes/ axial coding	A theme can be defined as a pattern that exhibits something significant or interesting about the data. Inter-related codes form a theme. At this step, we put initial codes together based on their similarities and differences. For example, the codes related to BCT were collated into a theme called "Technology".
Step 4: Review the themes	During this step, the themes discovered in step 3 were further analyzed to check their coherence and distinction from each other. We examined if the interview data supported the themes, and they make sense. In NVivo software, it is easier to move codes from one theme to another if they do not fit.
Step 5: Defining and naming themes/ mapping	During this step, a refinement of the themes is done to identify the essence of what each theme is about. We mapped the interrelated themes with the relevant contexts of the TOE framework
Step 6: Data display	During this step, we created a schematic diagram, Figure 1, to visualize the conceptual relationship among the factors and

Table 3: Steps that were undertaken for the thematic analysis

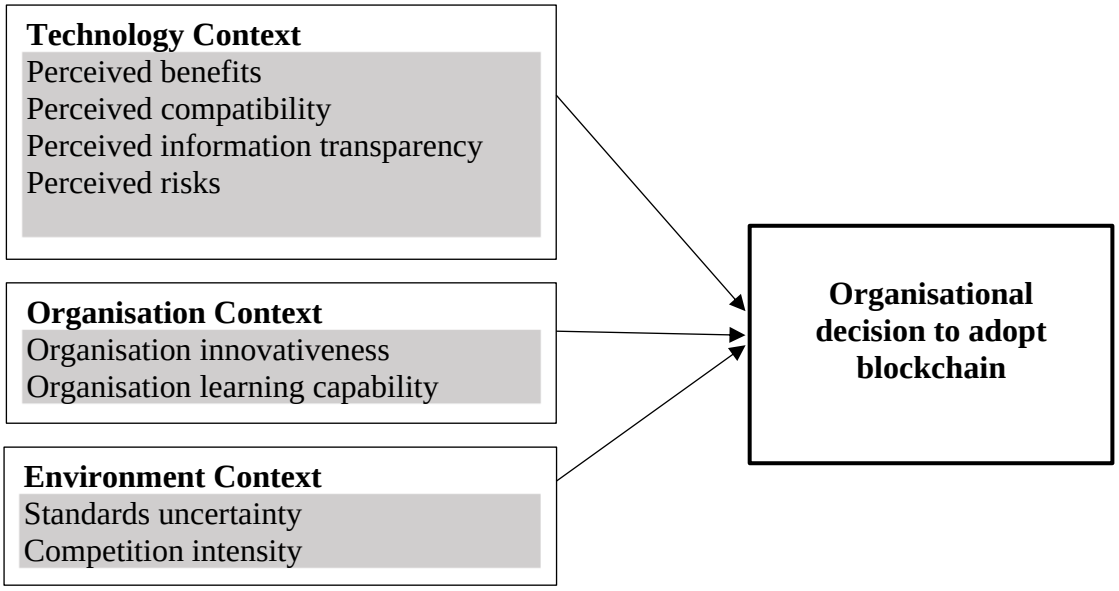

Figure 1: Factors mapping with the TOE contexts

To get further insights from the interview data, we performed a frequency analysis of every theme as shown in Table 4. The frequency shows how many times a theme was supported by the respondents and what the reason was.

TOE context	**Factor**	**Impact**	**Frequency**	**Impact Reason**
Technology	Perceived benefits	Positive	22	Positive impact because of timesaving, reduction in cost and expense, fast transactions
		Negative	0	-
		Not sure	1	Not sure about the impact of perceived benefits on the organizational decision to adopt BCT
	Perceived compatibility	Positive	20	Positive impact of compatibility with business processes, technical infrastructure, and skills
		Negative	0	

TOE context	Factor	Impact	Frequency	Impact Reason
		Not sure	3	Not sure about the effect of compatibility on the organization's decision to adopt BCT
	Perceived information transparency	Positive	19	Positive impact due to easy access and visibility of the information
		Negative	3	Negative impact due to lack of privacy
		Not sure	1	Not sure about the impact of information transparency on the organization's decision to adopt BCT
	Perceived risks	Positive	0	-
		Negative	21	Negative impact of due to security and privacy breaches, benefits uncertainty
		Not sure	2	Not sure about the impact of perceived risks on the organization's decision to adopt BCT
Organization	Organization innovativeness	Positive	20	Positive impact if an organization is open to new ideas and accepts the risks associated with them.
		Negative	0	-
		Not sure	3	Not sure about the impact of organization innovativeness on the organization's decision to adopt BCT
	Organizational learning capability	Positive	21	Positive impact if organization keep their employees up to date about the contemporary technologies and it has a

TOE context	Factor	Impact	Frequency	Impact Reason
				mechanism to store, share new knowledge.
		Negative	0	-
		Not sure	2	Not sure about the effect of organizational learning capability on the organization's decision to adopt BCT.
Environment	Standards uncertainty	Positive	0	-
		Negative	18	Negative impact due to the immaturity of BCT and lack of industry standards
		Not sure	5	Not sure about the impact of standards uncertainty on the organization's decision to adopt BCT
	Competition intensity	Positive	20	Positive impact because organizations feel motivated and pressurized to adopt BCT before their competitors and gain competitive advantages over them
		Negative	0	Negative impact because of being much technical and hard to understand
		Not sure	3	Not sure about the impact of competition intensity on the organization's decision to adopt BCT

Table 4: Frequency analysis of the factors

The following subsections explain how the identified factors influence BCT adoption among Australian organizations.

5.1. Technological context

The findings derived from the analysis of the responses of the participants show that the technological factors, namely, perceived benefits, perceived compatibility, and perceived information transparency have a positive impact on the organizational decision to adopt BCT. However, the factor perceived risks has a negative impact. Excerpts from the interview data related to every factor are given below.

Perceived benefits

Most of the interviewees agreed that the perceived benefits play an important role in BCT adoption. They stated that the benefits such as a reduction in expenses, time savings, peer-peer transactions, security, and disintermediation motivated them to adopt BCT.

An interview with a technical analyst (A13) working at a traveling agency mentioned, "*blockchain has certain benefits for our business. We have customers all over the world. It takes a couple of days to receive payment in our bank account in Australia. It was not only time-consuming but also expensive to our customers and us due to the several service charges imposed by the banks. Now we receive payments in cryptocurrency, which is fast and cost savings.*

Perceived compatibility

For the adoption of BCT, its smooth integration with the organization's existing businesses is very important (De Castro et al., 2020). One of the CEO (A8) providing enterprise BCT solutions supported this by saying, "*if blockchain is compatible, for example, if an organization is providing IT solutions such as AI or database and it has all the technical staff, then it would surely adopt BCT because it aligns with its business aims and objectives*". He further added that "*now suppose if an organization requires to install a completely new technological infrastructure, it will think twice to adopt blockchain because of its incompatibility*".

The CTO (A4) expressed similar thoughts about the compatibility of BCT for their business. He stated, "*We already had a team of IT professionals. So, it is normal for us to start working with any new technology like blockchain.*"

Perceived information transparency

Information transparency is one of the major features of BCT that attracts organizations toward its adoption (Saheb & Mamaghani, 2021; Sunny, Undralla, & Pillai, 2020). This increases the

overall performance of an organization. A solution architect (A19) emphasized this by stating, "*our clients wish to adopt blockchain because of the transparency of information it provides. The clients want a solution to facilitate their consumers to track the products they are buying is authentic*". He further stated, "*we recommend blockchain solutions to our clients who demand openness and visibility within and outside of their organization*".

Some of the interviewees (A2, A18, A22) mentioned information transparency as a barrier to BCT adoption. They stated that the availability of information to everyone breaches privacy laws.

Perceived risks

New technologies like BCT come with certain risks that hinder organizations from their adoption. During the interviews, respondents mentioned different risks of BCT, for instance, scalability, privacy, slow transaction processing speed, and the need for miners to run the network. One of the interviewees (A20) stated, "*usually, the big organizations control the industry, and they dictate how the processes should work, and how the vendors and suppliers and other small peer organizations should deal with them. These big players perceive fear of losing control after adopting blockchain*". Another risk highlighted by A18 was "*blockchain is a relatively new technology, and there is a lack of well-established blockchain systems in the market. Organizations cannot observe the real benefits of blockchain that cause worried about the value proposition, the return on their investment in blockchain*".

5.2. Organisational context

This research suggests that the organizational factors: organization innovativeness and organizational learning capability have a positive impact on the organizational adoption of BCT. Further explanation of these factors is given below.

Organization innovativeness

The new technologies like BCT come with a novel idea that has very limited trials and successful evidence. Therefore, the risk-taking and openness of an organization have a substantial relationship with the adoption of an innovation (Subramanian & Nilakanta, 1996). This was also reflected during our interview with a project manager (A5) of a leading IT organization. He said, "*we are the pioneer in Australia working with blockchain technology. When we started, there were no success stories about blockchain in Australia. However, we decided to take the risk and invested in developing blockchain solutions for our clients*". A similar thought shared by A17, "*since the blockchain is totally a novel idea, it requires*

organizations to change their legacy systems that is a massive process for many organizations. Therefore, only those organizations will adopt blockchain that are creative and contemporary in doing business".

Organization learning capability

The adoption process of technology starts when an organization acquires knowledge about that technology via a learning system (Gomes & Wojahn, 2017; Rogers, 2003). A learning system could be a formal knowledge management system, R&D department, organizing informational seminars and workshops within the organization, or sending employees to attend external conferences to gain new knowledge. Most of the interviewees endorsed the role of an organization's capability to learn about new technology emerging in the industry. They mentioned that the first step to adopting BCT is organizations must get the knowledge to understand BCT (A14 & A17). "w*e have a dedicated R&D department that floated the idea of blockchain to work with. We shared this idea with our employees through a newsletter and asked them to provide their feedback. Then, we analyzed the opportunities and risks associated with blockchain for our business, and finally decided to develop blockchain solutions for our clients",* said A12.

5.3. Environmental context

The analysis of the responses of the interviewed participants suggests that the environmental factors, namely, competition intensity has a positive impact, whereas the standards uncertainty has a negative impact on the organizational adoption of BCT. The detail is presented below.

Standards uncertainty

Uncertainty about the BCT standards is one of the main reasons that stymies its organizational adoption as stated by one of the legal experts (A21), "*organizations aren't likely to invest if they're not sure what the standards are going to be set for blockchain. They have been waiting until the formal standards are developed*". Most of the respondents agreed that Australian organizations are reluctant to adopt BCT because of the unavailability of the standards. The uncertainties cause organizations to distrust BCT, which ultimately impedes its adoption. "*Organisations are slow to adopt blockchain-based solutions because they have been waiting for the potential blockchain standards. They fear if the blockchain standards change over time, it might require them to make expensive investments in the future*", stated A20, a legal advisor.

Competition intensity

The organizations feel the fear of losing their competitiveness if their competitors have adopted new technology. This was endorsed by A21, "*we adopted blockchain solution because our competitors started to accept payments in digital currencies. We felt the pressure of losing our customers if we do not offer them that service*". According to Zhu, Kraemer, and Xu (2006), if similar organizations do things in a certain way in the industry, others feel a competition intensity. According to A9, "*whenever there is new technology coming out, everyone starts doing the same thing to become the first to develop a product and defeat others in the industry. For example, Facebook has started working with blockchain. I certainly think that the other IT giants like Google, Microsoft, and Amazon are not going to be far behind and will be doing something similar*".

6. Discussion and contributions

By using the TOE framework as a theoretical lens, the study aims to identify the factors that affect the organisational decision to adopt BCT in Australia. A total of eight factors have been identified through the interviews of decision makers and senior IT people from the adopters and potential adopter organizations. Out of the eight factors, five have exclusively been identified in this exploratory study. The newly identified factors include perceived information transparency, organizational learning capability, organization innovativeness, competition intensity, and standards uncertainty. Effect of the remaining three factors, perceived benefits, compatibility, and risks reported in the past studies on BCT adoption. This study validates their effect on the organizational decision of adopting BCT in Australia. The findings in the context of the TOE framework are further explained below.

Technology factors: in terms of the technology factors, the findings reveal that the perceived benefits, perceived risks, perceived compatibility, and information transparency are enablers, whereas the perceived risks work as an inhibitor towards the organizational decision of adopting BCT. Australian organizations adopt BCT when they perceive it beneficial for their business. Cost reduction, time-saving, and disintermediation are the main benefits of BCT for Australian organizations. This finding is consistent with the earlier studies of Orji et al. (2020), Saheb and Mamaghani (2021), and (Malik et al., 2021). This study found that organizations were more inclined to adopt BCT when they feel BCT is compatible with their technological and financial needs. Kim (2020) also found the similar result while examining BCT adoption. However, De Castro et al. (2020) found that regardless of BCT compatibility, organizations were reluctant to adopt BCT. Therefore, we suggest that organizations not only carefully evaluate BCT

compatibility with their business goals, but they also count other factors before deciding BCT adoption. Organization's perception towards the transparency of information, obtained through BCT, plays a positive role in BCT adoption. This finding is consistent with Al-Jabri and Roztocki (2015). Over the BCT network, participating organizations have more trust among each other. Consequently, organizations feel more confident and secure while sharing their private information with the partner organizations (Aslam, Saleem, Khan, & Kim, 2021). However, due to privacy concerns, information transparency also works as a barrier to BCT adoption. We suggest organizations should evaluate privacy laws before moving to BCT. The impact of perceived risks on BCT adoption was found negative. Yoo, Bae, Park, and Yang (2019) also reported the similar effects of perceived risks on BCT adoption. They stated that the risks associated with BCT, for instance, privacy disclosure, openness of information to everyone, and non-scalability hinder organizations to adopt BCT. We suggest organizations to carefully analyze the associated risks before deciding to adopt BCT.

Organizational factors: effect of organization learning capability and organizational innovativeness were found positive on BCT adoption. This finding aligns with the suggestions of Kulkarni and Patil (2020) and Newby, Nguyen, and Waring (2014). The finding is also similar to Marikyan, Papagiannidis, Rana, and Ranjan (2022). They found that the organizations capable of learning from new knowledge, ready to apply acquired knowledge into their business decisions; open to new ideas, and take risks are more likely to adopt BCT. This led to the conclusion that organizations should have a formal learning system to remain updated about the contemporary technologies beneficial for their business (Elhidaoui, Benhida, El Fezazi, Kota, & Lamalem, 2022).

Environmental factors: the study found that competition intensity has a positive, whereas standards uncertainty has a negative effect on the organizational decision to adopt BCT. Competition intensity compel organizations to adopt a contemporary technology like BCT before their rivals do. This keeps organizations competitive and encourages them to find innovative ways to sustain and maintain their competitive advantage in market. Past research also established that BCT adoption is crucial for organizations to hold their competitiveness (Bai & Sarkis, 2020; Wong et al., 2019; Wong et al., 2020). This study found that BCT still lacks formal standards that hinder organizations from its massive adoption. This was also endorsed by Guo and Liang (2016) and Balasubramanian et al. (2021). They mentioned that wide adoption of BCT would remain unsolved until the BCT related formal standards are well established by the relevant authorities. Therefore, it is suggested to urgently develop industry

standards for BCT to foster its adoption (Kühn et al., 2019; Sadhya & Sadhya, 2018; Venkatesh & Bala, 2012).

6.1. Contributions

Theoretically, this study contributes to the existing IT adoption literature in several ways. Firstly, the study provides empirical evidence about the factors affecting organizational decision to adopt BCT in Australia. This is the first in-depth exploratory study that bridges the knowledge gap on the factors relevant to the BCT adoption among Australian organizations. The identification of such factors is important, particularly for the Australian organizations interested in the value creation of BCT. Second, the study introduces new factors, namely, perceived information transparency, organization innovativeness, organization learning capability, standards uncertainty, and competition intensity on BCT adoption that are exclusively identified in this research. Third, this study confirms the findings of the earlier studies that the factors perceived benefits and perceived compatibility have an impact on the organizational adoption of BCT. Fourth, according to the best of our knowledge, this is the first study that has used the qualitative interpretive research approach offered by Klein and Myers (1999). Therefore, the study confirms the suitability of this approach for BCT. Lastly, most of the researchers have used the TOE framework in quantitative research. This study proves its validity in qualitative research as well.

Practically, the study contributes as follows: First, the decision-makers working with the Australian government and private organizations can use our findings to develop better national policies for the adoption of BCT in Australia. Second, the findings can help consulting and marketing companies while developing business strategies for their potential BCT customers. Third, standards uncertainty is found to be an inhibitor to the adoption of BCT. This requires the Australian government and other relevant organizations to develop BCT standards needed to remove the uncertainties of potential adopters. Last, the findings can be used by multinational organizations willing to expand their business in Australia.

7. Conclusion

The study uses the TOE framework to identify factors, from the plethora of factors reported in the past literature, affecting organizational decision to adopt BCT in Australia. Following the qualitative interpretative research approach, interviews of the decision-makers and senior IT people from the BCT adopter and potential adopter organizations were conducted. After

analyzing the interview data, a total eight factors, namely, perceived benefits, information transparency, compatibility, perceived risks, organizational learning capability, organization innovativeness, competition intensity, and standards uncertainty. The study constitutes important theoretical and practical implications for the Australian government and private organizations working with BCT.

The study has some limitations that provide a pathway for future research. The study has been conducted in the Australian context, which limits its external validity. Further, the study uses a small sample size that restricts the generalization of its findings. To overcome these limitations, a survey with a larger sample size would be conducted to enhance the generalizability of findings of this study.

