

**NEW ZEALAND'S REGULATION OF DISTRIBUTED LEDGER
TECHNOLOGY APPLIED TO SECURITIES SETTLEMENT**

Victoria Manning

A dissertation submitted in partial fulfilment of the requirements of the degree of Bachelor of
Laws (Honours) at the University of Otago – Te Whare Wananga o Otago

October 2018

Acknowledgments

To my supervisor, Professor Struan Scott, for his wisdom, kindness and interest in my work.

Your dedicated supervision has been invaluable.

To my friends that I have made throughout law school, you have made my experience truly

special. I will always have fond memories of Otago.

Finally, to my parents, Nicola and Mike, for their endless love and support in everything I do.

Abstract

Distributed Ledger Technology (“**DLT**”) encompasses a variety of technological structures, extending well beyond the blockchain innovation, with the potential in the securities settlement context to disrupt existing financial market infrastructures, intermediaries and transactional platforms. While DLT promises to usurp the role of traditional intermediaries, such as clearinghouses, its journey towards mainstream adoption will be constrained until regulators can be certain the technology will be advantageous to settlement systems, financial markets and the broader economy.

This dissertation focuses on the commercial utilisation of DLT in clearing and securities settlement on the New Zealand Stock Exchange (“**NZX**”). It outlines the regulation of the NZX’s securities settlement system at present and considers the role of intermediaries and their function in mitigating various risks. DLT is defined broadly as the processes and related technologies that enable nodes in a network to securely propose, validate and record state changes (or updates) to a synchronised ledger using a group consensus protocol that is distributed across the network’s nodes. DLT’s role in the mitigation of systemic, credit, liquidity and operational risks is assessed. The three distinct stages of DLT adoption in securities settlement are examined, and consideration given to whether its perceived advantages (incorruptibility, speed of settlement and record keeping abilities) will materialise.

While New Zealand has been largely silent on DLT’s applicability to securities settlement, the Australian Securities Exchange (“**ASX**”) is planning to introduce a DLT platform for clearing and settlement in 2021. This Australian initiative, together with the regulatory approaches to DLT taken in the United Kingdom and the European Union are discussed and their implications considered for securities settlement in New Zealand. It is evident that these closely related jurisdictions continue to value the role of intermediaries in their settlement processes.

The final part of this paper questions the need for intermediaries altogether. If the financial marketplace is willing to accommodate a DLT platform that removes these central institutions then a radical change in how securities settlement is regulated would be required - trust would

need to be placed in DLT. The dissertation contemplates whether New Zealand regulators could entrust the settlement process, as opposed to financial institutions, to regulate securities settlement. The legal risks that might emerge from the removal of intermediaries due to the adoption of DLT in New Zealand are discussed. Finally, it is recommended that New Zealand regulators respond to DLT's disruptive capabilities in order to provide legal clarity surrounding its various uses.

Table of Contents

NEW ZEALAND’S REGULATION OF DISTRIBUTED LEDGER TECHNOLOGY APPLIED TO SECURITIES SETTLEMENT	I
INTRODUCTION	1
CHAPTER ONE: REGULATION OF THE NZX’S SETTLEMENT SYSTEM AND THE FUNCTION OF AN INTERMEDIATED REGIME.....	4
A THE REGULATORY FRAMEWORK.....	4
B THE ROLE OF NZC AND NZD IN A TYPICAL SETTLEMENT CHAIN ON THE NZX	7
C RISK MITIGATION IN FINANCIAL MARKET INFRASTRUCTURES	9
D SUMMARY	12
CHAPTER TWO: DISTRIBUTED LEDGER TECHNOLOGY	14
A KEY FEATURES OF DLT.....	14
B PERCEIVED ADVANTAGES OF DLT	15
1 <i>Incorruptibility</i>	16
2 <i>Speed of settlement</i>	17
3 <i>Record-keeping abilities</i>	17
C STAGES OF ADOPTION.....	18
D SUMMARY	20
CHAPTER THREE: STAGE ONE ADOPTION AND THE IMPORTANCE OF THE CENTRAL INSTITUTION IN SECURITIES SETTLEMENT.....	21
A REGULATORY FRAMEWORK COMPARISON BETWEEN NEW ZEALAND, AUSTRALIA AND THE UNITED KINGDOM	22
B THE ASX CASE STUDY	23
1 <i>Current risks and inefficiencies the solution proposes to reduce for the ASX</i>	24
2 <i>Impact on the settlement chain and regulatory challenges</i>	24
C OVERVIEW OF THE REGULATORY RESPONSES TO DLT BY THE ESMA AND THE FCA IN THE UNITED KINGDOM	27
1 <i>The European Union regulatory framework’s accommodation of DLT</i>	27
2 <i>The FCA’s approach</i>	30
D RELEVANCE OF THE PFMIS	32
E SUMMARY	33

CHAPTER FOUR: REGULATING THE SETTLEMENT PROCESS – AN ANALYSIS OF STAGE TWO ADOPTION ON THE NZX.....	34
A IMPACT ON THE SETTLEMENT PROCESS AND THE INEFFICIENCIES THAT STAGE TWO ADOPTION IS ATTEMPTING TO REDUCE.....	35
B THE RISKS THAT STAGE TWO ADOPTION PRESENTS	36
1 <i>Operational risk</i>	36
2 <i>Settlement failure, credit and liquidity risk</i>	38
3 <i>Confidence in the settlement process</i>	39
4 <i>Systemic risk and the path forward for New Zealand</i>	40
C ACCOMMODATING STAGE TWO ADOPTION – RETHINKING FINANCIAL MARKET REGULATION.....	41
CONCLUSION	43
BIBLIOGRAPHY	45

List of Abbreviations

ACCC	Australian Competition and Consumer Commission
AML	Anti-Money Laundering
AML / CFT Act	Anti-Money Laundering and Countering Financing of Terrorism Act 2009
ASIC	Australian Securities Investments Commission
ASX	Australian Securities Exchange
CCP	Central Counterparties
CDO	Clearing Depository Operator
CHESS	Clearing House Electronic Sub-register System
CHO	Clearing House Operator
CSD	Central Securities Depository
CSDR	Central Securities Depositories Regulation (EU)
DLT	Distributed Ledger Technology
DvP	Delivery versus Payment
EMIR	European Financial Market Infrastructure Regulation
ESMA	European Securities and Markets Authority
FCA	Financial Conduct Authority (UK)
FMA	Financial Market Authority
FMC Act	Financial Markets Conduct Act 2013
FMI	Financial Market Infrastructure
LSE	London Stock Exchange
MiFIR	Markets in Financial Instruments Regulations (EU)
ML-ETR	Model Law on Electronic Transferable Records
MOU	Memorandum of Understanding
NZC	New Zealand Clearing Limited
NZD	New Zealand Depository Limited
NZDN	New Zealand Depository Nominee Limited
NZX	New Zealand Stock Exchange
PFMI	Principles for Financial Market Infrastructures

RBA	Reserve Bank of Australia
RBNZ	Reserve Bank of New Zealand
RBNZ Act	Reserve Bank of New Zealand Act 1989
RTGS	Real-time Gross Settlement
SFD	Settlement Finality Directive (EU)
SSF	Securities Settlement Facility

Introduction

Blockchain has attracted universal attention as the underlying digital innovation enabling the Bitcoin protocol.¹ Yet the technology has far greater capability beyond its existence as a vehicle for virtual currencies. It has been heralded as contributing to the second generation of digital disruption, revolutionising the “internet of information into the internet of value”² by allowing unprecedented levels of global collaboration between individuals and corporations.³ Despite difficult challenges in anticipating the trajectory of emerging technologies, blockchain has a myriad of potential uses across all sectors, with plausible scope for its adoption in banking and finance activities. Arguably, the commercial application of blockchain, and more broadly distributed ledger technology (hereafter “**DLT**”), has the potential in this context to disrupt existing financial market infrastructures, intermediaries and transactional platforms. This dissertation refers to the technology in DLT terms henceforth as it encompasses a variety of technological structures extending well beyond the blockchain innovation.

The primary focus of this dissertation is the commercial utilisation of DLT in clearing and securities settlement on the New Zealand Stock Exchange (“**NZX**”). Settlement systems are at the core of the infrastructure that underpins capital markets and the wider financial system.⁴ Thus, maintaining a sound and efficient settlement system is a precondition to a well performing

¹ Blockchain is incorrectly used interchangeably with bitcoin or digital currency. Bitcoin, introduced in Satoshi Nakamoto’s 2008 whitepaper, is the first application of the blockchain innovation. See generally Satoshi Nakamoto *Bitcoin: A Peer-to-Peer Electronic Cash System* (2008).

² Kenny McIver “From the internet of information to the internet of value” (July 2016) I-CIO <www.i-cio.com/big-thinkers/don-tapscott/item/from-the-internet-of-information-to-the-internet-of-value>; See also Alex Tapscott and Don Tapscott *Blockchain Revolution: How the technology behind Bitcoin is changing money, business, and the world* (Penguin, New York, 2016).

³ Erik Hofmann, Urs Magnus Strewe and Nicola Bosia *Supply Chain Finance and Blockchain Technology: The case of reverse securitisation* (Springer International Publishing, Cham (Switzerland), 2018) at 91.

⁴ Financial Markets Authority and the Reserve Bank of New Zealand “The Designation and Oversight of Designated Settlement Systems” (March 2015) Reserve Bank of New Zealand <www.rbnz.govt.nz/-/media/ReserveBank/Files/regulation-and-supervision/financial-market-infrastructure-oversight/the-designation-and-oversight-of-designated-settlement-systems-dss1.pdf?la=en> at 1.

financial system in the long-term.⁵ Given the strong regulation of New Zealand’s capital markets and settlement systems, DLT’s interaction with legal instruments and regulatory bodies in this context can facilitate our understanding of the legal obstacles ahead. Unlike disruptive technologies in other industries that adopt an “act first, seek forgiveness” later approach to regulation, innovations in financial markets require the explicit blessing of regulators prior to adoption.⁶ Thus, while DLT promises to usurp the role of traditional intermediaries, such as clearinghouses, its journey towards mainstream adoption will be inhibited until regulators can be certain the technology will be advantageous to settlement systems, financial markets and the broader economy.

It is useful to consider why it is of such importance that New Zealand regulators carefully scrutinise DLT’s vast applications in the banking and finance industry. Firstly, the advent of the internet led to the development of privacy and data protection law in 1998, thus highlighting how technological advancement has frequently been regarded as the impetus for law reform or the emergence of distinct new legal fields altogether.⁷ It is therefore imperative that regulators consider the possibility that DLT could forge a new model for settlement systems in the banking and finance industry that may similarly require revision of New Zealand’s legal framework and traditional regulatory approach. Secondly, regulators internationally have begun to consider DLT’s applicability to capital markets and clearing and settlement facilities. While there are limits on the complete global harmonisation of financial regulation, cross-border consistency is crucial.⁸ At present, however, a lack of regulatory clarity exists worldwide with multiple regulators, with overlapping mandates, holding contradictory positions.⁹ Thus, an analysis of approaches in comparable jurisdictions with parallel financial market infrastructure landscapes and regulatory frameworks can provide invaluable insight into potential ways forward for New

⁵ Cabinet Domestic Policy Committee “Policy Review of New Zealand’s Approach to Clearing and Settlement” (2008) CAB Min (08) 30/10 at [7].

⁶ Euroclear and Oliver Wyman *Blockchain in Capital Markets: The Prize and the Journey* (Euroclear and Oliver Wyman, February 2016) at 14.

⁷ Brad Smith and Harry Shum *The Future Computed: Artificial Intelligence and its role in society* (Microsoft Corporation, Washington, 2018) at 9.

⁸ Wayne Byres “Global Consistency in Financial Regulation: Is the glass half full, half empty, or just more transparent?” (Speech to the RiskMinds Risk and Regulation Forum, Nice, France, 10 September 2013).

⁹ Tapscott and Tapscott, above n 2, at 29.

Zealand. This is particularly crucial given that New Zealand has been largely silent on DLT in this specific context. The current evidence-base on DLT is therefore somewhat limited in this respect; however, the topic presents an opportunity for an open dialogue on a cutting-edge issue, with regulators, users and stakeholders alike, about the concept of securities settlement and financial market regulation more generally.

The first chapter of this dissertation outlines the regulation of the NZX's securities settlement system at present, considering the role of intermediaries and their function in mitigating various risks. Chapter Two defines DLT, endeavouring to do so in a way that allows for flexibility in arrangements. This enables analysis of three distinct stages of its adoption in securities settlement, which has a bearing on whether the perceived advantages of the technology will materialise. Chapter Three discusses the Australian Securities Exchange's ("ASX") limited-disruption utilisation of DLT for clearing and settlement and the cautious regulatory approaches to DLT taken in Australia, the United Kingdom and the European Union. It identifies how these closely related jurisdictions value the role of intermediaries in their settlement processes and why, in their view, the financial marketplace is not ready for their removal. Finally, Chapter Four contemplates whether New Zealand regulators can entrust the settlement process, as opposed to financial institutions, to regulate securities settlement. It also discusses the legal risks that could emerge as a result of the removal of intermediaries due to the adoption of DLT.

