

**THE INFLUENCE OF INSTITUTIONAL
PRESSURES AND SOCIAL CAPITAL ON
BLOCKCHAIN TECHNOLOGY DIFFUSION IN
MALAYSIAN AGRICULTURE AND FOOD
SUPPLY CHAIN: THE MODERATING ROLE OF
SOCIAL NETWORKS**

MUHAMMAD FAHAD ANWAR

UNIVERSITI SAINS MALAYSIA

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SOCIAL NETWORKS**

by

MUHAMMAD FAHAD ANWAR

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LIST OF ABBREVIATIONS

AFSC	Agricultural and Food Supply Chain
BCT	Blockchain Technology
CB-SEM	Covariance Based - Structural Equation Modeling
CFA	Confirmatory Factor Analysis
CMCO	Conditional Movement Control Order
CMV	Common Method Variance
CP	Coercive Pressure
DLT	Distributed Ledger Technology
DOI	Diffusion of Innovation (Theory)
DOSM	Department of Statistics Malaysia
LV	Latent Variables
MCO	Movement Control Order
MM	Mimetic Motives
NP	Normative Practices
OECD	Economic Co-operation and Development
PLS	Partial Least Squares
PLS-SEM	Partial Least Squares – Structural Equation Modelling
SC	Supply Chain
SDGs	Sustainable Development Goals
SEM	Structural Equation Modeling
SG	Shared Goals
SI	Social Influence
SLR	Systematic Literature Review
SN	Social Network
TI	Trust Institutional
TOE	Technology, Organization and Environment (Theory)
TP	Trust Interpersonal
TR	Trust Reciprocity
TT	Trust Technology

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**PENGARUH TEKANAN INSTITUSI DAN MODAL SOSIAL TERHADAP
PENYEBARAN TEKNOLOGI BLOCKCHAIN DALAM PERTANIAN DAN
RANTAIAN BEKALAN MAKANAN DI MALAYSIA: PERANAN
MODERASI RANGKAIAN SOSIAL**

ABSTRAK

Konvensional pertanian dan rantai bekalan makanan (AFSC) mengalami kebimbangan seperti keselamatan makanan, sisa makanan, kecekapan operasi, kejadian penipuan makanan, kebolehkesanan dan banyak lagi. Kebimbangan ini wujud disebabkan kekurangan kebolehkesanan, ketelusan, pendigitalan dan kesalinghubungan merentas AFSC. Selain itu, peristiwa COVID-19 baru-baru ini telah memaksa syarikat menggunakan penyelesaian pendigitalan untuk mengekalkan operasi perniagaan. Walaupun kebanyakan perniagaan kembali kepada amalan sedia ada setelah merasakan kelonggaran dalam kesusahan pandemik, ini membayangkan sistem yang diterima pakai tidak memenuhi keperluan syarikat AFSC. Sebagai tindak balas, penyelidik menganjurkan penggunaan teknologi blockchain (BCT) untuk membuka kunci keupayaan kebolehkesanan dan ketelusan serta menawarkan platform selamat untuk pendigitalan. Walaupun manfaat BCT untuk menambah baik AFSC, penggunaannya masih di peringkat awal. Oleh itu, kajian ini bertujuan untuk meningkatkan penyebaran BCT dalam AFSC di Malaysia dengan menilai pengaruh teori modal sosial dan teori institusi. Selain itu, kebanyakan kajian terdahulu terutamanya tertumpu pada niat untuk menerima pakai dan kajian ini meluaskan skop dan menambah dua peringkat sebelumnya pencarian pengetahuan dan penilaian ciri-ciri inovasi yang dirasakan. Objektif penyelidikan utama adalah untuk mengenal pasti penentu penting bagi setiap peringkat penyebaran BCT dan mengkaji peranan penyederhana rangkaian sosial dalam hubungan berasaskan kepercayaan. Teknik

pensampelan berstrata telah digunakan untuk mengumpul data daripada 253 syarikat yang beroperasi merentasi pelbagai segmen rantai bekalan makanan pertanian Malaysia. Pendekatan kuantitatif digunakan dan data dianalisis menggunakan PLS-SEM. Daripada penemuan untuk peringkat pertama penyebaran BCT (pencarian pengetahuan), motif mimetik, pengaruh sosial, dan timbal balik kepercayaan didapati signifikan. Untuk tahap dua (ciri inovasi yang dirasakan), teknologi kepercayaan adalah penentu dominan. Peringkat ketiga (niat untuk menerima pakai) mendapati motif mimetik, amalan normatif, pengaruh sosial, matlamat bersama, dan institusi kepercayaan adalah penentu yang signifikan. Lebih-lebih lagi, ini diuji jika rangkaian sosial sebagai moderator mempunyai kecenderungan untuk mengubah aspek kepercayaan. Dalam hubungan penyederhanaan ini, rangkaian sosial menyederhanakan dengan ketara perhubungan antara timbal balik kepercayaan dan perkongsian pengetahuan, teknologi amanah dan ciri inovasi yang dirasakan, dan kepercayaan interpersonal dan niat untuk menerima pakai. Sumbangan teori utama kajian ialah, perspektif baru penyebaran BCT dengan menilai penentu penting tekanan institusi dan modal sosial untuk setiap peringkat penyebaran. Manakala, kebaruan kajian ini terletak pada pendekatan multidimensi terhadap kepercayaan, yang dikaji melalui empat bentuk yang berbeza; kepercayaan kepada institusi, kepercayaan kepada teknologi, kepercayaan berdasarkan timbal balik, dan kepercayaan interpersonal, dan penilaian tentang cara rangkaian sosial menyederhanakan hubungan antara dimensi kepercayaan ini dan penggunaan blockchain. Kajian ini juga menyediakan pelbagai implikasi praktikal untuk keseluruhan sistem AFSC, matlamat peringkat kebangsaan, dan implikasi terperinci untuk pembuat dasar, syarikat teknologi dan pengamal.