Data Availability

Data is available on request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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Factors Affecting the Organizational Adoption of Blockchain Technology: Extending the Technology–Organization–Environment (TOE) Framework in the Australian Context

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Abstract: Blockchain technology (BCT) has been gaining popularity due to its benefits for almost every industry. However, despite its benefits, the organizational adoption of BCT is rather limited. This lack of uptake motivated us to identify the factors that influence the adoption of BCT from an organizational perspective. In doing this, we reviewed the BCT literature, interviewed BCT experts, and proposed a research model based on the TOE framework. Specifically, we theorized the role of technological (perceived benefits, compatibility, information transparency, and disintermediation), organizational (organization innovativeness, organizational learning capability, and top management support), and environmental (competition intensity, government support, trading partners readiness, and standards uncertainty) factors in the organizational adoption of BCT in Australia. We confirmed the model with a sample of adopters and potential adopter organizations in Australia. The results show a significant role of the proposed factors in the organizational adoption of BCT in Australia. Additionally, we found that the relationship between the influential factors and BCT adoption is moderated by "perceived risks". The study extends the TOE framework by adding factors that were ignored in previous studies on BCT adoption, such as perceived information transparency, perceived disintermediation, organizational innovativeness, organizational learning capability, and standards uncertainty.

Keywords: blockchain; adoption; factors; Australia; TOE; organization

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1. Introduction

Blockchain technology (BCT) is a new type of distributed and decentralized database that is managed by the participating entities called nodes. The entities manage the data without the involvement of any central controlling authority. Each node over the BCT network stores the same copy of the entire database. The network is run by the mutual consensus among the connected nodes. Initially, this novel and unique way of storing and managing data was developed to solve the double-spending problem in virtual currencies [1]. Later, many different use cases of BCT were proposed, e.g., electronic voting, network security, healthcare, human resource management (HRM), internet of things (IoT), cloud computing, music, supply chain, banking and finance, industry 4.0, and money laundering [2–4]. Recently, BCT has disrupted the global economy with the use of cryptocurrencies such as Bitcoin and Ethereum [5]. By using cryptocurrencies, organizations can transfer funds globally without the need for any formal intermediaries such as banks [6]. Many IT and digital experts suggest that BCT will reshape every industry in the future. This is also endorsed by renowned and reliable firms such as Gartner, PwC, Wintergreen, and IDC. They predicted that the BCT market would reach USD 176 billion to USD 3.1 trillion between 2025 and 2030 [7]. According to Underwood [8] and Tapscott and Tapscott [9],

BCT has several operational and strategic benefits for organizations. Mohammed, Potdar and Yang [7] and Alzahrani and Daim [10] consider the adoption of BCT a great source of competitive advantage for organizations. Surprisingly, despite all the benefits, actual organizational adoption of BCT all over the globe has not reached a significantly high level [11–16]. This lack of uptake motivated us to initiate this research to investigate the factors that influence BCT adoption among Australian organizations. We chose Australian organizations due to their low adoption despite the availability of sufficient technological infrastructure and strong support for BCT from the Australian government and private associations [17,18]. To the best of our knowledge, to date, there is a lack of in-depth empirical research about the factors that influence organizations' intentions to adopt BCT in Australia [18,19]. Although some prior studies examined the organizational adoption of BCT, their focus was on non-Oceania countries such as Ireland, Malaysia, Germany, etc. [20–22]. However, the findings of a study undertaken in one context, e.g., country, cannot be generalized to any other context because every context has its unique characteristics, for instance, technology readiness, networked readiness index, and uncertainty avoidance index [23] as shown in Table 1. Technology readiness and networked readiness indexes represent the level of readiness of a country in terms of the technological infrastructure to adopt new technology whereas uncertainty avoidance refers to how individuals, groups of people, or organizations of a specific country make decisions in new and risky situations. The higher value of the technology readiness index for Australia indicates that Australia is more ready to adopt new technology compared with the other countries. At the same time, it is a more fearful country due to the higher value of uncertainty avoidance.

Table 1. Comparison of Australia with other countries for the contextual characteristics [23].

Country	Characteristics		
	Technology Readiness Index	Networked Readiness Index	Uncertainty Avoidance Index
Germany	9.15625	77.48	65
Ireland	8.03125	72.13	35
Malaysia	7.46875	61.43	36
Australia	9.71875	75.09	51

According to Chandra and Kumar [24], findings of a study conducted in one context serve as a starting point for a study in another context. They further asserted, "it is imperative to study the specific contexts aligned from a firm's perspective". Thus, this study aims to answer the key research question:

What are the key factors influencing the adoption intention of BCT among Australian organizations?

To answer this research question, we employed a quantitative research approach based on the Technology–Organization–Environment (TOE) framework. An online survey questionnaire, coined under the TOE categories, was sent to the appropriate Australian organizations. The TOE framework has been used in many past studies on BCT adoption, which reflects its suitability for this study. The past studies report various technological, organizational, and environmental factors, e.g., relative advantages, compatibility, complexity, top management support, and competitive pressure that influence BCT adoption. However, the studies provide varying results for the same factor. For example, Clohessy and Acton [22] and Orji, et al. [25] found top management support as a critical factor for the organizational adoption of BCT whereas, Wong, Leong, Hew, Tan and Ooi [21] reported an insignificant effect of the top management support for BCT adoption. Likewise, De Castro, et al. [26] reported the favorable role of government regulations towards the organizational adoption of BCT, whereas, Albrecht, et al. [27] stated that government regulations prevent BCT adoption. This inconstancy in results could be due to the presence of hidden factor(s) that moderate the cause–effect (causal) relationship between the factors [28]. This aspect has not been addressed in previous studies that used the TOE framework for BCT adoption.

Baron and Kenny [29] recommend the addition of a moderating variable(s) when the findings of different studies vary for the same variable. They asserted that the moderating variable enhances the understanding of problem and prevents any misleading conclusions. Moreover, the past BCT studies lack the impact of many factors that seem relevant to BCT adoption, for instance, disintermediation and information transparency that are considered the core features of BCT. To address the limitations of the past studies, we extend the traditional TOE framework by incorporating the following new factors:

(i) Technological factors: information transparency and disintermediation;
(ii) Organizational factors: organization innovativeness, organizational learning capability;
(iii) Environmental factors: standards uncertainty, and
(iv) Moderating factor: perceived risks.

The relevance of the above factors to the organizational adoption of BCT in Australia was found by conducting semi-structured interviews of BCT experts and decision makers from different Australian organizations that had adopted or were in the process of adopting BCT (potential adopters). These factors were further underpinned with the secondary data including the extant literature on BCT adoption, different organizations' websites, government reports, and white papers. Definitions and further explanations of the above factors are provided in Section 3 of this paper.

The rest of the paper is organized as follows. We provide a literature review on the adoption of BCT, theoretical background including research model and hypotheses, research methodology, and the empirical results followed by a discussion on the findings. The paper concludes with the key findings and their theoretical and practical contributions, presents limitations of the research, and suggests directions for future research.

2. Literature Review

2.1. Adoption of Blockchain Technology

The adoption of BCT brings a significant change to an organization's internal and external operations [18]. Therefore, the organizational adoption of BCT has gained significant interest from researchers [22]. They have taken the deterministic approach to examine the organizational adoption of BCT. This approach assumes that an organization's intention to adopt BCT is influenced by a certain number of factors. For example, De Castro, Tanner and Johnston [26] investigated the adoption of BCT in the asset and wealth management industry in South Africa. They found that the relative advantages, computability, complexity, supportive technological environment, characteristics of the industry, and regulations are the main deterministic factors that influence the organizational adoption of BCT; Orji, Kusi-Sarpong, Huang and Vazquez-Brust [25], Dobrovnik, et al. [30], Barnes III and Xiao [31], and Kühn, et al. [32] evaluated the factors that influence BCT adoption in the logistics industry. They identified that the availability of specific BCT tools, infrastructural facility, and government policy and support are the main significant factors for BCT adoption; Wong, et al. [33], Wong, Leong, Hew, Tan and Ooi [21], Bai and Sarkis [34], Kouhizadeh, et al. [35], Ghode, et al. [36], and Kalaitzi, et al. [37] investigated BCT adoption for the supply chain industry. They found relative advantages, complexity, upper management support, cost, market dynamics, competitive pressure, and regulatory support as the influencing factors; Clohessy and Acton [22] found that BCT awareness, top management support, and organization size influence BCT adoption in Ireland. Loklindt, et al. [38], Mohammed, Potdar and Yang [7], Post, et al. [39], Hoxha and Sadiku [40], and Holotiuk and Moormann [20] investigated BCT adoption for the different industries including shipping and land record management. They showed that easy verification of transactions, data accuracy and reliability, and cost reduction influence an organization's decision to adopt BCT; Kulkarni and Patil [41] and Koster and Borgman [42] mentioned that the firm scope, learning culture, top management, customer readiness, competitive pressure, and government policies influence BCT adoption in banking and the public sector. Moreover, Albrecht, Reichert, Schmid, Strüker, Neumann and Fridgen [27] studied the post-decision stage of the BCT adoption. They found that market power, regulation,

transaction speed, transparency and costs, confidentiality, and interoperability were the prominent factors that influence BCT implementation in the energy sector.

During this literature review process, we noted that the factors that influence BCT adoption can be grouped into the TOE categories, namely, technological, organizational, and environmental contexts. Table 2 provides a summary of the factors reported in the published literature on BCT adoption.

Table 2. Factors affecting the organizational adoption of BCT.

TOE Contexts	Factors	Sources
Technological factors	Complexity, compatibility, cost, relative advantages, security, privacy, scalability, availability of specific BCT tools, trialability, observability, immutability, transactions speed, perceived novelty, disintermediation, perceived benefits, computability, infrastructural facility, increase in data availability, reduction of information asymmetry, easy verification of transactions, comprehensibility of the transactions, data accuracy and reliability, exclusion of false information from contractual information, hacking attempts system denials, high-security encryption, contract conclusion with a reasonable fee, transparency, integrity, confidentiality, interoperability, perceived challenges, hype, trust, storage capacity, decentralization, inclusiveness, territoriality, maturity	[7,18,21,25–27,30,37,38,40–45]
Organizational factors	Top management support, top management knowledge/awareness, firm size, capability of human resources, financial resources, presence of training facilities, organizational culture, supportive technological environment, perceived risk of vendor lock-in, perceived efforts in collaboration, organization learning capability, organization innovativeness, IT governance, huge resources (energy, infrastructure), high need for process harmonization, firm scope, existing infrastructure, learning culture	[22,25,26,32,37,41–44,46]
Environmental factors	Regulations, competitive pressure, government policy/support, stakeholder pressure, customer pressure, trading partner readiness, legal/standards uncertainties, institutional-based trust, technology progress in the industry, support from the community, professional consultation and assistance, perceived constraint of infrastructure, market turbulence, market power, market dynamics, customer readiness, consensus among trading partners, characteristics of industry	[21,25–27,32,37,41–44,46,47]

2.2. Research Gaps Found in the Published Literature

The following research gaps were observed in the past studies:

(i) Most of the research on BCT adoption has been conducted in non-Oceania countries and there is little research in the context of the Oceania region, particularly in Australia. Since the countries differ from each other in terms of their contextual and demographic characteristics such as GDP, union density, trade laws, and gender, therefore the findings of studies conducted in other countries cannot be applied in the Australian context.

(ii) There is an identified inconsistency in the results of the past studies. The studies report a linear relationship between the influencing factors and BCT adoption and ignore the impact of any intervening factor causing that inconsistency in findings.

To overcome these gaps of the past studies, the current study aims to investigate the factors affecting the adoption of BCT among Australian organizations. Moreover, the study inspects the impact of a moderating variable on the relationship between the factors and an organization's intention to adopt BCT.

2.3. Blockchain Technology in Australia

Australia is a BCT-friendly country where both government and private associations promote the adoption of BCT [43]. Australia started working with BCT when the Standards Australia submitted a proposal to the International Organization for Standardization (ISO) to develop BCT standards in 2016 [44]. Afterward, the Australian government put significant efforts to foster BCT adoption within the country. The most recent initiative of the Australian government is the issuance of the national roadmap for BCT [45]. The CSIRO's Data61, an Australian research agency, has been working to develop a national BCT network to enhance coordination among the public organizations [46]. The ASX, Australia's biggest stock exchange, partnered with "Digital Asset Holdings" to develop a private blockchain for the Australian equity market [47]. Blockchain Australia, a private association, has actively been working to encourage the use of BCT among Australian organizations [48]. Australia has all the technological infrastructure that organizations require to embrace innovation such as BCT [49,50]. Gunasekera and Valenzuela [18] and Maroun and Daniel [19] found in their study that the adoption of BCT could enhance the productivity of Australian industries such as finance, grain, and supply chain by 8–10%, resulting in a 2.6% rise in GDP. Garrard and Fielke [51] and Cao, et al. [52] mentioned that the beef sold under an Australian label in different countries is not Australian. To protect Australia's reputation, they suggested using shipment tracking with BCT to overcome this meat fraud. Monroe, et al. [53] recommended the use of BCT to empower consumers for peer-to-peer energy trading. They asserted that the BCT-enabled energy trading system could enhance the sharing economy in Australia. According to Foth and McQueenie [54], BCT can create many unexpected jobs in regional Australia. Australia is a land of innovators, early adopters, and avid users of innovation [55].

Considering this strong support and potential of BCT, it appears essential for Australian organizations to consider adopting BCT to enhance their business value and performance. However, recent documents issued by the Australian government and renowned firms indicate that Australian organizations have not adopted BCT heavily [49,56,57]. Therefore, the identification of the factors influencing the organizational adoption of BCT in Australia seems important.

3. Research Model and Hypotheses

3.1. TOE Framework

From the various options available in the IS literature, we chose the Technology–Organization–Environment (TOE) framework [58] as an underpinning theory to investigate BCT adoption. The TOE framework proposes that an organization's intention to adopt new technology is influenced by three contextual factors, namely, technology, organization, and the environment as depicted in Figure 1.

The technology context refers to the characteristics of technology that influence its adoption process. The organizational context describes the influence of an organization's features and resources on innovation adoption decisions. Environmental context states the influence of the external and inter-organizational environment in which an organization operates its business.

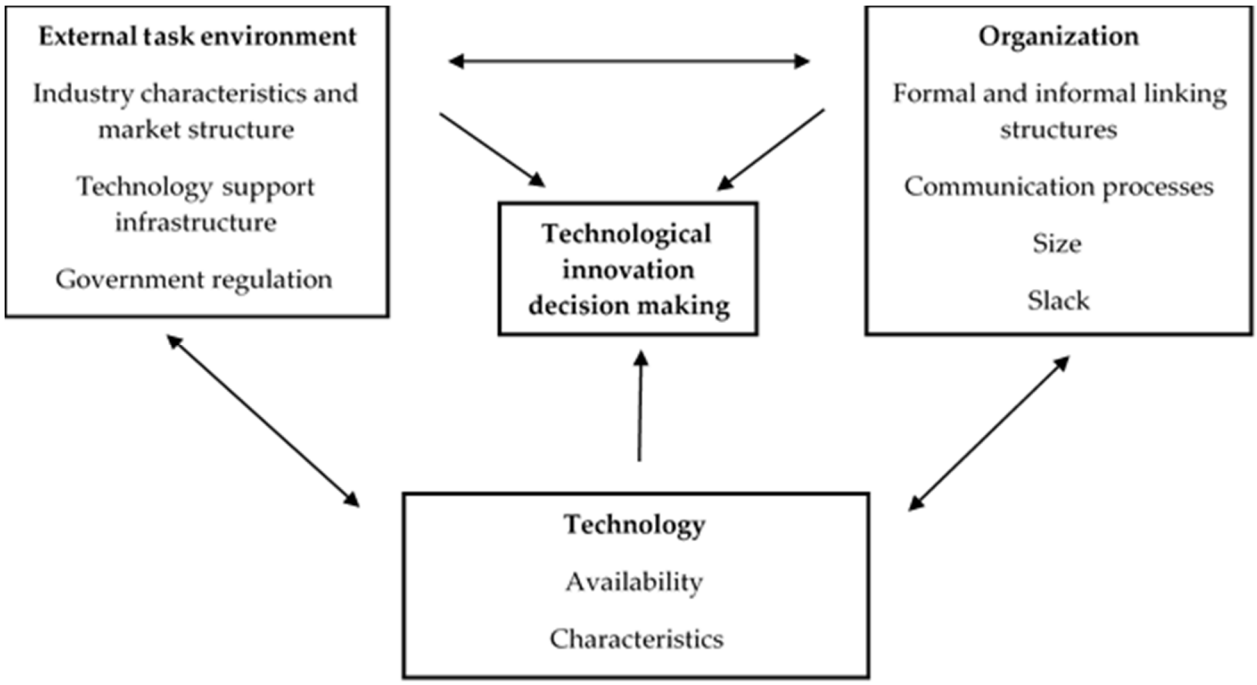

Figure 1. The TOE framework [58].

Rationale for Choosing the TOE Framework

Although other theories exist that have extensively been used to examine the adoption of different technological innovations at the organizational level [59], such as Diffusion of Innovation (DoI) [60] and Institutional Theory [61], the TOE framework has more explanatory power as explained below:

- Most of the available IT adoption theories at the organizational level are variants of the TOE framework that either divide or extend its dimensions. For example, the Institutional Theory [61] describes the influence of the environmental perspective on technology adoption that is already part of the TOE framework. Similarly, the DoI theory [60] contains technology and organizational aspects, which are also part of the TOE framework.
- Since the context is an important aspect of technology adoption, the TOE provides a useful starting point to examine the adoption process where it takes place [62].
- The TOE is the most validated theory to examine the adoption of new technologies at the organization level [59].