Chapter One:

Regulation of the NZX's Settlement System and the Function of an Intermediated Regime

A The regulatory framework

The NZX allows for the trading of securities, enabling buyers and sellers to match and form binding contracts with one another, among other functions.¹⁰ Designated settlement systems facilitate this process by operating and managing the transfer of the legal title of financial products via electronic means.¹¹ The NZX's clearing and settlement is administered by the NZCDC settlement system (hereafter the **"settlement system"**), which is deemed a "designated settlement system".¹² It is subject to joint regulation by the Financial Markets Authority (**"FMA"**) and the Reserve Bank of New Zealand (**"RBNZ"**)¹³ under what is sometimes referred to as the "twin peaks" model.¹⁴ The settlement system comprises two key intermediaries – a central counterparty clearing house (**"CCP"**) and a central securities depository (**"CSD"**). These are New Zealand Clearing Limited (**"NZC"**) and New Zealand Depository Limited (**"NZD"**) respectively.

The FMA and RBNZ's mandates are found in their respective legislative frameworks. The dual main purposes of the Financial Markets Conduct Act 2013 (**"FMC Act"**) are to:¹⁵

¹⁰ Shelley Griffiths "The Secondary Market" in John Farrar and Susan Watson (ed) *Company and securities law in New Zealand* (2nd ed, Brookers Ltd, Wellington, 2013) 1126 at 1165.

¹¹ Designated settlement systems are governed by the Reserve Bank of New Zealand Act 1989, pt 5C.

¹² Section 156N; and Reserve Bank of New Zealand (Designated Settlement System – NZCDC) Order 2010, cl 4.

¹³ Reserve Bank of New Zealand Act, pt 5C; and Financial Markets Authority "Designated settlement systems" <www.fma.govt.nz/compliance/licensed-providers/designated-settlement-systems/>.

¹⁴ Shelley Griffiths "The Financial Markets Authority" in John Farrar and Susan Watson (ed) *Company and securities law in New Zealand* (2nd ed, Brookers Ltd, Wellington, 2013) 1033 at 1036.

¹⁵ Financial Markets Conduct Act 2013, ss 3(a) and 3(b).

- (a) promote the confident and informed participation of businesses, investors, and consumers in the financial markets; and
- (b) promote and facilitate the development of fair, efficient, and transparent financial markets.

The predecessor to the FMC Act, the Securities Act 1978, was arguably regarded as supporting the simplistic notion of “investor protection”.¹⁶ In contrast, the FMC Act has a strong emphasis on the need to balance the various purposes of securities law, including to promote innovation and flexibility in financial markets,¹⁷ reflecting a modern forward-thinking approach to this field of law.¹⁸ To this end, this auxiliary purpose will bear on the assessment of a regulator’s role and function throughout this dissertation.

The Reserve Bank of New Zealand Act 1989 (“**RBNZ Act**”) further requires the RBNZ to exercise its powers under pt 5C, which governs designated settlement systems, for the purposes of:¹⁹

- (a) promoting the maintenance of a sound and efficient financial system; and
- (b) avoiding significant damage to the financial system that could result from the failure of a participant in a settlement system.

Thus, while the RBNZ and FMA have different objectives and responsibilities, a Memorandum of Understanding (“**MOU**”) guides them in their joint regulation task.²⁰ Effectively, this ensures their cooperation and prevents the unnecessary duplication of effort in identifying any

¹⁶ Thomas Gibbons “Purpose and Principles of Securities Regulation” in Stace (ed) *Financial Markets Conduct Regulation a Practitioner’s Guide* (LexisNexis, Wellington, 2013) 3 at 15.

¹⁷ This is incorporated in the additional purposes section of the Financial Markets Conduct Act, s 4(d).

¹⁸ Gibbons, above n 16, at 15.

¹⁹ Reserve Bank of New Zealand Act, ss 156K(a) and 156K(b).

²⁰ Financial Markets Authority and the Reserve Bank of New Zealand “Memorandum of Understanding” (9 September 2011) Reserve Bank of New Zealand <www.rbnz.govt.nz/-/media/ReserveBank/Files/Publications/MoU/4525498.pdf>.

risks developing in the financial system.²¹ Later in this dissertation the legal risks, and their resulting consequences, are examined from the respective regulators' standpoints, consistent with the ethos of the FMC Act and RBNZ Act. The FMA and RBNZ do not impose requirements directly onto individual parties who wish to trade financial products. Rather, an intermediated regime exists whereby Financial Market Infrastructures (“**FMI**”) are *entrusted* with preserving the integrity of the system. In other words, regulation is currently designed around direct oversight by intermediaries' (such as the NZC and NZD) to ensure minimum standards are met and an effective settlement system is maintained.

Through designation under pt 5C of the RBNZ Act, the settlement system is required to have NZX Clearing and Settlement rules (“**the rules**”). As a FMI's rules are likely to be one of the most important matters governing how that FMI operates, they usually set out a common platform and procedures for participants using the FMI.²² The NZCDC settlement system's rules dictate the relationship of the clearing house operator (“**CHO**”, which is further defined as NZC), as well as of the clearing depository operator (“**CDO**”, which is further defined as NZD) with those who interact with the system (namely, clearing participants and settlement agents).²³ NZX Limited, which owns the system, also performs an oversight role and provides the technology infrastructure services.²⁴

In turn, the joint regulators demand that various conditions be met, such as sustaining a high degree of operational reliability, monitoring and managing risk, maintaining sufficient financial resources to cover losses and effect settlement of payment obligations in the event of default by a participant, and having mechanisms in place to minimise disruptions.²⁵ The joint

²¹ At 1.

²² Cabinet Economic Growth and Infrastructure Committee “An enhanced oversight framework for financial market infrastructures” (4 May 2017) <www.rbnz.govt.nz/-/media/ReserveBank/Files/regulation-and-supervision/financial-market-infrastructure-oversight/regulatory%20developments/FMIs-Cabinet-paper.pdf?la=en> at 4.

²³ New Zealand Clearing Limited Clearing and Settlement Rules 2015; and New Zealand Depository Limited Depository Operating Rules, 2015.

²⁴ Reserve Bank of New Zealand (Designated Settlement System – NZCDC) Amendment Order 2017, cl 4.

²⁵ Financial Markets Authority and Reserve Bank of New Zealand, above n 4, at 8.

regulators can also request information relating to the settlement system at any time,²⁶ thereby requiring the operators to maintain proper information storage systems.

B The role of NZC and NZD in a typical settlement chain on the NZX

Advocates for the utilisation of DLT in this context claim that securities settlement is a process that is ripe for innovation, on the basis that it currently involves too many intermediaries (such as NZC, NZD and brokers) and too many principal tasks, including reconciliation of various ledgers.²⁷ Therefore, it is important to examine the role of NZC and NZD in NZX's settlement practice.

Buyers and sellers who want to trade on an NZX market will typically transact through agents or sharebrokers.²⁸ The broker conducts and settles the trade on behalf of his or her client.²⁹ Once a trade is executed on a NZX market, the trade is replaced with two transactions through the process of novation. NZC becomes the buyer to every "sell" transaction and the seller to every "buy" transaction.³⁰ A Clearing Participant, who must be accredited and approved by NZC for the purpose of clearing and settling trades in the clearing house, will be the counterparty to NZC on every transaction.³¹ This effectively means that NZC manages the risks of default on trading obligations by either buyer or seller,³² guaranteeing delivery of

²⁶ Reserve Bank of New Zealand Act, s 156ZL.

²⁷ Mark Carney (Governor of the Bank of England) "The promise of Fin Tech – something new under the sun?" (25 January 2017) Bank of England
<www.bankofengland.co.uk/publications/Documents/speeches/2017/speech956.pdf>.

²⁸ Griffiths, above n 10, at 1165.

²⁹ At 1165.

³⁰ NZX Clearing *Clearing House Overview* (NZX, 2016) at 11.

³¹ Accreditation involves meeting capital adequacy requirements and appointing a responsible person to ensure compliance with the clearing and settlement rules, amongst other obligations. Clearing Participants are also subject to ongoing obligations as per the clearing and settlement rules. Clearing Participants can take the form of General Clearing Participants, Individual Clearing Participants, Default Clearing Participants and Lending Clearing Participants. For the purposes of this dissertation, any distinction between them is unnecessary. See NZX, above n 30, at 9; and NZX *Guide to becoming a Clearing Participant* (2014) at 4-7.

³² Cabinet Domestic Policy Committee, above n 5, at 3.

securities.³³ From the perspective of the RBNZ, this process is crucial in ensuring an effective and efficient financial system. Clearing also involves processes associated with transmitting and reconciling, such as updating the accounts of trading parties on multiple ledgers, confirming that the counterparts agree to the terms, and establishing the final positions for settlement and netting of transactions.³⁴

NZD implements the trade and fulfills the delivery requirements of the underlying contract by exchanging securities against the cash payment (if, and only if, payment occurs), known as “delivery versus payment” (“**DvP**”).³⁵ NZD also provides for the centralised recording and transfer of beneficial interests in securities.³⁶ The transfer of legal title from seller to buyer is facilitated by New Zealand Depository Nominee Limited (“**NZDN**”) which performs the custodian trustee role. NZDN holds legal title (in trust) to securities and cash held in the NZD and assists the switch.³⁷ A centralised payment system enables the cash transfer between account holders to effect payment.³⁸ NZX’s cash settlement system is the ESAS real-time gross settlement (“**RTGS**”) payment system.³⁹ The default settlement cycle for equity and debt markets is T+2 (shorthand for trade plus two days).

To clarify, this dissertation is not asserting that regulation of the current process of securities settlement is antiquated. The legal framework in place is functional and fairly well harmonised across jurisdictions’ capital markets. Rather, it calls into question the traditional regulatory nexus of control whereby the FMA and RBNZ entrust multiple intermediaries. The basis upon which this challenge arises is due to DLT innovation making a new technological framework for securities settlement possible. Accordingly, the current role of intermediaries in reducing the risks faced by the settlement system must first be considered.

³³ NZX Clearing, above n X, at 11.

³⁴ Committee on Payments and Market Infrastructures *Distributed ledger technology in payment, clearing and settlement – an analytical framework* (Bank for International Settlements, 27 February 2017) at 10.

³⁵ Hofmann, Strewe and Bosia, above n 3, at 55; and NZX Clearing *Depository Overview* (NZX, 2016) at 10.

³⁶ NZX Clearing, above n 35, at 5.

³⁷ NZX “About NZX Clearing” <www.nzx.com/services/nzx-clearing/about>.

³⁸ Cabinet Domestic Policy Committee, above n 5, at 3.

³⁹ Reserve Bank of New Zealand “ESAS/RTGS overview” (July 2012) <www.rbnz.govt.nz/markets-and-payments/esas/esas-rtgs-overview>.

C Risk mitigation in financial market infrastructures

The key risks facing FMIs are outlined in the Principles for Financial Market Infrastructures (“PFMI”). These are:⁴⁰

- (a) systemic risk;
- (b) legal risk;⁴¹
- (c) credit risk;
- (d) liquidity risk;
- (e) general business risk;
- (f) custody and investment risk;
- (g) operational risk.

For the purposes of this dissertation, I am focusing on the four risks that are pertinent to DLT’s adoption; in that DLT may alleviate – or worsen – the risks facing securities settlement systems. Thus systemic, credit, liquidity and operational risks are now considered in turn.

A stable financial system, in part, depends on careful management and mitigation of the systemic risks that can arise in the operation of FMIs.⁴² It relies on the continuing provision of essential services by FMIs, even in the event of their becoming insolvent or suffering an infrastructure failure.⁴³ These failures may occur as a result of prolonged breakdown, or an inability of one or more of their participants to perform as expected.⁴⁴ In such circumstances,

⁴⁰ Committee on Payments and Market Infrastructures and the Technical Committee of the International Organization of Securities Commissions “Principles for financial market infrastructures” (April 2012) Bank for International Settlements <www.bis.org/cpmi/publ/d101a.pdf>.

⁴¹ “Legal risk” is the unexpected application of a law or regulation, usually resulting in a loss. This type of risk will not be discussed as cross-border transactions are outside the scope of this dissertation; Committee on Payments and Market Infrastructures and the Technical Committee of the International Organization of Securities Commissions, above n 40, at [2.4].

⁴² Cabinet Economic Growth and Infrastructure Committee, above n 22, at 2.

⁴³ At 2.

⁴⁴ At 2; and Committee on Payments and Market Infrastructures and the Technical Committee of the International Organization of Securities Commissions, above n 40, at [2.2].

a variety of “knock-on effects” are possible due to the interdependencies of FMIs and FMI participants in the New Zealand financial system.⁴⁵ The NZX and the broader economy may be disrupted and subject to serious credit and liquidity risks as a result.⁴⁶ Credit risk is the potential that a borrower or counterparty will fail to meet its obligations in accordance with agreed terms.⁴⁷ Liquidity risk is the risk that a financial institution cannot meet its short-term financial demands.⁴⁸

The intermediated regulatory regime in place attempts to manage credit and liquidity risks (as well as the other aforementioned risks) which, in turn, should reduce systemic risks. The starting point is that the legislative provisions in the RBNZ Act provide statutory backing to the finality of settlements, netting and transfer of collateral on a designated system.⁴⁹ Settlement finality is the defining point when key financial risks are transferred, in accordance with the rules of the settlement system.⁵⁰ This is complemented by the availability of netting agreements; a contract whereby each party agrees to aggregate and offset the amounts it owes against the amounts owed to it.⁵¹ These are held to be valid and enforceable in accordance with the rules of the designated settlement system.⁵² The legislative provisions provide certainty that settlement and netting agreements will not “unravel” despite any enactment to the contrary.⁵³

⁴⁵ Committee on Payments and Market Infrastructures and the Technical Committee of the International Organization of Securities Commissions, above n 40, at [2.2].