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MODERATING ROLE OF SOCIAL NETWORKS**

ABSTRACT

The conventional agriculture and food supply chain (AFSC) suffers from concerns such as food security, food waste, operational inefficiency, instances of food fraud, and lack of traceability, among others. These concerns exist due to a lack of traceability, transparency, digitalization, and interconnectedness across AFSC. In addition, the recent COVID-19 pandemic has forced companies to adopt digitalization solutions to sustain their business operations. While most businesses reverted to existing practices once the pandemic's adversities eased, this implies that the adopted system does not meet the needs of AFSC companies. In response, researchers advocated for the use of blockchain technology (BCT) to unlock the capabilities of traceability and transparency, as well as to offer a secure platform for digitalization. Despite the benefits of BCT in improving AFSC, its usage is still in the infancy stage. Therefore, this study aims to increase the diffusion of BCT in the Malaysian AFSC by assessing the influence of social capital theory and institutional theory. Also, most previous studies have particularly focused on intention to adopt, and this study extends the scope by adding two preceding stages: knowledge seeking and evaluation of perceived innovation characteristics. The key research objectives are to identify the significant determinants of each BCT diffusion stage and examine the moderating role of social networks in trust-based relationships. A convenience sampling technique was used to collect data from 253 companies operating across various segments of the Malaysian agri-food supply chain. A quantitative approach is employed, and the data

are analyzed using PLS-SEM. From the findings for the first stage of BCT diffusion (knowledge seeking), the mimetic motive, social influence, and trust reciprocity are found to be significant. For stage two (perceived innovation characteristics), trust technology is the dominant determinant. The third stage (intention to adopt) found that mimetic motive, normative practices, social influence, shared goals, and trust in institutions are significant determinants. Moreover, this tested whether the social network as a moderator has a tendency to change the facets of trust. In this moderation relation, social networks significantly moderate the relationships between trust and reciprocity, trust and knowledge sharing, trust and perceived innovation characteristics, and trust and interpersonal intention to adopt. The theoretical contribution of this study is a fresh perspective on BCT diffusion, assessing the significant determinants of institutional pressure and social capital for each diffusion stage. While, the novelty of this study lies in its multidimensional approach to trust, which is examined through four distinct forms; trust in institutions, trust in technology, trust based on reciprocity, and interpersonal trust, and the assessment of how social networks moderate the relationships between these trust dimensions and blockchain adoption. The study also provides various practical implications for the AFSC system as a whole, national-level goals, and detailed implications for policymakers, technology companies, and practitioners.

CHAPTER 1

INTRODUCTION

1.1 Introduction

The chapter first elucidates the research background and problem statement about the use of blockchain technology (BCT) in the agricultural and food supply chain (AFSC) in Malaysia. Next, the research question and objectives are formulated. After that, the significance and purpose of this study are written. Finally, the definition of key terms is followed by an outline of the forthcoming chapters.

1.1.1 Agriculture and Food Supply Chains (AFSC)

The AFSC is a foundational block for feeding humans in society. Because it enables the development of a farm-to-fork cycle by connecting the function of agriculture and the food sector, starting from 1) pre-production raw materials arrangement, 2) production, 3) post-production handling, packaging and processing, 4) warehousing, 5) transportation, until 6) retailers and consumers. The AFSC is responsible for integrating the farm-to-fork cycle in three transactional ways: information sharing, physical goods, and payments (Aday & Aday, 2020; Kamilaris et al., 2019). If the information is not shared in AFSC, it would result in a shortage or surplus of commodities in the market. Consequently, the excess supply causes waste, shortages, and impacts prices, leading to chaos in the market and hunger. The physical goods require AFSC to maintain quality (freshness, contamination, correct labelling, quantity, etc.), storage (where needed) and delivery to retailers and consumers. In return for physical delivery, the AFSC ensures payment processing between buyers and sellers according to agreed-upon (S. A. R. Khan et al., 2022; Ryan, 2016). Despite the availability of modern technologies, in most parts of the world, the AFSC has traditionally followed conventional systems, such as physical markets, numerous

intermediaries, and low modernization (Balaji & Arshinder, 2016; N. L. Ma et al., 2021; Özkan, 2021). As a result, during the COVID-19 pandemic, agriculture and food management were the biggest challenges for countries around the world. The situation demanded making AFSC more resilient to deal with the adversities of the COVID-19 and post-COVID-19 era, as well as enabling it to respond to relevant disruptions in the future.

1.2 Background of the Study

Globally, AFSC faces several pressing concerns. These include challenges related to food security, food waste, operational efficiency, instances of food fraud, traceability, and optimal use of collaborative resources. These problems have a significant impact on society as a whole. Moreover, the recent occurrence of the disruptive phenomenon known as COVID-19 has exacerbated the challenges and burdens faced by nations in ensuring the provision of sustenance for their people. Malaysia also faced similar concerns in managing the food supply to its society. Many researchers believed the use of technologies would potentially improve the overall efficiency of AFSC. One such initiative is BCT, which has the potential to address supply disruptions and other chronic issues, such as food waste, security, and safety along the AFSC. The following subsections further highlight and discuss how the Malaysian AFSC was affected during COVID-19, as well as how the application of BCT would help overcome the adversities of COVID-19 and establish a resilient post-COVID-19 system that can absorb any future incidents and prevailing issues in the AFSC.