Due to these advantages of the TOE framework, many studies have used it to investigate the organizational adoption of different technologies such as electronic data interchange (EDI), enterprise resource planning (ERP), supply chain management (SCM), customer relationship management (CRM) systems, cloud computing, and e-commerce [59,62]. Thus, the TOE framework was an appropriate choice for this study. The extended version of the TOE framework prepared for this study is presented in Figure 2.

Grouped into the technological, organizational, and environmental contexts of the TOE framework, the following sections explain the factors and their relevant hypotheses developed for this study.

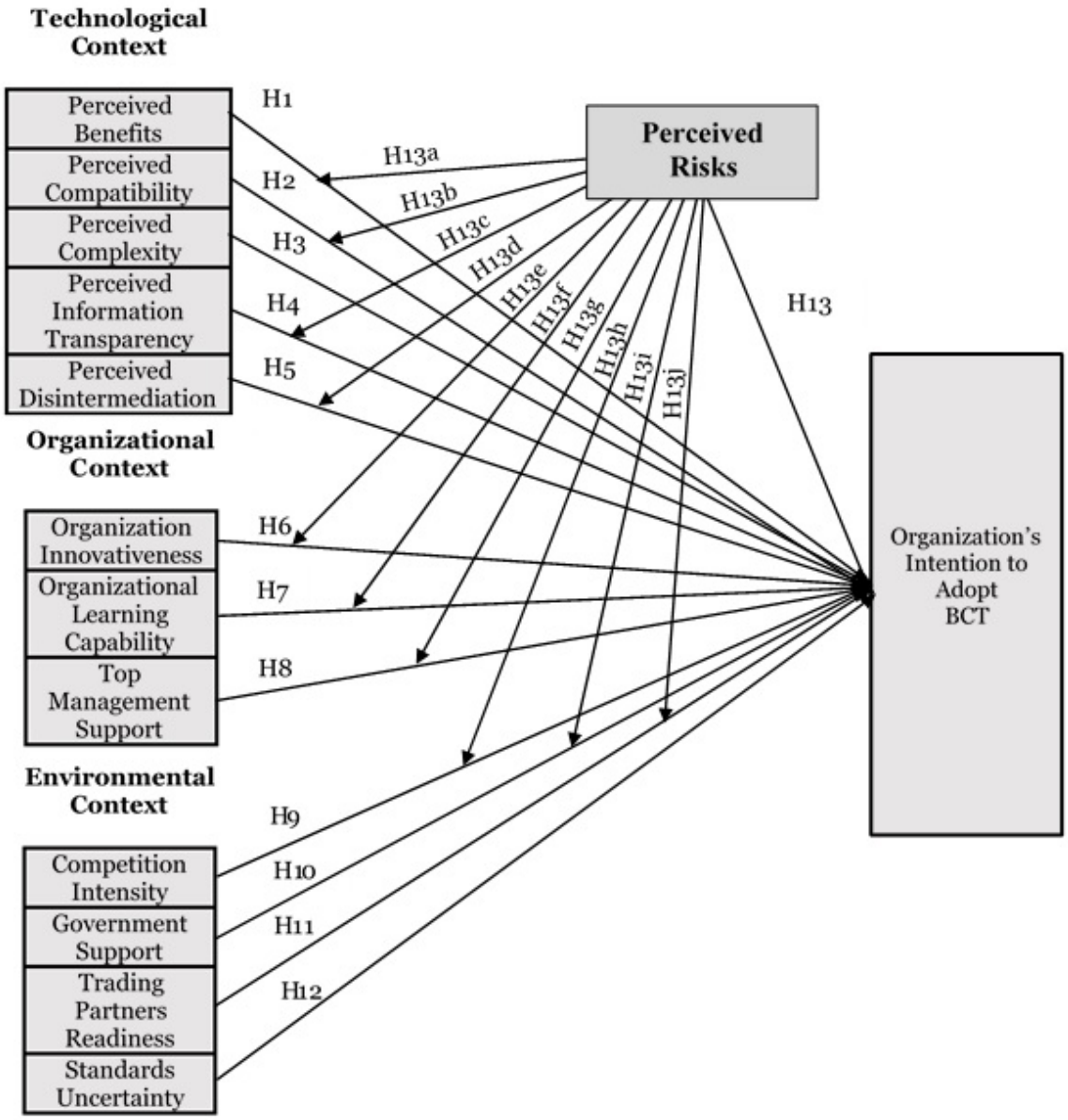

Figure 2. Extended TOE framework for the organizational adoption of BCT in the Australian context.

3.2. Technology Context

3.2.1. Perceived Benefits (PB)

Perceived benefits refer to the extent to which organizations perceive an innovation would be beneficial for their business [60]. BCT has many benefits such as improved auditing, cost reduction, enhanced data provenance, and trust that encourage organizations to its adoption [25]. De Castro, Tanner and Johnston [26] stated a positive role of perceived benefits in the adoption of BCT among organizations working in the wealth management industry. Therefore, it can be hypothesized that:

Hypothesis 1 (H1). *Perceived benefits positively influence an organization's intention to adopt BCT.*

3.2.2. Perceived Compatibility (PC)

Perceived compatibility refers to an organization's perception of how technology would be aligned with its business objectives [60]. De Castro, Tanner and Johnston [26] stated organizations become more inclined to adopt BCT when they perceive it as compatible with their IT infrastructure. On the other hand, organizations feel anxious about

BCT adoption when they do not find it compatible with their business operations [21]. Therefore, it can be hypothesized that:

Hypothesis 2 (H2). *Perceived compatibility positively influences an organization's intention to adopt BCT.*

3.2.3. Perceived Complexity (PCM)

Perceived complexity can be defined as the degree to which organizations perceive BCT as difficult to understand and use [26]. Wong, Leong, Hew, Tan and Ooi [21] reported complexity as a barrier for BCT adoption. Technicalities involved in BCT such as the use of public and private keys and hashing of blocks are complex processes that make organizations reluctant to its adoption [63]. Clohessy and Acton [22] reported that the perceived complexity of BCT hinders organizations from its adoption. Therefore, it can be hypothesized that:

Hypothesis 3 (H3). *Perceived complexity negatively influences an organization's intention to adopt BCT.*

3.2.4. Perceived Information Transparency (PIT)

Information transparency refers to the easy availability and verification of information for everyone [64]. Resultantly, it reduces information asymmetry and increases the traceability of information [40]. The organizations that value information transparency are more inclined to adopt technology that brings transparency within their business operations [64]. In BCT, every participant holds the same copy of data, and all the transactions are validated through a mutual consensus among the participants. This creates a transparent environment wherein the business stakeholders feel more confident while taking any decision [65]. BCT maintains an unchangeable history of the information (money, documents, and so on) that enhances trust among the stakeholders. Wamba, et al. [66] stated that information transparency plays a significant role in organizational intention to adopt BCT. Therefore, it can be hypothesized that:

Hypothesis 4 (H4). *Perceived information transparency positively influences an organization's intention to adopt BCT.*

3.2.5. Perceived Disintermediation (PD)

Disintermediation refers to the removal of an intermediary to run business operations [67]. Disintermediation is a core feature of BCT that enables organizations to have peer–peer transactions without the need for intermediaries, which saves economic costs, removes risks associated with the intermediaries, and improves business performance [68]. Organizations could readily interact, send approvals, and trace records when there is no third party involved. The disintermediation helps organizations to directly reach out to their customers. Consequently, they save overhead expenses, time, and earn customer loyalty. O'Dair [69] reported a positive impact of disintermediation of BCT in the music industry. Therefore, it can be hypothesized that:

Hypothesis 5 (H5). *Perceived disintermediation positively influences an organization's intention to adopt BCT.*

3.3. Organizational Context

3.3.1. Organization Innovativeness (OI)

Organization innovativeness can be defined as the willingness and openness of an organization to adopt new and novel ideas regardless of the risks associated with them [70]. Considering the newness and novelty of BCT, organization innovativeness seems vital for its adoption. Thong and Yap [71] reported organizational innovativeness as an essential

factor towards the adoption of new technology. Similarly, Lin, et al. [72] mentioned that innovativeness is extensively linked to an organization's decision to adopt and implement innovations. They claimed that higher organizational innovativeness leads to a greater organizational transformation, which results in the adoption of new technology. Since BCT is an innovative technology, it can be expected that an organization open to new ideas which considers BCT a source of opportunities is more likely to adopt BCT. Nuryyev, et al. [73] found a statistically significant effect of innovativeness on the organizational adoption of BCT. Therefore, it can be hypothesized that:

Hypothesis 6 (H6). *Organization innovativeness positively influences an organization's intention to adopt BCT.*

3.3.2. Organizational Learning Capability (OLC)

Organization learning capability refers to an organization's ability to acquire, store, share, and implement new knowledge in its business decisions. We adapted this concept from the organizational learning theory proposed by Argyris and Schon [74]. To sustain in a turbulent business world, organizations are highly necessitated to capture new knowledge about the contemporary technological trends happening in the world and apply this knowledge to their business decisions. Organizational learning brings novelty that could motivate organizations to adopt an innovation such as BCT. Woiceshyn [75] stated that when organizations acquire new knowledge from their environment, it leads them to adopt new ideas. Organizational change and innovation come through organizational learning. Kulkarni and Patil [41] stated that the organization's learning significantly influences BCT adoption. Therefore, it can be hypothesized that:

Hypothesis 7 (H7). *Organizational learning capability positively influences an organization's intention to adopt BCT.*

3.3.3. Top Management Support (TMS)

Top management support is an integral part of an organization's decision to adopt new technology. The lack of leadership support reduces the chances of adopting an innovation such as BCT [42]. De Castro, Tanner and Johnston [26] found that an organization adopts BCT when its leadership provides required resources. Clohessy and Acton [22] recommended top management support essential for the adoption of BCT. Therefore, it can be hypothesized that:

Hypothesis 8 (H8). *Top management support positively influences an organization's intention to adopt BCT.*

3.4. Environment Context

3.4.1. Competition Intensity (CI)

Competition intensity, also known as competitive or external pressure, is the extent to which organizations feel a fear of losing competitive advantage. Competition intensity has been recognized as an essential factor in the organizational adoption of BCT [33]. When an organization adopts BCT, its competitors also follow suit to maintain their competitive position. Wong, Leong, Hew, Tan and Ooi [21] said that competitive pressure catalyzes an organization's decision to adopt BCT. Therefore, it can be hypothesized that:

Hypothesis 9 (H9). *Competitive intensity positively influences an organization's intention to adopt BCT.*

3.4.2. Government Support (GS)

Government support refers to a government's policies, initiatives, and incentives to foster adoption of technology. According to Koster and Borgman [42], government

support works as a major driving force to speed up the adoption process of BCT. De Castro, Tanner and Johnston [26] stated that when a government does not provide proper support such as establishment of regulations, widespread adoption of BCT among organizations remains impossible. Kulkarni and Patil [41] and Wong, Leong, Hew, Tan and Ooi [21] reported government support as a critical factor for the adoption of BCT. Therefore, it can be hypothesized:

Hypothesis 10 (H10). *Government support positively influences an organization's intention to adopt BCT.*

3.4.3. Trading Partner Readiness (TPR)

Trading partner readiness refers to the preparedness of the partners of an organization to embrace new technology. Similar to any inter-organizational system, BCT requires strong collaboration and interaction among the trading partners [76]. When trading partners do not have adequate technical and financial resources, an organization alone cannot decide on the adoption of BCT [32]. Bai and Sarkis [34] claimed that the willingness of trading partners is essential for the organizational adoption of BCT. Therefore, it can be hypothesized:

Hypothesis 11 (H11). *Trading partner readiness positively influences an organization's intention to adopt BCT.*

3.4.4. Standards Uncertainty (SU)

Standards uncertainty refers to the unpredictability and unavailability of formal standards and regulations, generally enforced by government institutions, for a technology. The absence of the relevant standards creates doubts and uncertainties among organizations about the benefits of new technology [77]. On the other hand, well-developed standards guide or even force organizations to invest in innovations. This is also true for the BCT [78]. Given the nascent nature, relevant standards for BCT are still missing, causing organizations to be doubtful about its future development [79]. Therefore, it can be hypothesized that:

Hypothesis 12 (H12). *Standards uncertainty negatively influences an organization's intention to adopt BCT.*

3.5. Direct and Moderating Effect of Perceived Risks

As stated in the research conducted by Peter and Ryan [80], Bauer is the first person that proposed the concept of perceived risks. Afterward, many studies were conducted to measure the effect of perceived risks on technological innovations. According to Peter and Ryan [80], perceived risks refer to the nature and amount of risk perceived by an organization when deciding an action in an unknown situation. In the IT adoption literature, perceived risks are negatively associated with the adoption of new technologies [81–83]. The existing literature reports different facets of perceived risks such as performance risk, financial risk, time risk, physical risk, social risk, psychological risk, and privacy risk for the adoption of different technologies, e.g., e-services, mobile commerce, social robot, and smartphones [84]. In the case of BCT, it is not free from the risks such as privacy, high data storage, and "51% attack" that hinder organizations from its adoption [63]. Yoo, et al. [85] mentioned perceived risks as a barrier to the organizational adoption of BCT. The risks cause doubt among organizations towards BCT adoption [86,87]. Therefore, it can be hypothesized that:

Hypothesis 13 (H13). *Perceived risks negatively influence an organization's intention to adopt BCT.*

As stated above, the past studies report a direct negative effect of perceived risks on the adoption of technological innovations. The moderating role of perceived risks when applying the TOE framework to examine the organizational adoption of BCT has yet to

receive attention in the information system research. The reasons to choose perceived risks as a moderating variable in this study are given below:

(i) As previously mentioned in Section 1 of this paper, semi-structured interviews with the BCT experts were conducted to identify the factors influencing BCT adoption in Australia. The experts highlighted the moderating role of perceived risks in BCT adoption.
(ii) The past literature reports the moderating role of perceived risks in the adoption of different technological innovations. For example, Shen and Chiou [88] found that the perceived risks moderates the relationship between perceived ease of use and intention towards using internet services. Similarly, Khaksar, Khosla, Singaraju and Slade [84] reported the moderating role of perceived risks in the adoption of social assistive technology.
(iii) Given the higher value of the "uncertainty avoidance index" for Australia in Table 1, anecdotally it can be assumed that the perceived risks would moderate the relationship between the influential factors and organizations' intention to adopt new technology such as BCT.

Therefore, the following hypotheses are proposed for the moderating effect of perceived risks on the adoption of BCT among Australian organizations.

Hypothesis 13a (H13a). *Perceived risks moderate the relationship between perceived benefits and an organization's intention to adopt BCT.*

Hypothesis 13b (H13b). *Perceived risks moderate the relationship between perceived compatibility and an organization's intention to adopt BCT.*

Hypothesis 13c (H13c). *Perceived risks moderate the relationship between perceived information transparency and an organization's intention to adopt BCT.*

Hypothesis 13d (H13d). *Perceived risks moderate the relationship between perceived disintermediation and an organization's intention to adopt BCT.*

Hypothesis 13e (H13e). *Perceived risks moderate the relationship between organization innovativeness and an organization's intention to adopt BCT.*

Hypothesis 13f (H13f). *Perceived risks moderate the relationship between organizational learning capability and an organization's intention to adopt BCT.*

Hypothesis 13g (H13g). *Perceived risks moderate the relationship between top management support and an organization's intention to adopt BCT.*

Hypothesis 13h (H13h). *Perceived risks moderate the relationship between competition intensity and an organization's intention to adopt BCT.*

Hypothesis 13i (H13i). *Perceived risks moderate the relationship between government support and an organization's intention to adopt BCT.*

Hypothesis 13j (H13j). *Perceived risks moderate the relationship between trading partner readiness and an organization's intention to adopt BCT.*

Since the perceived risks per se have a negative impact on BCT adoption, we hypothesized its moderating effects for those factors that have a positive impact on BCT adoption.

4. Research Methodology

The study uses a positivist research approach with a quantitative methodology to collect and analyze the research data.

4.1. Research Method

We employed a survey method to collect data for this study. A licensed version of the Qualtrics online survey tool was utilized. The online survey is useful to collect data from a larger population to measure and test multiple variables and hypotheses [89]. Furthermore, the survey method is cost and time-effective, requires less effort to manage, and is free from respondent prejudice [90]. Thus, it was used in this study.

4.2. Unit of Analysis and Unit of Observation

A unit of analysis refers to the entity that a researcher states their findings are about at the end of the research. It can be an individual, group, or organization depending upon the nature and context of a study [91]. On the other hand, a unit of observation is an entity, which a researcher observes while investigating something about the unit of analysis [92,93]. For this study, the unit of analysis was the Australian organizations, and the unit of observation was the individuals that should be working as CEO, or the senior IT people such as CTO, IT directors/managers, and had a minimum of three years of BCT-related knowledge and experience. This cohort of senior management and IT people were selected because they are always well informed about the organization's strategies and decisions such as adopting new technology [71].

To automatically filter out the unwanted unit of analysis and the unit of observation, screening questions were incorporated at the start of the online survey. The screening questions help to keep survey data relevant and free from respondent bias [94,95]. The screening questions used in this study are provided in Appendix B.