⁴⁶ Cabinet Economic Growth and Infrastructure Committee, above n 22, at 2.

⁴⁷ Toby Fiennes “The Reserve Bank, cyber security and the regulatory framework” (19 July 2017) Reserve Bank of New Zealand <www.rbnz.govt.nz/research-and-publications/speeches/2017/speech-2017-07-19>.

⁴⁸ Fiennes, above n 47.

⁴⁹ Reserve Bank of New Zealand Act, pt 5C; and Reserve Bank of New Zealand (Designated Settlement System – NZCDC) Order 2010, explanatory note.

⁵⁰ Reserve Bank of New Zealand Act, s 156R provides that settlement effected in accordance with the rules of a designated settlement system must not be reversed, repaid, recovered or set aside.

⁵¹ Loretta DeSourdy “New legislation on netting and payments finality” (1996) 62 RBNZ Bulletin No. 2 61 at 61.

⁵² Reserve Bank of New Zealand Act, s 156T.

⁵³ Reserve Bank of New Zealand “Designated settlement systems FAQs” Reserve Bank of New Zealand <www.rbnz.govt.nz/faqs/designated-settlement-systems-faqs>.

The FMA and RBNZ rely on FMIs to ensure clear and certain final settlement, as well as having failure-to-settle mechanisms in place to minimise disruptions associated with the failure of one or more of their participants.⁵⁴ Herein lies the justification for the intermediated regime whereby NZC assumes risks on behalf of participants. The transferee needs to know that the security is free and clear of third party claims, provided the cash leg of the transaction has been delivered. In turn, the regulated intermediaries, such as NZC and NZD, enforce obligations on participants. For example, the risk framework includes margin requirements, provision of eligible collateral and upholding settlement practices (such as DvP and netting). The thorough internal regulatory structure of the NZCDC settlement system also provides for detailed rules relating to the consequences of settlement failure, setting out arrangements for managing the default or distress of a participant to the FMI.⁵⁵ Furthermore, if NZC⁵⁶ fails to deliver securities or payment, clearing participants or lending clearing participants (“**participants**”) can seek compensation for direct losses and NZC can recover these losses from the responsible participant for the failure.⁵⁷

Traditionally, prudential regulators have focused on credit and liquidity risks, but now attention is increasingly being turned to operational risk.⁵⁸ There is no globally accepted definition of operational risk, but the Basel Committee considered it would capture internal failures, as well as cyber risk.⁵⁹ However, while the regulatory regime provides for settlement finality and netting, it does not require business continuity plans nor provide regulators with direct crisis management powers in dealing with the failure of a FMI.⁶⁰ Yet the FMA and RBNZ, in fulfilling their regulatory objectives, expect a FMI’s risk management framework to

⁵⁴ Reserve Bank of New Zealand “Oversight of Financial Market Infrastructures in New Zealand (FMI1)” (March 2015) <www.rbnz.govt.nz/-/media/ReserveBank/Files/regulation-and-supervision/financial-market-infrastructure-oversight/oversight-of-financial-market-infrastructures-in-new-zealand.pdf?la=en> at 3.

⁵⁵ New Zealand Clearing Limited Clearing and Settlement Rules, r 4.3.

⁵⁶ The rules specifically refer to the clearing house operator (“CHO”). CHO is further defined as New Zealand Clearing Limited (NZC) in the New Zealand Clearing Limited Clearing and Settlement Rules, r 1.6.

⁵⁷ Rule 4.4.

⁵⁸ Fiennes, above n 47.

⁵⁹ Basel Committee on Banking Supervision “Basel III: A global regulatory framework for more resilient banks and banking systems” (December 2010 (rev June 2011)) Bank for International Settlements <www.bis.org/publ/bcbs189.pdf>.

⁶⁰ Cabinet Economic Growth and Infrastructure Committee, above n 22, at 4-5.

comprehensively deal with operational risks.⁶¹ Furthermore, the operational reliability of a FMI may be dependent on the continuous and adequate functioning of infrastructure providers that are critical to a FMI's operations.⁶² However, the RBNZ expects the operations of a FMI's critical infrastructure provider to be held to the same standards as if the FMI provided the service itself.⁶³ In effect, this places a lot of responsibility on settlement systems and intermediaries, particularly because failure to ensure operational resilience can cause systemic disruption to the financial system and the broader economy. In turn, the NZCDC settlement system mitigates risk by enforcing business continuity requirements on its clearing participants through the NZX clearing and settlement procedures.⁶⁴

D Summary

The RBNZ, as the prudential regulator, and the FMA, as the financial market regulator (and thus NZX's regulator), have different but complementary objectives in respect of the NZX securities settlement system. The intermediated regime requires the FMA and RBNZ to rely on institutions such as NZC and NZD to effectively manage risk (amongst other things) in order to fulfil their respective regulatory mandates. In turn, the settlement system has procedures and rules in place that reduce risks, but the possibility of unmanaged risk(s) there always remains.

New Zealand is currently reviewing its regulatory approach to FMI's.⁶⁵ The foundation for reform is concern that regulators lack sufficient legal powers to identify and address risks building up in FMIs, the failure of settlement systems, global trends relating to a more active

⁶¹ At 2.

⁶² Reserve Bank of New Zealand, above n 54, at 3.

⁶³ At 3.

⁶⁴ New Zealand Clearing Limited Clearing and Settlement Procedures 2016, r 2.7.1: A Clearing Participant must, at all times, maintain adequate disaster recovery and business continuity arrangements aimed to ensure timely recovery and continuation of its usual operations that are relevant to its role as a Clearing Participant following short, medium and long term disruption of its business; See also New Zealand Depository Limited Depository Operating Procedures 2015.

⁶⁵ Particularly those deemed "systematically important" which includes the NZCDC settlement system. See generally Cabinet Economic Growth and Infrastructure Committee, above n 22.

role for regulators, and alignment with the PFMI's.⁶⁶ In this regard, if DLT demonstrates that it can alleviate some of these concerns by managing risks more competently, a case can be mounted for it to replace the settlement system's current technological infrastructure.

⁶⁶ At 4-5.

Chapter Two:

Distributed Ledger Technology

Given that New Zealand is only at the preliminary stage of commercial adoption of DLT it is important to understand how DLT works. There is, however, inconsistency in the literature regarding the definition of DLT due to its evolving nature. For the purposes of this dissertation, a broad definition is preferred, focusing on the key features inherent in all DLT structures regardless of their flexible data structures. Accordingly, DLT refers to the processes and related technologies that enable nodes⁶⁷ in a network to securely propose, validate and record state changes (or updates) to a synchronised ledger using a group consensus protocol that is distributed across the network's nodes.⁶⁸

A Key features of DLT

Essentially, DLT is a database that records the properties and history of an asset;⁶⁹ this feature is not ground-breaking since every financial institution maintains transaction ledgers. However, DLT's revolutionary significance stems from its technological framework that adds "a new dimension to an old procedure."⁷⁰ DLT enables data to be decentralised and distributed across multiple servers that are connected on a peer-to-peer basis, thereby allowing network participants to share and retain identical and secure records. Each node has a full "copy" of the database (subject to permissions), or part thereof, although "copy" is a misleading word as there is no actual master-copy.⁷¹ Thus, the relevant DLT database is accessible across various users,

⁶⁷ In this context, a node refers to computers participating in the operation of a DLT arrangement.

⁶⁸ Committee on Payments and Market Infrastructures, above n 34, at 2.

⁶⁹ Michelle Bougas "How Distributed Ledger Technology is Transforming the Financial Marketplace" (Master of Science in Economic Crime Management Thesis, Utica College, 2016) at 2.

⁷⁰ At 2.

⁷¹ Alex Sims "Forget Bitcoin, Blockchain is a gamechanger" *The New Zealand Herald* (New Zealand, 17 December 2017).

sites, geographies or institutions.⁷² This feature is key to the purported incorruptibility of the technology as the opportunity for data to be lost or interfered with is limited when there is no single point of failure.⁷³

DLT's final key feature is that an alteration to the data or ledger can only be made when consensus is achieved across the unrelated nodes.⁷⁴ For simplicity, for a new transaction to be verified and recorded in the database, the nodes must *agree* that the participant owns the asset in the last agreed state before the participant can trade, by reconciling each individual version against all copies in existence. The transaction can then be recorded in the database and shared instantaneously across the network of participants.⁷⁵ The most commonly employed means of consensus is algorithmic verification (the blockchain database architecture uses this form), but diverse data structures can be used to achieve DLT consensus, depending on the permission set up. In contrast, under traditional mechanisms, consensus can only be achieved by clearinghouses or exchanges.⁷⁶

B Perceived advantages of DLT

DLT is perceived as offering three distinct advantages to securities settlement: incorruptibility, speed of settlement, and record keeping abilities. Each of these advantages is now examined in turn.

⁷² Mark Walport (UK Government Chief Scientific Adviser) *Distributed Ledger Technology: Beyond block chain* (Government Office for Science, 2016, GS/16/1) at 5.

⁷³ Annabelle Simpson "Australian Regulation of Blockchain and Distributed Ledger Technology in Banking and Finance" (2018) 29 JBFLP 73 at 73.

⁷⁴ At 76.

⁷⁵ Allens and Linklaters LLP "Blockchain Reaction" (2017) Allens <www.allens.com.au/general/forms/pdf/blockchainreport.pdf> at 6.

⁷⁶ Carney, above n 27.

1 *Incorruptibility*

Generally, DLT promises to deliver an authoritative, transparent record that is immutable for all practical purposes. Its technological resilience stems from both its consensus mechanism and its distributed nature. Firstly, if one node is compromised via a cyber-attack from a malicious third party, the consensus mechanism process will ensure it is rejected by the other nodes.⁷⁷ This enables entities to identify any instances of unauthorised tampering and to pinpoint the targeted node after an attack, ensuring a faster response.⁷⁸

Secondly, in order to compromise an entire DLT network, a hacker would have to infiltrate the majority of nodes in unknown locations simultaneously, requiring more computing power than that of the entire network.⁷⁹ While a “majority of nodes” is vague terminology, the number of servers required for alteration is database specific and determined by the administrators at inception.⁸⁰ That being said, the more widely held and distributed a system, the more secure it is.

Commentators have nevertheless doubted the incorruptibility and resilience of DLT due to the prevalence of bitcoin hacks being reported in the media.⁸¹ However, this is not illustrative of an underlying weakness in DLT because its fundamental security elements are strong; rather, the third-party providers of cryptocurrency exchanges and wallets may not have adequate security measures in place.⁸²

⁷⁷ Financial Conduct Authority (FCA) *Discussion Paper on distributed ledger technology* (Financial Conduct Authority, Discussion paper 17/3, April 2017) at [3.14].

⁷⁸ At [3.14].

⁷⁹ Simpson, above n 73, at 75.

⁸⁰ Mark Walport (UK Government Chief Scientific Adviser), above n 72.

⁸¹ See generally Julia Kollwe “Bitcoin price plunges after cryptocurrency exchange is hacked” *The Guardian* (United Kingdom, 11 June 2018) <www.theguardian.com/technology/2018/jun/11/bitcoin-price-cryptocurrency-hacked-south-korea-coincheck>; Darryn Pollock “The mess that was Mt. Gox: four years on *Coin Telegraph* (9 March 2018) <<https://cointelegraph.com/news/the-mess-that-was-mt-gox-four-years-on>>.

⁸² Simpson, above n 73, at 75.

2 *Speed of settlement*

Despite the aforementioned risk mitigation techniques adopted for securities settlement systems discussed in Chapter One, the lag between the time a trade is made and the time at which it settles is what drives a number of credit and liquidity related risks (known as counterparty risk and settlement risk), and thus presents an opportunity for improvement.⁸³ The standard T+2 settlement period requires financial institutions to assume significant risk during the trading period.⁸⁴ However, DLT can provide a shorter settlement time as the transparency of the ledger makes for a simpler reconciliation process, reducing the complexities of the system. For instance, T+0 could become standard practice whereby transactions settle in real-time or near real-time. DLT could eliminate, in theory, credit and liquidity risk as it requires pre-funding (whereby the cash and collateral to be traded exist prior to trading).⁸⁵ Furthermore, a faster settlement period means capital can be freed up for allocation to other transactions, improving market efficiency and liquidity.⁸⁶

3 *Record-keeping abilities*

DLT provides several advantages for immutable record keeping. It can reduce the need for reconciliation across multiple record-keeping infrastructures,⁸⁷ improve information flows and thereby facilitate checks in accordance with the Anti-Money Laundering and Countering Financing of Terrorism Act 2009 (“**AML / CFT Act**”) by increasing the traceability of transactions. The FMA and RBNZ clearly need to be satisfied that the settlement system complies with the AML / CFT Act as this applies to the settlement system and its participants.⁸⁸

⁸³ Hossein Kakavand, Nicolette De Sevres and Commissioner Bart Chilton “The Blockchain Revolution: An Analysis of Regulation and Technology Related to Distributed Ledger Technologies” (2017) SSRN <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2849251> at [2.1.1].

⁸⁴ Simpson, above n 73, at 78.

⁸⁵ Kakavand, De Sevres and Chilton, above n 83, at [2.1.1].

⁸⁶ Simpson, above n 73, at 79.

⁸⁷ Committee on Payments and Market Infrastructures, above n 34, at 1.

⁸⁸ The Anti-Money Laundering Act 2009 imposes obligations on “reporting entities”, such as customer due diligence checks and records kept of all customer transactions. “Reporting entities” includes “financial

The ability of DLT to replace paper trails with easily-auditable, digital ones could therefore lead to a reduction in financial crime and the costs associated with compliance with the AML / CFT Act.⁸⁹ Avoiding unnecessary compliance costs is specifically mentioned as an additional purpose in s 4(c) of the FMC Act.

C Stages of adoption

It must be emphasised that the extent to which these advantages offered by DLT will materialise in reality depends upon the degree of disruption to the current settlement process. The commercial utilisation of DLT in securities settlement can be considered across three distinct stages, that are set out below. The purpose of this phased categorisation is two-fold. Firstly, it recognises that the regulatory approach to DLT must depend on how the technology is utilised. Secondly, technological development in this context is incremental and so jurisdictions wishing to employ DLT are likely to host the technology in what I have labelled as “stage one adoption” to begin with.

Stage one adoption encompasses a private, permissioned DLT system. Access to the network is controlled, with pre-selected participants known to each other. Rights to modify the ledger are centralised to one organisation, such as an incumbent financial market infrastructure. Chapter Three explores this form of DLT in the context of the DLT platform to be operated by the Australian Securities Exchange (“ASX”); a solution that will replace their existing clearing house electronic sub-register system (“CHES”) in 2021.⁹⁰

The second stage of DLT adoption could entirely remove *regulated* clearing and settlement facilities in financial markets. In New Zealand, for example, this would render the role of NZC and NZD redundant. The NZX would allow entities, such as market participants, to carry out

institutions” in its definition as per s 5 of the Anti-Money Laundering Act 2009; Financial Markets Authority and Reserve Bank of New Zealand, above n 4, at 7.

⁸⁹ FCA, above n 77, at [3.26].

⁹⁰ ASX *CHES Replacement: New Scope and Implementation Plan – Response to consultation feedback* (September 2018) at 4.

transactions on the ledger.⁹¹ This solution could be either permissioned, or a hybrid form of permissionless and permissioned systems whereby different features are utilised from each DLT framework - for example, the network could be open, but rights to modify would be restricted. A marked change in the function and purpose of financial market regulation would be required for stage two adoption, shifting the regulatory focus from intermediaries to a new process. The implications for New Zealand's regulatory regime and legislative frameworks under this solution are examined in Chapter Four.

Stage three adoption is a public (also known as permissionless or open) DLT network, operated on the public internet. The research literature has tended to focus on this solution due to the prevalence of the Bitcoin protocol.⁹² However, this is problematic in many respects and fails to recognise DLT's various structures. There are no restrictions on who can join such a DLT network, with trading and settlement occurring directly between pseudonym investors.⁹³ The system has no responsible entities or oversight and is therefore governed solely by technical code.⁹⁴ Adopting DLT in this capacity therefore arguably removes the need for regulation or "legal code".⁹⁵ The ASX noted that this would not be a realistic solution for highly regulated markets, such as securities trading.⁹⁶ Regulated markets require participants to be appropriately licensed and known to regulators, and for there to be high levels of privacy and security, among other factors.⁹⁷ This stage three solution is not considered further in this dissertation because my intent is not to question the desirability of financial market regulation at all. Rather, my focus is on the assumption that effective regulation requires trusted intermediaries.

⁹¹ Committee on Payments and Market Infrastructures, above n 34, at 2.

⁹² See generally Tapscott and Tapscott, above n 2; Compare with Australian Securities and Investment Commission (ASIC) *Information Sheet 219: Evaluating Distributed Ledger Technology* (2017): the popularity of bitcoin is not indicative that the overarching DLT framework has been tried and tested to a standard so as to be ready for widespread industry use with varied applications.

⁹³ ASX *ASX's Replacement of CHESS for Equity Post-Trade Services: Business Requirements – Consultation Paper* (September 2016) at 15.

⁹⁴ Technical code refers to the software and protocols agreed upon by the owners or participants of a system with the aim of safeguarding their private interests; See Allens and Linklaters LLP, above n 75, at 13.

⁹⁵ In contrast to technical code, legal code is legislation, rules and regulations.

⁹⁶ ASX, above n 93, at 15.

⁹⁷ At 15.

D Summary

Global regulators are paying attention to DLT's progress for several reasons. The banking and finance industry has evolved from paper to digital format and is now, arguably, extending towards a DLT system. Each transition brings enhancements and impairments to the settlement process.⁹⁸ The degree to which these anticipated enhancements can be realised with DLT depends upon the stages of the solution employed. While this complicates the understanding of the technology, it must – and has largely been – appreciated from a regulatory and legal perspective. Given the privacy requirements of the banking and finance industry, regulators have focused on addressing permissioned and private DLT systems (which can be accommodated by both stage one and two adoption) in the context of securities settlement. The remainder of this dissertation addresses these two stages in turn, recognising that their respective technological structures call into question novel, yet distinct, legal issues.

⁹⁸ Bougas, above n 69, at 1.

Chapter Three:

Stage One Adoption and the Importance of the Central Institution in Securities Settlement

Notwithstanding DLT's purported incorruptibility and ability to eliminate certain risks, regulators universally are exercising caution in regard to the technology's perceived benefits. While DLT proof of concepts are being tested for widespread industry adoption, the technology still involves niche commercial deployment and this creates challenges for regulators in predicting the specific legal issues that will likely arise, and remain relevant, throughout DLT's evolution. However, ASX's planned replacement of CHESS with a DLT platform in 2021 highlights the necessity of giving thorough – and urgent – consideration to the regulatory environment surrounding DLT.⁹⁹ This is particularly important in New Zealand, which has been disappointingly silent on DLT's applicability to securities settlement, save for our participation in the International Organisation for Standardisation Secretariat.¹⁰⁰

Prior to engaging in an analysis of regulatory approaches in comparable jurisdictions, Chapter Three commences by contrasting the respective regulatory frameworks of New Zealand, Australia and the United Kingdom. This sets the context for subsequent discussion of the consequences of the ASX case study on the settlement chain outlined in Chapter One. Whether the risks facing settlement systems identified earlier are mitigated or heightened by the DLT solution are also examined as well as the Australian Securities Investments Commission's ("ASIC") evaluation of DLT. The chapter then turns to consider the experience of the United Kingdom. This jurisdiction is subject to regulation from both its Financial Conduct Authority ("FCA") and, for the time being, the European Securities and Markets Authority ("ESMA"). New Zealand, typically an importer of global regulation in this environment, can therefore

⁹⁹ Nino Odorisio "ASIC and ASX hot on distributed ledger technology" (2017) 69 Governance Directions No. 4 225 at 225.

¹⁰⁰ The ISO technical committee aims to propose international standards for DLT. See International Organisation for Standardisation Technical Committee 307 "ISO/TC 307: Blockchain and distributed ledger technologies" International Organisation for Standardisation <www.iso.org/committee/6266604.html>.

benefit from the responses of the FCA and the ESMA to DLT in the United Kingdom context when considering potential ways forward here. Chapter Three concludes by drawing on the PFMI, a rich source of standards for FMIs globally to mitigate risks. Collectively, these international principles and the approaches of both Australia and the United Kingdom hinge on the importance of a central institution in securities settlement.

A Regulatory framework comparison between New Zealand, Australia and the United Kingdom

Securities listed in the United Kingdom and Australia are mainly traded through the London Stock Exchange (“LSE”)¹⁰¹ and ASX, respectively. The FCA and Bank of England, and the Reserve Bank of Australia (“RBA”) and the ASIC, have comparable MOUs to New Zealand in terms of recognising their respective regulatory mandates and ensuring cooperation for the supervision of financial market infrastructure.¹⁰²

Securities on the LSE are cleared by LCH.Clearnet Ltd and settled through Euroclear UK & Ireland / CREST (“CREST”), the equivalents of NZC and NZD in the New Zealand context. However, a key difference is that the United Kingdom’s central counterparties (“CCP”) and central securities depositories (“CSD”) are subject to additional regulation by the ESMA to ensure consistency across the European Union member states.¹⁰³ Comparatively, New Zealand and Australia have a less complex regulatory structure. This may present an increased challenge for DLT in the United Kingdom as supervision is based on both domestic and European Union laws, requiring the “explicit blessing”, so to speak, of various regulators. Securities on the ASX

¹⁰¹ Committee on Payment and Settlement Systems *Payment Systems in the United Kingdom* (Bank for International Settlements, CPMI 53, April 2003) at 414.

¹⁰² See Financial Conduct Authority, Bank of England and the Prudential Regulation Authority “Memorandum of Understanding between the Financial Conduct Authority and the Bank of England, including the Prudential Regulation Authority” Financial Conduct Authority <www.fca.org.uk/publication/mou/mou-bank-pra.pdf>; and Reserve Bank of Australia “Memorandum of Understanding” <www.rba.gov.au/media-releases/2002/mr-02-08.html>.

¹⁰³ Financial Conduct Authority (FCA) *Markets in Financial Instruments Directive II Implementation – Policy Statement II* (PS17/14, July 2017) at 9.

that are cleared through ASX Clear, the CCP and ASX Settlement, the Securities Settlement Facility (“SSF”)¹⁰⁴ will be considered in the case study below.

The responsibilities of these intermediaries are effectively the same as those of NZC and NZD in the New Zealand regulatory structure. FMIs are entrusted with ensuring the securities settlement system is effective, for establishing secure arrangements for the timely clearing and settlement of obligations and for managing certain risks, such as credit and liquidity risks.¹⁰⁵ In turn, the CSDs and CCPs enforce rules¹⁰⁶ on participants, such as maintaining minimum levels of financial resources and adhering to settlement practices.

B The ASX case study

CHESS is the core computer system used by ASX’s licensed¹⁰⁷ clearing and settlement facilities (ASX Clear and ASX Settlement) to perform clearing, settlement and other post-trade services for the Australian equity market.¹⁰⁸ ASX proposes to operate, from 2021, a private permissioned network, with only licensed participants being given access to the DLT-based system. Importantly, private contractual information will be segregated and will not be shared with all participants on the network.¹⁰⁹

¹⁰⁴ A CSD is treated the same as a SSF in this context.

¹⁰⁵ Reserve Bank of Australia “Responsibilities of Authorities” <<https://www.rba.gov.au/payments-and-infrastructure/financial-market-infrastructure/principles/assessment-against-responsibilities/responsibilities-of-authorities/2014/pdf/2014-09-self-assessment-au-authorities-cs-facilities.pdf>>; and International Monetary Fund *United Kingdom: Supervision and systemic risk management of financial market infrastructures – Technical note* (IMF Country Report no. 16/156, June 2016) at 28.

¹⁰⁶ See generally Rules of the London Stock Exchange 2018.

¹⁰⁷ Corporations Act 2001 (Cth), pt 7.3 establishes a licensing regime for clearing and settlement facilities in Australia. Licensing authority rests ultimately with the responsible Minister, with licence obligations specified in the Corporations Act – and in any supplementary licence conditions – administered by ASIC and compliance is overseen jointly by ASIC and the Bank; Reserve Bank of Australia, above n 105.

¹⁰⁸ ASX *CHESS Replacement: New Scope and Implementation Plan – Consultation Paper* (April 2018) at 9.

¹⁰⁹ Odoriso, above n 99, at 227.

1 *Current risks and inefficiencies the solution proposes to reduce for the ASX*

Generally, the proposed solution will increase the efficiency of settlement on the ASX through improved record keeping, reduced reconciliation, real-time data and more timely transactions.¹¹⁰ While standard settlement time will remain at T+2, the solution will provide for settlement choices whereby market participants could settle trades intraday, end of trade date or T+1.¹¹¹ A shorter settlement timeframe contributes to reducing participants' credit and liquidity risk exposure.

Significantly, there is *potential* for DLT's design within the ASX to preserve the participant's legal name on the title until the point of settlement.¹¹² This would replace transfer into an omnibus account held by the settlement participant or a nominee (in the NZCDC system, this could change the role of NZDN or render it redundant) on the basis that it is no longer necessary to mitigate risk in this way.¹¹³ This would provide greater protection of clients' assets throughout the settlement process and make legal positions clearer in the event of a participant's default.¹¹⁴ Interestingly, the ASX aims to use the DLT platform to reduce approximately \$23 billion in fees paid to financial intermediaries.¹¹⁵

2 *Impact on the settlement chain and regulatory challenges*

While the ASX solution proposes implementation of an innovative new DLT platform that could change the settlement participant structure, it is unclear whether the expected benefits will fully materialise. The solution's implementation was delayed in response to user concerns about the risk of failure, stemming from the proposed timeframe of implementation being

¹¹⁰ ASX, above n 108, at 4.

¹¹¹ ASX, above n 93, at 9.

¹¹² At 8.

¹¹³ At 8.

¹¹⁴ At 8. It will also make it easier to move a client's unencumbered securities from a defaulting participant.

¹¹⁵ Michael del Castillo "Reality Check: ASX Delays DLT Launch Amid User Concerns" (4 September 2018) Forbes <www.forbes.com/sites/michaeldelcastillo/2018/09/04/reality-check-asx-delays-dlt-launch-amid-user-concerns/#322c5a7c2371>.

considered too short, as well as uneasiness about the addition of too many new services.¹¹⁶ While this dissertation primarily considers challenges from the relevant regulators' perspectives, it is important to also take note of the reluctance expressed by ASX users and their preference for an even more phased introduction of DLT. This is indicative of the characteristically risk-averse attitude in the financial market environment, even when the use of the technology is, in a sense, quite unambitious and represents only a limited-disruption introduction of DLT.¹¹⁷

The scope of this stage one option within the ASX has been likened to a private intranet, replacing the underlying technology for clearing and settlement mechanisms and thus enhancing the efficiency of background databases. Its impact on the settlement process is arguably negligible, with the exception of replacing the transfer of securities into an omnibus account (provided this proposed benefit comes to fruition). Some commentators doubt whether T+0 would become standard practice or whether there would be a reduction in clearing and settlement fees, particularly in light of the increased challenges in funding the processing power required to run DLT systems. Key business requirements such as netting and novation remain – and, importantly, the key licensed intermediaries (ASX Clear and ASX Settlement) remain. The RBA and ASIC can rely on these intermediaries to enforce rules on participants and maintain settlement practice; for instance, DvP settlement payments will continue to occur in central bank money.¹¹⁸ Furthermore, as participants are known and licensed, the ledger can still provide for rights of reversal and error correction.¹¹⁹

The solution therefore presents limited regulatory challenges. ASX engaged with ASIC, RBA and the Australian Competition and Consumer Commission (“ACCC”) throughout the replacement process to ensure it complies with regulatory requirements.¹²⁰ Furthermore, the

¹¹⁶ Del Castillo, above n 115.

¹¹⁷ Nick Clarke and Gavin Barnett *Four Scenarios for Blockchain in Capital Markets* (GBST, Discussion paper, 20 April 2016) at 4.

¹¹⁸ ASX, above n 93, at 7.

¹¹⁹ At 10.

¹²⁰ Extensive regulatory engagement has been undertaken with the RBA, ASIC and the ACCC, however, the solution is still subject to ongoing regulatory approval; ASX, above n 108, at 14.

ASX consultation paper considers that any of the aforementioned changes to settlement practice or the participant landscape will be supported by changes to the relevant rules or regulations, if so required.¹²¹ If the NZX considered the future integration of DLT to improve its settlement system in this way, it would likely fit within the current legal framework. In both cases, the system is controlled by the incumbent provider and regulatory oversight is unchanged, if not improved, via access to and surveillance of transaction data.¹²² Thus, while the ASX's DLT platform is a valuable foundation to test the technology, it does not remove or significantly reduce any of the risks facing settlement systems outlined in Chapter One. Instead, the relevant regulators¹²³ still rely on traditional intermediaries to limit these transactional risks, rather than allowing DLT to be trusted for this purpose.

The use of the technology in this way is reinforced by ASIC's Information Sheet 219 for existing licensees operating market infrastructure.¹²⁴ A strict technological-neutral stance was taken,¹²⁵ whereby ASIC held the existing regulatory framework can accommodate the circumstances of DLT's use that ASIC has seen so far.¹²⁶ Thus, it is clear ASIC only sees scope for a limited-disruption model for the time-being. It should be noted that ASIC does state that it expects the range of potential applications of DLT to grow exponentially over time and that it will continue to give considerable thought to regulatory issues that might arise.¹²⁷ However, this proviso on their current technologically neutral stance is unlikely to have a bearing on the above analysis; it is limited to potentially allowing for more flexible licensing arrangements in the future¹²⁸ (for instance, providers other than incumbent institutions). Therefore, the

¹²¹ ASX, above n 108.

¹²² ASX, above n 93, at 10.

¹²³ The RBA, ASIC and the ACCC.

¹²⁴ The Information Sheet 219 also provided guidance to start-ups that are considering operating market infrastructure. ASIC would provide licensing exemptions as per s 926A(2)(a) Corporations Act 2001 (Cth) ASIC, however the power does not extend to clearing and settlement facilities. Given that attaining a licence is onerous in Australia, it effectively limits the utilisation of DLT for clearing and settlement activities to incumbent providers (ASX Clear and ASX Settlement); ASX, above n 92.

¹²⁵ This stance will be critiqued further below in respect of the Financial Conduct Authority's approach in the United Kingdom.

¹²⁶ ASIC, above n 92.

¹²⁷ ASIC, above n 92.

¹²⁸ Simpson, above n 73, at 81.

conclusion stands that ASIC values the role of intermediaries who it can enforce standards on, by virtue of having a license. In any case, at present ASIC's technological neutral stance accommodates the ASX's DLT platform for replacement of CHESSE but not further beyond this, posing limited regulatory challenges.

C Overview of the regulatory responses to DLT by the ESMA and the FCA in the United Kingdom

The FCA is the United Kingdom's regulator with responsibility for supervising FMIs as well as the financial participants of FMIs. It regulates jointly with the Bank of England under the "twin peaks" model. The United Kingdom, as aforementioned, is also subject to the regulatory and supervisory frameworks for CSDs and CCPs in European Union legislation that the ESMA oversees. Both regulators take the view that their respective regulatory frameworks do not prevent the emergence of DLT in securities markets in the short-term.¹²⁹ This shared perspective is consistent with the ASX's utilisation of DLT in Australia as a technological improvement of existing market infrastructures. However, only the ESMA recognises this as the upshot of its analysis, by noting that while it is "unlikely for DLT to eliminate CCPs and CSDs," some processes may become redundant or the role of intermediaries may change over time.¹³⁰ This view is supported by a preliminary analysis of DLT under the European Union regulatory framework.

1 The European Union regulatory framework's accommodation of DLT

Clearing activities in the United Kingdom are governed by the European Market Infrastructure Regulations ("EMIR").¹³¹ The EMIR provides that certain over-the-counter derivative

¹²⁹ European Securities and Markets Authority (ESMA) *Report: The Distributed Ledger Technology Applied to Securities Markets* (ESMA50-1121423017-285, February 2017) at 2; and FCA, above n 77, at 8.

¹³⁰ At 2.

¹³¹ Regulation (EU) 648/2002 on OTC derivatives, central counterparties and trade repositories [2012] OJ 201/1.

transactions have to be cleared through CCPs.¹³² The Markets in Financial Instruments Regulations (“MiFIR”) extends the clearing obligations of CCPs to regulated markets for exchange-traded derivatives.¹³³ Furthermore, clearing may apply to other types of transactions which can be done through CCPs (and therefore must comply with EMIR rules) or other entities.¹³⁴ A CCP is defined as a “legal person that interposes itself between the counterparties to the contracts traded on one or more financial markets, becoming the buyer to every seller and the seller to every buyer.”¹³⁵ Therefore, an intermediary CCP is still required for some DLT transactions under European Union regulation. The exception would be if a securities market operator chose not to use a CCP, but this form of clearing is very uncommon, particularly for the most important regulated securities markets, such as the LSE.¹³⁶

Nevertheless, in theory, the LSE could discontinue using LCH.Clearnet Ltd and opt for an entity that is not subject to the EMIR in order to utilise DLT for securities clearing.¹³⁷ However, this may be viewed as regulatory arbitrage and swiftly reformed, given the systemic importance of the LSE and ESMA’s hesitancy towards CCPs being eliminated. In any case, clearing would still be subject to the United Kingdom’s regulatory obligations imposed by the FCA and the Bank of England. This analysis emphasizes the importance of CCPs in the United Kingdom financial market landscape, given that some DLT transactions will always require third party involvement (and it remains unclear what might happen in the alternative scenario). There is still, however, scope for incumbent CCPs to use DLT for stage one adoption, namely “mere technological improvement” as the ESMA notes this would present “limited regulatory hurdles”.¹³⁸

¹³² European Securities and Markets Authority (ESMA) *Discussion Paper: The Distributed Ledger Technology Applied to Securities Markets* (ESMA/2016/773, June 2016) at 20.

¹³³ Directive 2004/39/EC on Markets in Financial Instruments [2004] OJ L145.

¹³⁴ ESMA, above n 132, at 20.

¹³⁵ Regulation (EU) No 648/2012 on OTC Derivatives, Central Counterparties and Trade Repositories [2012] OJ L 201/1, art 2(1).

¹³⁶ ESMA, above n 132, at 23.

¹³⁷ Provided the security being cleared is an “other type of asset”, namely MiFID II securities, securities lending, repurchase agreements, collateral deposits, derivatives non-MiFID II instruments and non-MiFID II financial instruments. Note that MiFID II applies to certain securities on the LSE; Directive 2014/65/EU on Markets in Financial Instruments II [2014] OJ L137/349; ESMA, above n 132, at 22.

¹³⁸ ESMA, above n 132, at 9.

Furthermore, CSD's are regulated by the Central Securities Depositories Regulation ("CSDR")¹³⁹ and the Settlement Finality Directive ("SFD")¹⁴⁰ by virtue of designation.¹⁴¹ Thus, the requirement for a DLT framework to comply with CSDR and SFD regulations will depend on whether the framework is designated as a securities settlement system that,¹⁴² by extension, will affect its capacity to act as a CSD.¹⁴³ If the LSE adopted a DLT solution, CREST – the existing CSD – would be designated¹⁴⁴ and its new technological framework would need to comply with the ongoing requirements of the SFD and CSDR, such as DvP, settlement finality, operational resilience and cyber resilience.¹⁴⁵ If a DLT platform, however, was not designated¹⁴⁶ or was acting as a settlement internaliser,¹⁴⁷ the scope of its activities would be very limited to transactions that fell outside of the CSDR.¹⁴⁸ The ESMA notes that, in this case, the risk mitigants provided by CSDR and SFD would not apply, such as protection mechanisms in case of insolvency, resolution of settlement failure and so on.¹⁴⁹ Thus, the ESMA expects that the relevant Member State of the European Union would designate the DLT platform as a securities settlement system, in line with the SFD and CSDR, in order to avoid risks materialising.¹⁵⁰

This analysis emphasises the role of CSDs in risk mitigation and thus as an effective settlement system generally, justifying a cautious approach. While an incumbent CSD provider may be

¹³⁹ Regulation (EU) No 909/2014 on central securities depositories [2014] OJ L257.

¹⁴⁰ Directive (EU) 98/26/EC on Settlement Finality in Payment and Securities Settlement Systems [1998] OJ L166; and The Financial Markets and Insolvency (Settlement Finality) Regulations 1999 implements the SFD in the United Kingdom.

¹⁴¹ ESMA, above n 132, at 24.

¹⁴² Directive (EU) 98/26/EC on Settlement Finality in Payment and Securities Settlement Systems [1998] OJ L166, art 2.

¹⁴³ Regulation (EU) No 909/2014 on central securities depositories [2014] OJ L257, art 18(2).

¹⁴⁴ Committee on Payment and Settlement Systems *Payment, clearing and settlement systems in the United Kingdom* (Bank for International Settlements, CPMI 105, November 2012) at 456.

¹⁴⁵ ESMA, above n 129, at 16.

¹⁴⁶ ESMA, above n 132, at 25.

¹⁴⁷ A settlement internaliser is defined as any institution which executes transfer orders other than through a securities settlement system as per art 2 of the CSDR. It must comply with regulatory reporting obligations in art 9 of the CSDR; Regulation (EU) No 909/2014 on central securities depositories [2014] OJ L257, arts 2 and 9.

¹⁴⁸ ESMA, above n 129, at 15.

¹⁴⁹ At 15.

¹⁵⁰ At 15.

able to adopt DLT for technological replacement, the ESMA would need to be assured that it had the appropriate framework in place to address risks currently managed by traditional systems. Furthermore, the risk-based approach becomes evident when the ESMA states that it expects non-designated DLT CSD providers to be brought into the scope of the CSDR. However, designation criteria include the “systemic importance” of a system¹⁵¹ and a new DLT platform seeking to provide CSD services is unlikely to meet this threshold. Therefore, it is understood that the CSDR and SFD would effectively cater for a limited-disruption model aligned with that discussed earlier in the ASX case study. That is to say, the regulatory framework would largely accommodate incumbent CSDs wishing to employ DLT, but not further beyond that.

2 *The FCA’s approach*

The FCA’s approach is seemingly more dynamic than the ESMA’s, although it heralds the same focus on the role of central institutions. The FCA takes an approach of “technological neutrality” to DLT as applied to securities markets, which regulates “outcome” via oversight of institutions and their activities, rather than the specific technology.¹⁵² For example, the FCA expects firms to maintain appropriate records, but is open to them using paper-based or cloud-based solutions provided they can present these promptly on request.¹⁵³ The FCA observes that various rules may presuppose technology types and business models resulting in unforeseen regulatory barriers to innovation.¹⁵⁴ The FCA concludes that DLT does not face these barriers at present. The FCA also regards this stance as consistent with a proportionate regulatory balance between the risks and opportunities offered with DLT.¹⁵⁵ Given that the emphasis of technological neutrality is on institutions meeting their regulatory obligations in alignment with

¹⁵¹ Designation criteria considered by Member States under the SFD also includes the volume and value of all securities transactions that are settled through the system: ESMA, above n 132, at 25.

¹⁵² FCA, above n 77, at 7.

¹⁵³ At 23.

¹⁵⁴ At 23.

¹⁵⁵ Financial Conduct Authority (FCA) *Distributed Ledger Technology: Feedback Statement on Discussion Paper 17/03* (FS17/4, December 2017) at 3.

the current framework,¹⁵⁶ this approach restricts the utilisation of DLT to a limited-disruption model, despite initially appearing more flexible.

There are merits to a technologically neutral stance, including consistency with international approaches to DLT, such as the UNICTRAL Model Law on Electronic Transferable Records (“ML-ETRs”).¹⁵⁷ However, this approach can be criticised. A regulator who endorses a technologically neutral approach, and considers that the current framework provides for DLT, overlooks the possibility that some rules may conflict with DLT. For example, there are practices in place to mitigate operational risk in settlement systems, such as the requirement to have a second system available for a wholesale database transfer in the event of a technological failure. This is incompatible with DLT as the failure of one node (or many) does not affect the operation of the entire network. As a result, adherence to the rules in this respect is inauthentic and costly, unless necessary modifications are made. The same conclusion can be reached with ASIC’s technological neutrality approach in that it fails to appreciate the high level of security afforded by the consensus feature of DLT.¹⁵⁸ However, it must be stressed that operational risk is not *eliminated* with DLT (as will be discussed further in Chapter Four), but rather that regulatory demands are *shifting*.

¹⁵⁶ FCA, above n 77, at 8.

¹⁵⁷ The ML-ETR would provide for an ETR that would functionally replicate a paper record (“transferable document or instrument”) such as a document of title or negotiable instrument. Therefore, while it does not have a bearing on this analysis, it is interesting to note that international approaches are specifically referring to, and accommodating the use of, “distributed ledgers”. However, the ML-ETR is rather weak; it does not affect the substantive laws applying to transferable documents within a jurisdiction and only recommends for states to give favourable consideration to the document when revising their legislation in this space: UNCITRAL Working Group IV (Electronic Commerce) *Model Law on Electronic Transferable Records* 54th sess UN Doc A/CN.9/920 (13 July 2017).

¹⁵⁸ Simpson, above n 73, at 82.

D Relevance of the PFMIs

The PFMIs have been considered throughout this dissertation as international standards that are essential in reducing key risks facing FMIs.¹⁵⁹ Furthermore, NZC is required to perform self-assessments to comply with the PFMIs¹⁶⁰ and New Zealand's impending regulatory reform may involve the adoption of these principles in secondary legislation.¹⁶¹ Australian and European Union regulatory frameworks have also taken steps to amend relevant rules and standards to align with the PFMIs.¹⁶²

The definition of a FMI put forward in the PFMIs focuses on the centralisation of certain activities, such as clearing, that can allow the effective and efficient management of risks (and in some cases the elimination of risks).¹⁶³ Further standards rely on the traditional roles of CCPs and CSDs in settlement systems in order to be operative - for instance, netting and novation forming the legal basis of a FMI.¹⁶⁴ Therefore, these principles would require modification to approve the utilisation of DLT in stage two adoption (removing intermediaries), as supported by the view of the Committee on Payments and Market Infrastructures and the International Organization of Securities Commission in their recent White Paper that DLT bears promise but there is still a long way to go before that promise may be fully realised.¹⁶⁵

¹⁵⁹ Committee on Payments and Market Infrastructures and the Technical Committee of the International Organization of Securities Commissions, above n 40.

¹⁶⁰ NZX "NZX Clearing: Rules and Regulation" <www.nzx.com/services/nzx-clearing/rules-and-regulation>.

¹⁶¹ Cabinet Economic Growth and Infrastructure Committee, above n 22, at 48.

¹⁶² For the European Union, the PFMIs are implemented through EU regulations on CSDs and CCPs: International Monetary Fund, above n 105, at 4; and Australia has also implemented the PFMIs through ASICs regulations: <<https://www.rba.gov.au/payments-and-infrastructure/financial-market-infrastructure/principles/assessment-against-responsibilities/responsibilities-of-authorities/2014/pdf/2014-09-self-assessment-au-authorities-cs-facilities.pdf>>.

¹⁶³ Committee on Payments and Market Infrastructures and the Technical Committee of the International Organization of Securities Commissions, above n 40, at 7.

¹⁶⁴ At 24.

¹⁶⁵ Committee on Emerging Risks *IOSCO Research Report on Financial Technologies (Fintech)* (International Organization of Securities Commissions, February 2017).

E Summary

Chapter Three has highlighted that the solutions adopted by, and the regulatory approaches of, jurisdictions comparable to New Zealand value the role of intermediaries in the securities settlement process. The Australian and United Kingdom regulators do not, at present, see scope for a solution beyond the technological improvement of an incumbent clearing and settlement provider's utilisation of DLT. These cautious regulatory approaches may inhibit DLT's disruptive capabilities and are unlikely to spur the securities settlement revolution promised by various commentators. The global nature of the ASX's and LSE's clearing and settlement facilities, whereby there is an increased exposure to systemic risks¹⁶⁶ compared with the NZX's relatively closed market, may play a role in this regulatory caution. However, while the NZX's settlement system is not global in reach, it is "systemically important" in New Zealand¹⁶⁷ and does not bear any other significantly unique characteristics to the LSE's and ASX's clearing and settlement facilities that should justify departure from considering these approaches. Furthermore, the hesitant approach of these regulators is justified when attention is given to the multitude of risks involved in a solution beyond the first stage of adoption, which is the focus of Chapter Four.

¹⁶⁶ International Monetary Fund, above n 105, at 10.

¹⁶⁷ Cabinet Economic Growth and Infrastructure Committee, above n 22.

Chapter Four:

Regulating the Settlement Process – An Analysis of Stage Two Adoption on the NZX

The second stage of adoption challenges existing conventions by questioning the need for intermediaries altogether. As the previous chapters have demonstrated, regulators in New Zealand and comparable jurisdictions currently place their trust in these central institutions. If the financial marketplace is willing to accommodate a DLT platform that removes CCPs and CSDs, then a radical change in how we regulate would be required – namely, placing trust in DLT. An argument could be put forward that innovation necessitates this, thus repeating the regulatory transformation required “to take into account new market and technological paradigms” when the “move was made from paper-based to dematerialized securities”.¹⁶⁸ This approach would also pay homage to the FMC Act’s additional purpose to promote innovation.¹⁶⁹ With this in mind, the issues raised in this chapter’s analysis¹⁷⁰ can be encapsulated in a pivotal trade-off; namely, what are the risks associated with promoting innovation in the financial sector? Regulators must balance advancing technology against their responsibility to promote an efficient and sound financial system.¹⁷¹

This chapter begins by discussing the adoption of a DLT platform in New Zealand that would remove the need for intermediaries in NZX’s clearing and settlement. However, once consideration is given to the risks inherent in the stage two adoption of DLT, a more cautious approach, akin to that currently being adopted by the ASX, is recommended. Currently the risks outweigh the benefits of utilising DLT in a way that removes central and trusted intermediaries.

¹⁶⁸ FCA, above n 77, at 23.

¹⁶⁹ Financial Markets Conduct Act, s 4(d).

¹⁷⁰ The issues raised in this chapter from the adoption of DLT for securities settlement on the NZX are by no means exhaustive. The legal challenges identified and discussed are those that I consider DLT will encounter more immediately.

¹⁷¹ Financial Markets Conduct Act, s 4(d); Compare with Financial Markets Conduct Act ss 3(a) and 3(b).

A Impact on the settlement process and the inefficiencies that stage two adoption is attempting to reduce

Introducing a DLT platform that eliminates the need for NZC and NZD in NZX's clearing and settlement is possible, but is probably not realistic at this time. It envisions a critical mass of financial institutions (such as the current market participants) adopting DLT to carry out transactions, thus making clearing and settlement facilities redundant. It is likely this solution could initially be permissioned; that is to say, it would provide for access rights, and the identity of participants would typically be known to the network due to the security demands of the banking and finance industry.¹⁷² The main feature distinguishing this approach from stage one adoption would be the lack of a controlling entity with responsibility, since the DLT network would be accessible to a multitude of financial market players. Large financial institutions are already increasingly turning to consortiums to develop DLT infrastructure such as this.¹⁷³ However, it should be clarified that consortiums only seek to provide the technology rather than to perform the clearing and settlement functions in their own right.¹⁷⁴

This stage two solution could enable the benefits of DLT, outlined in Chapter One, to be achieved in the New Zealand securities settlement context, as they may not fully materialise with just the first stage of adoption whereby the existing tiered infrastructure remained. Removing the need for third party involvement in settling transactions relies on DLT's consensus mechanism to legally settle the transaction and confirm when title has passed. DLT would be entrusted with updating and preserving the integrity of the ledger, which is currently the role of clearing and settlement facilities today. Furthermore, DLT can "increase the speed of the entire settlement cycle from days to even minutes or seconds" eventually leading to continuous settlement.¹⁷⁵ On this basis (and provided DLT lives up to its reputation of impenetrability and operational resilience), the justification for traditional clearing and settlement facilities - that they limit counterparty and settlement risk - could be used against

¹⁷² ESMA, above n 132, at 8.

¹⁷³ Allens and Linklaters LLP, above n 75, at 6.

¹⁷⁴ Simpson, above n 73, at 79.

¹⁷⁵ Kakavand, De Seves and Chilton, above n 83, at [2.1.1].

them.¹⁷⁶ For every additional party involved in a transaction, the risk of that transaction being compromised increases.¹⁷⁷ In terms of regulatory reporting and compliance, the introduction of a DLT platform would enable financial institutions to use shared and aggregated data for due diligence and AML / CFT Act checks. However, the FCA noted that in practice this benefit may not materialise as historically regulated firms have been hesitant to outsource or share their AML responsibilities with other parties, including other regulated firms.¹⁷⁸

B The risks that stage two adoption presents

The risks that DLT introduces from a regulator's perspective stem largely from removing intermediaries who can enforce relevant standards, rules, and risk mitigation techniques. Instead these become replaced by an expectation of confidence and trust in a process. Without these central institutions, and the regulatory nexus of control, adherence to the FMA's and RBNZ's mandates becomes much more challenging. The legal risks presented by stage two adoption of DLT include operational risk, settlement failure and credit and liquidity risk, concern about confidence in the settlement process, and systemic risk. Each risk is now addressed in turn.

1 Operational risk

The new-found difficulty arising for regulators is that while the occurrence of operational glitches and failures may be lower with DLT, their impact is higher.¹⁷⁹ For example, an error in code or a cyber-attack on a DLT network may be easily spread over the entire system, affecting a greater number of nodes and individuals than a concentrated ledger.¹⁸⁰ The effect of an attack could be to revise recently settled transactions on the platform or to prevent current

¹⁷⁶ Simpson, above n 73, at 78.

¹⁷⁷ At 78.

¹⁷⁸ FCA, above n 77, at 16.

¹⁷⁹ ESMA, above n 132, at 18.

¹⁸⁰ Dirk Zetzsche, Ross Buckley and Douglas Arner *EBI Working Paper Series: The Distributed Liability of Distributed Ledgers – Legal Risks of Blockchain* (European Banking Institute, UNSWLRS 52, 2017) at 19.

and future transactions from being completed, thereby depriving consumers of access to financial services.¹⁸¹ Such a large-scale failure of a settlement system could result in the closing of the NZX, credit and liquidity losses by market participants,¹⁸² an undermining of the credibility of the financial services sector, and potentially cause systemic disruption to the broader economy.

Given that an operational failure occurring on a DLT network is potentially far more detrimental than when intermediaries exist, risk management strategies become all the more crucial. Currently, the RBNZ expects the operations of an intermediary's critical infrastructure provider to be held to the same standards as if it provided the service itself.¹⁸³ DLT, should therefore be held to equally high operational standards, yet there is no entity to assume responsibility. The absence of an intermediary ensuring operational resilience, enforcing business continuity procedures on its participants as well as settlement practices, such as T+2 (which can handle and account for errors and fraud before settlement is effected) is problematic.¹⁸⁴ Hence, there is a heightened need to be able to correct mistakes unless the DLT network is able to include additional functionalities, such as netting and delayed settlement, in order to comprehensively replace the technology underlying settlement systems.¹⁸⁵

In any case, DLT's decentralised structure presents additional operational risks because "no one is specifically tasked with responsibility" for "maintaining the functionality of FMIs".¹⁸⁶ Furthermore, the RBNZ and FMA currently lack sufficient crisis management powers to deal

¹⁸¹ Furthermore, a hacker may be able to access the information stored not only at the point of attack but the full breadth of information recorded on the ledgers. This has major implications for confidentiality and integrity of data, and while these are important, they are outside the scope of this dissertation; Angela Walch *The Bitcoin Blockchain as Financial Market Infrastructure: A Consideration of Operational Risk* (18 NYU Journal of Legislation and Public Policy 837, 2015) at 861-862.

¹⁸² International Monetary Fund *New Zealand: Regulation and Oversight of Financial Market Infrastructures – Technical note* (IMF Country Report no. 17/115, May 2017) at 15.

¹⁸³ Reserve Bank of New Zealand, above n 54, at 3.

¹⁸⁴ Bougas, above n 69, at 8.

¹⁸⁵ ESMA, above n 132, at 15.

¹⁸⁶ Walch, above n 181, at 874.

with the failure of FMIs running centralised ledgers.¹⁸⁷ In order to accommodate a stage two DLT platform, regulators may therefore need to direct regulatory powers in order to fill the gaps created by the removal of NZC and NZD. However, this may not be sufficient to alleviate concerns about the network’s operational resilience as DLT has not yet been sufficiently relied upon by financial market transactions that it can be unequivocally stated as impenetrable.¹⁸⁸

2 Settlement failure, credit and liquidity risk

The implementation of DLT, under stage two adoption, proposes real-time settlement where each transaction would be individually sent on a gross basis.¹⁸⁹ A consequence of this scenario is that NZC would no longer assume risk for participants through novation, and settlement practices such as netting would be eliminated. Proponents of DLT raise no legal objection to the removal of these functions on the basis that, in theory, liquidity and credit risks are no longer a concern. However, from a regulator’s perspective, it would be imprudent not to question this given that a failed DLT transaction could have disastrous consequences for the participants involved and possibly the wider financial system.

For instance, it is conceivable that settlement failures could occur whereby the cash leg of the transaction would be delivered, but not the securities leg (or vice versa) as a result of interoperability issues with legacy systems. In order to achieve real-time securities settlement, effectively streamlining the process into a single step, both the asset and the cash legs of the transaction need to be processed on the DLT network. It is unlikely that any government would permit fiat currency onto the ledger in the foreseeable future.¹⁹⁰ A “bridge” would be needed between the DLT network and the relevant legacy systems,¹⁹¹ for instance, interoperability with New Zealand’s ESAS cash settlement system. The European Central Bank considered that

¹⁸⁷ See generally Cabinet Economic Growth and Infrastructure Committee, above n 22; International Monetary Fund, above n 182.

¹⁸⁸ Simpson, above n 73, at 91.

¹⁸⁹ Committee on Payments and Market Infrastructures, above n 34.

¹⁹⁰ Hofmann, Strewe and Bosia, above n 3, at 55.

¹⁹¹ ESMA, above n 132, at 14.

current DLT solutions have not sufficiently demonstrated, to date, how the cash leg of securities transactions can be combined with the securities leg.¹⁹² Consequently, sufficient safeguards need to exist to protect the interests of participants when, or if, the process fails. The system would need to determine where liability fell for failed settlement given the absence of a central institution managing this risk.¹⁹³ Without such recourse for participants, confidence in the system would be tenuous.

3 *Confidence in the settlement process*

Instilling confidence in the settlement process, and consequently the financial market,¹⁹⁴ is a particularly pertinent issue. As a corollary of the risks identified earlier, if an error in coding or a cyber-attack resulted in the creation of fraudulent obligations, DLT may nevertheless legitimise the transaction. The current design of DLT is that, once validated, a transaction is irrevocable. The immutability of the ledger, while a key feature of DLT, removes any margin for error and can lead to losses without a recourse mechanism.¹⁹⁵ Therefore, recourse for participants would need to be clarified prior to any adoption of a stage two DLT platform. The options for recourse raise further, yet distinct, legal issues.

Firstly, if the transaction was legitimised, the DLT framework would need to be able to integrate a reversal framework which would return rights back to the participant who suffered the loss.¹⁹⁶ However, providing for reversibility goes against the immutable – and fundamental – characteristic of the technology. While immutability has clear benefits for permissionless networks, it appears ill-suited to securities settlement. The FCA endorsed incorporating

¹⁹² Andrea Pinna and Wiebe Ruttenberg *Occasional Paper Series: Distributed ledger technologies in securities post-trading: Revolution or evolution?* (European Central Bank, OCP No 177, April 2016) at 4; and European Central Bank *The potential impact of DLTs on securities post-trading harmonisation and on the wider EU financial market integration* (September 2017).

¹⁹³ See generally New Zealand Clearing Limited Clearing and Settlement Rules, rr 4.3 and 4.4.

¹⁹⁴ Financial Markets Conduct Act, s 3(a): to promote the confident and informed participation of businesses, investors, and consumers in the financial markets.

¹⁹⁵ Gabriel Callsen “Fintech, DLT and regulation” (2017) 45 *International Regulatory Digest* 58 at 60.

¹⁹⁶ This is how dispute resolution processes currently works in payment card systems and also in electronic funds transfer systems: World Bank Group *Distributed Ledger Technology (DLT) and Blockchain* (FinTech Note No. 1, 2017).

irreversibility into the ledger, in the view that recourse would be problematic or near impossible without reversal rights.¹⁹⁷ However, this calls enforceability into question, as it is not clear who would be responsible for flagging and correcting errors in accordance with a specified time frame and in compliance with the requirements of the financial market.¹⁹⁸

Secondly, an avenue for recourse for the party suffering loss would potentially be against the DLT infrastructure providers or consortium operators. However, it is likely that these technology providers would enter into contractual agreements similar to those currently used by the banking and finance industry software providers.¹⁹⁹ Thus, the provision of a DLT framework would be “without warranty of any kind, express or implied.”²⁰⁰ Such an outcome demonstrates how liability would fall primarily on the participants, unless modified by the DLT’s governance framework or where gross negligence on behalf of the operator no longer precludes their liability.

4 Systemic risk and the path forward for New Zealand

Risk of systemic disruptions to New Zealand’s financial system are heightened if credit, liquidity and operational risks are not properly managed by a well-designed and reliable system. From the RBNZ’s perspective, it is critical for a DLT system to ensure operational reliability, to guarantee delivery of securities and to coordinate actions in the event of a participant’s failure or a settlement failure. Clearly, as the analysis above identifies, the stage two adoption of DLT still has some way to go before it can effectively manage these risks and ensure participants’ confidence that the settlement process will be trustworthy.

So what should the path forward for New Zealand be? New Zealand’s regulatory approach to DLT must be cautious, precise and proportionate to properly address the technology’s risks and

¹⁹⁷ FCA, above n 155, at 12; The FCA discussed immutability in the context of digital currencies but the same reasoning applies to securities settlement.

¹⁹⁸ ESMA, above n 132, at 15.

¹⁹⁹ Simpson, above n 73, at 87.

²⁰⁰ At 87.

vulnerabilities.²⁰¹ Appreciation must also be given to the respective regulatory roles of the RBNZ and FMA currently. While the FMC Act provides that innovation should be promoted in financial markets,²⁰² allowing innovation to the extent offered by stage two adoption of DLT in securities settlement may unduly result in unmanageable risks. It may be that innovation is abandoned, or at least somewhat restrained, until DLT can demonstrate that it can adequately manage credit, liquidity and operational risks, and thus systemic risk. This is particularly critical given how closely interconnected financial institutions are, as was highlighted by the global financial crisis; a failure which saw the tightening of regulations internationally, unsurprisingly.²⁰³ With the financial stability mandate of the RBNZ in mind, it is justified to take a cautious approach and be wary of “worst-case scenarios” arising. Given that a flaw in DLT, or an inability to manage its risks, may result in the closing of the NZX, an approach aligned with the United Kingdom and Australia is warranted. The path forward for New Zealand may therefore ideally include the adoption of DLT gradually into NZX’s settlement system (on a stage one basis), a solution comparable to ASX’s utilisation of this technology, until the substantial benefits of the technology can materialise and the risks associated with it are addressed. Beyond this, DLT cannot yet be considered mature enough for inclusion into New Zealand’s settlement system.

C Accommodating stage two adoption – rethinking financial market regulation

While the trade-off is expected to favour financial stability and maintaining confidence in the system,²⁰⁴ it must be considered how a stage two DLT solution would be accommodated in the New Zealand financial marketplace in the alternative. The regulatory landscape in its entirety is at odds with a solution that requires trust in a process. NZC and NZD are only one part of the NZX, albeit a significant part, as this dissertation has emphasised. However, financial markets are multifaceted, involving various actors and participants.²⁰⁵ Therefore, regulation

²⁰¹ Allens and Linklaters LLP, above n 75, at 6.

²⁰² Financial Markets Conduct Act, s 4(d).

²⁰³ See generally Cabinet Economic Growth and Infrastructure Committee, above n 22.

²⁰⁴ Reserve Bank of New Zealand Act, s 156K; Financial Markets Conduct Act, s 3.

²⁰⁵ Gibbons, above n 16, at 11.

focuses on the responsibility of various entities²⁰⁶ to ensure the transparency and effectiveness of the trading process.²⁰⁷ The FMC Act regulates securities from when they are first offered to the public and provides a wider framework for conduct regulation relating to the trading of those securities.

In light of this, the original conception of DLT, the bitcoin blockchain protocol, was founded on an ethos of anti-regulation and anti-institutionalism. However, since bitcoin's inception, DLT has demonstrated it has various data structures, some of which can be reconciled with regulatory frameworks and demands - as the stages of adoption analysis highlighted earlier. Yet, replacing centralised institutions with trust in a DLT process that was not designed for regulation presents a major tension. Regulators do not "trust" markets will work, the FMA and RBNZ entrust *multiple* intermediaries and participants to "keep the engines of industry turning", so to speak.²⁰⁸ Thus, in order to accommodate stage two DLT innovation, a marked shift would be required in how financial markets, in general, are regulated.

²⁰⁶ For example, licensed share brokers, listed issuers and financial advisers; Gibbons, above n 16, at 11; and Financial Markets Conduct Act, s 3(a).

²⁰⁷ Griffiths, above n 10, at 1165.

²⁰⁸ Evan Mackenzie Jones "Has the Supreme Court Turned and Waved Goodbye to the Essence of the New Zealand Securities Regime? – An Analysis of the Purposes Underpinning Securities Market Regulation in New Zealand" (LLB (Hons) Dissertation, University of Otago, October 2013) at [11].

Conclusion

The central focus of this dissertation has been on whether New Zealand regulators are able to trust the process that DLT adoption would bring, or whether regulated intermediaries are essential to securities settlement on the NZX. Such an inquiry involves a trade-off between risks, innovation, and stability, along with close scrutiny of the respective mandates of the FMA and RBNZ. The extent to which DLT would be used (that is, at which stage it would be adopted) is pivotal to this trade-off. The perceived advantages of DLT, such as immutable record keeping and the speed of settlement, are features that are particularly attractive for securities settlement going forward. The ASX has taken the lead internationally in planning to use the technology, within the next three years, to improve its existing financial market infrastructure for the Australian equity market. This demonstrates how rapidly DLT is developing. New Zealand should not ignore this innovation by its closest neighbor and should no longer remain silent on the DLT issue in the securities settlement context. It would be prudent for New Zealand regulators to closely monitor the process for, and the effectiveness of, ASX's introduction of a DLT platform in 2021. We can capitalise on this Australian experience to better inform similar developments here.

While there is arguably scope for adoption of a solution comparable to the ASX's platform on the NZX, it is unlikely that our regulators would go so far as to accept a DLT platform that removed central intermediaries. At this time, this is a clearly justified and advisable position to hold. Clearing and settlement facilities are effectively the 'plumbing' of financial markets. To this end, regulators rely on intermediaries to maintain a sound and efficient settlement system, which is a precondition to a well performing financial system. Thus, erring on the side of caution, consistent with the approaches of the United Kingdom and Australia, is warranted since an operational failure, or DLT's inability to ensure settlement, could cause widespread disruption to New Zealand's financial system. DLT has not yet proven that regulators and participants can trust it will guarantee delivery of securities. However, this does not mean the need to consider this form of disruption in the securities settlement environment should be avoided. Ultimately, interoperability with the applicable regulatory frameworks is key to

DLT's mainstream adoption. The NZX will ultimately need the explicit blessing of the FMA and RBNZ before it employs DLT, in *any* form.

Regardless of whether the use of DLT in New Zealand's securities settlement system is initially modelled on the approach being adopted by the ASX, or whether our regulators consider that DLT is not yet ready for inclusion into the New Zealand financial marketplace in any respect, a response from the FMA and RBNZ is recommended on this issue. The regulatory landscape surrounding DLT requires greater clarity here and New Zealand urgently needs to come up to speed with international developments on this cutting-edge issue. Commencement of a robust investigation into the adoption of a DLT platform is a necessary and critical step forward for New Zealand.

Bibliography

A *Legislation and Regulations*

1 *New Zealand*

Anti-Money Laundering and Countering Financing of Terrorism Act 2009

Financial Markets Conduct Act 2013

Reserve Bank of New Zealand Act 1989

2 *Australia*

Corporations Act 2001 (Cth)

3 *United Kingdom*

Financial Markets and Insolvency (Settlement Finality) (UK) Regulations 1999

Financial Services and Markets Act (UK) 2000

Financial Services and Markets Act 2000 (Recognition Requirements for Investment Exchanges and Clearing Houses) Regulations (UK) 2001

4 *European Union*

Directive (EU) 98/26/EC on Settlement Finality in Payment and Securities Settlement Systems [1998] OJ L166.

Directive 2004/39/EC on Markets in Financial Instruments [2004] OJ L145.

Directive 2014/65/EU on Markets in Financial Instruments II [2014] OJ L137/349.

Regulation (EU) 648/2002 on OTC derivatives, central counterparties and trade repositories [2012] OJ 201/1.

Regulation (EU) No 909/2014 on central securities depositories [2014] OJ L257.

B *Books and chapters in books*

Alex Tapscott and Don Tapscott *Blockchain Revolution: How the technology behind Bitcoin is changing money, business, and the world* (Penguin, New York, 2016).

Brad Smith and Harry Shum *The Future Computed: Artificial Intelligence and its role in society* (Microsoft Corporation, Washington, 2018).

Erik Hofmann, Urs Magnus Strewe and Nicola Bosia *Supply Chain Finance and Blockchain Technology: The case of reverse securitisation* (Springer International Publishing, Cham (Switzerland), 2018).

Mark Walport (UK Government Chief Scientific Adviser) *Distributed Ledger Technology: Beyond block chain* (Government Office for Science, 2016, GS/16/1).

Shelley Griffiths “The Financial Markets Authority” in John Farrar and Susan Watson (ed) *Company and securities law in New Zealand* (2nd ed, Brookers Ltd, Wellington, 2013) 1033.

Shelley Griffiths “The Secondary Market” in John Farrar and Susan Watson (ed) *Company and securities law in New Zealand* (2nd ed, Brookers Ltd, Wellington, 2013) 1126.

Thomas Gibbons “Purpose and Principles of Securities Regulation” in Victoria Stace (ed) *Financial Markets Conduct Regulation a Practitioner’s Guide* (LexisNexis, Wellington, 2013) 3.

C *Journal Articles*

Alexis Collomb and Klara Sok “Blockchain / Distributed Ledger Technology (DLT): What Impact on the Financial Sector?” (2016) 103 *Digiworld Economic Journal* 93.

Angela Walch “The Bitcoin Blockchain as Financial Market Infrastructure: A Consideration of Operational Risk” (2015) 18 *NYU Journal of Legislation and Public Policy* 837.

Annabelle Simpson “Australian Regulation of Blockchain and Distributed Ledger Technology in Banking and Finance” (2018) 29 *JBFLP* 73.

Gabriel Callsen “Fintech, DLT and regulation” (2017) 45 *International Regulatory Digest* 58.
Lawrence Trautman “Is Disruptive Blockchain Technology the Future of Financial Services?” (2016) 14 *Quarterly Report* 242.

Loretta DeSourdy “New legislation on netting and payments finality” (1996) 62 *RBNZ Bulletin* No. 2 61.

Nino Odorisio “ASIC and ASX hot on distributed ledger technology” (2017) 69 *Governance Directions* No. 4 225.

Stephane Blemus “Law and Blockchain: A legal perspective on Current Regulatory Trends Worldwide” (2018) 14 *RTDF* 1.

D Parliamentary and Government Materials

Cabinet Domestic Policy Committee “Policy Review of New Zealand’s Approach to Clearing and Settlement” (2008) CAB Min (08) 30/10.

Cabinet Economic Growth and Infrastructure Committee “An enhanced oversight framework for financial market infrastructures” (4 May 2017).

E Papers and Reports

Allen and Overy *The Financial Conduct Authority: An Overview* (2013).

Andrea Pinna and Wiebe Ruttenberg *Occasional Paper Series: Distributed ledger technologies in securities post-trading: Revolution or evolution?* (European Central Bank, OCP No 177, April 2016).

Arthur Cox *Proposal for Standardisation of Blockchain and Electronic Distributed Ledger Technologies* (February 2017).

ASX *ASX’s Replacement of CHESSE for Equity Post-Trade Services: Business Requirements – Consultation Paper* (September 2016).

ASX *CHESSE Replacement: New Scope and Implementation Plan – Consultation Paper* (April 2018).

ASX *CHESSE Replacement: New Scope and Implementation Plan – Response to consultation feedback* (September 2018).

Australian Securities and Investment Commission (ASIC) *Information Sheet 219: Evaluating Distributed Ledger Technology* (2017).

Bank for International Settlements *Cross-border securities settlements* (March 1995).

Bank for International Settlements *Real-time Gross Settlement Systems* (March 1997).

Committee on Emerging Risks *IOSCO Research Report on Financial Technologies (Fintech)* (International Organization of Securities Commissions, February 2017).

Committee on Payment and Settlement Systems *Payment Systems in the United Kingdom* (Bank for International Settlements, CPMI 53, April 2003).

Committee on Payment and Settlement Systems *Payment, clearing and settlement systems in the United Kingdom* (Bank for International Settlements, CPMI 105, November 2012).

Committee on Payments and Market Infrastructures *Distributed ledger technology in payment, clearing and settlement – an analytical framework* (Bank for International Settlements, 27 February 2017).

Council of Financial Regulators *Review of Competition in Clearing Australian Cash Equities: Conclusions* (June 2015).

David Mills and others *Distributed ledger technology in payments, clearing and settlement* (Finance and Economics Discussion Series 2016-095, 2016).

Dirk Zetsche, Ross Buckley and Douglas Arner *EBI Working Paper Series: The Distributed Liability of Distributed Ledgers – Legal Risks of Blockchain* (European Banking Institute, UNSWLRS 52, 2017).

Euroclear and Oliver Wyman *Blockchain in Capital Markets: The Prize and the Journey* (Euroclear and Oliver Wyman, February 2016).

European Central Bank *The potential impact of DLTs on securities post-trading harmonisation and on the wider EU financial market integration* (September 2017).

European Securities and Markets Authority *Discussion Paper: The Distributed Ledger Technology Applied to Securities Markets* (ESMA/2016/773, June 2016).

European Securities and Markets Authority *Report: The Distributed Ledger Technology Applied to Securities Markets* (ESMA50-1121423017-285, February 2017).

Financial Conduct Authority *Discussion Paper on distributed ledger technology* (Financial Conduct Authority, Discussion paper 17/3, April 2017).

Financial Conduct Authority *Distributed Ledger Technology: Feedback Statement on Discussion Paper 17/03* (FS17/4, December 2017).

Financial Conduct Authority *Markets in Financial Instruments Directive II Implementation – Policy Statement II* (PS17/14, July 2017).

Financial Industry Regulatory Authority *Distributed Ledger Technology: Implications of Blockchain for the Securities Industry* (January 2017).

Financial Markets Authority *Regulatory response guidelines* (August 2016).

Financial Markets Authority *Strategic risk outlook* (2017).

Financial Markets Law Committee *Distributed Ledger Technology and Governing Law: Issues of Legal Uncertainty* (March 2018).

Grant Spencer (Deputy Governor and Head of Financial Stability) *Regulatory Impact Statement: An Enhanced Oversight Framework for Financial Market Infrastructures* (Reserve Bank of New Zealand).

International Monetary Fund *New Zealand: Regulation and Oversight of Financial Market Infrastructures – Technical note* (IMF Country Report no. 17/115, May 2017).

International Monetary Fund *United Kingdom: Supervision and systemic risk management of financial market infrastructures – Technical note* (IMF Country Report no. 16/156, June 2016).

Jeroen van Oerle and Patrick Lemmens *Distributed ledger technology for the financial industry: blockchain administration 3.0* (ROBECO, May 2016).

Josh Stark *Applications of Distributed Ledger Technology to Regulatory & Compliance Processes* (R3 Reports, 2017).

Markus Brunnermeir and others *The Fundamental Principles of Financial Regulation* (ICMB, 2009).

Nick Clarke and Gavin Barnett *Four Scenarios for Blockchain in Capital Markets* (GBST, Discussion paper, 20 April 2016).

Phoebus Athanassiou *Impact of digital innovation on the processing of electronic payments and contracting: an overview of legal risks* (Legal Working Paper Series No 16, European Central Bank, October 2017).

Sarah Meiklejohn *Top Ten Obstacles Along Distributed Ledger's Path to Adoption* (R3 Report, 2017).

World Bank Group *Distributed Ledger Technology (DLT) and Blockchain* (FinTech Note No. 1, 2017).

Xiaohang Zhao and others *Cross-Border Settlement systems: Blockchain models involving Central Bank Money* (R3 Reports, 2018).

F Theses and research papers

Emily Fry “Blockchain Innovation and Securities Regulation: An Analysis of Initial Coin Offerings under the Financial Markets Conduct Act 2013” (LLB(Hons) Dissertation, University of Otago, October 2017).

Evan Mackenzie Jones “Has the Supreme Court Turned and Waved Goodbye to the Essence of the New Zealand Securities Regime? – An Analysis of the Purposes Underpinning Securities Market Regulation in New Zealand” (LLB (Hons) Dissertation, University of Otago, October 2013).

Michelle Bougas “How Distributed Ledger Technology is Transforming the Financial Marketplace” (Master of Science in Economic Crime Management Thesis, Utica College, 2016).

G Internet Resources

Allens and Linklaters LLP “Blockchain Reaction” (2017) Allens
<www.allens.com.au/general/forms/pdf/blockchainreport.pdf>.

Basel Committee on Banking Supervision “Basel III: A global regulatory framework for more resilient banks and banking systems” (December 2010 (rev June 2011)) Bank for International Settlements <www.bis.org/publ/bcbs189.pdf>.

Committee on Payments and Market Infrastructures and the Technical Committee of the International Organization of Securities Commissions “Principles for financial market infrastructures” (April 2012) Bank for International Settlements <www.bis.org/cpmi/publ/d101a.pdf>.

Financial Conduct Authority, Bank of England and the Prudential Regulation Authority “Memorandum of Understanding between the Financial Conduct Authority and the Bank of England, including the Prudential Regulation Authority” Financial Conduct Authority <www.fca.org.uk/publication/mou/mou-bank-pra.pdf>.

Financial Markets Authority “Designated settlement systems”
<www.fma.govt.nz/compliance/licensed-providers/designated-settlement-systems/>.

Financial Markets Authority and the Reserve Bank of New Zealand “Memorandum of Understanding” (9 September 2011) Reserve Bank of New Zealand <www.rbnz.govt.nz/-/media/ReserveBank/Files/Publications/MoU/4525498.pdf>.

Financial Markets Authority and the Reserve Bank of New Zealand “The Designation and Oversight of Designated Settlement Systems” (March 2015) Reserve Bank of New Zealand <www.rbnz.govt.nz/-/media/ReserveBank/Files/regulation-and-supervision/financial-market-infrastructure-oversight/the-designation-and-oversight-of-designated-settlement-systems-dss1.pdf?la=en>.

Hossein Kakavand, Nicolette De Sevres and Commissioner Bart Chilton “The Blockchain Revolution: An Analysis of Regulation and Technology Related to Distributed Ledger Technologies” (2017) SSRN <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2849251>.

International Organisation for Standardisation Technical Committee 307 “ISO/TC 307: Blockchain and distributed ledger technologies” International Organisation for Standardisation <www.iso.org/committee/6266604.html>.

Kenny McIver “From the internet of information to the internet of value” (July 2016) I-CIO <www.i-cio.com/big-thinkers/don-tapscott/item/from-the-internet-of-information-to-the-internet-of-value>.

London Stock Exchange “For Traders and Brokers: Rules and Regulations” <www.londonstockexchange.com/traders-and-brokers/rules-regulations/rules-regulations.html>.

Mark Carney (Governor of the Bank of England) “The promise of Fin Tech – something new under the sun?” (25 January 2017) Bank of England <www.bankofengland.co.uk/publications/Documents/speeches/2017/speech956.pdf>.

NZX “About NZX Clearing” <www.nzx.com/services/nzx-clearing/about>.

NZX “NZX Clearing: Rules and Regulation” <www.nzx.com/services/nzx-clearing/rules-and-regulation>.

Reserve Bank of Australia “Memorandum of Understanding” <www.rba.gov.au/media-releases/2002/mr-02-08.html>.

Reserve Bank of New Zealand “Designated settlement systems FAQs” Reserve Bank of New Zealand <www.rbnz.govt.nz/faqs/designated-settlement-systems-faqs>.

Reserve Bank of New Zealand “ESAS/RTGS overview” (July 2012) <www.rbnz.govt.nz/markets-and-payments/esas/esas-rtgs-overview>.

Reserve Bank of New Zealand “Oversight of Financial Market Infrastructures in New Zealand (FMI1)” (March 2015) <www.rbnz.govt.nz/-/media/ReserveBank/Files/regulation-and-supervision/financial-market-infrastructure-oversight/oversight-of-financial-market-infrastructures-in-new-zealand.pdf?la=en>.

F Newspaper and Magazine Articles

Alex Sims “Forget Bitcoin, Blockchain is a gamechanger” *The New Zealand Herald* (New Zealand, 17 December 2017).

Darryn Pollock “The mess that was Mt. Gox: four years on” *Coin Telegraph* (9 March 2018) <<https://cointelegraph.com/news/the-mess-that-was-mt-gox-four-years-on>>.

Julia Kollewe “Bitcoin price plunges after cryptocurrency exchange is hacked” *The Guardian* (United Kingdom, 11 June 2018) <www.theguardian.com/technology/2018/jun/11/bitcoin-price-cryptocurrency-hacked-south-korea-coincheck>.

Michael del Castillo “Reality Check: ASX Delays DLT Launch Amid User Concerns” (4 September 2018) Forbes <www.forbes.com/sites/michaeldelcastillo/2018/09/04/reality-check-asx-delays-dlt-launch-amid-user-concerns/#322c5a7c2371>.

H Other Sources

London Stock Exchange *MIT201 – Guide to the Trading System* (2016).

New Zealand Clearing Limited Clearing and Settlement Procedures 2016.

New Zealand Clearing Limited Clearing and Settlement Rules 2015.

New Zealand Depository Limited Depository Operating Rules 2015.

NZC Clearing *TCS BaNCS Overview* (NZX, 2016).

NZX Clearing *Clearing House Overview* (NZX, 2016).

NZX Clearing *Depository Overview* (NZX, 2016).

NZX *Guide to becoming a Clearing Participant* (2014).

NZX *Guide to becoming a NZX Participant* (2016).

NZX Limited Participant Rules 2017.

Reserve Bank of New Zealand (Designated Settlement System – NZCDC) Amendment Order 2017.

Rules of the London Stock Exchange 2018.

Satoshi Nakamoto Bitcoin: A Peer-to-Peer Electronic Cash System (2008).

Toby Fiennes “The Reserve Bank, cyber security and the regulatory framework” (19 July 2017) Reserve Bank of New Zealand <www.rbnz.govt.nz/research-and-publications/speeches/2017/speech-2017-07-19>.

UNCITRAL Working Group IV (Electronic Commerce) *Model Law on Electronic Transferable Records* 54th sess UN Doc A/CN.9/920 (13 July 2017).

Wayne Byres “Global Consistency in Financial Regulation: Is the glass half full, half empty, or just more transparent?” (Speech to the RiskMinds Risk and Regulation Forum, Nice, France, 10 September 2013).