1.2.1 Malaysian AFSC During COVID-19

In 2020, a novel virus named COVID-19 emerged, affecting societies worldwide. Due to the contagious nature of the virus, both national and international-level institutions and regulators have announced the need to follow health protocols, such as health screening, avoiding social or face-to-face interaction, and implementing travel and trade restrictions. As a result of COVID-19, not only the general public but also commercial activities were disrupted. Among these commercial activities, the supply chain (SC) is indispensable for society, as it manages to deliver food and agricultural commodities for household consumption (N. L. Ma et al., 2021; Özkan, 2021).

According to the Organization for Economic Co-operation and Development (OECD) (2020), the AFSC has been impacted globally by COVID-19, which has disrupted the entire farm-to-fork cycle, comprising agricultural production, processing, warehousing, logistics, consumer demand, and retail operations. OECD further reported that interruptions are different for countries or regions and stem from country-specific regulations (movement restrictions, temporary shutdown, restriction of business hours, closure of international trade, etc.) put in place to stop the transmission of diseases (COVID-19) into the society (Aday & Aday, 2020). The regulations have led to shocks in the supply, demand, and production of agricultural and food commodities (Ali et al., 2022). Because in AFSC, the farm-to-fork activities are time sensitive (e.g., processes lead time, product useful/shelf life) and considered an important indicator of food loss and waste prevention (Steuer et al., 2016), supply disruption (M. H. Ali, Suleiman, et al., 2021) and panic market conditions (Amirudin & Gim, 2019). Also, the role of intermediaries or middlemen made the AFSC complex and less integrated. Moreover, the COVID-19 protocols restricted all business

stakeholders, including AFSC entities, to limited physical movement to avoid virus contamination in society Dixon et al., 2021).

In the Malaysian context, the situation with AFSC and the implications of COVID-19 were quite similar to those in many other countries. The Malaysian government also imposed COVID-19 restrictions and lockdowns to break the chain of the deadly virus. These orders, namely the movement control order (MCO), conditional movement control order (CMCO), and recovery movement control order (RMCO), had slightly different SOPs, as shown in Table 1.1 where the MCO was the strictest among all restriction and the intensity gets lower for CMCO and RMCO respectively. The enforcement of MCO was stricter throughout the country, first regulated on 18th March, 2020 and considered effective in breaking the chain (Tang, 2022). In the wake of the pandemic's impact on the agriculture sector, pricing and food security have become more crucial (Department of Statistics Malaysia (DOSM), 2021). According to The World Bank (2020), during the pandemic, compliance with COVID-19 restrictions has generated significant volatility in food markets in Malaysia. The report further stated that movement control restrictions have generated many lags in AFSC activities. For example, the pandemic results in a rise in food prices because of panic-buying, supply chain disruptions and MCO (EDP, 2020). The panic buying behavior is similar to the study by Amirudin and Gim (2019), which found that consumers tend to buy in excess, or exhibit the panic buying phenomenon, when they perceive difficulty in accessing food sources.

Table 1.1 COVID-19 restriction orders in Malaysia

Source: (MahWengKwai & Associates, 2021)

Restriction orders	Timeline	No social gatherings	Restrict movements	Closure of institutions and businesses
--------------------	----------	----------------------	--------------------	--

Movement control order (MCO)	Regulation 1 18/03/2020 to 31/03/2020	✓	✓*	✓*
			* Except for moving to buy life necessity goods and services, food, and healthcare	* Except those involved in life necessities; food, utilities, banks, healthcare, security and defence
	Regulation 2 01/04/2020 to 14/04/2020	✓	✓*	✓*
			* Reduced movement (for the exception condition in regulation 1) to within a radius of 10km from the place of residence, and not allowed to accompany another person	* Required authorization letter to move workplace for those involved in life necessity goods production and services
	Regulation 3 15/04/2020 to 28/04/2020	✓	✓	✓
	Regulation 4 29/04/2020 to 03/05/2020	✓	✓*	✓
			* Single traveler restrictions lifted for buying life necessities	
Conditional movement control order (CMCO)	Regulation 5 4.5.2020 to 12.5.2020	✓	✓*	✓*
			* Restrictions limited to international and written letters required from the Police for movement other than fulfilling necessities	* Closure limited to tourism, leisure, recreational, filming, saloon and barber shops
Recovery movement control order (RMCO)	Regulation 6 13/05/2020 to 09/06/2020	X*	X*	X
		* House visits and gatherings allowed compliance with the directives of local notifications	* Travel modes operate with 50% space/passengers to comply with social distancing	
	Amendment of Regulation 6 on 22/05/2022	X*	X*	X
		* Mostly allowed, but comply with local directives	* Lifted tourism ban and minimum passenger restriction for all	

			modes of transportation	
	Regulation 7	X*	X*	X*
	10/06/2020	* No social	* Restrictions on	* Limited to
	to	gatherings,	movement, which	necessity goods and
	31/12/2020	where	the local	services, where
		imposed by	government	imposed by local
		the local	imposed due to	government due to
		government	active cases	active cases
		due to active		
		cases		

Research published by the Malaysian Agricultural Research and Development Institute (MARDI) (2021) in FFTC-AP (Food and Fertilizer Technology for the Asian and Pacific Region) indicates that the agricultural sector faced severe distribution and marketing hurdles (Table 1.2) during MCO and CMCO in Malaysia (MARDI, 2021). They further investigated that during MCO, 68.8% of AFSC entities (also referred to as business partners/stakeholders and AFSC companies) switched to online platforms to gain market accessibility. Surprisingly, the majority (60%) of AFSC entities returned to conventional practices once the MCO was replaced with CMCO (conditional movement control order). This situation concludes the ineffectiveness of existing online platforms.