4.3. Target Population and Sampling

BCT adopters and potential adopter organizations in Australia were the target population for this study. To find the total population, we used multiple online sources including the Australian securities exchange directory, Blockchain Australia, Google, LinkedIn, and BCT-related websites such as "VentureRadar", "Crunchbase", and "Coindesk". According to the data collected from these online sources, the total population size obtained was 917 organizations belonging to different industries that made the target population diverse.

For the sampling, we used the proportionate stratified random sampling technique that is appropriate when the target population is heterogeneous as in our study [90]. This technique requires dividing the total population into homogeneous subgroups known as strata. We randomly selected a sample proportionate to the size of each stratum. This technique allows researchers to reduce selection bias and overall variance in the sample, which in turn increases the generalizability of research findings. For this study, an industry type was taken as a stratum. We obtained a sample size of 500, which is acceptable in social science research [89]. According to Sekaran and Bougie [89], a sample size between 30 and 500 is acceptable. Table 3 provides sampling details.

Table 3. Summary of the stratified random sampling and response rate.

Type of Industry	Total Population	Sample	Percentage (Out of 917)	Response	Percentage (Out of 500)
Automotive	17	11	1.2	7	1.4
Construction	11	8	0.87	3	0.6
Consultancy	56	30	3.27	14	2.8
Education	117	61	6.65	21	4.2
Electronics	28	16	1.74	7	1.4
Finance	80	44	4.8	13	2.6
Government	3	2	0.22	1	0.2
IT	219	112	12.21	43	8.6

Table 3. *Cont.*

Type of Industry	Total Population	Sample	Percentage (Out of 917)	Response	Percentage (Out of 500)
Insurance	56	30	3.27	12	2.4
Manufacturing	38	23	2.51	11	2.2
Pharmaceutical	46	26	2.84	9	1.8
Retail	29	17	1.85	8	1.6
Supply chain	145	75	8.18	29	5.8
Telecommunication	24	15	1.64	7	1.4
Transport	33	20	2.18	8	1.6
Legal	15	10	1.09	3	0.6
Total	917	500	54.53	196	39.2

4.4. Questionnaire Designing

Several measures were taken to design a reliable questionnaire for this study:

- We used validated measuring items for the perceived compatibility, perceived complexity, perceived information transparency, top management support, organization innovativeness, organizational learning capability, government support, trading partner readiness, competition intensity, standards uncertainty, and perceived risks from the existing peer-reviewed literature on information systems research. The items were adapted and modified to meet the requirement of this study. Table 4 provides detail about the measuring items for each factor and their sources. Measuring items for perceived disintermediation were not found in the existing literature, hence we developed it for this study by following the guidelines of MacKenzie, et al. [96].
- Use of duplicate and long questions, technical and specialized terms were avoided.
- Feedback from the senior academic and researchers working in the information system domain was sought to evaluate instrument relevance and content clarity in order to avoid any difficulty or non-response that the respondents might have faced while completing the survey.
- The questionnaire was sent to language experts for proofreading including review of grammatical errors and wording.

The questionnaire is provided in Appendix A.

Table 4. Factor, their measuring items, and source.

Factor	Measuring Items	Source
Perceived benefits (PB)	Blockchain reduces overhead expenses Blockchain reduces data error rates Blockchain reduces transaction costs while transferring funds Blockchain saves time while accomplishing business tasks Blockchain increases the organization's overall productivity	[97,98]
Perceived compatibility (PC)	Blockchain fits well with business processes Blockchain is compatible with technological infrastructure Blockchain fits well with technological skills	[99,100]
Perceived complexity (PCM)	Blockchain requires extra technical skills to use Blockchain is difficult to understand from a business perspective Blockchain is conceptually difficult to understand from a technical perspective	[99]
Perceived information transparency (PIT)	Access to information across the blockchain View of any activity with the data in the blockchain See the flow of the entire data in the blockchain	[101]
Perceived disintermediation (PD)	Store data without the involvement of any intermediary Access data without the involvement of any intermediary Share data without the involvement of any intermediary Audit without the involvement of any intermediary	Authors
Top management support (TMS)	Provides the necessary resources for blockchain Considers blockchain as strategically important Actively involved in IT-related decisions	[102,103]
Organizational innovativeness (OI)	Actively seek new ideas Like to do things in new ways Are open to taking risks	[104]

Table 4. *Cont.*

Factor	Measuring Items	Source
Organizational learning capability (OLC)	Have a mechanism to store new knowledge Encourage their employees to acquire new knowledge and skills Employees share their work experiences, ideas, or learning with each other Have practices to utilize new knowledge in their IT-related decisions	[105]
Government support (GS)	Policies support the adoption of blockchain Introduces economic incentives for blockchain adoption Is active in setting up the facilities to promote blockchain	[98]
Trading partner readiness (TPR)	Willing to adopt blockchain Technologically ready to adopt blockchain Financially ready to adopt blockchain	[97]
Competitive intensity (CI)	Feel pressure when competitors have adopted blockchain Feel the fear of losing a competitive advantage if they do not adopt it See competitors benefiting from adopting blockchain	[106]
Standards uncertainty (SU)	See blockchain has not reached its maturity See blockchain still requires changes to become more efficient compared with existing technologies Cannot predict that blockchain would become an industry standard in the near future	[104]
Perceived risks (PR)	It is not secured Transactions' information will be compromised while using it It will not provide its expected benefits	[107]
Intention to adopt blockchain (INT)	Adopt blockchain whenever they will have access to it in the future Adopt blockchain in the future Adopt blockchain frequently in the future	[108]

4.5. Measurement Scale

The 5- and 7-point are the two main versions of the Likert scale that are frequently used in information systems research. However, the 7-point scale outperforms the 5-point scale in terms of providing more flexibility and options to respondents, which increases the reliability and accuracy of the research findings [109,110]. Therefore, the 7-point Likert scale was considered more appropriate for the present study. We used response options from "1—strongly disagree" to "7—strongly agree".

4.6. Pilot Testing

The reliability and validity of the instrument were confirmed through a pilot study using data from 25 completed surveys. The sample for the pilot study was drawn from the same sample frame used for the main study.

4.7. Data Collection Process

The survey link along with the research objectives was emailed to the target organizations. To collect accurate information, every organization was requested to forward the survey to the CEO, or senior IT staff such as the CTO and IT directors/managers having BCT experience and knowledge. A follow-up email was sent to the non-respondent organizations. During the entire data collection period, ethical protocols were observed.

A total of 196 anonymous completed surveys were received, yielding a response rate of 39.2%, which is considered acceptable in online survey research [111].

4.8. Data Analysis Technique

To analyze the survey data, the PLS-SEM technique with SmartPLS 3 software was used. Despite the availability of other data analysis techniques such as correlation, regression, and analysis of variance, PLS-SEM is widely used for quantitative data analysis [112]. It allows researchers to analyze the relationship of the observed (measured) and unobserved variables (latent constructs) while the traditional techniques can analyze measured variables only [113]. Additionally, the moderator effects can be directly incorporated and computed into the model with the PLS-SEM [112]. Thus, the PLS-SEM was used in this study. In the PLS-SEM process, data is analyzed in the form of a measurement model and structural model. The measurement model measures latent variables whereas the structural model measures the hypotheses based on the path analysis.

5. Data Analysis and Results

5.1. Preliminary Data Analysis

Before proceeding to the SEM analysis, a preliminary data analysis confirmed the absence of missing values, selection bias, non-response bias, multicollinearity, and common method bias. Such biases in data reduce the validity of findings. Therefore, we confirmed that the data were free from these biases.

Nonresponse Bias: Nonresponse bias occurs when some respondents of the chosen sample are unable or unwilling to participate in the survey [114]. The respondents who fail to respond may be different from the rest of the population. Consequently, the true representation of the target population is not reflected in the survey data. The inferences derived from the collected data may be false and the validity of the research is compromised [115]. The nonresponse bias is introduced when the recruitment of the respondents is based on self-selection [115,116]. The participants voluntarily decide to participate in a survey. To assure that the collected data is free from self-selection bias and it truly represents the target population, we performed the comparison of the sample population and the respondents who completed the survey as shown in Table 3. From the comparison, it is clear that the actual respondents truly reflect the target and sample population, which confirms that no selection bias was present in the collected data. Furthermore, we checked the non-response bias with Levene's test for equality of variances [117] and independent-samples t-test, for all the factors. We divided the respondents between early respondents (who responded before the reminder, 45.5%) and late respondents (who responded after the reminder, 54.5%). The equal variance significance values for all the factors were found to be higher than the significance level of 0.05, which implies that both groups, early and late respondents, have the same variance. Thus, non-response bias was not found in the data.

Multicollinearity: We assessed multicollinearity for every exogenous factor through the value of variance inflation factor (VIF) as suggested by Hair Jr, et al. [118]. The VIF value of five shows high collinearity. For this study, the VIF values for all the factors were found between 1.123 and 1.953. Thus, no multicollinearity was found among the independent factors.

Common Method Bias: We performed the Harman one-factor test to confirm common bias as suggested by Podsakoff, et al. [119]. The test yielded fourteen factors. The largest factor showed 29.313% of the total variance. A value less than 50% implies that common method bias was not present in data [120].

5.2. Demographic

The demographic data indicated that most of the organizations were from the banking/finance, education, IT, and supply chain industries. These industries seem to be most appropriate for BCT. Regarding the respondents, females were 42.9% and males 57.1%. The age of most respondents was between 26 and 50 years. In the educational qualification of the respondents, postgraduate degree was highest, undergraduate second, and college certificate third. Most of the respondents were CEO (15.3%), CTO (23%), and IT directors (16.8%). Others included IT manager, technology strategy manager, database administrator, supply chain manager, and finance director/manager.

5.3. Measurement Model

The study assessed the reliability of the measurement model by calculating Cronbach's alpha, composite reliability (CR), average variance extracted (AVE); discriminant validity through the square root of the AVE, and cross-loadings. The minimum acceptable values of outer-loadings, Cronbach's alpha, and CR should be equal or greater than 0.7, and for the AVE, it should be greater than 0.5 [121]. Similarly, for the square root of the AVE of every construct, the value should exceed all the correlations among the constructs in the same block of the factor correlation matrix. Overall, the statistical results for the measurement model were above the minimum acceptable values as depicted in Tables 5 and 6. Hence, the reliability and validity criteria for this study were achieved. The values for the cross-

loadings were according to the recommendations of Fornell and Larcker [122]. Each measuring item of every construct was loaded higher than the indicators of any other off-diagonal construct.

Table 5. Reliability of constructs and their measuring items.

Construct with Measuring Items	Outer Loadings	CR	AVE	Cronbach's Alpha
Competitive Intensity (CI)		0.863	0.678	0.761
CI1	0.754			
CI2	0.879			
CI3	0.831			
Perceived Complexity (PCM)		0.894	0.738	0.823
CMP1	0.829			
CMP2	0.869			
CMP3	0.878			
Government Support (GS)		0.900	0.749	0.833
GS1	0.863			
GS2	0.846			
GS3	0.887			
Intention to adopt BCT (INT)		0.881	0.711	0.796
INT1	0.786			
INT2	0.858			
INT3	0.883			
Organization Innovativeness (OI)		0.887	0.724	0.810
OI1	0.829			
OI2	0.856			
OI3	0.868			
Organization Learning Capability (OLC)		0.887	0.663	0.831
OLC1	0.778			
OLC2	0.860			
OLC3	0.782			
OLC4	0.834			
Perceived Benefits (PB)		0.905	0.704	0.859
PB1	0.776			
PB2	0.871			
PB3	0.851			
PB4	0.856			
Perceived Compatibility (PC)		0.899	0.749	0.833
PC1	0.866			
PC2	0.847			
PC3	0.883			
Perceived Disintermediation (PD)		0.879	0.645	0.816
PD1	0.744			
PD2	0.847			
PD3	0.814			
PD4	0.804			
Perceived Information Transparency (PIT)		0.929	0.814	0.887
PIT1	0.889			
PIT2	0.903			
PIT3	0.914			
Perceived Risks (PR)		0.880	0.711	0.797
PR1	0.834			
PR2	0.806			
PR3	0.887			
Standards Uncertainty (SU)		0.879	0.708	0.793
SU1	0.777			
SU2	0.876			
SU3	0.867			
Top Management Support (TMS)		0.886	0.722	0.807
TMS1	0.827			
TMS2	0.875			
TMS3	0.846			
Trading Partner Readiness (TPR)		0.886	0.722	0.805
TPR1	0.773			
TPR2	0.914			
TPR3	0.857			

Table 6. Correlation of constructs compared with the square root of AVEs.

Constructs	CI	PCM	GS	INT	OI	OLC	PB	PC	PD	PIT	PR	SU	TMS	TPR
CI	0.823 *													
PCM	0.682	0.859 *												
GS	0.043	0.411	0.866 *											
INT	0.327	0.581	0.588	0.843 *										
OI	0.159	0.382	0.505	0.223	0.851 *									
OLC	0.204	0.222	0.110	0.195	0.638	0.814 *								
PB	0.410	0.500	0.225	0.589	0.435	0.270	0.839 *							
PC	0.290	0.041	0.481	0.502	0.577	0.588	0.163	0.865 *						
PD	0.565	0.490	0.195	0.323	0.067	0.484	0.244	0.568	0.803 *					
PIT	0.500	0.603	0.365	0.063	0.217	0.166	0.457	0.485	0.348	0.902 *				
PR	0.235	0.111	0.402	0.684	0.359	0.405	0.326	0.215	0.667	0.518	0.843 *			
SU	0.175	0.299	0.025	0.270	0.168	0.383	0.038	0.130	0.514	0.463	0.651	0.841 *		
TMS	0.288	0.620	0.319	0.601	0.500	0.147	0.530	0.501	0.073	0.219	0.120	0.598	0.850 *	
TPR	0.304	0.321	0.540	0.301	0.101	0.073	0.631	0.090	0.297	0.336	0.475	0.208	0.533	0.850 *

* square root of AVEs.

5.4. Structural Model

To determine the significance of path coefficients, a standard bootstrapping procedure with 500 samples and 196 cases was performed. The structural model was evaluated with the values of coefficients of determination (R^2), effect size (f^2), predictive relevance coefficient (Q^2), and the path coefficients [118,123].

The value of R^2 is the extent to which the independent constructs explain the variance in the dependent constructs [118]. The bigger value of R^2 reflects that the model has more predictive power. We found R^2 = 0.822, which implies that perceived benefits (PB), perceived compatibility (PC), perceived complexity (PCM), perceived information transparency (PIT), perceived disintermediation (PD), top management support (TMS), organization innovativeness (OI), organization learning capability (OLC), government support (GS), competition intensity (CI), trading partner readiness (TPR), standards uncertainty (SU), and perceived risks (PR) accounted for 88.2% variance of the intention to adopt blockchain (INT).

The value of f^2 represents the strength of the effect of a particular independent construct on the dependent construct in the structural model [124,125]. Cohen, et al. [126] states f^2= 0.02; f^2 = 0.15, and f^2= 0.35 as small, medium, and large effects, respectively. Our results for f^2 were found between 0.016 and 0.608. The perceived benefits (PB), perceived information transparency (PIT), perceived disintermediation (PID), and trading partner readiness (TPR) were reported to have a large effect size, whereas, perceived complexity (PC), perceived risks (PR), organization innovativeness (OI), organization learning capability (OLC), top management support (TMS), competition intensity (CI), and standards uncertainty (SU) were reported with medium effect. However, perceived complexity (PCM) and government support (GS) showed small effects. According to Chin, et al. [127], even the smallest value of f^2 for a construct is important because it reflects that the construct at least has some effect.

In addition to R^2, we performed the predictive relevance test (Stone–Geisser's Q^2) to evaluate the predictive validity of the models [128–130]. The higher value of Q^2 for a dependent construct indicates that the model has predictive relevance for that construct [131]. In our case, the dependent construct is "intention to adopt blockchain" (INT). We performed the blindfolding procedure to obtain the cross-validated redundancy value for INT, which was Q^2 = 0.526 indicating a high predictive relevance of the model for the INT.

To test the hypotheses, we performed the significance test for path coefficients. According to Chin, Marcolin and Newsted [127], the path coefficients should have a "t-value" greater than 1.645 at a significance level of 0.05 and more than 2 at a significance level of 0.01. Table 7 shows the significance test of the path coefficients.

From the obtained results, it is clear that the hypotheses H1–H13 possess more than the accepted threshold of the "t-value" [127]. The path coefficient of perceived benefits (PB), perceived compatibility (PC), perceived information transparency (PIT), perceived disintermediation (PD), organization innovativeness (OI), organization learning capability (OLC), top management support (TMS), competition intensity (CI), government support (GS), and trading partner readiness (TPR) has a positive value, which implies that they have a positive relationship with intention to adopt blockchain (INT), whereas, perceived complexity (PCM), standards uncertainty (SU), and perceived risks (PR) have a negative value, which means they have an adverse relationship with INT. In other words, the higher the complexity, risks, and uncertainty of the BCT are, the lower the organization's intention to adopt BCT in Australia.

Table 7. Path coefficient analysis.

Hypothesis	Relationship	Path Coefficient	t-Value	Decision
H1	PB→INT	0.259	3.947 *	Supported
H2	PC→INT	0.178	3.158 **	Supported
H3	CMP→INT	−0.165	3.859 **	Supported
H4	PIT→INT	0.163	3.713 *	Supported
H5	PD→INT	0.357	6.341 *	Supported
H6	OI→INT	0.273	4.770 *	Supported
H7	OLC→INT	0.056	2.371 **	Supported
H8	TMS→INT	0.124	3.102 *	Supported
H9	CI→INT	0.265	4.538 *	Supported
H10	GS→INT	0.041	2.337 *	Supported
H11	TPR→INT	0.210	3.950 *	Supported
H12	SU→INT	−0.170	3.185 *	Supported
H13	PR→INT	−0.146	2.506 *	Supported
H13a	PB→PR→INT	−0.104	0.951 **	Not Supported
H13b	PC→PR→INT	−0.163	2.204 *	Supported
H13c	PIT→PR→INT	0.087	1.995 *	Supported
H13d	PD→PR→INT	0.175	2.583 *	Supported
H13e	OI→PR→INT	−0.209	2.925 *	Supported
H13f	OLC→PR→INT	−0.102	1.252 **	Not Supported
H13g	TMS→PR→INT	0.026	0.458 **	Not Supported
H13h	CI→PR→INT	0.380	3.561 *	Supported
H13i	GS→PR→INT	0.008	0.265 **	Not Supported
H13j	TPR→PR→INT	−0.013	0.190 **	Not Supported

** $p < 0.01$, * $p < 0.05$.

5.5. Measuring the Moderating Effects

To examine the moderating effects of PR on the relationship between PB, PC, PIT, PD, OI, OLC, TMS, CI, GS, and TPR with INT, we used the product indicator approach [132]. The results showed that PR has significant moderating effects on the relationship of PC, PIT, PD, OI, CI, and INT that confirms the hypotheses H13b, H13d, H13e, and H13h. However, no moderating effects of PR were found on the relationship between PB, OLC, TMS, GS, and TRP with INT, which implies that the hypotheses H13a, H13f, H13g, H13i, and H13j are not supported.

Additionally, we evaluated the performance of the model with and without adding PR as a moderating variable. It was noted that the significance level of the relationship between the dependent and independent variables significantly changes. For example, the TPR becomes insignificant at $p < 0.01$. However, it remains significant at $p < 0.05$.

6. Discussion

The study aims to find the factors that influence the adoption of BCT among Australian organizations. Based on the TOE framework, we found that different technological, organizational, and environmental factors affect the organizational adoption of BCT in Australia. The results support all the hypotheses, H1–H13, developed in this study. In addition to that, the results confirm that the variable perceived risks (PR) moderates the relationship between influential factors and BCT adoption. The results of this study extend the TOE framework by adding the new factors: perceived information transparency (PIT), perceived disintermediation (PD), organization innovativeness (OI), organization learning capability, competition intensity (CI), trading partner readiness (TPR), and standards uncertainty (SU) under its technological, organizational, and environmental contexts. Furthermore, the TOE framework has been extended with the inclusion of the perceived risks (PR) as a moderating variable.

In the context of the TOE framework, the results and their interpretation and comparison with the past studies are presented below. The implications of the study are also presented.

6.1. Technology Context

The technological factors are perceived benefits, compatibility, information transparency, and disintermediation positively influence the adoption of BCT, whereas the perceived complexity has a negative influence. The effect of perceived disintermediation is a new insight that was not reported in the past studies on BCT adoption. When organizations perceive that they could run their business without the involvement of any intermediary, they are attracted to adopt BCT. The disintermediation reduces the transaction cost and speedy payments [67,133], which motivates organizations to adopt BCT. However, Adams, et al. [134] pointed out that "blockchains may replace many firms across a wide number of sectors who currently (earn) profit from providing services (as an intermediary). Disintermediation may be painful for many (organizations) and have its own risks". Therefore, we suggest the BCT community create opportunities for organizations providing their services as an intermediary. The findings show that the compatibility of BCT with an organization's technological and financial needs significantly affects its adoption. This finding is consistent with Kim [135] but inconsistent with De Castro, Tanner and Johnston [26] that found BCT incompatible with the legacy infrastructure of the wealth management industry in South Africa. Therefore, we recommend organizations carefully evaluate and understand the compatibility of BCT with their business objectives before deciding on its adoption. The study found that the perceived complexity of BCT negatively impacts an organization's decision to adopt BCT. The organizations that perceive BCT as difficult to use or understand feel fear of its adoption which ultimately contributes to the low BCT adoption in Australia. De Castro, Tanner and Johnston [26] found that people from non-IT backgrounds perceive BCT as more complex compared with those having IT know-how. Therefore, we suggest organizations develop a better understanding of BCT while deciding on its adoption. In this study, perceived transparency of information through BCT has been found to be an enabler of the organizational adoption of BCT, which is consistent with the study of Al-Jabri and Roztocki [64]. Information transparency enhances trust among the organizations involved in the BCT network, consequently, organizations coordinate and share information with full of confidence.

6.2. Organizational Context

Organizational factors are innovativeness, and organization learning capability were found to be significant to the adoption of BCT, which is similar to the findings of Johnson [136], Kulkarni and Patil [41], and Newby, Nguyen and Waring [70]. We found that the organizations that are capable of acquiring new knowledge, store and apply that knowledge; hence, they are deemed to be open to new ideas, and ready to take risks, meaning they are more likely to adopt BCT. Therefore, we suggest organizations should have a learning mechanism to remain aware of developments happening in the world that could be important for their business. Regarding the top management support, our findings are consistent with those of Orji, Kusi-Sarpong, Huang and Vazquez-Brust [25], and Clohessy and Acton [22], who found that without the support of top management, the organizational adoption of BCT is less likely. This is because the top leadership is the authority to approve strategic decisions such as the adoption of new technology and allocate resources for it. This finding contrasts with Wong, Leong, Hew, Tan and Ooi [21] who found an insignificant impact of top management support on BCT adoption. Anecdotally, this could be that the top management was not convinced or was not aware of the benefits of BCT. Therefore, we suggest educating top management about BCT while initiating the idea of its adoption.

6.3. Environmental Context

The environmental factors are competition intensity, government support, and trading partner readiness positively, whereas the standards uncertainty negatively influences the adoption of BCT. The positive impact of the competition intensity on BCT adoption implies that organizations want to remain competitive at the forefront of their rivals. Competition intensity encourages organizations to find ways to grow and sustain their competitive

advantage. Prior studies have also established that the adoption of BCT is important for organizations to retain their competitiveness [21,33,34]. We found a significant effect of government support on the adoption of BCT. This means organizations are satisfied with the recent initiatives of the Australian government for BCT. This finding also confirms the results of Orji, Kusi-Sarpong, Huang and Vazquez-Brust [25] who reported that when a government shows support in terms of developing policies and regulations, it enhances organizations' confidence and trust in the BCT. However, few studies reported that governments have not laid down specific regulations about BCT for different industries, so any change in regulations may adversely affect investment in BCT projects [45,137,138]. Therefore, we recommend that organizations check government regulations relevant to their industry before making any decision to adopt BCT. We found trading partner readiness has a significant influence on BCT adoption. This finding confirms the inter-organizational nature of BCT. Organizations can not adopt BCT until their trading partner are ready to adopt it. Any decision of BCT adoption without the willingness of trading partners would result in negative consequences [32,41]. We endorse the statement presented by Bai and Sarkis [34] wherein they suggested to ensure the willingness of multiple stakeholders to adopt BCT. The impact of standards uncertainty was identified as negative on the adoption of BCT, which implies that organizations are still seeking BCT-related industry standards. This finding is consistent with Guo and Liang [139] who reported that BCT adoption would be unsolved until the industry standards related to BCT are established. To accelerate the adoption of BCT, establishment of industry standards for BCT it is urgently needed [32,63,104]. This finding may help the relevant government and private industrial agencies to pay attention to the development of BCT standards.

6.4. Direct Effect of Perceived Risks

The direct impact of perceived risks is found to be negative causing organizations to be reluctant to adopt BCT. Resultantly, BCT adoption is not gaining attention among Australian organizations. This finding is aligned with the earlier study of Yoo, Bae, Park and Yang [85] that reported that the risks such as privacy disclosure, misuse of information, and un-scalability hinder organizations to adopt BCT. It suggests that organizations should carefully analyze the risks before deciding on the adoption of BCT.

6.5. Moderating Effect of Perceived Risks

We found that the perceived risks moderate the relationship between perceived compatibility (PC), perceived information transparency (PIT), perceived disintermediation (PD), organization innovativeness (OI), competition intensity (CI), and intention to adopt blockchain (INT), thereby supporting the hypotheses H13b–H13e, and H13h. These findings imply that irrespective of the compatibility of BCT with organizations' business values—their expectations for information transparency through BCT, perceiving BCT disintermediation as an opportunity, being innovative, and feeling the intensity of competitiveness—organizations become reluctant to adopt BCT because of the risks linked with BCT. The moderating role of PR was not found for PB (perceived benefits), organization learning capability (OLC), top management support (TMS), government support (GS), and trading partner readiness (TPR). Thus, the hypotheses H13a, H13f, H13g, H13i, and H13j are not supported. This is contrary to our proposed hypotheses. A possible explanation for this might be that when the organizations consider the high level of perceived benefits, top management support, trading partner readiness, and government support, they feel more comfortable and are inclined towards BCT adoption. Moreover, if organizations are more knowledgeable about BCT through their learning capability, they know how to manage the risks.

6.6. Implications

The study outlines some important implications for both theory and practice, which are given below.

6.6.1. Theoretical Implications

First, according to the best of our knowledge, this is one of the first positivist studies that provides empirical evidence about the factors influencing organizational adoption of BCT in the Australian context. Most of the research on BCT is from its technical understanding and advancement perspective. Although the technological perspective of BCT is important for its future development, understanding its adoption is also critical for maximum value creation. Thus, first, this study theoretically contributes by establishing the foundation for future research in the Australian context. Second, the prior studies on the organizational adoption of BCT establish a linear relationship between the TOE factors and the intention to adopt BCT. This is one of the first studies that extends the TOE framework by introducing a moderating variable for the organizational adoption of BCT. Researchers can use this extended TOE model shown in Figure 2 as a starting point for future research to study organizations' intentions to adopt any innovation in general and BCT in particular. With the addition of the new factors, the extended model has more explanatory power than the original TOE framework. Third, the study identifies the factors that influence the organizational adoption of BCT, particularly in Australia. Fourth, we extend the existing literature on different factors influencing BCT adoption in general. Future research can study these factors in-depth to expand the list. Fifth, the research presents a validated research model for the adoption of BCT at the organization level. This model can be used to study the adoption of other distributed inter-organizational technologies such as electronic data interchange (EDI). Finally, we have developed and validated a measuring scale for the perceived disintermediation, which would help researchers in their future studies on BCT.

6.6.2. Practical Implications

In addition to having theoretical implications, the study has various important implications for practice. First, our findings would provide guidelines to the policy and decision makers working with the Australian government to develop national policies to promote BCT adoption among Australian organizations. This also applies to the private associations such as "Blockchain Australia" that have actively been working to foster BCT adoption in Australia. Second, disintermediation is found to be a significant factor in BCT adoption. This finding urges the organizations working as an intermediary to redesign their business models to sustain in the market. Third, the findings could help consulting and marketing companies to consider factors identified in this study while providing their services to the potential adopters of BCT, saving time and effort. For example, it is useless to provide services to a customer whose trading partners are not ready to adopt BCT. Fourth, we have found that organizations feel reluctant to adopt BCT due to the lack of established standards of BCT. Therefore, this finding is important for governments and private regulatory bodies to develop relevant standards to remove the uncertainties hindering BCT adoption. Fifth, the study highlights the role of an organization's top management in BCT adoption. Therefore, the organization's top management should be determined and focused on the adoption of new technology. Top management's clarity towards value creation is conducive to achieve successful adoption of BCT in their organization. Finally, the competition intensity is found positive for BCT adoption. Therefore, IT vendors develop BCT apps that provide a competitive advantage to their customers.

7. Conclusions

The BCT is an important technology that could bring several strategic and operational advantages to organizations. However, its adoption among organizations has not reached a significant level including in Australia. To examine this lack of uptake, this study aimed to find the factors influencing the adoption of BCT among Australian organizations. By following a quantitative approach, this study proposed and confirmed an extended TOE framework. In contrast to the earlier studies on the organizational adoption of BCT that establish a linear relationship between influential factors and an organization's intention to adopt BCT, this study introduced a moderating variable. A data sample

was collected from the Australian organization through an online survey. The PLS-SEM technique with SmartPLS software was used for the data analysis. The results of the study highlight that technological factors: perceived benefits, compatibility, information transparency, and disintermediation; organizational factors: organization innovativeness, organization learning capability, and top management support; and environmental factors: competition intensity, government support, trading partners readiness, and standards uncertainty play an important role in the organizational adoption of BCT in Australia. The findings of this study provide direction to decision makers and policymakers, BCT vendors, technology practitioners, and researchers to develop strategies that contribute to the successful adoption and value creation of BCT.

Although this study achieved its aim, additional empirical research will further enhance its applicability and validity. For example, at the moment, the study focuses on the Australian context that reduces its external validity. Future research can be conducted in other countries, which have different regulatory and technological developments, to enhance its generalizability. Further, the study is cross-sectional. There is a high likelihood of changes in findings as time progresses. In the future, we hope to develop a dynamic model capable of predicting an organizations' intention to adopt BCT over time.

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Appendix A

Survey Questionnaire

Please respond to each statement by indicating the degree of agreement or disagreement by using the following scale.

1 = Strongly Disagree
2 = Disagree
3 = Somewhat Disagree
4 = Neutral
5 = Somewhat Agree
6 = Agree
7 = Strongly Agree

Factor	Questions
Perceived benefits (PB)	In my opinion, organizations adopt blockchain when they perceive that:
	Blockchain reduces overhead expenses
	Blockchain reduces data error rates
	Blockchain reduces transaction costs while transferring funds
	Blockchain saves time while accomplishing business tasks
	Blockchain increases the organization's overall productivity
Perceived compatibility (PC)	In my opinion, organizations adopt blockchain when they perceive that:
	Blockchain fits well with their business processes
	Blockchain is compatible with their technological infrastructure
	Blockchain fits well with their technological skills
Perceived complexity (PCM)	In my opinion, organizations do not adopt blockchain when they perceive that it:
	Blockchain requires extra technical skills to use
	Blockchain is difficult to understand from a business perspective
	Blockchain is conceptually difficult to understand from a technical perspective
Perceived information transparency (PIT)	In my opinion, organizations adopt blockchain when they perceive that:
	Blockchain enables them to have transparent access to information across the network
	Blockchain enables them to have a transparent view of any activity in the data
	Blockchain enables them to have a transparent flow of the entire data
Perceived disintermediation (PD)	In my opinion, organizations adopt blockchain when they perceive that:
	Blockchain enables them to store their data without the involvement of any intermediary
	Blockchain enables them to access their data without the involvement of any intermediary
	Blockchain enables them to share their data without the involvement of any intermediary
	Blockchain enables them to audit without the involvement of any intermediary
Top management support (TMS)	In my opinion, organizations adopt blockchain when:
	Their top management provides the necessary resources for blockchain
	Their top management considers blockchain as strategically important
	Their top management is actively involved in IT-related decisions
Organizational innovativeness (OI)	In my opinion, organizations adopt blockchain when:
	They actively seek new ideas
	They like to do things in new ways
	They are open to taking risks
Organizational learning capability (OLC)	In my opinion, organizations adopt blockchain when:
	They have a mechanism to store new knowledge
	They encourage their employees to acquire new knowledge and skills
	Their employees share their work experiences, ideas, or learning with each other
	They have practices to utilize new knowledge in their IT-related decisions
Government support (GS)	In my opinion, organizations adopt blockchain when:
	The Australian government supports the adoption of blockchain
	The Australian government introduces economic incentives for blockchain adoption
	The Australian government is active in setting up facilities to promote blockchain
Trading partner readiness (TPR)	In my opinion, organizations adopt blockchain when:
	Their trading partners are also willing to adopt blockchain
	Their trading partners are also technologically ready to adopt blockchain
	Their trading partners are also financially ready to adopt blockchain
Competitive intensity (CI)	In my opinion, organizations adopt blockchain when:
	They feel pressure when their competitors have adopted it
	They feel the fear of losing a competitive advantage if they do not adopt it
	They see their competitors benefiting from adopting it
Standards uncertainty (SU)	In my opinion, organizations do not adopt blockchain when:
	They see blockchain has not reached its maturity
	They see blockchain still requires changes to become more efficient compared with existing technologies
	They cannot predict that blockchain would become an industry standard in the near future
Perceived risks (PR)	In my opinion, organizations do not adopt blockchain when they perceive that:
	Blockchain is not secured
	Their transactions' information will be compromised while using blockchain
	Blockchain will not provide its expected benefits
Intention to adopt blockchain (INT)	In my opinion:
	Organizations would adopt blockchain whenever they will have access to it in the future
	Organizations would adopt blockchain in the future
	Organizations would adopt blockchain frequently in the future

Appendix B

Screening Questions

Q1. Which country do you belong to? Please select from the list of countries given below.
(survey exits if a respondent selects a country other than Australia)
Q2. Which of the following age groups best describes you?
(survey exits if a respondent select age less than 18 years)
Q3. Please indicate which of the following technologies best describes your knowledge/experience?

- B2B-Commerce
- Blockchain Technology
- Electronic Data Interchange (EDI)
- Distributed DBMS
- Other (please type)

(survey exits if a respondent does not select "Blockchain Technology")
Q4. Please indicate which of the following technologies your organization has been involved with?