Table 1.2 Hurdles in marketing and distribution during COVID-19

Source: (MARDI, 2021)

Hurdles	MCO	CMCO
Limited market	57.8%	21%
Transportation and distribution	12.5%	15.2%
Costs increase	12.2%	18.3%
Delayed order	11.9%	25.6%
Product storage	5.5%	19.9%
Total contribution	100 %	100%

The situation demands that AFSC entities leverage disruptive technologies to perform business operations virtually (wherever possible) to comply with COVID-19

local and country regulations and prepare for similar future risks and events (Ayed et al., 2022; Mumtaz et al., 2021; Oruma et al., 2021; Özkan, 2021). Therefore, it requires a secure and integrated e-supply chain model (such as blockchain technology (BCT)) for AFSC entities to interact actively with each other, share demand and supply information, and perform business transactions digitally (Amentae & Gebresenbet, 2021; Barbosa, 2021; Sridhar et al., 2022). The BCT is a sort of Distributed Ledger Technology (DLT) where no one else can access the user's data. In other words, the BCT is a method of storing and processing information and data that is nearly impossible to edit, hack or tamper (Gupta, 2017). Some of Malaysia's neighboring countries (Indonesia, Thailand, and Vietnam) are also exploring the use of BCT in AFSC.

1.2.2 Applications of BCT in AFSC

The BCT tends to enhance traceability, trust, and connect all stakeholders across AFSC and the marketplace, even without their physical presence. In conventional SC, the lack of traceability and transparency resulted in many inadequacies; rises in prices by intermediaries, supply gaps or unavailability, misconduct, profit exploitations and lack of resilience (Borah et al., 2020). The issues of AFSC are quite similar in the context of Malaysia, such as food waste, food contamination and fraud, surplus or short supplies in retail markets, and a lack of integration from farm to fork, as well as issues related to ceability and transparency (Malaysiakini, 2018; New Straits Times, 2016). For example, a lack of transparency resulted in market inefficiencies and exploitation by middlemen (TheStar, 2022). Another example is that 40% of fresh produce products are wasted in the post-harvest stage because they do not meet the cosmetic requirements of retail markets (TheStar, 2021). Alternatively, having an integrated AFSC would possibly result in finding

alternative uses by processing and other industry customers where product cosmetics are not a major concern. Similarly, traceability is an important determinant to ensure food safety and mitigate food fraud. However, as most Malaysian food companies use paper-based records at warehouses, transportation, and distribution centres, this makes it difficult to track and trace in the case of any incident (The Malaysian Reserve, 2020). To overcome these problems, BCT provides a safe and transparent information platform for AFSC entities through trustworthy networks (Kouhizadeh et al., 2021), enriches collaboration among business partners and stakeholders across AFSC, and improves operational capabilities (Pan et al., 2020).

Elaborating further, BCT is more suitable for AFSC models (Köhler & Pizzol, 2020). Many BCT platforms already exist in the market, e.g., IBM Food Trust, SAP Cloud Blockchain, Hyperledger Grid, Oracle Blockchain, and Microsoft Azure, which FSC has successfully implemented. The potential benefits of BCT in AFSC include:

- According to the study by Collart and Canales (2022), BCT extends the resilience of an AFSC to address food security and safety.
- The use of BCT increased operational efficiency in SCs by reducing extensive paperwork and improving track and trace (Yang, 2019).
- BCT can utilize its distributed status (no central intermediary) to reduce the complexity of the system and insecurity, notably for smart contract-based transactions (Kouhizadeh et al., 2021).
- Avoiding malpractices, scams or frauds in the distribution of government-subsidized products to societies during the pandemic (Bala & Kaur, 2022).

- The integration of BCT-enabled AFSC would help in the prediction of resource availability (i.e., shortage of labor, drivers and managerial staff) (Kayikci et al., 2021).

For Malaysia, BCT utilization would present an opportunity to enhance modernization and enrich the resilience of the AFSC. According to Datuk Seri Mustapa Mohamed (Economic Administrator at Prime Minister's Office), Malaysia must make use of its recovery from this crisis to emerge as a robust and inclusive post-pandemic economy in a structurally changed environment (The World Bank, 2021).