- B2B-Commerce
- Cloud Computing
- RFID
- Robotics
- Internet of Things (IoT)
- Blockchain Technology
- Electronic Data Interchange (EDI)
- Artificial Intelligence
- Distributed DBMS
- Social Media Technologies
- Gaming
- Other

(survey exits if a respondent does not select "Blockchain Technology")
Q5. Please indicate which of the following job titles best describes your role?

- Chief Executive Officer President Chairperson
- Chief Technology Officer Chief Information Officer Chief Digital Officer
- IT Manager
- Business Development Manager
- Other
- IT Director
- Technology Strategy Manager
- Finance Director Finance Manager
- Customer Service Manager
- Database Administrator
- Supply Chain Manager
- Store Manager
- Sales Manager
- Other

(survey exits if a respondent does not select IT related job)
Q6. How many years of knowledge/experience of blockchain technology do you have?

- Less than 3 years
- 3–4 years
- 5–7 years
- 8–10 years
- Above 10 years

(survey exits if a respondent selects "Less than 3 years")

Q7. How would you rate your knowledge of blockchain technology?

- Little knowledge of blockchain technology
- Good knowledge of blockchain technology
- Excellent knowledge of blockchain technology

(survey exits if a respondent selects "Little knowledge of blockchain technology")

Q8. What is/was the status of involvement of your organization with blockchain technology?

- Currently interested in blockchain technology and actively seeking related information
- Currently in the process of deciding adoption of blockchain technology
- Currently implemented blockchain technology
- Previously implemented blockchain technology, but currently not using

Q9. What is/was the size of your organization in terms of the number of employees?

- Having employees between 1 and 4
- Having employees between 5 and 19
- Having employees between 20 and 199
- Having employees more than 200

Q10. What is the annual revenue of your organization?

- Less than $1 million
- Between $1–5 million
- Between $5–50 million
- Above $50 million

Q11. Which of the following industries describes your organization?

- Automotive
- Electronics
- Services
- Chemical
- Finance/Banking
- Insurance
- Construction
- Manufacturing
- Education
- Consultancy
- Pharmaceutical
- Information Technology
- Supply Chain
- Real Estate
- Government
- Telecommunication
- Retail
- Transport
- Legal
- Other

Q12. What type of blockchain technology you have knowledge/experience of?

- Public
- Private
- Hybrid
- Other (please type)

Q13. What is the highest level of your education?

- College Certificate
- Undergraduate Degree
- Postgraduate Degree or Higher
- Professional Certificate/Diploma
- Other (please type)

Q14. What is your gender?

- Male
- Female
- Not Specified

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7.1 Summary

This chapter discusses the findings of both the qualitative and quantitative phases of this research. The discussion of both phases is presented in two different research articles that were accepted in Q1 journals. Findings of the qualitative phase are based on the interpretations of the decision-makers working in the Australian organisations that have either adopted or were in the process of adopting BCT. Results of the quantitative phase confirm the findings of the qualitative phase. However, some of the findings of this research contradict the past studies on BCT adoption that were conducted in the context of different countries. All the hypotheses developed in the quantitative phase are found true. The chapter also discusses the moderating effect of the 'perceived risks'.

Chapter 8: Conclusion

BCT is a novel technology that has the potential to bring many benefits to different industries including supply chain management, health, banking, finance, e-commerce, e-government, insurance, etc. However, organisations have not adopted BCT heavily. This study aims to identify factors, which influence organisations when they decide the adoption of BCT.

This study has specifically been conducted in the Australian context. Regardless of the plethora of factors reported in the BCT literature, it is still unknown what specific factors influence Australian organiations. To meet the study aim, a mixed-method approach, namely, sequential exploratory was employed. In this approach, research was completed in two phases, qualitative and quantitative.

The research paper, "Adoption of Blockchain Technology among Australian Organizations: A Mixed-Methods Approach" concludes the whole research except the moderating effect of 'perceived risks', which is explained in the previous chapter (also available online at https://www.mdpi.com/2071-1050/13/16/9404). The paper was accepted in a peer-reviewed conference "Australasian Conferences on Information Systems" that was held in 2020 in New Zealand. The paper can be accessed via the following weblink https://aisel.aisnet.org/acis2020/16/

The research paper summarizes the theoretical and practical contributions of the research. The limitations and future directions of the research are also presented in the paper.

2020

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Abstract

There are several applications and benefits of Blockchain Technology (BCT) reported for different industries e.g. health, finance, supply chain, government, and energy. However, despite the benefits reported in the scholarly and commercial literature, organizations have not adopted BCT heavily across the globe including Australia. This lack of uptake provides the rationale to initiate this research to identify the factors that influence the adoption of BCT among Australian organizations. We use a mixed-methods approach based on the Technology, Organization, Environment (TOE) framework. First, we develop a theoretical model grounded on the findings of qualitative interviews of BCT experts and decision-makers working with different Australian organizations, and then confirm it through a quantitative study with an online survey. The results of the study show that the organizational adoption of BCT is influenced by the different factors that belong to the technological, organizational, and environmental contexts of the TOE framework.

Keywords blockchain, organizational, adoption, TOE, Australia

1 Introduction

Blockchain Technology (BCT) is a disruptive digital innovation that helps to manage data over a distributed and peer-peer network without the involvement of any intermediary (Nakamoto 2008). There are several benefits of BCT, for example, information transparency, security, traceability, cost reduction, speed, are proposed for different industries such as finance, healthcare, supply chains, government, and energy (Friedlmaier et al. 2018). Various global leading organizations such as IBM, Walmart, Microsoft have been finding ways to utilize BCT to enhance their business process and value. Despite all this, the review of scholarly and commercial literature reveals that the BCT has not been gaining heavy organizational adoption all over the globe (Woodside et al. 2017).

Researchers tried to investigate the organizational adoption of BCT in different contexts and countries. Holotiuk and Moormann (2018) examined the factors influencing organizational adoption of BCT in the finance industry of Germany. However, they did not include BCT-specific aspects and developed a general framework, based on the existing knowledge of IT adoption. Wong et al. (2019) conducted a similar study for the adoption of BCT among Malaysian SMEs in the supply chain business. Clohessy and Acton (2019) explored the impact of top management support, organization size, and organizational readiness on the adoption of BCT in Ireland. Their study is limited to the selected factors. Albrecht et al. (2018) investigated the implementation of BCT in the energy sector. Werner et al. (2020) applied the mixed-methods approach for BCT adoption. However, their study focused on the implementation stage of the adoption process and explained the impact of BCT adoption on organization performance.

From the above studies on BCT adoption, and further reviewing the IS adoption literature, we came to know that there is an absence of studies that explore the factors influencing BCT adoption among Australian organizations. This lack of uptake motivated us to initiate this research. We chose Australia because of the following certain reasons.

Australia has been working to find ways to offer its e-services through BCT for a long time. The CSIRO's Data61, one of the leading research agencies in Australia, aims to develop a national blockchain to integrate different government departments to enhance their coordination, cooperation, and data sharing (Austrade 2018; DFAT 2018). The government has started a pilot project for trading water rights through BCT (CRCNA 2020). Recently, the Australian government has announced a BCT-roadmap to provide support and funding for the government, private sector, and researchers to foster innovation and collaboration around BCT (DISER 2020). There is also great support for BCT at the private level. Blockchain Australia, a private association, has actively been promoting the adoption of BCT among Australian organizations (Australia 2020). The Economist Intelligence Unit (EIU), a research and analysis corporation, ranked Australia first in its technology readiness index (Unit 2018), indicating that the country has all the required infrastructure to embrace new technology like BCT.

Having all the above-mentioned support and initiatives from the Australian government and private sector, the Australian organizations have not adopted BCT heavily (ACS 2019; Australia 2016). Therefore, the primary aim of this study is to find the answer of the research question:

"What are the factors that influence an organization's intention to adopt BCT in Australia?"

To address the above research question, we chose an exploratory sequential mixed-methods design including qualitative inquiry (phase 1) followed by a quantitative study (phase 2). The mixed-methods design is considered appropriate when there is a lack of research on the topic, as is our case. Venkatesh et al. (2016) suggest that when qualitative and quantitative approaches are combined, a more complete knowledge about the phenomenon under consideration is achieved.

2 Phase 1: Qualitative Inquiry

Given the absence of a study on BCT adoption in Australia, we decided to use a qualitative approach in phase 1 to identify the BCT-specific factors that influence Australian organizations to adopt BCT. Eisenhardt (1989) recommends the use of a well-established theory as a starting point while investigating a phenomenon through qualitative methods. She states that the theory helps to shape the type of questions being asked, provides directions on how to collect and analyze the data, and gives information about the issues. Therefore, phase 1 of our study is based on the TOE framework, proposed by Tornatsky and Fleischer (1990). The TOE framework describes that the organization's intention to

adopt new technology is influenced by three different contexts, namely, technological, organizational, and environmental.

The **technology context** of the TOE framework refers to the factors related to the technology itself, it is BCT in our case, the **organizational context** comprises the factors related to the organization, and the **environmental context** states the factors related to the environment wherein an organization operates its business. Oliveira and Martins (2011) stated that the TOE framework is the most prominent framework that is used to examine the organizational adoption of various technologies including ERP systems, EDI, E-commerce, KMS, Internet, and many more. Further, they stated that the existing theories and models such as the Diffusion of Innovation (Rogers 2003) and Institutional Theory (DiMaggio and Powell 1983), which explains the technology adoption at an organizational level, are either the variation of the TOE framework or their parts are included in the TOE framework. This robustness and solid foundation of the TOE framework motivated us to use it as a theoretical lens for our study.

During phase 1, we conducted 23 semi-structured interviews with BCT experts and decision-makers working in different organizations in Australia. The data collection activity continued from Jan 2020 to April 2020. The interviewees were selected through purposive theoretical sampling and were based on the following predefined qualifying criteria: (1) they should have a minimum of three years of knowledge/experience with BCT, and (2) they should be working as decision-makers within an organization, which had adopted BCT or in the process of BCT adoption. We used LinkedIn, Google along our professional network to know the contact details of the interviewee and their organization status with BCT. Table 1 shows the details of the interviewees and their respective organizations.

Organization Type	**Interviewees**	**Interviews**
IT	CEOs, Founders, Software Engineer, System Analyst, CTO, Project Manager	8
Finance	CEO, Founder, CTO	3
Travel	CEO, Technical Analyst	2
Education	Director	1
Government	Senior Computer Forensics Officer	1
Consulting	CEOs, Project Manager, Solution Architect	4
Legal	CEOs, Director	4
	Total	**23**

Table 1. Summary of the interviewees and their respective organizations

All the interviews were transcribed and the data was analyzed using the QSR NVivo tool under the guidelines of Strauss and Corbin (1990). Multiple iterations of the data analysis were performed. Underlying concepts were drawn by examining the transcribed data line-by-line. Based on the similarities and differences, the identified concepts were grouped into factors. Finally, the factors were mapped with the contexts of the TOE framework. The qualitative analysis showed that the organization's intention to adopt BCT was influenced by the technological factors including perceived benefits, compatibility, complexity, information transparency, disintermediation, and perceived risks; organizational factors comprising organization innovativeness, organization learning capability, and top management support; environmental factors consisting competition intensity, government support, trading partner readiness, and standards uncertainty. Table 2 provides the frequency analysis of the responses received from the interviewees about the influence of every factor on BCT adoption, adapted from (Ali 2016).

Factors	**Frequency of Responses**		
	Positive	**Negative**	**Not Sure**
Perceived benefits	23	0	0
Perceived compatibility	20	0	3
Perceived complexity	0	19	4
Perceived information transparency	22	0	1
Perceived disintermediation	19	2	2

Perceived risks	0	21	2
Organization innovativeness	21	0	2
Organizational learning capability	20	0	3
Top management support	23	0	0
Competition intensity	19	0	4
Government support	20	0	3
Trading partner readiness	19	0	4
Standards uncertainty	0	19	4

Table 2. Frequency analysis of the responses received from the interviewees for every factor

3 Phase 2: Research Model and Hypotheses

Phase 2 involved a quantitative study that aims to examine the empirical and statistical relationships between the factors that emerged as relevant to BCT adoption in phase 1. Based on the findings of phase 1 and the prior literature on the adoption of BCT and inter-organization systems like EDI, which exhibit the characteristics like BCT, we propose the research model, theoretical linkages, and research hypotheses shown in Figure 1. The following sections explain hypotheses development.

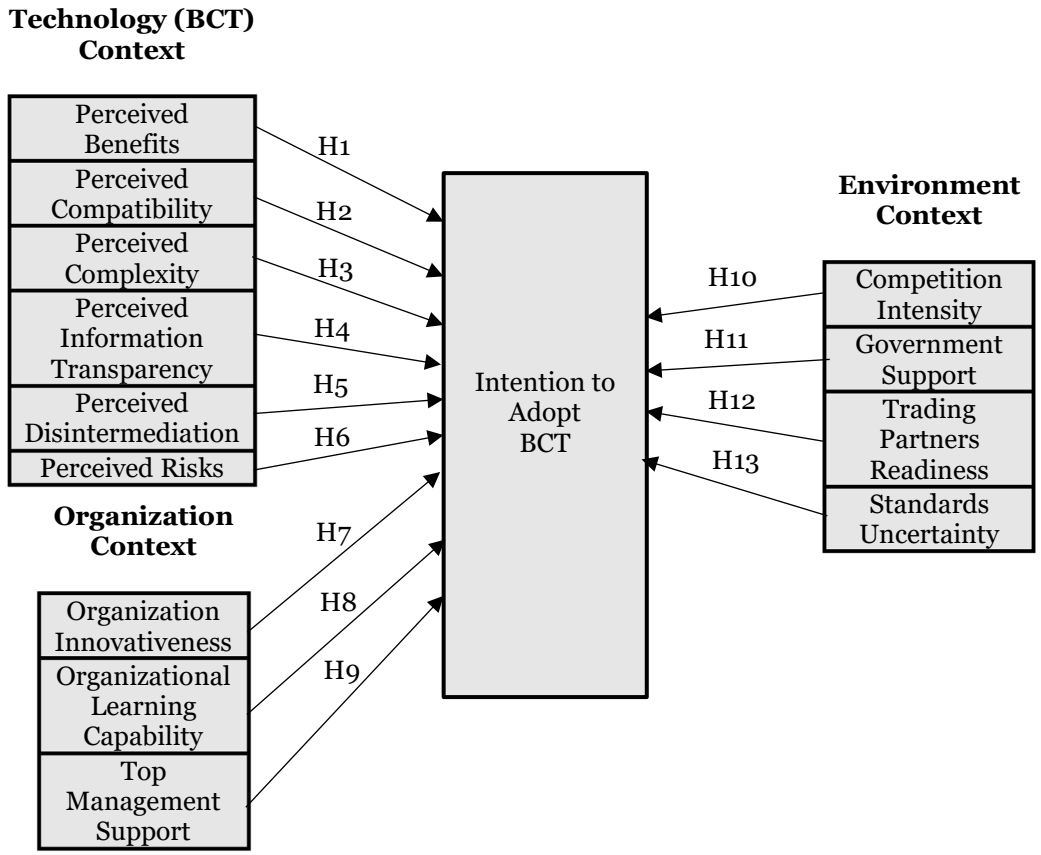

Figure 1: *Proposed theoretical model for the adoption of BCT*

3.1 Technology context

Perceived Benefits (PB). Perceived benefits refer to the positive consequences that an organization perceives from the use of technology. Many of the past studies consistently report the positive influence of perceived benefits on IT adoption. For example, Chwelos et al. (2001) studied the impact of perceived benefits on EDI. Barnes III and Xiao (2019) and Wong et al. (2019) stated that organizations adopt BCT when they expect BCT benefits in their business. Therefore, we propose that:

H1. *Perceived benefits of BCT positively influence the organization's intention to adopt BCT.*

Perceived Compatibility (PC). Perceived compatibility of technology describes the perception of an organization towards the suitability of that technology with its values and technological infrastructure.

Kühn et al. (2019) reported that if BCT is not compatible with the organization's existing IT infrastructure, there are fewer chances of its adoption. Sadhya and Sadhya (2018) stated that organizations are more likely to adopt BCT if it fits well with their existing business processes. Kalaitzi et al. (2019) reported similar effects of perceived compatibility. Therefore, we put forward the following:
H2. *Perceived compatibility of BCT positively influences the organization's intention to adopt BCT.*
Perceived Complexity (CMP). Perceived complexity is the degree to which organizations perceive technology is difficult in using and understanding. Huang et al. (2008) found that the complexity negatively influenced organizations' intention to adopt I-EDI technology. Wong et al. (2019) found that the technical complexity of BCT was a challenge to Malaysian organizations to understand, which adversely affected their decision to the adoption of BCT. Clohessy and Acton (2019) reported the perceived complexity of BCT as a barrier that negatively affects the organizational adoption of BCT. This leads us to proposing the following:
H3. *Perceived complexity of BCT negatively influences the organization's intention to adopt BCT.*
Perceived Information Transparency (PIT). Perceiving the transparency of information as a result of implementing technology is considered an important factor in the organizational intention to adopt that technology (Al-Jabri and Roztocki 2015). Francisco and Swanson (2018) said that BCT provides a transparent and trusted single source of distributed information, which motivates organizations towards its adoption. Wamba et al. (2020) reported the perceived transparency of information as the main determinant of organizational adoption of BCT in the USA. Sander et al. (2018) declared transparency and visibility of information as important determinants of BCT adoption. Therefore, it can be hypothesized that:
H4: *Perceived information transparency positively influences the organization's intention to adopt BCT.*
Perceived Disintermediation (PD). Disintermediation refers to the ability of BCT to manage peer-peer data transactions without the involvement of any third party (Larios-Hernández 2017). The disintermediation creates new types of BCT-based disintermediated services such as machine-to-machine (M2M) transactions, Blockchain as a Service (BaaS), which were unthinkable before the inception of BCT (Zamani and Giaglis 2018). The transaction cost can be reduced with the BCT-disintermediation because it establishes direct communication among businesses. O'Dair (2016) states that approximately 12.7% of royalties that goes to the third parties as operating cost could, through the BCT-disintermediation, be made available directly to artists in the music industry. Hence, it can be hypothesized that:
H5: *Perceived disintermediation positively influences the organization's intention to adopt BCT.*
Perceived Risks (PR). Perceived risks refer to the extent that organizations perceive the negative consequences of adopting BCT. There are many benefits of BCT reported, however, it is not without risks such as privacy, initial adoption costs, storage concerns, and 51% attack (Sadhya and Sadhya 2018). Erturk et al. (2019) mentioned that unscalability and slow speed of BCT hinder organizations to adopt BCT. Based on the this, it can be hypothesized that:
H6*: Perceived risks of BCT negatively influences the organization's intention to adopt BCT.*

3.2 Organization Context

Organizational Innovativeness (OI). Innovativeness is the willingness and ability of an organization to adopt new technology for the improvement of its services (Tajeddini et al. 2006). Thong and Yap (1995) related organizational innovativeness to the management's decision to adopt new technology. Newby et al. (2014) stated that the innovativeness of an organization plays a significant role in its decision to adopt an innovation. During the qualitative phase of our study, we observed that organizations, which adopted BCT, were more innovative as compared to the non-adopters. Venkatesh and Bala (2012) indicated that if there is a culture of innovativeness, an organization is more likely to adopt the inter-organizational system. Since the BCT is an inter-organizational system, we can hypothesize that:
H7. *Organizational innovativeness positively influences the organization's intention to adopt BCT.*
Organizational Learning Capability (OLC). Organizational Learning Capability (OLC) reflects an organization's ability to acquire new knowledge from its internal and external environment and then store, disseminate, and implement that knowledge into its business decisions (Jerez-Gómez et al. 2007).

Organizational learning provides an environment wherein organizations create new ideas, share and apply that knowledge, which consequently leads to the adoption of an innovation (Chadhar and Daneshgar 2018). Kulkarni and Patil (2020) stated that the learning culture of an organization significantly influences the adoption of BCT. Therefore, we propose that:

H8. *Organizational Learning Capability (OLC) positively influences the organization's intention to adopt BCT.*

Top Management Support (TMS). Top management is considered essential to the adoption of new technology. Koster and Borgman (2020) explained the positive influence of top management support on the adoption of BCT in the Netherland. Hughes et al. (2019) reported that if the top management is not supportive, BCT adoption within an organization is not possible. This is further supported by Clohessy and Acton (2019) regarding the BCT adoption in Ireland. Based on this, we propose that:

H9. *Top management support positively influences the organization's intention to adopt BCT.*

3.3 Environment Context

Competition Intensity (CI). Competition intensity (also called competitive or external pressure) refers to the degree that an organization feels from its competitors. Competition intensity has long been recognized as an important factor in the adoption of inter-organizational systems like EDI (Zhu and Kraemer 2005). Wong et al. (2019) showed that competitive pressure played an important role in the adoption of BCT. Barnes III and Xiao (2019) claimed that when an organization invests in BCT, competitors might follow suit and adopt BCT to maintain their competitive position. Therefore, it is reasonable to propose:

H10: *Competitive intensity positively influences the organization's intention to adopt BCT.*

Government Support (GS). Government support is considered a major driving force in the organizational adoption of new technology (Tan and Teo 2000). Koster and Borgman (2020) found that government support speeds up the adoption of BCT among organizations. Few other studies (Kulkarni and Patil 2020; Wong et al. 2019) also reported government support as a significant indicator of the successful adoption of BCT. This leads to proposing:

H11. *Government support positively influences the organization's intention to adopt BCT.*

Trading Partner Readiness (TPR). BCT, similar to any inter-organizational system like EDI requires strong collaboration and interaction among the trading partners (Werner et al. 2020). Chwelos et al. (2001) stated that an organization alone cannot decide the adoption of an inter-organizational system until its trading partners are financially and technologically ready for it. Kühn et al. (2019) state that an organization adopts BCT when its trading partners are ready to share their data over the BCT network. Therefore, we propose that:

H12. *Trading partner readiness positively influences the organization's intention to adopt BCT.*

Standards Uncertainty (SU). Organizations feel reluctant to adopt a technology for which there are no established standards in the market (Venkatesh and Bala 2012). Standards uncertainty creates fear of losing investments while adopting new technology. Kühn et al. (2019) found that there are no clear standards of BCT regarding data privacy, funds transfer, smart contracts that impede organizations to adopt BCT. Sadhya and Sadhya (2018) reported standards uncertainty as a barrier towards large-scale organizational adoption of BCT. These perspectives lead to the following hypothesis:

H13. *Standards uncertainty negatively influences the organization's intention to adopt BCT.*

4 Phase 2: Research Methodology

To test the model, a Qualtrics online survey was conducted with the help of a well-reputed data collection agency in Australia. The data were collected from June 2020 to August 2020. The survey was distributed to the decision-makers like the CEO, and the senior IT people like CTO, IT directors/Managers working with the organizations that had adopted or in the process of adopting BCT in Australia, and they had a minimum of three years of BCT-related knowledge and experience. We employed a 7-point Likert scale to measure the responses ranging from 1-Strongly Agree to 7-Strong Disagree. We received a total of 191 anonymous completed surveys with a response rate of 38.20%, based on 500 surveys distributed. The measuring scales of all the constructs, except perceived disintermediation, were adapted and modified

from the prior studies on IT adoption. The scale for the 'perceived disintermediation' was developed by following the guidelines of MacKenzie et al. (2011), see appendix.

5 Phase 2: Results

We used PLS-SEM path modeling with SmartPLS 3 software to test the proposed theoretical model.

5.1 Evaluation of the Measurement Model

The measurement model was assessed by determining the values of Cronbach's alpha, Composite Reliability (CR), Average Variance Extracted (AVE), square root of the AVE, and cross-loadings.

Internal Consistency and Reliability. The results of Cronbach's alpha, CR, and AVE for all variables were found greater than the acceptable values recommended by Hair Jr et al. (2016) i.e. Cronbach's alpha and CR should be > 0.7, and the AVE > 0.5. The results were found between the following ranges:

Cronbach's alpha	CR	AVE
0.764-0.884	0.864-0.928	0.628-0.811

Discriminant Validity. To measure the discriminant validity, we followed the Fornell and Larcker (1981) test, which requires that for each construct the square root of its AVE should exceed all correlations between that construct and any other construct value as shown bold in Table 3. In addition to that, we confirmed the discriminant validity through the cross-loadings procedure. Each indicator of every latent variable was loaded higher than indicators of any other off-diagonal variable, which implies that the loading separates each latent variable. The matrixes for the cross-loadings are not included in this paper because of the page space limitations.

Construct	1	2	3	4	5	6	7	8	9	10	11	12	13	14
CI	**0.816**													
CMP	0.646	**0.857**												
GS	0.583	0.498	**0.853**											
INT	0.709	0.536	0.684	**0.830**										
OI	0.664	0.469	0.567	0.708	**0.828**									
OLC	0.548	0.382	0.657	0.639	0.658	**0.792**								
PB	0.332	0.493	0.573	0.738	0.675	0.623	**0.827**							
PC	0.653	0.489	0.664	0.674	0.718	0.635	0.710	**0.824**						
PD	0.625	0.426	0.611	0.648	0.647	0.631	0.668	0.644	**0.797**					
PIT	0.670	0.499	0.650	0.653	0.756	0.764	0.714	0.708	0.654	**0.841**				
PR	0.497	0.685	0.413	0.489	0.450	0.275	0.364	0.372	0.393	0.441	**0.900**			
SU	0.621	0.765	0.508	0.582	0.503	0.400	0.466	0.508	0.411	0.446	0.693	**0.825**		
TMS	0.561	0.482	0.587	0.646	0.650	0.691	0.645	0.542	0.682	0.640	0.382	0.529	**0.829**	
TPR	0.704	0.606	0.707	0.718	0.743	0.669	0.750	0.649	0.631	0.709	0.490	0.602	0.690	**0.835**

Perceived Benefits (PB), Perceived Compatibility (PC), Perceived Complexity (CMX), Perceived Information Transparency (PIT), Perceived Disintermediation (PD), Top Management Support (TMS), Organization Innovativeness (OI), Organization Learning Capability (OLC), Government Support (GS), Competitive Intensity (CI), Trading Partner Readiness (TPR), Standard Uncertainty (SU), Perceived Risk (PR), Intention to Adopt BCT (INT)

Table 3. Latent variable correlations and square roots of Average Variance Extracted (AVE)

5.2 Evaluation of the Structural Model

The evaluation of the structural model was performed through the assessment of the coefficients of determination (R^2), effect size (f^2), predictive relevance coefficient (Q^2), and the significance of path coefficients as suggested by Hair Jr et al. (2016).

The R^2 value suggests the extent to which the independent constructs could explain the variance in the dependent constructs. The R^2 of the dependent variable INT was found 0.806, which means that the

independent constructs PB, PC, CMP, PIT, PD, PR, TMS, OI, OLS, CI, GS, TPR, and SU together accounted for 80.6% variance in INT.

The strength of the effect (f^2) of independent variables on the dependent variable was found between f^2=0.127 and f^2=0.321 indicating the medium to large effect size (Hair Jr et al. 2016) of PB, PC, CMP, PIT, PD, PR, TMS, OI, OLS, CI, GS, and TPR on INT. However, the effect size of SU was found small.

The Q^2 value was found .526, which exceeds the minimum threshold of zero (Hair Jr et al. 2016) implying the model has predictive relevance for the constructs.

The results of the path coefficients and their level of significance are given in Table 4, which shows that OI, CI, and TPR are significant at p<0.01, and PB, PC, CMX, PIT, PD, PR, TMS, OLC, GS, PR are significant at p<0.05, which confirms the hypotheses H1, H2, H3, H4, H5, H6, H7, H8, H9, H10, H11, and H12. However, SU found insignificant. Consequently, hypotheses H13 is not supported.

Hypothesis	Relationship	Beta (β)	*t*- value	Outcome
H1	PB -→ INT	0.158	2.172*	Supported
H2	PC -→ INT	0.146	2.435*	Supported
H3	CMX -→ INT	-0.198	2.187*	Supported
H4	PIT -→ INT	0.155	1.997*	Supported
H5	PD -→ INT	0.110	2.441*	Supported
H6	PR -→ INT	-0.154	1.980*	Supported
H7	OI -→ INT	0.178	2.211*	Supported
H8	OLC -→ INT	0.136	2.005*	Supported
H9	TMS -→ INT	0.110	2.431*	Supported
H10	CI -→ INT	0.450	6.636**	Supported
H11	GS -→ INT	0.138	2.042*	Supported
H12	TPR -→ INT	0.250	2.351**	Supported
H13	SU -→ INT	-0.065	0.670	Not Supported

*p < 0.05, **p<0.01

Table 4. Path Coefficient Test

6 Discussion

Based on the mix-methods approach, qualitative-interviews and quantitative-online survey, the present study is an early attempt to investigate the factors influencing organizations to adopt BCT in Australia. The results reveal that the factors belong to technological context (perceived benefits, perceived compatibility, perceived information transparency, perceived disintermediation), organizational context (organization innovativeness, organization learning capability, top management support), and environmental context (competitive intensity, government support, trading partner readiness) significant positive influence organization's intention to adopt BCT. Moreover, the results show that perceived complexity and perceived risks have a negative influence, whereas, the standards uncertainty has no significant effect on the BCT adoption.

The results show that organizations adopt BCT when they perceive that BCT would bring benefits, for instance, reduction in transaction cost, improved security, and is compatible with their business needs and legacy systems. The perceived complexity negatively influences BCT adoption. These results of our study are consistent with Wong et al. (2019) and Gunasekera and Valenzuela (2020). Perceived transparency of information has been found positively significant in the previous studies (Al-Jabri and Roztocki 2015), which is consistent with our study. Our study statistically proves the significant positive influence of perceived disintermediation on BCT adoption. The quick and speedy data management/business operations without the involvement of any third party motivate organizations to adopt BCT. The perceived risks are reported as a negative factor in the adoption of BCT. The results show that the organizations, which perceive their information will be misused or their security will be at risk, are reluctant to adopt the BCT. This finding is consistent with the previous studies of Yoo et al. (2019). The top management support that is consistently found significant in previous studies, is also found significant in our study. Without the support, active involvement, and provision of the resources by the top management, the BCT adoption is not possible. This result is consistent with Clohessy and Acton (2019). However, it is inconsistent with Wong et al. (2019) that reported top management support

insignificant on BCT adoption in Malaysia. Organizational learning capability and organization innovativeness are found significant. The organizations, which are capable to acquire, store, apply new knowledge and learn; open to new ideas, and ready to take risks are more likely to adopt BCT. The competitive intensity is reported as the most influential factor to adopt BCT. This implies that when the organizations see their competitors had adopted the BCT and getting benefits, they feel the fear of losing control over the market. Consequently, they are compelled to adopt BCT. The finding agrees with the previous studies of Wong et al. (2019), Kulkarni and Patil (2020). Government support is found significant, which is aligned with the findings of (Koster and Borgman 2020; Kulkarni and Patil 2020; Wong et al. 2019). The results for the trading partner readiness suggest that the organizations adopt BCT when their trading partners are also willing and ready, technologically and financially, to adopt the BCT. Kulkarni and Patil (2020), Kühn et al. (2019), and Chwelos et al. (2001) reported the similar effect of trading partners readiness on the adoption of BCT and inter-organizational systems. Surprisingly, the standards uncertainty is found insignificant in this study, which is contrary to the findings of the previous studies (Kühn et al. 2019; Sadhya and Sadhya 2018; Venkatesh and Bala 2012). Since the Australian government took initiatives e.g. blockchain roadmap to promote the adoption of BCT, it could have resulted in the decrease of the uncertainty of BCT standards among organizations.
It is clear in the above discussions that the results of the current study are aligned with the previous studies and consistent across the qualitative and quantitative phase of the study.

6.1 Implications

Theoretical. First, our study contributes to the theory by developing and empirically validating a theory-driven and data-grounded model of BCT adoption among Australian organizations. The model highlights factors such as perceived information transparency, perceived disintermediation, organization innovativeness, organizational learning capability, which are important to consider but were ignored in the prior research on BCT adoption. It is also important to note that the literature on BCT acknowledges the importance of disintermediation, declares it as the main feature of BCT, and a driving factor of BCT adoption, but its impact has not been tested for BCT adoption. We not only develop the measuring scale of the perceived disintermediation but also measure its influence on BCT adoption. Second, our study extends the TOE framework by incorporating the BCT specific factors which were not available in the original TOE framework. The extended model provides a richer and more comprehensive explanation of the BCT adoption in Australia. The model is drawn from the results of the mix-methods approach, which enhances its validity.
Practical. The results of our study can inform policymakers of the Australian government and private organizations working to promote the adoption of BCT among organizations in Australia. The results show government support as an important factor in the adoption of BCT. Therefore, the Australian government could develop more refined policies and strategies to enhance the BCT adoption. The perceived disintermediation of BCT motivates the organization towards its adoption. Therefore, the organizations running their business as an intermediary need to redesign their business models to sustain in the market. The consulting and marketing companies could also use our results to develop their informed decisions and campaigns.

7 Conclusion

Based on the TOE framework, the study investigates the factors affecting the adoption of BCT among Australian organizations using a mix-methods approach. The study derived a 13-factors theoretical model from the findings of the interview data of BCT experts and decision-makers; then developed the hypotheses from the extant literature and confirmed the model through collecting data with an online survey. Among the 13 hypotheses, 12 were found supported and one was rejected. The results showed that:

- Technological factors including perceived benefits, perceived compatibility, perceived information transparency, and perceived disinformation have a positive influence on the organization's intention to adopt BCT, whereas, the perceived complexity and perceived risks have a negative influence.
- Organizational factors comprising organizational innovativeness, organizational learning capability, and top management support are the driver of BCT adoption.

- Environmental factors encompassing competitive intensity, government support, trading partner readiness encourages organizations to adopt BCT. However, standards uncertainty has no major influence.

The study has both theoretical and practical contributions, which are useful both for theory development and making decisions for the adoption of BCT. Besides the implications, the results of the study must be interpreted with the considerations of some limitations. First, the study investigates the adoption of BCT among Australian organizations. Second, the study uses the TOE framework as a theoretical lens. Last, the study considers the direct relationship between the dependent and independent variables. Therefore, we aim to conduct future research in a broad range of countries, integration of more theoretical lenses, and inclusion of the moderating variables to examine BCT adoption.

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Appendix

Perceived disintermediation

Definition: Refers to the degree to which organizations perceive that blockchain enables organizations to run their data transactions without the involvement of any intermediary.