1.3 Problem Statement

BCT comes up as a formidable enabler of information integrity and flow in AFSCs, where challenges such as data fragmentation, insufficient traceability, and food safety violations are prevalent. These challenges were further highlighted in the recent disruptive event of COVID-19, thus demanding real-time, tamper-proof, and distributed information systems, i.e., BCT, to ensure information integrity and flow (Kazancoglu et al., 2022; Muduli et al., 2022; Sharma et al., 2022; Yang et al., 2021). The potential of BCT was demonstrated by Walmart and IBM's blockchain solution, which reduced the time to track mangoes from 6 days to 2.2 seconds, addressing food safety and recall effectiveness. Moreover, the solution could prevent food loss by providing information for decision-making related to food demand, supply, and stock availability for actors across the AFSC (IBM, 2018; Walmart, 2021). However, the realization of these benefits depends on the diffusion of BCT across all actors in the AFSC (H. Xiong et al., 2020; Mathauer & Hofmann, 2019), not just isolated adoption by a few global organizations. In the Malaysian context, fragmented agriculture, informal intermediaries, and inadequate record-keeping present significant challenges

(Ismail, 2022; The Star, 2024; The Malaysian Reserve, 2024); therefore, BCT is not only advantageous but also indispensable for establishing a trustworthy and transparent AFSC.

Despite the potential BCT holds, its diffusion is limited in developing countries such as Malaysia. In addition, many studies on BCT focus on adoption intention (Taherdoost, 2022), while overlooking the essential phases of the diffusion process suggested by Rogers (1983, 2003, 2010) and Straub (009). (exhibited in Figure 1.1), including stage 1 knowledge (seek knowledge about a technology), and stage 2 persuasion (perceived innovation characteristics associated with a technology) for non-users. This ultimately leads to a limited explanation of how BCT disseminates across the social system and gets ingrained in practice. For instance, Wong, Tan, et al. (2020) found that 71.97% of participants had an insufficient understanding of BCT, but did not investigate the factors influencing knowledge seeking. Another study by Susanty et al. (2024) highlights the limited knowledge of SC partners about BCT. Similarly, Wong et al. (2020) employ the TOE model to assess the behavioral intention of BCT, finding a lack of management support due to a perception of low relative advantage of BCT in supply chains, which is related to perceived innovation characteristics. The discussion confirmed the need to study BCT adoption, with the addition of two preceding stages. To support this, Table 1.3 presents pieces of evidence from past studies that confirm problems in the Malaysian context are consistent with the literature, i.e., a lack of knowledge and a lack of perceived innovation characteristics.

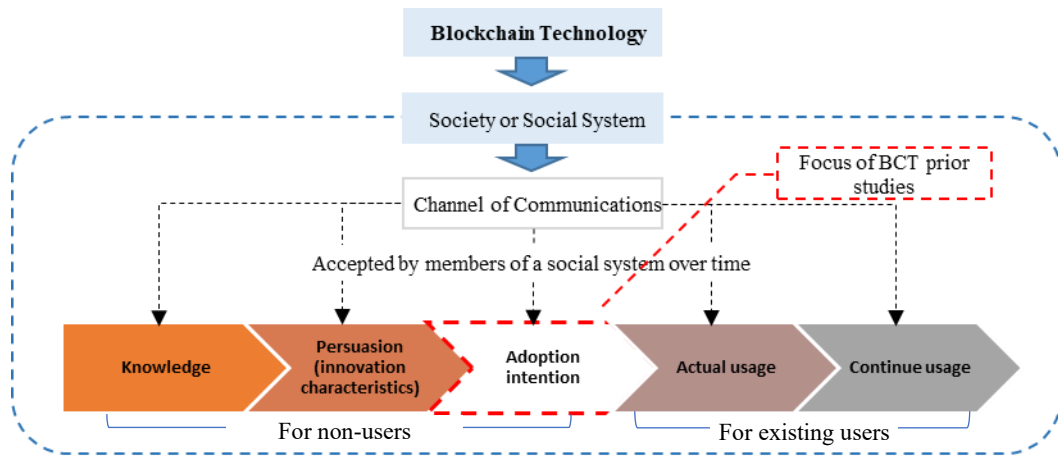


Figure 1.1 Illustration of BCT diffusion extracted from Rogers (1983) and the focus of prior studies on BCT

Moreover, existing studies fail to take into account critical contextual enablers and barriers that are pertinent to the Malaysian context, including cultural resistance or enablers, institutional orientation, and lack of trust (AlAfnan, 2024; Aziz et al., 2024; Susanty et al., 2024; Wong, Tan, et al., 2020; Yogarajan et al., 2023). It requires a context-sensitive framework that integrates comprehensive social and institutional dynamics to understand how BCT can take root in Malaysia's AFSC. Therefore, this study addresses the necessity through assessing two pivotal and insufficiently explored factors influencing BCT diffusion: (1) institutional pressures (coercive, mimetic, and normative), and (2) social capital, encompassing trust (in technology, institutions, reciprocity, and interpersonal relationships), shared objectives, and social influence. Previous research (e.g., DiMaggio & Powell, 1983; Nahapiet & Ghoshal, 1998; Cai et al., 2019) has demonstrated that these factors influence the comprehension, legitimization, and integration of innovations within social systems; however, their precise influence on the diffusion of BCT across AFSCs remains inadequately investigated. The research assesses how social networks influence the link between

trust and the diffusion of BCT, recognizing that the structure and strength of social connections affect the speed and efficacy of innovation dissemination.

Table 1.3 Lack of BCT diffusion with evidence from past studies

Title	Objective	Study context	Findings	Source
Knowledge, diffusion and interest in blockchain technology in SMEs	The objective of the study is to comprehend the extent of BCT knowledge and motivations to use BCT	Country: Italy Population: SMEs	This study reported findings: * Limited knowledge about BCT, which is also a potential barrier towards adoption. * Very slow BCT adoption rate * Perceived advantages increase BCT adoption intentions, while perceived disadvantages would negate BCT adoption intentions. * Trust in BCT as a new technology	(Bracci et al., 2022)
Barriers to the adoption of blockchain technology in business supply chains: A total interpretive structural modelling (TISM) approach	The research aims to explore barriers to BCT adoption and measure the interrelation effect using the TISM decision-making technique.	Country: India Population: Automotive industry	The study found key drivers in SC are a lack of BCT familiarity, low awareness of the benefits of BCT, and a lack of trust in BCT, which are creating hindrances to making impactful decisions about the use of BCT.	(Mathivathanan et al., 2021)
Blockchain Technology in the Food Supply Chain: Empirical Analysis	The study aims to understand the feasibility of BCT in AFSC	Country: India Population: AFSC entities	The researchers have concluded that BCT has several advantages, including traceability, low-cost operations, authenticity, immutability, and smart contracts. Weak nodes are found to have low BCT knowledge, scalability issues, and high costs and complexity.	(David et al., 2022)
CEOs' understanding of blockchain	This study presents the perception of	Country: Sweden	Besides the significant advantages of BCT, the	(Elliot et al., 2021)

technology and its adoption in export-oriented companies in West Sweden: a survey	CEOs of export-oriented companies about BCT	Population: CEOs of export-oriented companies	results showed that 72% of CEOs have little or no knowledge about BCT, and only 10% of CEOs have ever been involved in the implementation or use of BCT before.	
A decision-aid model for evaluating challenges to blockchain adoption in supply chains	To determine the challenges to deciding on adopting BCT in SCs	Country: India Population: Leather industry	Lack of knowledge, perceived security concerns, or a lack of trust in BCT are among the top five causes that hinder the adoption of BCT in SC.	(Karuppiah et al., 2021)
Food tracking and blockchain-induced knowledge: a corporate social responsibility tool for sustainable decision making	The aim is to conduct a case analysis of a multinational organization that offers BCT to consumers.	Country: Italy Population: Food sector	Consumers are unsure whether the organization is using BCT, but they are more interested in a high level of traceability in food products. It implies the need for BCT exists in the marketplace, but there is a lack of technology diffusion through communication channels.	(Rainero & Modarelli, 2021)

1.4 Research Objectives

Hew et al. (2020) found that the role of institutions is crucial for business entities in the SC to adopt BCT. The role of institutions should be supported to increase the participation of business entities in BCT-enabled systems throughout AFSC. This partnership might collaborate with local government and industry groups, which have a significant influence on agricultural food producers. It is an option for both parties. Suppose the business entity understands these institutional pressures. In that case, it will be able to build a favorable motivation for BCT-enabled AFSC, which ultimately drives the willingness to acquire knowledge and implement it effectively. First and foremost, business entities should be encouraged to integrate BCT-enabled AFSC to meet demands and comply with regulatory requirements due to the coercive pressures

exerted by dominant customers and regulatory authorities (Hartley et al., 2022). Secondly, since agricultural and food products must always be safe and clean to consume, the expectations for quality-assured and traceable foods are substantial (M. H. Ali, Chung, et al., 2021; Ehsan et al., 2022; Tan et al., 2022).

Additionally, companies that use BCT may benefit from a more favorable public reputation (Gopalakrishnan et al., 2019; Kramer et al., 2021b; Tokkozhina, Ferreira, et al., 2022). Other vertical and horizontal AFSC business entities are compelled to use BCT because of similar normative constraints. Thirdly, agriculture and food producers that utilize BCT tend to perform better, which generates mimetic pressures on others who do not use BCT, and so drives them to grasp an understanding and knowledge about BCT then further help to adopt BCT (Kouhizadeh et al., 2021; Kummer et al., 2020; Lacity, 2018). With these facts, it is stated that the AFSC entities would be more sensitive to the institutional forces that encourage them to understand and join the BCT-enabled AFSC. It leads to the development of the first research objective:

RO1. To assess the influence of institutional pressures (coercive, mimetic, and normative) on BCT diffusion in the Malaysian AFSC.

In the early days of new technology, members of the social system would have limited information and comprehension of the technology; hence, the rate of technology adoption is shaped by the opinions of experts, competitors, and customers (Pentina et al., 2012). Moreover, the adoption and rejection factors appear to evolve, suggesting that social processes underpin agricultural innovation and that further study is needed to explore such advances from this perspective (Sneddon et al., 2011). Because the question of whether an innovation is successfully diffused in ‘real’ is

dependent on social factors (Rogers, 2010; Rogers, 1983; Vatanasakdakul & Aoun, 2010). These social factors perhaps include trust and associations among the actors in society (Paxton, 1999). Some studies support that social capital would help agricultural entities to adopt desired practices such as climate change practices (Ogunleye et al., 2021), irrigation technologies (Hunecke et al., 2017), agricultural innovations (Lambrecht et al., 2014; Micheels & Nolan, 2016), and SC technology adoption (Tsai et al., 2021). The following second research objective arises from the discussion mentioned earlier:

RO2. To assess the influence of social capital (social influence, shared goals, trust technology, trust reciprocity, trust interpersonal, and trust institutional) on BCT diffusion in the Malaysian AFSC.

According to The Institute of Chartered Accountants in England and Wales (ICAEW) Insights (202), BCT, as a new and not yet widely implemented technology, is challenging for users and organizations to trust. In addition, trust interpersonal, institutional and reciprocity are essential to be considered on the road to BCT implementation in SC (Brookbanks & Parry, 2022; D. Ghode et al., 2020a; D. J. Ghode et al., 2021; Smits & Hulstijn, 2020; Tokkozhina, Lucia Martins, et al., 2022). Researchers seldom study the role of social networks in developing trust towards accepting innovation. According to Zhao et al. (2012), social networks can nurture trust, interpersonal relationships, and reciprocity, meaning that people tend to trust those they know. Similarly, Han et al. (2020) found a significant positive relationship between trust, social networks, and the intention to share knowledge. Another study has proven the importance of social capital in fostering trust towards innovation projects

(King et al., 2019). Based on the discussion, the researchers set the third research objective:

RO3. To assess the moderation effect of social networks on the relationship between different facets of trust (trust technology, trust reciprocity, trust interpersonal, trust institutional) and BCT diffusion in the Malaysian AFSC.

To summarize, this research aims to expand the scope of BCT adoption to encompass comprehensive BCT diffusion and to investigate the influence of institutional pressures and social capital on the diffusion of BCT. The objectives enable the development and testing of the proposed conceptual model for the diffusion of BCT in Malaysian AFSC.

1.5 Research Questions

To answer research objectives about the diffusion of BCT in AFSC, the following questions are formed.

RQ1. What is the influence of institutional pressures (coercive, mimetic, and normative) on BCT diffusion in the Malaysian AFSC?

RQ2. What is the influence of social capital (social influence, trust technology, trust reciprocity, trust interpersonal, trust institutional, and shared goals) on BCT diffusion in the Malaysian AFSC?

RQ3. Do social networks moderate the relationship between different facets of trust (trust in technology, trust in reciprocity, trust in interpersonal relationships, trust in institutions) and BCT diffusion in the Malaysian AFSC?

1.6 Scope of the Study

The scope of this research is to determine the influence of social capital and institutional factors on the diffusion of BCT in the Malaysian AFSC. The researcher seeks responses from agricultural companies associated with the Malaysian AFSC. The predictors of this study are picked from the literature to form a framework for evaluation. According to Balloun et al. (2011, for organizational-level studies, researchers should aim for more than one respondent from each organization. However, when collecting more samples from each organization, it is possible to observe rating variance among leaders of the same organization. Hence, this study aims to get one response from each organization's owner, director, or manager. Upon collecting data from respondent companies, PLS-SEM (partial least squares structural equation modelling) and descriptive estimations was run to answer the research objectives of the study.

1.7 Significance of the Study

Governments can utilize the outcomes of this study to implement initiatives and policies that accelerate the diffusion of BCT in the Malaysian AFSC because there are many irregularities with conventional AFSC.

Prior studies in the context of Malaysia have found a lack of knowledge and understanding, as well as a lack of trust, to be prime causes that hinder the diffusion process of BCT. According to the diffusion of innovation theory, the decision-making process is influenced by social structures, norms of that particular social system, opinion leaders and change agents (also referred to as a medium of communication according to DOI theory by E. M. Rogers (1983) page 24-28 and 35) because accepting any innovation is more of a social phenomenon of change. Where social relations and

affiliations can help potential users in the stages of knowledge seeking and contributing, assessing technology characteristics, deciding whether to adopt or not, continuing to use technology, and discontinuation (E. M. Rogers, 1983), therefore, this study attempts to see whether institutional pressures and social capital can influence the diffusion process of BCT across the Malaysian AFSC.

1.7.1 Theoretical Contributions

The results of this research will have multiple theoretical contributions. The first theoretical contribution is the use of institutional pressures and social capital as a medium to disseminate BCT. In contrast, previous studies have primarily used institutional pressures as predictors of technology adoption. Additionally, the focus of previous studies has been on BCT adoption. According to the DOI theory, adoption is a sub-step of BCT diffusion. However, in this study, we will consider that the whole BCT diffusion process is positively influenced by our proposed framework, thereby accelerating BCT diffusion in AFSC.

Second, trust in literature is seldom studied as a general concept. In this study, we suggest breaking down trust into four aspects: trust in technology, reciprocity, interpersonal, and institutional. It would help to explain the deep insight into the influence of each aspect of trust on BCT diffusion.

Finally, the additional (third) contribution of this study is that we have presented prior studies on BCT in the Malaysian context. We conducted a systematic literature review and present the results, including the quantity of BCT studies, timeline, research focus, and other infographics.

1.7.2 Practical Contributions

Initially, this research will support governments, policymakers, and technology firms in understanding the importance of social capital and institutional pressures in promoting BCT across the masses in the Malaysian AFSC. Additionally, it addresses the prevalent issue of a lack of trust in BCT by breaking down trust into four dimensions: trust in technology, trust in interpersonal relations, trust in reciprocity, and trust in institutions.

The second practical contribution is about the potential benefits of BCT across the Malaysian AFSC. As a result of this research, governments, policymakers, and experts would be able to identify how they can increase BCT diffusion. Eventually, BCT would encompass the resilience of AFSC entities to deal with future disruptive events, such as COVID-19, and facilitate early recovery from economic losses. Additionally, it would address conventional challenges of AFSC, including reducing food loss, business integration and transparency, overcoming price and profit manipulations by intermediaries, and enhancing the financial well-being of AFSC entities.

The third contribution refers to the national-level progress of AFSC, as the existing agriculture and food sector is in distress due to a low level of modernization. Studying BCT diffusion would help achieve national objectives, such as the National Priority Areas (NPAs) of food safety and security, the Shared Prosperity Vision-SPV 2030 agenda for the digital economy, and reducing waste disposal.

To conclude, the proposed framework would enable Malaysia to emerge globally as a structurally transformed economy in the post-pandemic era and enhance its resilience capabilities against future disruptive events.

1.8 Definition of Key Terms

The important key terms that have been used in this thesis are defined as follows:

1.8.1 COVID-19

COVID-19 is a spread of an infectious virus and a kind of swan (black) event that is unpredictable and highly devastating to society (Taleb & Blyth, 2011).

1.8.2 Agriculture and Food Supply Chain (AFSC)

The term AFSC refers to the integrated structure of farm-to-fork activities performed by multiple entities, encompassing the management of material, information, and financial flows. The farm-to-fork activities include pre-production of raw materials and crop information, production, post-production handling, packaging and processing, warehousing, transportation, retail, and consumer services. The entities involved in performing these activities include growers/farmers, raw material producers/suppliers (such as seeds, fertilizers, and chemicals), food processing companies, storage companies, transporters, retailers, distributors, and consumers (Kamilaris et al., 2019).

1.8.3 Blockchain Technology (BCT)

BCT is a type of DLT recognized in businesses and SCs for decentralized data management and security (Amor & Yahia, 2022). According to IBM (Gupta, 2017), BCT is a process of preserving information and data in a manner that is practically impossible to edit, hack, or deceive.

1.8.4 BCT Diffusion

The term BCT diffusion in the current study is based on Rogers (1995;2003), which refers to the process of spreading BCT (innovation) over time among entities

(business partners/stakeholders) of the Malaysian AFSC (social system). The BCT diffusion can be measured through the assessment of five stages of decision-making: knowledge, persuasion (perceived technology characteristics), intention to adopt, usage, and continued usage (Grover et al., 2019, p.750). For instance, Wamba and Queiroz (2022) used the latter three stages to measure BCT diffusion; intention to adopt blockchain, blockchain adoption, blockchain routinization.

1.8.5 Coercive Pressure (CP)

Through coercive pressures, the BCT can be disseminated using formal and informal pressures by focal firms, customers, and market forces to entities across the Malaysian AFSC. The definition states, “Coercive pressures originate from dominant customers or suppliers, as well as industry associations and regulators” (Yigitbasioglu, 2015).

1.8.6 Mimetic Motives (MM)

The definition denotes mimetic motive as a phenomenon when firms “mimic actions of other organizations” (Liang et al., 2007). Elaborating further, organizations operating in a business environment mimic the practices of leading organizations, hoping that the adopted practices will increase their business performance (DiMaggio & Powell, 1983).

1.8.7 Normative Practices (NP)

Normative practices are defined as “the perceived extent to which members of the dyadic relational channels have adopted and or the extent to which the government and industry agencies promote the use of information technology” (Liang et al., 2007). During COVID-19 and post-COVID-19 situations, the ways of conducting business

and an organizational willingness to change can be defined and influenced by institutional pressures (Alblowi et al., 2022).

1.8.8 Social Influence (SI)

The definition follows Venkatesh et al. (2003), who define social influence as the degree to which a user or organization evaluates the importance of the opinion of a social group that believes in the use of technology.

1.8.9 Social Networks (SN)

It is defined as a process of identifying networks and network relationships, also described as the strength of ties and the extent of frequent group interaction, meetings, and other social relations and informal gatherings (Davidsson & Honig, 2003).

1.8.10 Shared Goals (SG)

Shared goals are defined as the extent to which one (e.g., an organization) has collective goals, missions and visions with other people (Chow & Chan, 2008).

1.8.11 Trust Technology (TT)

Trust Technology means that BCT has the potential to make a positive change to existing processes, and firms will be more likely to make investments in the infrastructure and resources required for adoption (Gupta, 2017; Lezoche et al., 2020; Meidute-Kavaliauskiene et al., 2021).

1.8.12 Trust Reciprocity (TR)

It is based on the notion that trust is a reciprocal process and it grows when it is reciprocated by other parties. The definition is referenced from Ostrom (2003) “Trust reciprocity determines the importance of reciprocal relationships in explaining the origins of trust and trustworthy behavior”.

1.8.13 Trust Interpersonal (TP)

It is defined as the willingness of a party to be responsible for the acts of another party on the grounds of the presumption that the other party will take concrete action that is important to the trustee, irrespective of the ability to track or influence the other party (Mayer et al., 1995).

1.8.14 Trust Institutional (TI)

“Trust Institutional refers to members’ endorsement of general institutions/government policy and strategy, and their willingness to place themselves in vulnerable situations regardless of whether they can monitor or control business/market conditions” (Guh et al., 2013).

1.9 Organization of the Chapters

This thesis comprises five chapters. The first chapter presents an introduction to this area of research (diffusion of BCT in Malaysian AFSC) in a systematic manner, following the research background, problem statement, research questions, objectives, significance, and both theoretical and practical contributions. Then, the scope of current research and definition of key terms are presented.

The next chapter (two) reviews the existing literature on BCT and discusses theories that support this research. The literature review also identifies research gaps and outlines the development of a research model grounded in institutional theory and social capital theory.

The methodology of the current research is then explained in Chapter 3. The chapter begins with an introduction to philosophies of research and how this current research follows them. In the later part, the sample population, sample size, research design and statistical techniques are discussed.

Next, Chapter 4 comprises the results of descriptive statistics and PLS-SEM. Finally, Chapter 5 includes a discussion of the results, implications, limitations, and future directions.