Measuring items:

Organizations adopt blockchain when they perceive that it will enable them to:

1) store their data without the involvement of any intermediary
2) access their data without the involvement of any intermediary
3) share their data without the involvement of any intermediary
4) audit their data without the involvement of any intermediary

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Appendices

Appendix A

Measuring items

Construct	Definition	Measuring Items	
Perceived benefits	Refers to the overall benefits that organisations perceive blockchain can bring into their businesses	Organisations adopt blockchain when they perceive that it:	(Chwelos et al., 2001) (Rawashdeh & Al-namlah, 2017)
		reduces overhead expenses	
		reduces data error rates	
		reduces transaction costs while transferring the funds.	
		saves time while accomplishing business tasks	
		increases the organisation's overall productivity	
Perceived compatibility	Refers to the degree to which organisations perceive blockchain's compatibility with all aspects of their businesses	Organisations adopt blockchain when they perceive that it:	(Moore & Benbasat, 1991) (Atkinson, 2007)
		fits well with their business processes	
		compatible with their technological infrastructure	
		fits well with their technological skills	
Perceived complexity	Refers to the degree to which organisations perceive blockchain	Organisations do not adopt blockchain when they perceive that it:	(Moore & Benbasat, 1991) (Atkinson, 2007)
		requires extra technical skills to use	

	being difficult to understand and use	is difficult to understand from a business perspective	(Teo, Wei, & Benbasat, 2003)
		is conceptually difficult to understand from a technical perspective	
Perceived information transparency	Refers to the blockchain's ability to provide transparent access, flow, and visibility of the same data to the organisations	Organisations adopt blockchain when they perceive that it will enable them to have the transparent:	(Terry Anthony Byrd, 2000)
		access to information across the network.	
		view of any activity in the data.	
		flow of the entire data.	
Perceived disintermediation	Refers to the blockchain's core value that enables organisations to run their data transactions without the involvement of any central controlling intermediary	Organisations adopt blockchain when they perceive that it will enable them to:	Authors
		store their data without the involvement of any intermediary	
		access their data without the involvement of any intermediary	
		share their data without the involvement of any intermediary	
		audit without the involvement of any intermediary	

Top Management Support	Refers to the organisations' top management support, necessary involvement, and provision of the resources for the adoption of blockchain	Organisations adopt blockchain when their top management:	(Soliman & Janz, 2004) (Igbaria, Zinatelli, Cragg, & Cavaye, 1997)
		provides the necessary resources for it	
		considers it as strategically important	
		actively involves in the IT-related decisions	
Organisational innovativeness	Refers to the innovativeness of organisations to adopting blockchain	Organisations adopt blockchain if they:	(Venkatesh & Bala, 2012) (Newby et al., 2014)
		actively seek new ideas	
		like to do things in new ways	
		are open to taking risks	
Organisational Learning Capability	Refers to the organisations' ability to accumulate, store, share, and apply new knowledge to adopt blockchain	Organisations adopt blockchain when:	(Muñoz-Pascual et al., 2019)
		they have a mechanism to store new knowledge	
		they encourage their employees to acquire new knowledge and skills	
		their employees share their work experiences, ideas, or learning with each other	
		they have practices to utilize new knowledge in their IT-related decisions	
Government Support	Refers to the Australian government's	The Australian government:	(M. Tan & Teo, 2000)
		policies support the adoption of blockchain	

	policies, initiatives, and incentives for the adoption of blockchain	introduces economic incentives for blockchain adoption	(Rawashdeh & Al-namlah, 2017)
		is active in setting up the facilities to promote blockchain	
Trading Partner Readiness	Refers to the organisations' trading partners willingness and level of technological and financial readiness to adopt blockchain	Organisations adopt blockchain when their trading partners are also:	(Zhu, Dong, et al., 2006) (Chwelos et al., 2001) (Rawashdeh & Al-namlah, 2017)
		willing to adopt blockchain	
		technologically ready to adopt blockchain	
		financially ready to adopt blockchain	
Competitive Intensity	Refers to the intensity which organisations feel when their competitors adopt blockchain	Organisations adopt blockchain when they:	(Zhu, Kraemer, & Dedrick, 2004) (Teo et al., 2003)
		feel pressure when their competitors have adopted it	
		feel the fear of losing a competitive advantage if they do not adopt it	
		see their competitors benefiting from adopting it	
Standards Uncertainty	Refers to the uncertainty that organisations feel to forecast accurately whether the blockchain will be stable over time and become a standard	Organisations do not adopt blockchain when they:	(Venkatesh & Bala, 2012)
		see it has not reached its maturity	
		see it still requires changes to become more efficient comparing to existing technologies	

		cannot predict that it would become an industry standard in the near future	
Perceived Risks	Refers to the uncertainty that organisations perceive possible negative consequences of adopting blockchain	Organisations do not adopt blockchain when they perceive that:	(M. Tan & Teo, 2000) (M. S. Featherman & Pavlou, 2003)
		it is not secured	
		their transactions' information will be compromised while using it	
		it will not provide its expected benefits	
Intention to Adopt	Refers to the extent to which organisations are likely to adopt blockchain in future	It is expected that:	(Teo et al., 2003) (S.-J. Hong & Tam, 2006) (Kim & Ammeter, 2014)
		organisations would adopt blockchain whenever they will have access to it in the future.	
		organisations would adopt blockchain in the future.	
		organisations would adopt blockchain frequently in the future.	

Appendix B

General Questions

Which of the following age groups best describes you?

- ◯ Less than 18 Years
- ◯ 18-25 Years
- ◯ 26-40 Years
- ◯ 41-50 Years
- ◯ 51-60 Years Above
- ◯ 60 Years

Please indicate which of the following technologies best describes your knowledge/experience?

- ◯ B2B-Commerce
- ◯ Blockchain Technology Electronic
- ◯ Data Interchange (EDI) Distributed
- ◯ DBMS
- ◯ Other (please type) ☐

Please indicate which of the following technologies your ***organisation*** has been involved with?

◯ B2B-Commerce	◯ Internet of Things (IoT)	◯ Distributed DBMS
◯ Cloud Computing	◯ Blockchain Technology	◯ Social Media Technologies
◯ RFID	◯ Electronic Data Interchange (EDI)	◯ Gaming
◯ Robotics	◯ Artificial Intelligence	◯ Other

Please indicate which of the following job titles best describes your role?

- ○ Chief Executive Officer / President / Chairperson
- ○ IT Director
- ○ Database Administrator
- ○ Chief Technology Officer / Chief Information Officer / Chief Digital Officer
- ○ Technology Strategy Manager
- ○ Supply Chain Manager
- ○ IT Manager
- ○ Finance Director / Finance Manager
- ○ Store Manager
- ○ Business Development Manager
- ○ Customer Service Manager
- ○ Sales Manager
- ○ Other

Thank you for your time. Please read to the following information to proceed Next.

Research Background Information

This research aims to investigate the F*actors Affecting the Organisational Adoption of Blockchain Technology in Australia: A Mixed-Methods Approach* .Blockchain is an emerging technology, which promises abundant benefits in almost every industry of today's digital business world. However, despite the benefits posits in scholarly and commercial media, blockchain technology adoption by organisations is low, particularly in Australia. Therefore, this research project aims to investigate the factors that influence an organisation's decision to adopt blockchain technology. This is a purely educational research and has been approved by the Human Research Ethics Committee (HREC) of the Federation University Australia via project No. B19-017.

What are your rights as a participant in this study?

Your participation in this research is voluntary. You are free to choose not to answer any survey question without consequences. Filling this survey is considered as your implied consent to participate in this research. However, you can withdraw your consent without consequences at any time until the survey is not submitted. As the survey is anonymous, so the consent can not be withdrawn after it is submitted.

What are the risks involved?

There are no physical, social, legal, psychological, or other risks involved in this research. The survey is anonymous and would take 15-20 minutes to complete. No confidential information is required in this survey.

What happens to the information gained from this study?

The data, which you would provide by completing the survey, will be combined with other participants' responses and analyzed to determine if there exists any relationship among the factors. The collected data will be stored, on the university system, for a minimum of five years and then securely destroyed after this time. However, access to collected data is subject to legal limitations e.g. freedom of information, etc.

How can you get in touch with the research team?

Should you have any question about the research, please feel free to contact the research team:

Saleem Malik (Research Student) email:smalik@federation.edu.au
Dr. Mehmood Chadhar (Principal Supervisor) email:m.chadhar@federation.edu.au
Prof. Madhu Chetty (Associate Supervisor) email:madhu.chetty@federation.edu.au

Should you (i.e. the participant) have any concerns about the ethical conduct of this research project, please contact the Federation University Coordinator Research Ethics, Research Services, Federation University Australia,
P O Box 663 Mt Helen Vic 3353
Telephone: (03) 5327 9765
Email: research.ethics@federation.edu.au
CRICOS Provider Number 00103D

How many years of knowledge/experience do you have with blockchain technology?

- ◯ Less than 3 years
- ◯ 3-4 years
- ◯ 5-7 years
- ◯ 8-10 years Above
- ◯ 10 years

How would you rate your knowledge of blockchain technology?

- ◯ Little knowledge of blockchain technology Good
- ◯ knowledge of blockchain technology Excellent
- ◯ knowledge of blockchain technology

What is/was the status of involvement of your *organisation* with blockchain technology?

- ◯ Currently interested in blockchain technology and actively seeking related information
- ◯ Currently in the process of deciding adoption of blockchain technology
- ◯ Currently implemented blockchain technology
- ◯ Previously implemented blockchain technology, but currently not using

What is/was the size of your organisation in terms of the number of employees?

- ◯ Having employees between 1 and 4

- ◯ Having employees between 5 and 19
- ◯ Having employees between 20 and 199
- ◯ Having employees more than 200

Which of the following industries describe your organisation?

- ☐ Automotive
- ☐ Construction
- ☐ Information Technology
- ☐ Electronics Services
- ☐ Manufacturing
- ☐ Supply Chain
- ☐ Chemical Finance
- ☐ Education
- ☐ Real Estate Government
- ☐ Other (please type)
- ☐ Consultancy
- ☐ Telecommunication
- ☐
- ☐ Pharmaceutical
- ☐

☐ ____

What type of blockchain technology you have knowledge/experience of?

- ◯ Public
- ◯ Private
- ◯ Hybrid
- ◯ ____ Other (please type)

What is your highest level of education?

- ◯ College Certificate Undergraduate
- ◯ Degree Postgraduate Degree or
- ◯ Higher Professional Certificate/
- ◯ Diploma
- ◯ ____ Other (please type)

What is your gender?

- ◯ Male
- ◯ Female
- ◯ Other

In my opinion, organisations adopt blockchain technology when they perceive that:

	Strongly Agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
Blockchain reduces overhead expenses.	○	○	○	○	○	○	○
Blockchain reduces data error rates.	○	○	○	○	○	○	○
Blockchain reduces transaction costs.	○	○	○	○	○	○	○
Blockchain saves time while accomplishing business tasks.	○	○	○	○	○	○	○

In my opinion, organisations adopt blockchain technology when they perceive that:

	Strongly Agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
Blockchain fits well with their business processes.	○	○	○	○	○	○	○
Blockchain is compatible with their technological infrastructure.	○	○	○	○	○	○	○
Blockchain fits well with their technological skills.	○	○	○	○	○	○	○

In my opinion, organisations adopt blockchain technology when they perceive that:

	Strongly Agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
Blockchain will enable them to have transparent access to information across the network.	○	○	○	○	○	○	○
Blockchain will enable them to have transparent view of any activity in the data.	○	○	○	○	○	○	○
Blockchain will enable them to have a transparent flow of the entire data.	○	○	○	○	○	○	○

In my opinion, organisations adopt blockchain technology when they perceive that:

	Strongly Agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
Blockchain will enable them to store their data without the involvement of any third party.	○	○	○	○	○	○	○
Blockchain will enable them to access their data without the involvement of any third party.	○	○	○	○	○	○	○
Blockchain will enable them to share their data without the involvement of any third party.	○	○	○	○	○	○	○
Blockchain will enable them to audit without the involvement of any third party.	○	○	○	○	○	○	○

In my opinion, organisations adopt blockchain technology when their:

	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
Top management provides the necessary resources for blockchain.	○	○	○	○	○	○	○
Top management considers blockchain as strategically important.	○	○	○	○	○	○	○
Top management actively involves in blockchain-related decisions.	○	○	○	○	○	○	○

In my opinion, organisations adopt blockchain technology when:

	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
They actively seek new ideas.	○	○	○	○	○	○	○
They like to do things in new ways.	○	○	○	○	○	○	○
They are open to taking risks.	○	○	○	○	○	○	○

In my opinion, organisations adopt blockchain technology when:

	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
They have a mechanism to store new knowledge.	○	○	○	○	○	○	○

	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
They encourage their employees to acquire new knowledge and skills.	○	○	○	○	○	○	○
Their employees share their work experiences, ideas, or learning with each other.	○	○	○	○	○	○	○
They have practices to utilize new knowledge into their IT-related decisions.	○	○	○	○	○	○	○

In my opinion, organisations adopt blockchain technology when they see that:

	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
Australian government's policies are supportive for the adoption of blockchain.	○	○	○	○	○	○	○
Australian government introduces economic incentives for blockchain adoption.	○	○	○	○	○	○	○
Australian government is active in setting up the facilities to promote blockchain.	○	○	○	○	○	○	○

In my opinion, organisations adopt blockchain technology when:

	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
Their trading partners are also willing to adopt blockchain.	○	○	○	○	○	○	○
Their trading partners are technologically ready to adopt blockchain.	○	○	○	○	○	○	○
Their trading partners are financially ready to adopt blockchain.	○	○	○	○	○	○	○

In my opinion, organisations adopt blockchain technology when:

	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
They see that their competitors have adopted blockchain.	○	○	○	○	○	○	○
They feel the fear of losing a competitive advantage if they do not adopt blockchain.	○	○	○	○	○	○	○
They see that their competitors benefiting from adopting blockchain.	○	○	○	○	○	○	○

In my opinion, it is expected that:

	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
organisations would adopt blockchain whenever they will have access to it in the future.	○	○	○	○	○	○	○
organisations would adopt blockchain in the future.	○	○	○	○	○	○	○
organisations would adopt blockchain frequently in the future.	○	○	○	○	○	○	○

In my opinion, organisations <u>avoid to adopt</u> blockchain technology when:

	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
They see that blockchain has not reached its maturity.	○	○	○	○	○	○	○
They see that blockchain still requires changes to become more efficient.	○	○	○	○	○	○	○
They ***<u>cannot</u>*** predict that blockchain would become an industry-standard in the near future.	○	○	○	○	○	○	○

In my opinion, organisations <u>avoid to adopt</u> blockchain technology when they perceive that:

	Strongly Agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
Use of blockchain requires extra technical skills.	○	○	○	○	○	○	○
Use of blockchain is difficult to understand from a business perspective.	○	○	○	○	○	○	○
Use of blockchain is conceptually difficult to understand from a technical perspective.	○	○	○	○	○	○	○

In my opinion, organisations avoid to adopt blockchain technology when they perceive that:

	Strongly Agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
Use of blockchain technology is not secure.	○	○	○	○	○	○	○
Their transactions related information may be misused while using blockchain technology.	○	○	○	○	○	○	○
Use of blockchain will not benefit to their expectations.	○	○	○	○	○	○	○

Approval

Human Research Ethics Committee

Principal Researcher:	Dr Madhu Chetty
Co-Researcher/s:	Dr Mehmood Chadhar Mr Muhammad Saleem Malik
School/Section:	**School of Science, Engineering and Information Technology (SEIT)**
Project Number:	**B19-017**
Project Title:	**An integrated Framework of Factors affecting adoption of blockchain technology at organisation level.**
For the period:	21/02/2019 **to** 01/02/2021

Quote the Project No: B19-017 in all correspondence regarding this application.

Approval has been granted to undertake this project in accordance with the proposal submitted for the period listed above.

Please note: It is the responsibility of the Principal Researcher to ensure the Ethics Office is contacted immediately regarding any proposed change or any serious or unexpected adverse effect on participants during the life of this project.

In Addition: Maintaining Ethics Approval is contingent upon adherence to all Standard Conditions of Approval as listed on the final page of this notification

COMPLIANCE REPORTING DATES TO HREC:

Annual project report:
21 February 2020

Final project report:
1 March 2021

The combined annual/final report template is available at:
https://federation.edu.au/research/support-for-students-and-staff/ethics/human-ethics/human-ethics3

Fiona Koop
Coordinator, Research Ethics
21 February 2019
Please note the standard conditions of approval on Page 2:

Amendment Approval

Human Research Ethics Committee

Principal Researcher:	Dr Madhu Chetty
Co-Researcher/s:	Dr Mehmood Chadhar Mr Muhammad Saleem Malik
School/Section:	**School of Science, Engineering and Information Technology (SEIT)**
Project Number:	**B19-017**
Project Title:	**An integrated Framework of Factors affecting adoption of blockchain technology at organisation level.**
For the period:	1/2/2021 **to** 30/6/2021

Quote the Project No. B19-017 in all correspondence regarding this application.

Amendment Summary: N/A
Extension: Extension approved until 31/6/2021
Personnel: N/A

Please note: Approval has been granted to undertake this project in accordance with the proposal and amendments submitted for the period listed above. Ongoing ethics approval is contingent upon adherence to the Standard Conditions of Approval on Page 2 of this notification.

COMPLIANCE REPORTING TO HREC:

Final project report:
30 July 2021

https://federation.edu.au/research/support-for-students-and-staff/ethics/human-ethics

Fiona Koop
Coordinator, Research Ethics
1 February 2021

Please note the standard conditions of approval on Page 2: