# THE GOVERNANCE OF BLOCKCHAIN TECHNOLOGY IN REAL-TIME FINANCIAL REPORTING

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## ABSTRACT

This research delves into the application of Blockchain Technology (BT) in enhancing governance and accountability within Real-time Financial Reporting. Recognised as a pivotal innovation, BT revolutionises diverse sectors by offering robust, transparent, and decentralised solutions, particularly in enhancing internal control systems. This study specifically investigates BT's role in bolstering emerging financial trends such as decentralised finance (DeFi), non-fungible tokens (NFTs), and its synergy with advanced technologies like artificial intelligence (AI) and the Internet of Things (IoT) in the realm of financial reporting.

Central to this investigation is the exploration of how BT can be harnessed as a singular, adaptable information source in a multi-stakeholder environment, facilitating immediate data interpretation for decision-making processes. Additionally, the study examines the governance mechanisms within BT networks in the accounting and finance domains and the evolving roles of Stakeholders of Financial Reporting (SFR).

The research objectives are twofold: firstly, to understand the accountability and governance complexities involved in employing BT for Real-time Financial Reporting and secondly, to understand how BT's consensus-based verification trait contributes to the flexibility and reliability of information in real-time financial reporting. These objectives are explored through the perspectives of various SFR regarding the use of BT in Real-time Financial Reporting.

Employing a phenomenological approach, the study gathers insights through one-to-one interviews with stakeholders in the financial reporting process, selected using a snowballing technique, ensuring the data's relevance, reliability, and validity. The responses are transcribed verbatim and subjected to thematic analysis using NVivo Version 12 identifying and interpreting patterns within the data to address the research questions and summarise key insights.

Innovation Diffusion Theory (IDT) was used to interpret the responses of the interviewees, based on the key concepts of the theory. The key findings of this study interpret the stakeholders' views and level of readiness (the evaluation stage) of utilising on the Blockchain Technology, which is crucial in ensuring decentralised decision-making processes and maintaining the security, stability, and integrity of the network, ultimately fostering trust in Real-time Financial Reporting among users and stakeholders. It also enables active participation in shaping the direction of Blockchain development, ensuring alignment with regulatory requirements, and fostering innovation and governance and scalability in utilising the consensus-based verification trait is vital as it mitigates the risk of fraud, manipulation, and unauthorised changes to the ledger, ensuring the integrity and immutability of the data stored on the Blockchain.

The practical implications of this research are significant, offering valuable insights for accounting and finance professionals on the potential transformative impact of BT on financial reporting processes and the challenges related to governance and accountability and achieving flexible and single source information (immediacy) involved in its widespread adoption. The conceptual framework analyses Blockchain Technology for Real-time Financial Reporting. It weighs the benefits (transparency, accountability, competitive edge) against challenges (verification, governance, cost) to inform industry decisions on Blockchain Technology adoption and implementation strategies.

The study concludes that the governance and accountability issues in Real-time Financial Reporting with Blockchain Technology are lack of guidance, global standards, insufficient use cases in the accounting industry and lack of regulation on the use of the technology. The Blockchain trait consensus-based verification achieves real-time flexibility and single source information by providing authorised, verified, transparent and unalterable information in the process towards preparing and issuing a financial report.

Keywords: Blockchain Technology, Real-time, Financial Reporting, Accountability, Governance, Stakeholder Perspective, Phenomenological Approach, Innovation Diffusion Theory

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**Definition of Terms**

The terms in this section should be terms directly related to the research that will be used by you throughout the study.

FR - Financial Reporting

SFR - Stakeholders of Financial Reporting

TAM-Technology Acceptance Model

IDT-Innovation Diffusion Theory

ST-Stakeholder Theory

IL-Institutional Logics

XBRL – eXtensible Business Reporting Language

XML – eXtensible Markup Language

RT – Real-Time

ICAEW – Institute of Chartered Accountants England & Wales

ACCA – Association of Certified Chartered Accountants

WWL – World Wide Ledger

CBV – Consensus Based Verification

BT – Blockchain Technology

ERP – Enterprise Resource Planning

IASB – International Accounting Standards Board

IFRS – International Financial Reporting Standards

ERP – Enterprise Resource Planning

SaaS – Software-as-a-service

CFfR – Conceptual Framework for Financial Reporting

N - Nodes

SN – Sub-Nodes

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# CHAPTER 1: INTRODUCTION

## 1.1 INTRODUCTION

This thesis explicates the current challenges faced in effective real-time financial reporting and explores the potential for Blockchain Technology (BT) to provide solutions in enhancing the current financial reporting (FR) by addressing the challenges posed. Particularly, it is the objective of this study to understand governance and accountability issues arising from utilising BT in financial reporting, to meet the needs of the Stakeholders of Financial Reporting (SFR) (defined in Chapter 2) and perceptions of stakeholders' future roles and responsibilities as preparers and users of real-time financial reporting. Blockchain appears to be the next step in technology transformation and will reshape the business landscape. It is expected to have an impact on business practices over the next few years, which will add new challenges and complexities to the profession of accountants and auditors (Abdennadher, Grassa, Abdulla & Alfalasi, 2022).

BT was introduced by Nakamoto (2008) as a method of validating ownership of the virtual currency bitcoin. After 7 years of successful use with bitcoin, BT is recognised as an alternative to ownership ledgers based on classical double entry book-keeping. BT is nothing short of a decentralised revolution (Wang & Su, 2020). Entrepreneurs are actively investigating Blockchain suitability for recording ownership of a wide range of assets, from stocks and bonds to real estate, automobile titles, luxury handbags, and works of art. Further applications under study by governments include using Blockchain for public records such as real estate titles, birth certificates, driver's licenses, university degrees and voting procedures (Casino, 2019).

Blockchain uses the concepts of public-key cryptosystems to verify the user's authority to execute transactions and cryptographic hash functions to achieve consensus among network nodes about Blockchain data. The use of public key cryptosystems to provide digital signatures was proposed by Diffie and Hellman (Gamage, Weerasinghe & Dias, 2020).

BT is the business process reengineering aspect of an organisation's financial recording and reporting processes system. BT may introduce new challenges and opportunities to the future of financial reporting. FR provides investors information of business investments and the efficiency of capital utilisation. It achieves this from end-to-end procedures, principles, assurance and monitoring and control, which concentrated on FR and other regulatory materials (Financial Reporting Council, 2018). Blockchain has the potential to materially improve information reliability in financial statements.

In addition BT has the potential to provide opportunities towards the two proposed reporting standards on general sustainability-related disclosure requirements, and climate-related disclosure requirements issued via the recent the requirements in IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information and IFRS S2 Climate-related Disclosures for companies to explain how sustainability-related risks and opportunities are reflected in the financial statements and to use assumptions consistent with the financial statements when applicable; and the IASB's new project on Climate-related Risks in the Financial Statements, which will utilise learnings from the International Sustainability Standards Board's (ISSB) work on S1 and S2.

BT works as a distributed digital ledger system which ensures the transparency, traceability, and authenticity of information, along with smart contractual relationships within global supply chain networks (Helo & Shamsuzoha, 2020). BT promises to make the next decade one of great upheaval and dislocation but also immense opportunity for those who seize it. As at May 2019, there are 44% organisations globally who have implemented Blockchain. Technology provides trusted online transactions to the industry. People and industries are trying to use Blockchain because of the following benefits it offers (Javaid, Haleem, Singh, Khan, S, Suman, 2021). Blockchain promises innovation and new ways to create value on this powerful platform.

As the use cases of BT increases, it is vital to explore the accountability and governance issues that arise with the use of BT. Understanding governance and accountability mechanisms in BT is crucial in ensuring the reliability and trustworthiness of Real-time Financial Reporting. Clearly defined governance structures establish decision-making processes, while accountability frameworks ensure transparency and auditability of financial data stored on the Blockchain. This fosters trust among stakeholders, including investors, regulators, and the public, in the accuracy and integrity of financial information reported in real-time. Ultimately, a well-defined governance and accountability framework empowers the adoption of BT for efficient and reliable Real-time Financial Reporting. As this study depicts the use of BT in real-time financial reporting, the underlying governance and accountability issues of the technology should be understood and addressed to ensure a transparent, true, and fair view of the financial reports.

Real-time Financial Reporting presents opportunities for organisations to enhance their decision-making process and provide timely information to constituents (Appelbaum & Smith, 2018). Real-time reporting has a myriad of benefits, including operational efficiency, keeping employees motivated as they are on top of the information when clients make enquiries, able to encourage faster decision making and highly insightful advisory services in the fraternity of accounting and finance. Real-time Financial Reporting is further explained in Section 2.3.3.

To understand the application and uses of Real-time Financial Reporting, SFRs will be able to provide an accurate depiction and value creation of the viability of utilising BT in Real-time Financial Reporting . The challenges, and limitations experienced by SFRs in the FR process and how they overcome it. The purpose of this chapter is to provide an overview of the research study.

The discussion of Chapter 1 is organised as follows: -

Section 1.1 provides an introduction to the research and a summary of the governance and accountability factors that contribute towards the use of BT in Real time Financial Reporting.

Section 1.2 provides the background and evolution of FR and explicates the research gap in FR research that examine immediacy issues for FR using BT in Section 1.3. Section 1.4 discusses the current governance and accountability issues surrounding FR and BT.

Section 1.5 discusses the relevant theoretical perspectives relevant to the phenomenon under investigation whilst Section 1.6 discusses the research objectives and research questions. Section 1.7 discusses the research methodology and data collection method. The significance of the study is addressed in Section 1.8. Section 1.9 concludes the chapter.

## 1.2 FINANCIAL REPORTING: A PARADIGM SHIFT TO REAL-TIME

FR is a system of communicating recorded and summarised business and financial transactions to stakeholders. The International Accounting Standards Board (IASB) is responsible for all technical matters, including issuance of International Financial Reporting Standards (IFRSs), preparation, and issuance, of exposure drafts, setting up procedures for reviewing comments received on documents that have been published for comments; and issuing bases for conclusions.

The Conceptual Framework for Financial Reporting (CFfR) describes the objective of and concepts for general purpose financial reporting. It is a practical tool that helps the IASB to develop requirements in IFRS Standards based on consistent concepts. Refer to Figure 1 that depicts the evolution in financial reporting.

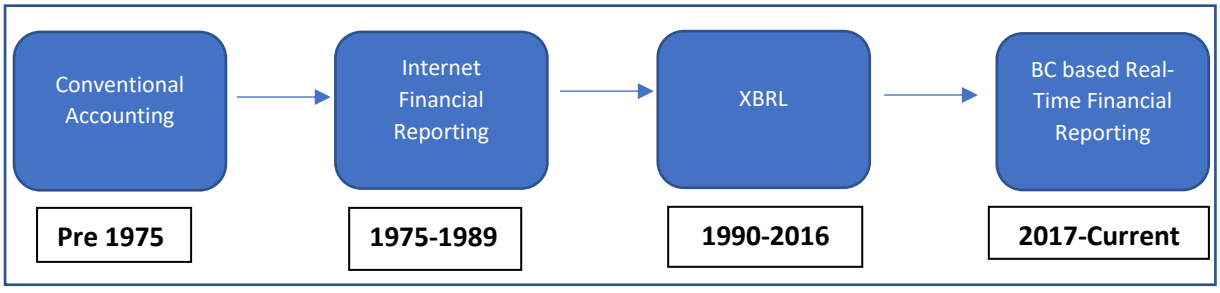


**Figure 1.1: Evolution of Financial Reporting** [1]

[1] *Year 2016 does not reflect the end of XBRL. It reflects a continuum indicating the advent of Blockchain based reporting in 2017, and XBRL continues to grow and possibly merge with BT in the near future.*

As BT becomes widely adopted across industries, SFRs (preparers of financial reports, auditors, and users including investors, analysts, regulatory bodies, government, creditors, financial institutions, financial press, Information Technology (IT) analysts and others) must enhance their services by harnessing the BT revolution, by encouraging companies to embark on the adoption of BT, as well as supporting its application (Schmitz & Leoni, 2019).

The next section examines the FR regime and how it has evolved over time with emerging technology advancements and provide Real-time Financial Reporting initiatives. The subsequent sections highlight the need for Real-time Financial Reporting.

### 1.2.1 Conventional Reporting (pre-1975)

Traditional FR is becoming more and more disengaged from shareholders' expectations and needs in making wise investment decisions. Markets have started to reward disclosure methods that go beyond the strict parameters of traditional financial reporting, as well as using reporting practices as a proxy for managerial excellence. Uncertainty is brought about by companies' incomplete information among stakeholders (Dietrich, Kachelmeier, Kleinmuntz, Linsmeier, 2001).

Investors and creditors are exposed to information risk as a result of this uncertainty. A consequence of this is that there is an expectation of a greater rate of return on their capital. Lower stock prices occur from higher cost of capital for the company, which is caused by higher rate of return. Increasing investor understanding and trust through voluntary disclosure policies lowers the uncertainty in the returns to capital suppliers, which is again anticipated to lower the firm's cost of external financing (Madhani. 2018).

### 1.2.2 Internet Reporting & Real-Time Financial Reporting

"Real-time" is a very popular term in the world of reporting and analytics. Timeliness of reporting can deliver real returns to the business. As the Association of Chartered Certified Accountants (ACCA) highlighted in *Understanding Investors: The Road to Real-time Reporting (2013),* 70% of investors said companies reporting in real time are better positioned to attract investment, and 73% indicated that companies who report faster have more mature corporate governance. But "real-time" reporting and analytics can mean many things to many people.

Data in an organisation is often in silos due to traditional technology restraints, and different departments have different data needs. Automating, centralising, and standardising data are key in reducing the amount of data replication will get you one closer and closer to "real-time" access to meaningful data (Continuous Accounting Action Plan Series, 2018). Further discussion on this set out in Section 2.4.4. The following section follows through with the advent of XBRL in the evolution of financial reporting.

### 1.2.3 XBRL-eXtensible Business Reporting Language

The XBRL, eXtensible Business Reporting Language (XBRL), an initiative led by the American Institute of CPAs (AICPA), is an XML-based Web-based business reporting specification. It inherits the main objectives of the eXtensible Markup Language (XML), providing a method to tag financial information to improve the automation of information location, retrieving and providing technical solutions to the resource discovery.

Twenty years have passed since XBRL was first launched; this language (in its subsequent evolutions) has become the global standard of electronic financial reporting. Disseminated worldwide, XBRL has been adopted by a range of businesses, from listed companies to small and medium-sized enterprises, as well as used for tax returns and regulatory filings, in the private and public sectors.

Further, the "conquest" of the European Union's regulated markets with the single electronic reporting format (ESEF) mandate: meant from financial years beginning on or after 1 January 2020, issuers must mark up the IFRS consolidated financial statements, contained in their annual financial reports prepared in eXtensible HyperText Markup Language (XHTML) format, using Inline XBRL (iXBRL).

Literature on XBRL is vast and has constantly grown over the last twenty years; it includes both academic and operational studies dedicated to practitioners. As a multidisciplinary concept, XBRLis analysed from different aspects: as a new language for corporate financial reporting, as a technological innovation, as an opportunity for shareholders or and as a new educational topic (Bartolacci, Caputo, Fradeani, Soverchia, 2021). The next section addresses the assurance issues in FR.

### 1.2.4 Blockchain Technology & Real-Time Financial Reporting

According to Doğan and Ertugay, 2019, the Blockchain distributed ledger structure, whose transactions cannot be deleted or changed, is defined as a digital ledger for accounting, which is basically a recording and reporting system. The parties to the commercial transactions record the transactions in their own ledgers by using the double-entry system. On the basis of BT, instead of making separate accounting entries in each enterprise based on documents, a registration system can be created that allows transactions to be recorded directly in a common ledger with the participation and approval of all parties. After the transaction registry is completed, it will be almost impossible to hide and destroy transactions, since it is cryptographically signed and distributed to all nodes. Therefore, transactions between parties in the Blockchain are recorded and stored in the system in real-time and monitored instantly. "Real-time Blockchain Accounting System" (RBAS) is defined as a software solution that enables the exchange of monetary values between two or more parties, records this exchange transaction, reliably stores it, and enables the preparation of financial statements when required.

Blockchains are shared and distributed data structures, or ledgers, that can securely store digital transactions without using a central point of authority. More importantly, Blockchains enable automated execution of smart contracts in peer-to-peer (P2P) networks. They can alternatively be thought of as databases that allow multiple users to make changes to the ledger at the same time, which can result in multiple chain versions.

Rather than having the ledger maintained by a single trusted centre, each individual network member maintains a copy of the chain of records and agrees by consensus on the current ledger status (Andonia, Robua, Flynna, Abramb, Geachc, Jenkinsd, McCallumd, Peacock, 2019). However, there has been limited discussion in academic literature on issues surrounding real-time FR in the context of BT. The next section elaborates the current assurance issues in FR.

## 1.3 ASSURANCE ISSUES IN FINANCIAL REPORTING

The wave of accounting scandals that had occurred recently in the international financial community has raised criticisms on the quality of FR (Agrawal and Chadha, 2005; Brown et. al., 2010). Several prominent companies were involved in accounting frauds, such as Enron, WorldCom, Marconi, Parmalat, etc, which has weakened investor confidence in the management teams and the financial reports.

The widespread failure in financial disclosure has created the need to improve the financial information quality and to strengthen the control of managers by setting up good governance structures (Karamaou and Vafeas, 2005; Beekes and Brown, 2006; Brown and Caylor, 2006; Firth et. al., 2007; Petra, 2007).

As the focus shifts to other types of reporting such as Sustainability Reporting (SR) and Integrated Reporting (IR), with more emphasis than before on climate-change and value creation, it is arguable whether there will be a need for more, or other, forms of assurance beyond the financial statement audit. The proposed amendments to Bursa Malaysia listing requirements in January 2022 indicate all transactions are properly authorised and should be recorded as necessary to enable the preparation of a true and fair view of the financial statements (Bursa, 2022).

The need of assurance of current FR presentation indicators, and whether they are the actual drivers behind value creation is questionable (KPMG, 2018). Demands from stakeholders for more evidence beyond entity-only information are growing, and able to construe them real-time, and minimum basis exists currently. The next section discusses the efficacy of BT in Financial Reporting.

## 1.4 GOVERNANCE AND ACCOUNTABILITY ISSUES IN FINANCIAL REPORTING

Corporate governance has emerged as a key determinant in identifying company's strengths and weaknesses. One of the most important functions of corporate governance is to ensure the quality of FR process (Cohen et al., 2004).

One factor is examined to make sure that organisations' credibility in maintaining their FR scheme is effective corporate governance. This is due to the fact that it can increase the effectiveness and efficiency of managerial activities (Wardani & Zulkifli, 2017). One main cost in ensuring quality reporting comes from auditors' verification of clients' transactions with their counterparties. While each audit firm or team (generically referred to as "auditor") may possess information useful to other auditors, each one's traditionally audit independently because it is not customary to share proprietary information among audit firms—it is challenging to find a trusted third party to facilitate timely and secure communications, not to mention clients' reluctance to reveal information to other auditors and legal issues concerning data privacy (e.g., General Data Protection Regulation) (Cao, Cong & Yang, 2018).

Brownlee et. al., (1990) posits that the quality of corporate financial reports should be judged against a changing standard that has evolved over time in relation to information needs, expectations and demands of financial statement users. The next section goes on to describe the statement of problem in this study.

Organisations utilising Blockchain must adapt their policies and procedures over internal controls and counterparty risk assessment to address increasing regulation over the distribution of financial data, while their audit committees must be prepared to address these challenges leading up to financial statement preparation. External auditors need to assess Blockchain implementation as a financial reporting risk and balance the potentially more reliable and timelier audit evidence obtained from Blockchain-based reporting systems against the related increase in internal control testing (Smith & Castonguay, 2020).

## 1.5 STATEMENT OF PROBLEM

Presently, there is limited examination by researchers as to how accounting practitioners or profession has addressed BT and how knowledge of it is needed to operate the functions of the future accounting and finance profession. BT has gained momentum recently, and it could countenance a reconsideration of what we ruminate to be the margin of reporting. Despite an increase in the publication of use cases of BT, there is still minimal research on the use of BT, specifically in FR.

An increasing number of studies (Scholz & Stein, 2018; Karajovic et al., 2019; Tan & Low, 2019, KPMG, 2019; Deloitte, 2019) have been carried out on the introduction of BT as a platform for accounting transactions of the future. Most of these studies have been mainly undertaken to understand the concept of Blockchain and how it can eliminate the current challenges faced by financial reporting.

These are (IFAC, 2018) as follows:

(i) Cost and complexity of recording and aggregating transactions across multiple entities.

(ii) Difficulty in identifying a single source from which users can obtain credible, up to date/prompt company reporting across multiple-jurisdictions and companies.

(iii) Making FR engaging and flexible in a multi format and multi-stakeholder environment.

Some of the advantages that can be seen vis-à-vis Blockchain for accountants and auditors are immediate validation of postings, verification of financial and non-financial information and acceleration of time (Deloitte, 2019). The authors focus on the aspect of verification without having the obligation to rely on a trusted third party. Companies have the possibility with Blockchain to record their transaction directly onto a joint register. This would be revolutionary compared to cloud computing or banking, in which both data and money are no longer treated in-house, but provided to a third party, creating an interlocking system of enduring accounting records. The Deloitte study states, "Since all entries are distributed and cryptographically sealed, falsifying or destroying them to conceal activity is practically impossible". It is similar to the transaction being verified by a notary –only in an electronic way."

This is supported by Abdennadher, Grassa, Abdulla & Alfalasi (2020), where BT can be used as a source of verification for reported transactions. Through the utilisation of decentralisation and cryptographic hashing, distributed ledger technology makes the history of any digital asset both unalterable and transparent.

Academic literature is still in its early stage to on solutions set with accounting standards or frameworks on how to produce real-time FR with BT, as BT is a new technology, and it will take time for substantial literature to be published.

There is a lack of academic literature to support how these real-time reports can be achieved with emerging technologies such as Blockchain. There are publications on the use of BC in FR but limited in terms of the governance and accountability of BC in FR and supporting guidelines and conformance standards in this arena.

Several research studies and professional reports have discussed the implications of BT on the accounting and assurance discipline and profession (Lazanis, 2015; Yermack, 2017; Rückeshäuser, 2017). Kwilinski (2019) claims that the development of BT will lead to the cessation of traditional double-entry accounting as the legitimacy of accounting will be fully automated. Indeed, BT will permit accounting records to be synchronised between contractors.

Triple-entry accounting will take place and, by providing a tertiary destination that automatically verifies transactions for bookkeeping, will become fundamental to the accounting industry.

Repetitive tasks, related to the firms' daily operations, can be performed by smart contracts and this will save time and allow accountants to focus on value-added work (Karajovic et al., 2019). Dai and Vasarhelyi (2017) argue that BT provides real-time, verifiable information disclosure and progressively automated assurance.

In the context of the discussion above, it is timely to understand this phenomenon from the perspectives of stakeholders of FR in enabling prompt-up to date, single source credible information which has value, governance, and accountability in financial reports. In this context, prompt-up to date means real-real-time, credible information achieved by consensus-based verification and the single source information provided by Blockchain. Whilst maintaining an assurance and regulatory boundary, the responsibilities, and roles of Stakeholders of Financial Reporting (SFR) have yet to be examined. There is limited research to evaluate major challenges, perceptions and acceptance of BT, and the challenges faced in the use of BT in providing accurate Real-time Financial Reporting. This study aims to address the current governance and accountability issues in FR utilising BT, where real-time financial information will be reliable and accountable. This study is only limited to understanding the governance and accountability issues and challenges in utiling BT is Real-time Financial Reporting, and to understand how the Blockchain trait consensus-based verification achieves flexibility and single source information in real-time. The study does not examine the challenges faced by the types of Blockchains (public, private or consortium) used. The next section will deliberate the research objectives and research questions of the study.

## 1.6 RESEARCH OBJECTIVES & RESEARCH QUESTIONS

Based on the research gap, these are the following research objectives and research questions of this study.

Specifically, the objectives of the study are as follows:

1) To understand governance and accountability issues in applying Blockchain Technology in Financial Reporting.

2) To understand how Blockchain trait consensus-based verification achieves flexibility and single source information in real-time (immediacy) of Financial Reporting.

The research questions are:

1) What are the governance and accountability issues related to applying Blockchain Technology in Financial Reporting?

2) How does the consensus-based verification trait of a Blockchain achieve Real-time Financial Reporting?

This study objectives are twofold, Firstly, it aims to understand the governance and accountability issues arising from using BT in Real-time Financial Reporting. Secondly, it aims to understand how the Blockchain characteristic 'consensus-based verification' supports real-time processing of transactions in financial reporting, utilising real time confirmations, since network members approve data as it is added to the Blockchain. The objectives once achieved can reveal BT could be a solution to address the challenge of FR to be single source and flexible in a multi-stakeholder environment, where information can be interpreted real-time to facilitate decision making, the governance of the Blockchain network in the accounting and finance discipline, as well as the changing roles of each SFR.

In view of the above considerations, the suitability of Blockchain for accounting must be discussed, as several academic and industrial research papers propose this. Certainly, the Blockchain in combination with decentralised consensus induces organisational transformation through the decentralisation of single business processes. For instance, decentralised consensus could potentially raise employee involvement in the validation of accounting transactions, leading to more diversified controls through transparency induced by the Blockchain.

Financial transparency is a major issue in accounting and internal control system, which is concerned about the openness and availability of information on a Blockchain.

For the purpose of this study, SFRs are defined as preparers of financial reports, auditors, and users including investors, analysts, regulatory bodies, government, creditors, financial institutions, financial press, Information Technology (IT) analysts and others internal and external SFRs. The Conceptual Framework of this study in Section 4.6 provides the expected relationship of the variables perceived benefits of the reliability of utilising BT in Real-time Financial Reporting, the perceived intricacy Financial Reporting and the perceived cost of compliance of utilising BT in Real-time Financial Reporting. These are thoroughly discussed in Sections 4.6 and 5.4. The next section provides the theoretical perspective of the study.

## 1.7 THEORETICAL PERSPECTIVE

This study draws upon the Innovation Diffusion Theory (IDT) to provide a framework for an understanding of the emerging issues related to BT in FR. IDT, formulated by Everett Rogers in 1962, elucidates how new ideas, products, or practices spread throughout a society or social system. It posits that adoption of innovations follows a predictable pattern, beginning with early adopters and eventually reaching the mass population. The theory emphasises the role of communication channels, social networks, and individual characteristics in influencing the adoption process.

By understanding these dynamics, innovators can devise strategies to promote adoption and facilitate the diffusion of innovations more effectively. For this research, IDT forms the basis for developing a conceptual framework to guide the interpretation of the and frame the acceptance by SFRs and use of BT as well as applying the trait consensus-based verification in Real-time Financial Reporting.

This study is significant as it provides input on how BT will address the current challenge of real time FR and how the SFRs will move to their new roles with BT. The next section elaborates on the significance of this study.

## 1.8 METHODOLOGY

This study adopts a qualitative approach situated in the interpretive paradigm, utilising phenomenology. Phenomenology is a form of qualitative research that focuses on the study of an individual's lived experiences within the world (Neubauer, Witkop & Varpio, 2019). Phenomenology is the chosen methodology in this study as this study aims to understand the phenomenon of BT via perceptions of stakeholders. In-depth one-to-one interviews are conducted with respondents to understand stakeholders of FR perceptions on the use of BT as a platform in supporting real-time accurate, verified FR. NVivo software version 12 is used to code, analyse, and interpret the data collected. This is discussed further in Chapter 3. The next section will provide the significance of this study.

## 1.9 SIGNIFICANCE OF THE STUDY

This study contextualises the use of the disruptive technology BT in taking the FR process to be real-time in an accurate and reliable form to users of financial statements. Blockchain together with AI, Robotic Process Automation, Big Data and others are considered technologies of the future. In terms of use cases in the accounting and finance industry, BT has attention from banks, private equity firms, startups, and other financial institutions in conducting transactions using Blockchain and are favourable to implementing the technology into their business model.

The function of the Blockchain - the decentralised and immutable ledger - could bring a revolution in revolutionise the system of record-keeping. It has the potential to transform the backend systems of transacting and reduce a large amount of operational costs.

Blockchain would be crucial in solving the current problems challenges faced in transacting and transferring information into financial reports. The main advantages of Blockchains are efficiency, cost reduction, transparency, and elimination of third parties. Blockchain improves the efficiency of a transaction as it eliminates decision time. Keeping and managing records can be automated and therefore completed faster than manpower. Payments and settlement can be done without the need for third parties and high brokerage fees. Blockchain uses cryptography to provide third-party trust. Eventually, Blockchains will be distributed, allowing both parties the real-time information of the transaction, thus leading to transparency (Gupta & Gupta 2018).

BT may represent the next level of accounting (Reuter, 2020). Companies will benefit by having a high degree of standardisation, enabling auditors to verify a large portion of the most critical data behind the financial statements automatically, minimised costs and employees could spend freed-up time adding value to the company's development. There will be traceable auditing where the auditor and compliance officer are included in the entire accounting process by running a trust node.

The transformations, caused by BT, will place the accounting and assurance profession in the midst of a technological transformation (Chartered Global Management Accountant & Certified Fraud Examiners, 2018). Tan and Low (2019) claim that, while accountants will no longer be the central authority of a blockchain-based accounting system, they will probably continue to be the party responsible for preparing the firm's financial reports. Moreover, accountants will become responsible for deciding on accounting policies and defining strategies for the choice and accreditation of validators.

Clear governance lays out decision-making, and accountability frameworks guarantee transparent financial data. This builds trust in the accuracy and the need to have Real-time Financial Reporting. In short, good governance and accountability pave the way for trustworthy Real-time Financial Reporting with BT. The key findings of this study based on the concepts and stages of IDT indicates the need for robust governance measures and strategies for adoption of BT in Real-time Financial Reporting.

The next section discusses the organisation of the remainder of this thesis.

## 1.10 ORGANISATION OF THE THESIS

The rest of this thesis is organised as follows.

Chapter 2 provides a structured literature review and identifies the research gap, the problem statement, the theoretical framework, and the research objectives and corresponding questions. Chapter 3 explains the research methodology, paradigm and supporting theories and data collection method employed to address the research objectives. Chap 4 provides the findings and interpretation of this thesis based on the perceptions derived from the one-to-one interviews supported with citations from journals and articles. Chapter 5 concludes the research with a summary of the study and future research prospects. The next section provides a conclusion of this introduction chapter.

## 1.11 CONCLUSION

This chapter has discussed the motivations for this study and how it will be conducted. The overall findings of this study indicate that there is a strong potential for adoption of BT in Real-time Financial Reporting. BT provides solutions to the current problems in FR as mentioned in section 1.4 above and the limitations and challenges of adoption of BT will be discussed Chapter 4 and 5 of this study. The next chapter discusses the prior literature to support the motivation for this study.

# CHAPTER 2: LITERATURE REVIEW

## 2.1 INTRODUCTION

This chapter provides a critical review of prior research and sets the context by discussing the evolution of FR in tandem with developments of BT to identify the research gaps in motivating this present study.

The literature review begins with elucidating the historical development FR as technology advances and how FR can leverage on BT. BT has a vast potential for improvising the efficiency and effectiveness of the FR process.

The remaining discussion in this chapter is organised as follows. Sections 2.2 to 2.6 introduces the past, current and future FR regime, from the conventional accounting right up to present, the emergence of BT in FR, the benefits of BT, specifically in providing real-time information, the sustainability of this emerging technology in FR and the stakeholders perceptions of future roles as users of information from financial reports. The development of the use of accounting software, internet FR, technology skills by accountants, the evolution of FR in modern times, the conceptual framework in financial reporting, fair-value financial reporting, value-creation in financial reporting, real-time financial reporting, the advent of XBRL, the introduction of BT and its use cases in various sectors, its potential in accountable, reliable information in financial reporting, offered in real-time will be discussed in a systematic manner in this section. Sections 2.7 and 2.8 discuss the theoretical perspectives and framed theories that support this study. Section 2.9 focuses on the research objectives and research questions of the study and Section 2.10 concludes.

## 2.2 EVOLUTION OF FINANCIAL REPORTING (FR)

Prior to the discussion on evolution of FR, it is important to delve into the evolution of accounting, as it forms the basis towards FR. Table 2.1 in Appendix 2 provides the stages of evolution in accounting and the corresponding literatures that provide the understanding and insights of this evolution from a historical perspective, to where we stand in the current stance.

FR is the communication of financial and non-financial information relating to the financial position of the company through several media to that informs various users their decision-making process (Uyob, Saas & Ahmi, 2019). It forms a frame of reference for the evaluation of existing practices and development of new ones. According to IASB (2018) the purpose of FR is to provide useful information for economic decision making. A conceptual framework will form a theoretical basis in determining how transactions should be measured (historical value or current value) and reported. In other words, how they are presented or communicated to users.

The digital age ushered in the era of big data, prompting discussions on the relevance and sufficiency of traditional financial reporting models. Stakeholders increasingly demand non-financial information, such as environmental, social, and governance (ESG) metrics, reflecting a broader understanding of corporate performance.

The evolution of financial reporting mirrors the dynamic nature of business, finance, and regulation. From ancient record-keeping to the digital age, the journey has been marked by a continuous quest for transparency, accuracy, and adaptability. As businesses continue to evolve, financial reporting will likely undergo further transformations to meet the demands of an ever-changing global landscape.

In a rapidly changing technology-driven era, most notably the internet, the language of FR has become digitalised. In the next 20 years, FR become stronger and more vibrant due to disruptive technologies such as machine learning, artificial intelligence, Blockchain, and big data analytics. With the convergence of artificial intelligence and Blockchain, it is now clear that soon, the work of the accounting profession will be hugely supported by automation (Turegun, 2019).

FR is evolving to meet the requirements of a widening range of users, as well as responding to economic changes. Accountants are not required anymore to brood over maintaining comprehensive registers of cash or commodity transactions manually.

When IBM released their first computer in 1952, accountants were the first to use them. Recent initiations in technology have taken accounting into the realm of computer-software such as *Xero*[2]. These new progressions are much more instinctive and spontaneous, empowering accountants to conduct their day-to-day tasks faster and efficiently. An understanding of the development and evolution in FR will be useful in discussing how FR responded to technological innovation since early days. The next section discusses the development of the accounting field from its roots to its modern equivalent.

## 2.3 FINANCIAL REPORTING IN MODERN TIMES (2010 TO CURRENT)

Over the past decades, the nature of FR has evolved to meet the changing needs of users. Business and capital markets have become more challenging, with greater complexity in business models, sources of risk and uncertainty, as well as sophistication in how risk is managed. This evolution reflects a desire for information that is relevant to users, even if such information may be more subjective and less reliable.

FR disclosure requirements and practices have also had to respond to these changes by shifting from simply providing breakdowns of line items on the face of the financial statements to providing more detailed disclosures, including disclosures of assumptions, models, alternative measurement bases and sources of estimation uncertainty, amongst others. In some ways, disclosures have become the balancing item in the calculus of how to provide credible, decision-useful information.

[2] Xero-A *cloud-based accounting software platform for small businesses*

In light of these trends in the role and importance of financial statement disclosures, questions have arisen as to how auditors should apply auditing concepts in obtaining sufficient appropriate audit evidence about financial statement disclosures to support their opinion on the financial statements as a whole (IASB, 2011).

Roszkowska (2020) supports the argument that improving FR transparency and the audit process with emerging fintech solutions can be an important mechanism for companies and investors to reduce tails risk and stabilise the stock market as a whole. The next section will continue to discuss the connection and relationship between FR framework and the capital market.

### 2.3.1 The Capital Market & Conceptual Framework for Financial Reporting (CFfR)

There is a preponderance of evidence in finance literature indicating stating that capital market participants depend on financial information to make various decisions (Agyei-Mensah, 2013; Bernard, 1992; Bernartzi et. al., 1997; Bhattacharya, 1979; Fama, 1965; Fama, 1970; Gnanarajah, 2015; Kothari, 2001).

The Conceptual Framework states that the objective of FR is to provide financial information about a reporting entity that is useful to existing and potential investors, to lenders, and to other creditors who would want to make decisions about providing resources to the entity (IASB, 2010).

The Conceptual Framework identifies the qualitative characteristics of relevance (predictive value, confirmatory value, or both) and faithful representations (complete, neutral, and free from error) as fundamental characteristics of usefulness, and it lists comparability, verifiability, timeliness, and understandability as enhancing qualitative characteristics (IASB, 2010). In 2018, there was a revision to the CFfR where revised definitions of an asset and a liability as well as new guidance on measurement and derecognition, presentation and disclosure.

This study will set focus on the characteristics of faithful representations, verifiability, and timeliness, which can be strongly supported by a Blockchain. The next section looks at the fair value orientation in FR.

### 2.3.2 Financial Reporting, Value Creation, Sustainability Reporting, and Integrated Reporting

Increasingly, corporate FR has faced tremendous pressure to meet stakeholder demands for greater openness and transparency. 74% of finance leaders who took part in a survey conducted by Ernst & Young stated in summary that investors increasingly use nonfinancial information in their decision-making, and 72% said that focusing purely on FR offers only a partial view of the company's value-creation framework. Stakeholders increasingly want to see how companies are creating long-term value. The survey suggests that business leaders need to exploit the potential of new technologies, and new talent with the skills to use it, if they want to restore trust and explain to stakeholders how they are creating long-term value (Ernst & Young, 2020).

At the United Nations Climate Change Conference (COP26) in 2021, the IFRS Foundation Trustees announced the creation of the International Sustainability Standards Board (ISSB) that will provide the foundation for consistent and global – (environmental, social and governance (ESG)) reporting standards that will enable companies to report on ESG factors affecting their business (PwC, 2022).

The environmental benefits of utilising Blockchain for industry and enterprise are substantial, but somewhat untapped.

BT overall is still in its infancy and requires further research and piloting efforts to achieve large-scale adoption, the COP26 summit is seen as the perfect opportunity to motivate such adoption (Roberts, 2021). While the Conferences of the Parties COP26, 27, and 28 primarily focused on national commitments to climate action and mobilising financial resources (United Nations Framework Convention on Climate Change, 2022) the potential of BT for Real-time Financial Reporting in the context of climate change mitigation has emerged as a fringe topic. Proponents argue that Blockchain's transparency and immutability could enhance the tracking and verification of climate finance flows, potentially fostering trust and accountability (Kornejew, 2022).

However, discussions on integrating Blockchain with real-time financial reporting for climate action remain nascent, requiring further exploration of governance structures and regulatory frameworks before widespread adoption becomes feasible.

According to the International Integrated Reporting Council (IIRC) basic thesis, in the frame of the business model the best way to integrate is to identify coherent relationships between resources as inputs and value creations as outputs. Thereby, the backbone of integrated reporting could be expressed as the relationship between resource allocations and value creations. In other words, this new reporting methodology tries to present the cause as behaviours to acquire resources, and the effect (result) as the level of value creation. On the other hand, this summarised aim of integrated reporting is lacking when a simpler question comes to mind: as Flower Value Creation Reporting: Answering the Question „Value to Whom" according to the International...147(2015), "Value to investors, value to society or value to present and future generations. Flower (2015) discussed the IIRC's failures and mentioned that the IIRC use the concept of value as value to investors.

Gotken & Gotken (2017) do not completely agree with him, as in their view, integrated reporting framework needs further discussion with respect to value creation. Therefore, the study tries to answer the question "*value to whom again* ?" in a more comprehensive manner. In doing so, the study aims to deepen the critical perspective for value creation reporting according to the International <IR> Framework to answer this question more clearly. They assert that the concept of value used in the International <IR> Framework (IIRC, 2013b) means more than value to investors. FR has gone through stages of evolution as seen from Figure 1.1 in Chapter 1.

The future of FR focusses on providing non-financial information with the ability for users to analyse data with integrative thinking and strategise towards value creation for the organisation. The next section looks at an important concept and principle in FR, Real-Time FR.

### 2.3.3 Timeliness and Real-Time Financial Reporting

Timeliness is an important characteristic of high-quality FR (FASB 1980; 2010). Investors attach high importance to timeliness of FR (Susak, 2020). The timeliness of financial information is one of several qualitative characteristics that make information useful to existing and potential investors (IASB, 2018).

Timeliness of FR can be classified into two aspects (Abernathy et al., 2017): (1) frequency of interim reporting and (2) reporting delay. The latter aspect, which is also the subject of this study, can be measured by the number of days between the first day of the financial year and the date of publication of the annual accounts (Atiase et al., 1989, in Reheul et al., 2014; Clatworthyand Peel, 2016) or number of days between the first day of the financial year and the date of the audit report delay in the audit report (Ashton et al., 1987, in Abernathy et al., 2017; Nelson et al., 2019). The length of the review process is considered a cardinal factor for the timeliness of reporting (Sultana et al., 2014; Chan et al., 2016).

According to a report by EY (2013), 'Real time' is a narrative technique in which the events depicted take place entirely within the span of the depiction, and at the same rate. Reporting information in real time means disseminating company information in a continuous manner, rather than at set time intervals, as at present.

The report states that companies already come under pressure from investors and regulators to speed up their closing process, i.e. the gap between year-end and publication of results. Those that take longer than the average is increasingly regarded as having inefficient systems. A move to real-time reporting could be a significant extension of this market sentiment.

With investors using market data that may be updated by the millisecond, and getting information on demand, the debate about how long company reporting can continue to be done on such a vastly slower timescale must start now.

Therefore, market participants need to be ready for potentially far-reaching repercussions – both for the future process of reporting, and the wider investor environment. Blockchain algorithms used in accounting enable the collaborative creation of a digital ecosystem with more properties and capabilities far beyond what is used today, i.e. the traditional ledgers (Watson & Mishler, 2017).

These show that Blockchain technologies will benefit and have a positive impact on real-time accounting practices (Bystrm, 2019). The next section looks at the need to ensure continuous accounting.

### 2.3.4 The Need for Continuous Accounting

Continuous Accounting transforms the way finance and accounting teams work by incorporating control, automation, and period-end closing tasks into day-to-day activities. This gives accountants the transparency needed to provide accurate reports at any time of the month and helps drive more informed decisions for the organisation. When accountants stop trying to cram weeks of work into one and no longer have to perform remote tasks, accuracy inevitably improves, and valuable people with specific are better utilised. Tasks that were only deferred until the end of a period are now embedded in day-to-day activities, finally bringing the pace of accounting to the pace of business operations (Nnenna & Amaka, 2020).

Blockchain can be used in continuous accounting. Blockchain ledgers can be used to store and audit information which can be easily shared with relevant stakeholders such as government, creditors, and business partners to provide an ongoing assurance (Vardia & Singh, 2022). The next section is on XBRL and the evolution of BT.

### 2.3.5 XBRL and Blockchain Technology

XBRL enables structured data, which is a prerequisite for machine readable blockchains (Monterio, 2016, Swan, 2015). XBRL and Blockchain can form a kind of “products symbioses”, which is a biological term meaning…….. Blockchain will become more efficient if XBRL provides high-quality structured data.

XBRL has the advantage as it represents the *de-facto* standard for the electronic exchange of financial and non-financial information and ensures that along the financial supply chain stakeholders' machine to machines can communicated efficiently without any data breaks. The expectation by the market is very high given the vast investments in Blockchain infrastructure projects (Beerbaum, 2018). Speed is another area where Blockchain and XBRL have their true advantages. Accounting processes can be automated to a large extent, while control and audit costs are reduced due to the integrated validation. XBRL combined with a Blockchain has the potential to enable real-time reporting and real-time accounting, as stakeholders have direct access to Blockchain accounting information.

The research analyses the use of XBRL in FR between late 2010 to present. Financial Accounting Standards Board [FASB] 2000), and the smooth functioning of capital markets (Hunton et.al.,2003). XBRL adds a vital attribute to FR as it provides an explicit semantic and machine-readable representation of the information elements found in business reporting in general and in financial statements (Debreceny and Gray, 2001). Within the information supply chain, XBRL reports will assist information consumers, such as investors, analysts, researchers, and value-added information intermediaries, in their decision-making process. XBRL is vital in the democratisation of markets. The flow of continuous information on significant changes in management or mergers and acquisitions is important to stake-holders and facilitates marketplace exchanges. The next section is on FR and the way forward with BT.

### 2.3.6 Financial Reporting and Blockchain Technology

The FR practice is not stagnant. It can be enhanced and adapt to the continually shifting business and regulatory atmosphere. Indeed, many new reporting models for businesses have been put forward over the last few years (ICAEW, 2017). Good FR plays a part in assisting to restore the trust that has been taken away, in the view by stakeholders of financial reporting. Companies must be able to converse more noticeably, flexibly, and efficiently with investors and other stakeholders about how they intend to move forward in a supportable manner.

Stakeholders require greater transparency vis-à-vis strategy, business models and risks, and the cost-effective prospects of the establishments with which they participate.

There has been a range of efforts to improve accounting information transparency. In particular, the International Financial Reporting Standards (IFRS) aim to bring transparency to financial markets, promoting trust, growth and financial stability in the global economy (IFRS, 2019). More recently, integrated reporting has been developed as a framework to communicate financial and other value-relevant information to investors in an integrated report (de Villiers et al., 2017; Rinaldi et al., 2018). Legislation regarding the accountability of accountants and auditors in the discharge of their duties are held accountable to their duties has become are becoming increasingly severe. Nevertheless, unless we come up with a new accounting recording method that can solve the fundamental trust issue between insiders and outsiders of the company, there can only be marginal improvement on information transparency. information transparency can only be improved marginally.

The current challenges that are facing FR today are, include, amongst others, the costs and complexities of recording and aggregating transactions across multiple entities, difficulty of identifying a single source from which users can obtain credible, up-to-date/prompt company reporting across multiple-jurisdictions and companies, and making corporate reporting engaging and flexible in a multi-format and multi-stakeholder environment, whilst maintaining an assurance and regulatory body. BT quickly became a potential solution to address the afore-mentioned issues within financial reporting. The next section discusses the overall benefits of BT.

### 2.3.7 Overall Benefits of Blockchain Technology

Although there are potential cost savings and tangible benefits of using BT such as the efficiency of invoice processing, there are potential costs associated to the technology such as a fee to use the Blockchain platform. It is crucial for involved parties such as suppliers, buyers, and financial institutions to understand the net value of Blockchain before they make a decision to implement the technology.

Considering the application potentials of BT for managing supply chain risks, it is important to identify specific supply chain activities for which risk can be reduced and then come up with viable remedies for enhancing supply chain resilience (Min, 2019), These remedies should comply with the underlying principles for enhancing supply chain resilience such as prevent risk occurrence, reduce the impact of supply chain disruptions, improve the flexibility for coping with supply chain disruptions and change bad habits built by a business-as-usual attitude.

In addition to being efficient, the Blockchain has other unique characteristics that make it a breakthrough innovation. Blockchain is considered reliable because full copies of the Blockchain ledger are maintained by all active nodes. Thus, if one node goes offline, the ledger is still readily available to all other participants in the network. A Blockchain lacks a single point of failure.

In addition, each block in the chain refers to the previous blocks, which prevents deletion or reversing transactions once they are appended to the Blockchain. Nodes on a Blockchain network can come and go but the network integrity and reliability will remain intact if Blockchain is being used. In this way, no single party controls a Blockchain, and no single party can modify it or turn it off. The next section looks at the trait of Blockchain, consensus-based verification, which supports real-time FR.

Blockchain's internet-based foundation eliminates the need for an intermediary and provides an added level of privacy for users. These transactions are periodically bundled into blocks; these are linked together in chains, making up the entirety of Blockchain (Bitcoin and beyond: Cryptocurrencies, Blockchains, and Global Governance (Jackson, 2018). The implication of this, is that Blockchain provides for a more secure and enhanced ledger for transactions to be recorded in, which in turn creates a unique opportunity for those in auditing to utilise such a technology in their work. A breach in the security of this system is virtually impossible, namely because all entries are distributed and cryptographically sealed (Blockchain Technology: A Game-Changer in Accounting?).

Blockchain's development can best be likened to the development of double-entry bookkeeping, which revolutionised the industry by creating a dependable, accurate system for recording transactions. Not only did that establish a better foundation for accounting to grow 2 upon; it created an avenue for the audit profession to prosper.

One example of how Blockchain requires data standards are smart contracts. These are digitised contractual obligations that reside in Blockchain. A smart contract between two parties may specify that if the debt coverage ratio of one party falls below a certain level, an action is triggered by the digital contract. As the concept of the smart contract was developed, it became clear that reliable, consistent, machine-readable data is necessary for smart contracts to be fulfilled. The only way to enable access to consistent, machine-readable data is through universally accepted data standards. Smart contracts that rely on data prepared using a financial data standard can automatically trigger an action without the need for human intervention. The development of Blockchain makes the need for standards essential. The excitement and interest in Blockchain based technologies has raised awareness about the lack of financial standards, and technology enthusiasts focused on identifying existing standards that can be leveraged, and developing new ones where needed. A summary of the overall benefits of BT is articulated in Table 2.2.

| Criteria of BT | Benefits |
|---|---|
| Efficiency | • Any transaction once registered on the blockchain, cannot be modified, or removed.<br>• Track information over short- and long-term period, allowing secure, trustworthy version of knowledge. |
| Transparency | • No single individual can make the changes without knowing other participants in the business model. |
| Security | • The individual transaction is encrypted and has a verified connection with the previous transactions with help of hashing algorithms. |
| Network Distribution | • No one holds the network, permitting various users to consistently have numerous documents of the exact data. |
| Traceability | • It allows every group to trace the interests and confirm that it is not substituted or misapplied during the collection chain approach. |
| Reduced Costs | • Reduces intermediary transactions, resulting in reduced costs. |
| Availability | • Availability is higher as productivity increases by using blockchain because it divides each section into each department so that every individual can focus on a particular task or work. |
| Automation | • Smart contracts that reduce human intervention. |
| Decentralised | • Transfer of control and judgment created from a centralised organisation to a P2P network. |
| Tokenisation | • The worth of an asset including digital as well as material, is transformed into a digital token. |

**Table 2.2: Summary of Benefits of Blockchain Technology**

**Source: Ali, Jaradat, Kulakli, Abuhalimeh (2021)**

In summary, given the potential organisational changes induced by the application of BT, it can be concluded that it is worthwhile to have a closer examination of the technology and the impact of organisational restructuring. It should be reiterated that this study aims at describing at a macro-level how BT can be utilised to facilitate Real-time Financial Reporting in providing an engaging and flexible multi-stakeholder compliant financial report. It also scrutinises the continuous governance of the Blockchain network in maintaining trust and resiliency. In addition, the roles of SFRs, which includes Board of Directors, preparers of financial statements, auditors, investors, IT specialists, data analysts, regulators, and others, are rapidly evolving in the context of BT. The next section is on Blockchain network governance and accountability.

### 2.3.8 Blockchain Network Accountability and Governance

To understand how BT redefines organisational governance, we need to revisit the literature on corporate governance, which is concerned with organisational goals and the control of organisational stakeholders on collective outcomes (Aguilera, Desender, Bednar & Lee, 2015; Aguilera, Filatotchev, Gospel & Jackson, 2008; Moore & Kraatz, 2011; Williamson, 1996). Corporate governance concerns "who rules" and "how the organization is ruled" (Moore & Kraatz, 2011; Fama & Jensen, 1983; Hambrick et.al., 2008). Like any governance issues, corporate governance is about the distribution of power and control. Historically, corporate governance has its economics roots in agency theory (Jensen & Meckling, 1976), which is concerned with moderating principled behaviour. Different corporations can have different risks, attitudes, and preferences.

Owners focus on profit maximisation, and managers are assumed to be self-interested and involved in misconducts that benefit their own career advancement or compensation at the expense of owner's benefits (Dalton, Hitt, Certo & Dalton, 2007). Therefore, for managers, discrete benefits can outweigh the apprehension of the organisation's profitability.

Blockchain-based companies would be a novel type of institution, potentially requiring new economic analysis and governance mechanisms. Therefore, several studies emphasise the importance of government oversight of Blockchain adoption (Davidson et al. 2016; Yeoh 2017). Other studies identify problems with Initial Coin Offering (ICO) bans and examine optimal ICO regulation (Robinson 2017; Barsan 2017; Chohan 2017; Kaal and DellErba 2017; Li and Mann 2018; Zetzsche et al. 2018). According to Kaal and Vermeulen (2017), 25 countries are considering comprehensive cryptocurrency regulation. Such regulation is crucial to prevent money laundering and black-market transactions. Piazza (2017) discusses the adoption of Blockchain in corporate governance purely from a regulatory perspective and posits that, owing to regulatory uncertainty, the prudence of adopting bitcoin and Blockchain for ownership reporting and accounting is questionable.

Contrarily, Piazza (2017) advocates for the incorporation of Blockchain as a tool for corporate voting. In a comprehensive analysis, Brainard (2016) examines diverse cryptocurrency regulations and potential courses of action. Moreover, a distinct body of literature underscores the significance of coordinated societal regulations (Atzori 2015; Hughes and Middlebrook 2015; Mills et al. 2016; Robinson 2017; Nabilou and Prum 2019). Harwick (2016) delves into economic barriers, legal considerations, technical challenges, intermediary issues, governance factors, and proposed solutions related to cryptocurrencies. The subsequent section addresses the Blockchain trait consensus-based verification and its benefits in Real-time Financial Reporting.

### 2.3.9 Consensus Based Verification and its benefits in Real-time Financial Reporting

In the last five years, many Blockchain systems have been successively emerging. The decentralisation, consensus mechanisms, smart contract and other properties make them applicable to various fields such as finance, education, medicine, and technology. One of the core characteristics of a blockchain, consensus, plays an important role in the stability of a Blockchain system operation. The continuous improvement of consensus mechanisms such as PoW (Proof-of-Work), PoS (Proof-of-Stake), DPoS (Delegated-Proof-of-Stake) and PBFT (Practical Byzantine Fault Tolerance) has led to the development of BT to Blockchain 3.0 (Zhang, Wu & Wang, 2020).

(Wait, 2019) argues the benefits for accounting and auditing can derive from implementing a blockchain, stems directly from the technology design and its characteristics. Blockchain brings decentralisation, strong authentication, and tamper-resistant ledger of all historical transactions. There is a claim that Blockchain permits “triple-entry bookkeeping”, where a transaction leads to not two but three entries, namely, debit, credit and a cryptographic signature to verify the validity of a transaction. Data are encrypted and validated by participants before being added to the ledger. The new entry is verified via a predetermined mechanism: a consensus protocol (Casino et al., 2019), i.e., 51% of the members of the chain need to agree to it. Upon acceptance of the transaction, the entire ledger is updated. Multiple entries, which represent transactions, are put together into a “block”, which is added to the ledger (Welker, 2018).

Hence, in a process that leads to financial reporting, the ability to rely on a Blockchain will depend on factors such as the robustness of the consensus mechanism, depth of the community supporting the blockchain, and reliability of the cryptography involved, among other things. The next section is on Blockchain accountability and governance.

## 2.4 BLOCKCHAIN IMPLEMENTATION CHALLENGES AND LIMITATIONS

There is no question that Blockchain has attracted the attention of many industries, companies, governments, and regulators who have recognised its potential. There is also growing hype surrounding the technology among tech-savvy business leaders. However, many of the anticipated benefits of technology still have a long way to go to become a reality soon, as the nature of the technology still imposes critical limitations (Aranda, 2017). Researchers often emphasise the transaction turnaround time (scalability), processing power and transaction costs, interoperability, confidentiality, and security of the Blockchain (Aranda 2017, Coyne and McMickle 2017, Kokina et al. 2017).

In terms of the scalability of the transaction, Bitcoin processes about 4 transactions per second on average with a throughput of up to 7 transaction per second (according to https://www.blockchain.com). Such transaction processing capacity is incomparable to the processing requirements of financial institutions whose settlement networks and systems process thousands of transactions per second. For example, Visa Net, the network used by Visa Inc. to process global payment transactions, processes an average of 1,700 transactions per second (tps) with tested capacity to process up to 65,000 transaction messages (Visa Inc., 2019). With reference to transaction costs and inter-operability of the blockchain, to verify transactions, particularly on public blockchains that use proof-of-work consensus, each node in the network performs the same tasks on its own copy of the Blockchain data.

Therefore, proof-of-work is inefficient compared to traditional ERP systems for tracking accounting transactions due to the high consumption of computer processing power and electricity needed to process transactions (O'Leary, 2017). As many Blockchain systems are developed for party adoption, the problem of inter-operability increases. In multiple industries, many Blockchains are being developed individually by many different organisations and to different standards.

Grewal-Carr and Marshall (2016) stress that this situation defeats the purpose of distributed ledgers, fails to take advantage of network effects, and is less efficient. BT allows transactions to be recorded in the records of multiple transaction parties at the same time as all parties have access to the same public database.

## 2.5 STAKEHOLDERS OF FINANCIAL REPORTING

The roles of SFRs are likely to change due to the shift of the recording and reconciliation of transactions from a manual to a gradually automated procedure. Internal control over FR has long been recognised as an important feature of a company and its earnings quality (see Kinney et.al., 1990; Kinney, 2000; Kinney, 2001). However, prior to Sarbanes-Oxley, actual standards in place were very limited in scope. The sole statutory regulation of internal control was the Foreign Corrupt Practices Act (FCPA) of 1977, while the only required public disclosure of significant internal control deficiencies was in the firm's 8-K, when disclosing a change in auditors (SEC, 1988; Geiger and Taylor, 2003; Krishnan, 2005). Section 404 of Sarbanes-Oxley Act 2002 states that (effective date of implementation November 15, 2004), managers must review and provide an annual report on their internal control, assessing the effectiveness of the internal control structure and procedures. However, even before the implementation of Section 404, firms began disclosing material weaknesses in internal control in response to Section 302 of Sarbanes-Oxley, where the disclosure requirements related to internal controls were strengthened. The next section looks at the new roles awaiting accountants in FR.

### 2.5.1 New Roles for Accounting & Finance Professionals in Financial Reporting

There will be no drastic changes in roles of accountants with BT. It is more of some repeatable and recurring processes that can be automated, giving accountants more time on value added activities such as business decision making and strategising activities.

As Blockchain systems standardise transaction processing across many industries, a professional accountant, including professional auditors, may be able to help provide assurance to users of the technology. The professional accountant may be able to fill a potential future role because of their skill sets, independence, objectivity, and expertise.

The following list of potential new roles for a professional accountant is illustrative only and not all-inclusive; significant regulatory and professional hurdles may have to be addressed before a professional accountant is able to take on these potential roles.

*2.5.1.1. Auditor of Smart Contracts and Oracles*

As described above, smart contracts can be embedded in a Blockchain to automate business processes. Contracting parties may wish to engage an assurance provider to verify that smart contracts are implemented with the correct business logic. In addition, a professional accountant or auditor could verify the interface between smart contracts and external data sources that trigger business events. Without an independent evaluation, users of BT face the risk of unidentified errors or vulnerabilities. To take on this new role, a professional accountant may need a new skill set, including understanding technical programming language and the functions of a Blockchain (Popchev, Radeva, Velichkova, 2022).

In the context of a financial statement audit, management will be responsible for establishing controls to verify whether the smart-contract source code is consistent with the intended business logic. An independent auditor auditing an entity with smart contracts on a Blockchain is likely to consider management's controls over the smart contract code. However, many companies may choose to reuse smart contracts built by other entities already active on a Blockchain. Future auditing standards and auditing guidelines may need to contemplate this technology and thereby bring clarity to the role of the professional accountant and auditor in those scenarios.

Blockchains may result in better corporate governance models with higher accuracy, accessibility, and efficiency, resulting in improved decision making by shareholders. Smart contracts on blockchains in the future can provide novel ways of governing corporates (Daluwathumullagamage & Sims, 2020).

*2.5.1.2. Service Auditor of Consortium Blockchains*

Prior to launching a new application on an existing Blockchain platform or leveraging or subscribing to an existing Blockchain product, users of the system may desire independent assurance as to the stability and robustness of its architecture.

Instead of each participant executing their own due diligence, it may be more efficient to hire a professional accountant to complete these tasks. In addition, critical Blockchain elements (e.g., cryptographic key management) should be designed to include sophisticated General Controls in Information Technology (GITC) that provide ongoing protection for sensitive information, as well as processing controls over security, availability, processing integrity, privacy and confidentiality. A trusted and independent third party may be needed to provide assurance as to the effectiveness of controls over a private Blockchain on an ongoing basis (KPMG, 2017).

#### *2.5.1.3. Administrator Functions*

Permissioned Blockchain solutions may benefit from a trusted, independent and unbiased third party to perform the functions of a central access-granting administrator. This function could be bearing the responsibility for verification of identity or a further vetting process to be completed by a participant before they are granted access to a Blockchain. This central administrator could validate the enforcement and monitoring of the Blockchain's protocols. If this function is performed by a user/node of the Blockchain, then an undue advantage could exist and trust among consortium members could be weakened. Since this role would be designed to create trust for the Blockchain as a whole, due care will be needed when establishing both its function and its legal responsibilities. As a trusted professional, an independent auditor may be capable of carrying out this responsibility. However, this role may raise new questions for the profession (Sunny, Hajek, Munk, Abedin, Satu, Efat, Islam, 2022).

#### *2.5.1.4. Arbitration Functions*

Business arrangements can be complex and result in disputes between even the most well-intentioned parties. For a permissioned Blockchain, an arbitration function might be needed in the future to settle disputes among the consortium-Blockchain participants. This function is analogous to the executor of an estate, a role typically filled by various qualified professionals, including professional accountants and auditors.

Participants on the Blockchain may require this type of function to enforce contract terms where the spirit of the smart contract departs from a legal document, contract, or letter. Further considerations should be explored to determine whether an arbitration function is necessary.

At the present, accounting practitioners do not have or probably have not come to the realisation of the impact of technology advancements, mainly BT and how knowledge of it is needed to operate the functions of the future accounting and finance profession.

BT has gained momentum recently, and it could countenance a reconsideration of what we ruminate to be the margin of reporting. This might only prove its implication far in the future but raises essential questions about the concept of the 'entity' in reporting moving from a firm to a node of participants.

This looked at how the Blockchain characteristic 'consensus-based verification' will support immediacy and real-time processing of transactions in FR utilising real-time confirmations, since network members approve data as it is added to the Blockchain (Cherukupally, 2021). The study will explore whether BT will address the challenge of FR to be single source and flexible in a multi-stakeholder environment, where information can be interpreted real-time to facilitate decision making, the governance of the Blockchain network in the accounting and finance discipline, as well as the changing roles of stakeholders financial reporting.

## 2.6 REAL-TIME FINANCIAL REPORTING – GAP IN THE LITERATURE

The research gaps have been identified based on the above discussion.

### 2.6.1 Research Gap 1: Governance and Accountability issues

Accountability refers to the need to justify a decision or decision-making process to others, a crucial extrinsic motivation common to business professionals (Tetlock,1983; Kennedy,1993; Siegel-Jacobs and Yates,1996).

Although not yet directly linked to technology use, this extrinsic motivation may influence decisions of working professionals on technology use. Previous studies report that in various decision-making contexts, accountability can affect the complexity of a person's thoughts and elaboration (Petty and Cacioppo 1979; Tetlock 1983; Kennedy 1993; Rich2004), which in turn can directly or indirectly influence his or her decision to use a technology.

According to Mending et.al.,2017, a lack of the required new organisational policies to clarify the usage of BT could be a challenge. BT adoption may change or transform current organisational cultures. Gorane and Kant, 2015 emphasise that organisational culture outlines the guidelines of the work cultures, values, and appropriate behaviour within organisations.

Also, adopting BT in supply chain processes requires new roles, responsibilities, and expertise to support the different facets of adopting technology (Mendling et. al.,2017). Limited technical expertise and knowledge of using BT act as a barrier of adopting this new technology into the supply chain. Although there is growing interest in Blockchain in the technical market, the limited number of applications and technical developers of Blockchain are an issue (Mougayar, 2016). BT is an information technology (Swan, 2015), which can be disruptive and requires altering or replacing legacy systems (Mougayar, 2016). Converting to new systems may change organisational culture or hierarchy and lead to resistance and hesitation from individuals and organisations (Jharkharia and Shankar, 2005).

Theoretically, the Innovation Diffusion Theory (IDT) helps to predict and evaluate the level of applicability of a new information technology in terms of its usefulness and ease of use for individuals and organisations (Venkatesh et.al.,2003; Wallace and Sheetz, 2014). Blockchain application can be evaluated from the IDT angle, as it is disruptive technology where use cases of its platform are progressing in leaps and bounds.

(Mathiyazhagan et.al.,2013) emphasises that if organisations wish to have sustainable supply chains with supporting a new information technology that is adopted by all the supply chain network, they need to embed sustainability practices into their organisational vision and mission.

Proactive plans to implement sustainability at all organisational levels and throughout the supply chain are also needed (Tseng, Lim, and Wong, 2015). Lack of standard tools, methods, and indicators hinder successful implementation and measurement of sustainability practices (Mangla, Govindan, and Luthra, 2017) within a Blockchain environment, for a given organisation.

BT is in its early stages and supply chains that have successfully implemented this technology to track their sustainable practices are difficult to find.

Lack of business models and best practices in implementing BT are challenges (Mougayar, 2016). One of the main drivers of adopting sustainable practices in organisations is environmental regulations and rules. Organisations are investing in and seeking to meet minimal sustainability criteria, which can simultaneously impede their creativity and innovativeness in implementing sustainable methods (Sajjad, Eweje, and Tappin, 2015).

A driver that can improve creativity in implementing sustainability is customers' demands for sustainable products and processes. Lack of customers' awareness and willingness to contribute to sustainable development is a barrier of sustainability implementation. In this case, customers do not understand the green certification schemes and are unwilling to contribute to recycling processes or pay more for sustainable products (Chkanikova and Mont 2015; Mangla, Govindan, and Luthra, 2017).

Innovativeness refers to the degree to which an individual, group or organisation is relatively quick in adopting innovation as compared to others in the society. Based on the innovativeness, adopters can be classified into five categories such as innovators, early adopters, early majority, late majority, and laggards (Rogers, 1995). People had used a particular system more when other in the neighbourhood had used it (Kraut et.al., 1998). Diffusion process can be accelerated or decelerated in early and later parts of the diffusion curve by the influential and imitators (Bulte &Joshi, 2007).

The review builds on the surveys of Bushman and Smith (2001), Lambert (2001) and Fields, Lys, and Vincent (2001), strive to limit overlap with those papers by focusing on research that has evolved since the time of those surveys.

Specifically, in the governance area, papers have begun to explore how a commitment to FR quality influences both board structure and ownership structure, although the causality of this relation is likely to go in both directions). In the executive compensation area, although literature on the role of accounting-based performance measures has noticeably waned, considerable literature on the relation between executives' equity incentives and FR quality has emerged.

Finally, mainly due to because increased data availability, empirical research on the role of FR in debt contracting has grown rapidly in recent years. With respect to governance, much of the literature emphasises informal contracting based on signalling, reputation, and certain incentive structures, whereas in the debt-contracting literature, research is more balanced across formal and informal contracts. The general conclusion from this literature is that FR is useful because more efficient contracts are possible when contracting parties commit to a more transparent information environment. As a result, one does not expect to see firms converging to a single dominant type of corporate governance structure, compensation contract, debt contract, or FR system. Instead, one expects to observe heterogeneity in these mechanisms that is a function of firms' economic characteristics.

Although the literature on debt contracts tends to accept this notion, the governance literature seems more burdened by the notion that some governance structures are unconditionally "good" or "bad" (for example, governance structures frequently asserted as unconditionally "bad" include a board with a high proportion of directors, a CEO that also serves as chairman of the board, a CEO with relatively low equity incentives, and a firm with relatively weak shareholder rights).

In summary, there has been minimum literature on the accountability and governance of BT. To date there are limited use cases of BT in FR and minimum literature, over the last 3 years (2020-2022) on the upcoming uses of BT, besides being limited as the support technology for cryptocurrencies. There is some evidence by researchers on BT being able to provide, accurate real-time financial data. However, the direct influence of BT on Real-time Financial Reporting and the reliability of the data (consensus-based verification) trait needs are unclear.

According to the Financial Reporting Council (2018), corporate reporting is a mechanism to create trust in a company's financial position and performance. It does this through the rules, regulations, assurance requirements and communications practice which are focused on annual reports and other regulatory documents.

While corporate reporting generally works well, challenges remain, including:

• The cost and complexity of recording and aggregating transactions across multiple entities,

• The difficulty of identifying a single source (for users) of credible, up to date/prompt company reporting across multiple companies and jurisdictions, and

• Making corporate reporting engaging and flexible in a multi-format and multi-stakeholder environment, whilst maintaining an assurance/regulatory boundary. The point above has potential to be addressed by BT, and BT can provide a solution. However, there is no prior study which explicates the accountability and governance issues arising from the use of BT.

Continuing from Section 1.2.4, the concept and principle of RBAS is discussed here. Based on BT, instead of making separate accounting entries in each enterprise based on documents, a registration system can be created that allows transactions to be recorded directly in a common ledger with the participation and approval of all parties. After the transaction registry is completed, it will be almost impossible to hide and destroy transactions, since it is cryptographically signed and distributed to all nodes (Alkan, 2021).

Therefore,transactions between parties in the Blockchain are recorded and stored in the system in real-time and monitored instantly. "Real-time Blockchain Accounting System" (RBAS) is defined as a software solution that enables the exchange of monetary values between two or more parties, records this exchange transaction, reliably stores it, and enables the preparation of financial statements when needed (Potekhina & Rumkin, 2017). There are two parties involved in a typical business transaction: the party supplying he goods or services and the party demanding the goods or services. While one of the parties delivers the goods or provides the service, the other party pays or borrows for the relevant goods or services.

Both parties record the relevant transactions separately in their own accounting systems. In the BT based accounting system, the distributed ledger, which verifies the records in real time, participates in the registration process as a third party. The real-time blockchain accounting system proposes a triple-entry accounting system. Therefore, the blockchain distributed ledger is a third-party inclusion on the traditionally presented double-entry accounting (Dai & Vasarhelyi, 2017).

#### *2.6.1.1 The concept of accountability and governance, and its meaning in theory and in practice*

Accountability and governance are fundamental concepts in both theory and practice, playing crucial roles in organisational structures, public institutions, and various aspects of societal functioning.

Accountability in theory is the obligation of an individual or an organisation to be answerable for its actions, decisions, and the resulting consequences. It involves a clear chain of responsibility and the expectation that those in positions of authority or stewardship will justify their actions to relevant stakeholders. Accountability in theory includes the elements of responsibility, transparency, answerability, and consequences.

In principle, the concept of accountability forms the cornerstone of corporate governance. Boards of directors, executives, and managers are accountable to shareholders, ensuring responsible decision-making and ethical behavior. This includes financial reporting, where companies must adhere to accounting standards and provide transparent financial reports. In the area of public sector reporting, there is government accountability where public officials are accountable to citizens and transparency in administration, where governments are expected to operate transparently, with public records, open meetings, and accessible information.

In relation to governance in theory, it refers to the processes, structures, and systems by which an organisation or society is directed and controlled. It involves the distribution of power, decision making processes, and mechanisms to ensure accountability. The elements of governance include structures, processes, and power distribution. Elements of ethical standards, board oversight, ethical guidelines and public governance form governance in theory.

*2.6.1.2 The various aspects of accountability and governance as is currently practiced*

Aspects of accountability and governance that is currently practices are legal and ethical compliance. Adherence to laws, regulations, and ethical standards that apply to a particular industry or organisation. The importance of compliance with legal and ethical standards is essential for maintaining credibility, avoiding legal consequences, and promoting a positive organisational culture.

Next aspect is stakeholder engagement involving and communicating with various stakeholders, including employees, customers, investors, and the community, to understand their concerns and incorporate their perspectives into decision-making processes. The importance of engaging stakeholders fosters a sense of inclusion, ensures diverse perspectives are considered, and helps in making more informed decisions.

Next aspect is board oversight provided by a board of directors or governing body to ensure that the organisation is managed effectively, ethically, and in the best interest of stakeholders. Effective board oversight is critical for strategic decision-making, risk management, and ensuring the organisation's long-term sustainability.

The next aspect is risk management, which identifies, assesses and mitigates the risks that could affect the achievement of organisational objectives. Effective risk management ensures that an organisation can anticipate and respond to potential challenges, protecting its reputation and maintaining stability.

The next aspect is performance measurement and reporting and the establishment of key performance indicators (KPIs) and regular reporting on organisational performance against these metrics. Performance measurement and reporting enable organisations to track progress, identify areas for improvement, and be accountable to stakeholders.

The next aspect is continuous improvement which is a commitment to ongoing assessment and enhancement of organisational processes, policies, and practices. The importance of embracing a culture of continuous improvement helps organisations adapt to changing circumstances, stay competitive, and maintain high standards of governance.

The next aspect is a set of principles and guidelines that define acceptable behavior and ethical standards for individuals within an organisation. The importance is a strong code of conduct promotes a positive organisational culture, sets expectations for behavior, and helps prevent misconduct.

The next aspect is external audits and reviews which are independent assessments of an organisation's financial statements, internal controls, and overall performance by external auditors or regulatory bodies. External audits provide assurance to stakeholders and demonstrate a commitment to accountability and transparency. In summary, accountability and governance encompass a range of principles and practices that contribute to ethical, responsible, and effective organisational management. Embracing these aspects helps build trust, mitigate risks, and ensure long-term success.

To address this research gap, it is crucial to explore effective governance structures necessary to manage participant access, establish data quality standards, and create dispute resolution mechanisms in Real-time Financial Reporting with BT.

### 2.6.2 Research Gap 2: Consensus-based Verification Trait

So far, there has been some literature that addresses real-time financial reporting. Generally, in the late 90's and early 2000, the literature on FR were mainly centered on economic implications of FR. Recent studies indicate that certain shifts in the economics-accounting mapping do, however, occur over time.

For example, the Earnings Response Coefficient (ERC) has been found to decline over recent years (see, for example, Barth et.al., 1998; Collins and Kothari, 1989; Collins et.al., 1997; Easton and Harris, 1991; Francis and Schipper, 1999; Hayn, 1995; Lev and Zarowin, 1998; Rayburn, 1986).

Further, a continuous shift in emphasis from earnings to the book value of equity has been documented (see Barth et.al., 1998; Collins et.al., 1997).

According to Lang and Lundholm, 1993 and Botosan,1997, the most common mode of information disclosure examined in accounting research is the printed annual report. However, other modes of disclosing corporate performance information such as press releases, analyst briefings, and conference calls, and now IFR, are increasingly important (e.g., AJW; Frankel et.al., 1999; Bagnoli et. al., 1999).

This trend raises questions of how and why corporations are using these newer modes of corporate reporting to supplement or replace paper-based reporting. The FR disclosure environment at the national level is likely to induce corporate disclosure.

The disclosure environment includes various dimensions of national culture (Gray, 1988), the nature of financing (Ball, 1995; Nobes, 1998), and regulatory arrangements (Ball et.al., 2000). Gray (1988) explained that differing patterns in the cultural variables between countries has led to differing patterns of accounting and varying levels of corporate disclosure.

Cerf's (1961) inaugural empirical study of factors influencing the adequacy of US corporate annual report disclosure laid the foundation for a succession of studies conducted in numerous countries. Variables hypothesised to influence disclosure levels in these studies include a variety of firm specific characteristics, such as size, profitability, listing status, and leverage.

The examination of the determinants of voluntary disclosure is motivated by various research objectives, including the possibility of inadequate disclosure and the need for regulating such disclosure. Inadequate disclosure may affect users' economic decisions and efficiency of capital markets. Alternatively, systematic differences in disclosure found among firms within and across industries are used as a basis for the argument that efficient solutions are being found in the market for financial information (Malone et. al., 1993; Wallace and Naser, 1995). Early evidence of market efficiency includes Benston's (1969) finding that voluntary disclosure was common in the US before disclosure regulation imposed by the Securities Exchange Act of 1934.

The next discussion is on internet reporting. A few studies discuss the benefits of providing financial information on the Internet (e.g., McCafferty, 1995; Louwers et.al., 1996; Green and Spaul, 1997; Trites and Sheehy, 1997; Trites, 1999). Cost savings from the reduction of production and distribution associated with print-based annual reports and incidental from non-shareholder financial statement users is one of the main benefits from providing financial reports on the Internet.

Internet reporting improves users' access to information by providing information that meet their specific needs, allowing non-sequential access to information through the use of hyperlinks, interactive and search facilities, and allowing the opportunity for providing more information than available in annual reports. This improved accessibility of information results in more equitable information dissemination among stakeholders.

Diffusion is a process which alters the structure and functioning of social systems by introducing an innovation within a system (Rogers, 1995). An innovation can be an idea, object or practice which is new to the members of the society. According to Rogers (1995), adoption of innovation is determined by five attributes: relative advantage; compatibility; complexity; trialability; and observability. Relative advantage refers to the perceived degree of the betterment of an innovation to the idea replaced by it. Relative advantage can be measured in economic terms, social prestige, convenience, and satisfaction. Compatibility is a significant predictor of using a service (Carter and Bélanger, 2005) whereas complexity has been negatively related to using a service (Leanet al., 2009).

Trialability refers to a degree of an innovation experimentation on a limited basis. Observability is related to outcome visibility of an innovation implementation. Trialability and observability are positively related to the rate of adoption.

Next, Internet Financial Reporting (IFR) has produced valuable insights into the determinants of companies' disclosure choices. For example, Ashbaugh et.al. (1999) document IFR practices and provide preliminary evidence on why some firms disseminate financial information on their corporate web sites, while others do not.

The results indicate that firms engaging in IFR are larger and more profitable than those not engaging in IFR. Ashbaugh et.al., 1999 was one of the first studies to examine the IFR issue; however, it did not provide a theoretical rationale for its analysis. Several recent studies have attempted to alleviate this problem by using theories on voluntary disclosure (Ettredge et.al., 2002; Debreceny et.al., 2002; Xiao et.al., 2004) to generate hypotheses.

Ettredge et.al., (2002) classify IFR into required filings (i.e., disclosures that are required by the Securities Exchange Commission (SEC), such as Forms 10-K and 10-Q) and voluntary disclosures and investigate whether Internet dissemination of both types of data can be explained by theories of incentives for voluntary disclosure by traditional methods (e.g., Lang and Lundholm 1993).

The results show that the presence of required items on a company's web site is associated with size and information asymmetry while the presence of voluntary disclosures is associated with size, information asymmetry, demand for external capital, and disclosure reputation.

Debreceny et.al., (2002) study voluntary IFR in 22 countries to identify the firm and environmental determinants of IFR. Instead of separating the Internet financial content into required and voluntary items (in a manner like Ettredge et.al., 2002), they examine both the content and presentation methods of disclosure. The findings reveal that the presentation aspect of IFR is more associated with the level of technology and disclosure environment than the content of IFR.

Xiao et al. (2004) measure IFR in multiple dimensions (i.e., content, presentation methods, mandatory items, and voluntary items) and analyse the determinants of Internet-based disclosures by Chinese listed companies.

Their primary focus is on factors unique to the Chinese context, such as the existence of state ownership dominance. They find that IFR is positively and significantly associated with the proportion of legal person ownership, but not with ownership by domestic private investors, foreign investors, or the state. One characteristic of prior studies is the strong focus on quantitative aspects of the determinants of IFR.

Several studies examine the relationship between IFR and factors such as firm size, profitability, leverage, etc. (e.g., Craven and Marston 1999; Ettredge et.al., 2002; Debreceny et.al., 2002; Oyelere et.al., 2003). Only a few studies investigate qualitative determinants of Internet-based disclosures such as ownership structure (Xiao et.al., 2004) and level of technology (Debreceny et.al., 2002). Another characteristic of prior studies is the common use of analysts' ratings obtained from the CFA Institute (formerly AIMR).

To explore the link between firms' engagement in IFR and reputations for their corporate reporting practices, both Ashbaugh et al. (1999) and Ettredge et.al., 2002 use a sample of firms for which analysts' ratings of overall disclosure quality were available from the CFA Institute in its 1994/95 and 1995/96 "An Annual Review of Corporate Reporting Practices". Around late 2000 the tone of the literatures in FR moved more towards the governance and accountability of financial reporting.

In the context of FR research, considering consideration of informal contracts allows for a much richer analysis of governance-related working relationships among executives, directors, and shareholders.

If one were to consider only formal contracts involving these parties, one might conclude that FR plays a relatively limited role in governance-related contracts. According to Armstrong, Grey & Weber (2010), researchers have uncovered a wide array of important contracting roles for FR.

Based on the second objective on real-time FR which is made possible using the Blockchain trait consensus-based verification, accounting reports may comprise significant different perspectives like accounting operations (transaction processing, accounts payable and receivable, internal financial reporting), external reporting (statutory reporting, corporate finance, treasury and financial risk, and regulation, including internal audits, compliance with regulatory requirements and taxes), management accounting (forecasting, budgeting, costing and reporting on variances like cost control or detailed reports about performance against budget, as well as cash flow management), the management support (like identifying and analysing strategic options, decision support, designing and tracking key personnel indicators, benchmarking, strategic management accounting, and business risk management), the staff management, training, scrutiny of capital projects, emphasis on customers and products, reports about debtor and creditor ageing, auditing, internal controls implementation, risk management, error or fraud detection, accountability, among others.

The Association of Chartered Certified Accountants (ACCA) recently published a research study called "Understanding investors: the road to real-time reporting" based on a survey of 300 professional investors, half of them representing institutions with more than US$500m in assets under management, which found that there is a significant level of demand for real-time reporting.

They stated that real-time information allows them to better understand corporate performance and consequently improve their ability to react quickly.

They also believe that surveyed believe companies will be able to provide real-time information are those that have more robust corporate governance and are more likely to attract investment from institutions of them representing institutions with more than US$500m in assets under management, which found that there is a significant level of demand for real-time reporting. They stated that real-time information allows them to better understand corporate performance and consequently improve their ability to react quickly.

To address research gap 2, understanding the distributed consensus verification approach enhances trust and transparency in financial data, allowing for faster and more efficient reporting cycles in Real-time Financial Reporting with BT is crucial in order for SFRs to gain immediate access to reliable financial information, facilitating informed decision-making.

As this research relates to adoption of technology, the next section looks at several theories used in extant literature on technology adoption.

## 2.7 THE TECHNOLOGY ACCEPTANCE MODEL (TAM), INNOVATION DIFFUSION THEORY (IDT), STAKEHOLDER THEORY (ST) AND INSTITUTIONAL LOGICS (IL)

The following theories are commonly found in studies involving application of technology:

- Technology Acceptance Model (TAM)
- Innovation Diffusion Theory (IDT)
- Stakeholder Theory (ST) and
- Institutional Logics (IL)

### 2.7.1 Technology Acceptance Model (TAM) and Innovation Diffusion Theory

TAM focuses on the factors and decision-making processes an individual will go through in any decision to accept and use a technology. As this study is assessing the use of BT in real-time financial reporting, it is vital to analyse the ‘acceptance’ perspective of this technology.

Davis (1989) developed TAM to determine factors that influence the acceptance of technology. Two important individual beliefs about using information technology are "perceived usefulness" (PU) and "perceived ease of use" (PEOU) that can explain individual's intention to use the technology.

Davis concluded that perceived usefulness was the strongest predictor to one's intention to use an information technology.

In TAM, the goal is to utilise the primary determinant of use to accept or not to accept a new tool. The intention to utilise is controlled by the individual's personality toward utilising a specific tool. PU and PEOU impact a person's state of mind toward utilising a specific tool. Perceived usefulness (PU) is characterised as how much individuals trust that utilising a specific tool would improve his or her task execution. Perceived usefulness is the key determinant that emphatically influences users' convictions and expectation to utilise the innovation.

Perceived ease of use (PEOU) is characterised as how much the user utilises a specific tool, and it is free of effort. Past research has demonstrated that perceived ease of use (PEOU) impacts aims in two ways: direct and indirect impact through usefulness of the tool.

As indicated by Davis, PEOU has no critical impact on behavioural expectation to utilise because PU intervened in its impact. PEOU does not have direct effect on user's behavioural goal since it affects behavioural expectation through PU.

Further studies refined the importance of PU and PEOU and placed greater emphasis on attitude and social factors on behavioural intention. In 2003 a paper by Venkatesh et.al.,2003 empirically compared eight models. Based on their work in a variety of settings he produced a set of hypotheses to explore and explain the variables which impinge on acceptance and use, which they called the Unified Theory of Acceptance and Use of Technology (UTAUT) (Ward, 2018).

In arriving at the decision to use TAM at the initial stage of the study, it is useful to note that Walsham (2006, p.325) argues that theories are chosen in accordance with "….the researcher's own experiences, background and interests."

The background study conducted for the purpose of this research, includes a robust literature review of prior fieldwork, suggesting a strong, influential impact of BT in FR in the future.

Rogers (1995) proposed that the theory of 'diffusion of innovation' was to establish the foundation for conducting research on innovation acceptance and adoption. Rogers synthesised research from over 508 diffusion studies and came out with the 'diffusion of innovation' theory for the adoption of innovations among individuals and organisations.

The theory explicates "the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 1995).

Basically, diffusion is the process by which members of a social system communicate an innovation through certain channels over time. The Rogers' (1995) diffusion of innovation theory explained that the innovation and adoption happened after going through several stages including understanding, persuasion, decision, implementation, and confirmation that led to the development of Rogers (1995) S-shaped adoption curve of innovators, early adopters, early majority, late majority, and laggards.

Diffusion of innovation theory had been used in literature for determining diffusion and adoption of information technology such as cloud computing (Oliveira et. al., 2014), green IT (Bose and Luo, 2011), virtual technology (Fuller et. al., 2007) and Web 2.0 services (Corrocher, 2011).

Diffusion theory suggests that technology can have different levels of diffusion in a different industry (Zhu et.al., 2012). Furthermore, industries can cross-fertilize each other. The innovation-decision process is the process through which an individual acquires the knowledge about the innovation leading to forming of an attitude toward the innovation(persuasion), followed by a decision whether to accept or reject the innovation, then followed by implementing the innovation and whether to continue using innovation or not (Rogers, 1995). The literature suggests that during the knowledge phase people build their technological frame about the new technology and that social context plays a significant role in influencing the people throughout the process (Karsten and Laine, 2007).

As this study aims to understand the perspectives of SFRs in real-time FR utilising BT, it is vital to assess the readiness, acceptance, and attitude towards the diffusion of innovation or technology readiness of the organisation and their preparedness in handling BT.

### 2.7.2 Stakeholder Theory (ST) and Institutional Logics (IL)

Stakeholder theory has been used as a framework to explain corporate earnings management, particularly with respect to earnings quality (the selection of more conservative accounting policy choices) and the timing of earnings announcement under management discretion.

Thomson (1993) provided an early example through an analysis of stakeholder power during the pre- and post-privatisation of the UK electricity industry.

Pre-privatisation focus of primary stakeholder groups (government, consumers, competitors) on rates of return incentivised management to minimise profits to avoid price-capping, whereas post-privatisation profit- maximising accounting choices were selected, as management were incentivised by newly constructed bonus and share option contracts to align their interests with those of the recently created shareholders.

In a similar vein, Bowen, DuCharme and Shores (1995) found that implicit claims between an organisation and its customers, suppliers, employees and short-term creditors act as incentives for management to use long-run income-increasing accounting choices in relation to depreciation and inventory.

The use of a socio-economic perspective to evaluate accounting policy choice, as explored in such studies, provides a richer, more inclusive explanation of behaviour than reference to economic theories alone (Mangos and Lewis, 1995).

Mattingly, Harrast and Olsen (2009) argued that stakeholder management is an effective process for governing organisations as it is associated with higher levels of accountability and higher earnings quality.

Their findings clearly indicated that companies with more effective stakeholder management followed conservative accounting choices and had more transparent financial disclosure, thereby meeting a wider range of stakeholders' needs. Likewise, Hui, Klasa and Yeung (2012) illustrated that suppliers and customers with a bargaining advantage influence the selection of more conservative accounting policies. Such stakeholders bear significant downside risks if an organisation fails but gain little from strong corporate performance.

The conceptualisation of stakeholder theory was taken from accounting and finance literature (citing Cornell and Shapiro, 1987). They argued that managers have an incentive to minimise the adverse reaction of stakeholders to bad news by delaying related earnings announcements.

Building on this, Burgstahler and Dichev (1997) argued that firms with higher earnings face lower transaction costs: consumers will pay a premium for assurance that warranties will be honoured, and suppliers/lenders offer better terms if repayment is more certain. They reasoned that implicit claims act as incentives for management to select accounting choices that maximise profits/minimise losses.

Drawing on the 'proactive-accommodative-defensive-reaction' organisational strategy model and the life-cycle model (citing Jawahar and Mclaughlin, 2001), Camara, Chamorro and Moreno (2009) examined how the amount and type of financial information in the annual reports of the tobacco industry varied over the period 1887-1986 depending on the interests and power of key stakeholder (the State, employees and society).

One area where stakeholder theory is repeatedly used (in conjunction with legitimacy theory and agency theory) is within the voluntary disclosure of intellectual capital (see for example Alcaniz, Gomez-Bezares and Roslender, 2011; Castilla-Polo and Gallardo-Vázquez, 2016; Leuz and Verrecchia, 2000, and; Yongvanich and Guthrie, 2005). Disclosure is dealt with within traditional balance sheet measures but can be supported by non-financial metrics and narrative, as, for example, developed in the Danish Intellectual Capital Statement (Nielsen, Roslender and Schaper, 2017).

Beattie and Thomson (2007) and Beattie and Smith (2012) offered a managerial stakeholder perspective (disclosure driven by demands of primary stakeholders) and ethical stakeholder theory perspective (responsibility-driven disclosure) to explain motives for voluntary disclosure. They concluded that whilst the needs of financial market participants were paramount, the media and consumers were influential in disclosure decisions, especially disclosures that aimed to avoid scrutiny from stakeholder groups.

There is widespread criticism of the nature of FR for reinforcing shareholder primacy and failing to meet stakeholder needs. Murphy, O'Connell and Ó hÓgartaigh (2013), for example, contended that stewardship is central to the 'living law' of accounting and is fundamental to encouraging corporate decision-makers to broaden their responsibilities. Barsky, Hussein and Jablonsky (1999) also called for disclosure to encompass a societal balanced score card approach.

A 'wheel of stakeholder interests' was presented, and stakeholder theory was discussed (citing Woodward et al., 1996 and Langtry, 1994). They argued that FR practices contributed to the selection of a poor strategy at United Technologies Corporation that favoured shareholders over other stakeholder groups.

This study emphasises that SFRs will be requested to provide their perceptions on the readiness and preparedness of implementing real-time FR utilising BT withing their organisations and institutions.

The ST will be appropriate in interpreting their perceptions and supporting their opinions and views from a stakeholder's perspective. Next section will discuss the institutional logics theory.

Thornton and Ocasio (1999) define institutional logics (ILs) as "the socially constructed, historical pattern of material practices, assumptions, values, beliefs, and rules by which individuals produce and reproduce their material subsistence, organise time and space, and provide meaning to their social reality".

The concept of institutional logics consists of connected material and symbolic elements that cooperate to form a type of institutional order. As a result, institutional logics consist of a strong contingent set of social norms driving behaviour by a logic of appropriateness (Guerreiro et.al., 2012).

The main assumption of the institutional logics approach is that the interests, values, and identities of individuals and organisations are embedded within prevailing institutional logics (Thornton and Ocasio, 2008). Therefore, institutional logics shape cognition and guide decision making by contributing to organisational actors focusing on a limited number of factors and solutions that are in line with the prevailing logic and determine salient issues and problems (Thornton, 2002).

ILT provides organisations with their organising principles for a specific field (Friedland and Alford, 1991). ILTs are the basis of the taken-for-granted rules of field-level participants and their guiding behaviour (Scott, 2001). ILTs are important theoretical constructs because they help explain the connections that create a sense of common purpose and unity within an organisational field (Reay et. al., 2009).

Besides this, institutional theorists have argued that organisational fields are organised by a dominant institutional logic, although two or more institutional logics can exist simultaneously (Scott, 2008; Thornton and Ocasio, 1999).

ILTs are also an important aspect in understanding institutional change. The concepts of institutional logics and institutional change are highly interrelated (Reay et.al., 2009). Institutional change is often associated with the introduction of a new logic for the field (Lounsbury, 2002; Scott et.al., 2000; Suddaby and Greenwood, 2005).

Many institutional researchers interpret institutional change as the movement from one dominant logic to another (Greenwood et.al., 2002; Hoffman, 1999). Despite the existence of other logics, the dominant logic guides the behaviour of participants (Reay et al., 2009). A plethora of studies have shown how a newly introduced logic can become the dominant logic, which will provide a new guidance for the field members (Kitchener, 2002; Hensmans, 2003; Scott et al., 2000).

Upon reflection of above theories, the next section justifies the appropriateness of the IDT Theory for this study.

## 2.8 UTILISING IDT AS A BASIS FOR THE THEORETICAL FRAMEWORK

This study uses IDT as a basis for interpreting and understanding the data gathered from the study. The discussions of FR, revolving around real-time, the accountability and governance of BC, illustrates how these items can be viewed in a bigger and wider picture of how stakeholders of FR roles will evolve. Real-time FR will bring countless benefits to the accounting profession, and points towards highly insightful services that could be performed in a shorter period.

Generally, the theoretical framework in this study is divided into two parts-the first part analyses the study from a broader viewpoint whilst the second component adopts a narrower, more focused perspective.

According to (Grover & Kar, 2019), the theory of innovation diffusion has been used to determine diffusion and adoption of information technology such as cloud computing (Oliveira et al., 2014), Green IT (Bose and Luo, 2011), Virtual Technology (Fuller et al., 2007), and Web 2.0 Services (Kolochar, 2011).

Diffusion theory holds that technology is spread to other industries (Zhu et al., 2012). In addition, sectors can inspire each other. Knowledge about innovation that leads to the formation of attitudes towards innovation (belief), followed by the decision to accept or reject the innovation, followed by implementation of innovations and whether they should be used further (Rogers, 1995).

The aim of the study is to understand the phenomenon under study by viewing the subject from different angles and perspectives (Denzin, 1978).

The use of a multi-paradigm that involves the use of multiple as well as competing theories is advocated by researchers as a means to attempt to gain a better understanding of the phenomenon under investigation (Lewis and Grimes, 1999). The use of contrasting theories can give richer insights into the phenomenon under investigation (Lewis and Grimes, 1999). BT is a disruptive technology which use cases are on the rise in the accounting, finance, taxation and auditing industry.

Adoption of BT will be revolutionary to the accounting and finance industry and evaluating the concepts within IDT will be most suitable in interpreting the data collected from the interviews.

The study used the five concepts of IDT, which are relative advantage, compatibility, complexity, trialability and observability to interpret the findings of the research in Chapter 4.

This study aims to ascertain how real-time FR is made possible with BT, and to understand the future roles of SFR, all in the time of BT. Chapter 1 sets out the research objectives and the attributes contributing to the study. The usage of IDT in order to understand and interpret this study is very crucial.

The study uses the descriptive characteristics within IDT to provide the analysis and emerging themes from this section. The IDT descriptive characteristics are articulated in Table 2.

| **IDT Characteristic** | **Description** |
|---|---|
| Relative Advantage | The degree to which an innovation is seen as better than the idea, program, or product it replaces. |
| Compatibility | How consistent the innovation is with the values, experiences, and needs of the potential adopters. |
| Complexity | How difficult the innovation is to understand and/or use. |
| Trialability | The extent to which the innovation can be tested or experimented with before a commitment to adopt is made. |
| Observability | The extent to which the innovation provides tangible results. |

**Table 2.3: IDT Characteristics (Source: The Author)**

Rogers and Shoemaker (1971) observed that five attributes of an innovation or IDT characteristics above are largely involved in influencing the adoption of an innovation. The individuals' perceptions of these five characteristics predict the rate of adoption of innovations (Rogers, 2003). Rogers believed that these five qualities determine between 49 and 87 percent of the variation in the adoption of new products (Les Robinson, 2009). In the context of this research, the product is BT. Each of the attributes are explained in detail in Sections 2.8.1 to 2.8.5 below.

### 2.8.1 Relative Advantage

A simple yet a powerful concept for diffusion of an innovation. It is common that a person will only adopt a new idea, a new product, or a service if he perceives it to be a better option than the one in practice. If a user finds a new innovation more advantageous than the current operational one, he or she will be compelled to adapt to the new innovation.

Thus, the more advantageous the innovation, the more quickly it will diffuse in a social system. The degree of relative advantage is often expressed by a pot of sub dimensions (economic profitability, low initial costs, decreases in discomfort, social prestige, saving time and effort, immediacy of rewards) (Francesco, 2012).

The other elements of innovation diffusion such as communication channels are crucial to disperse the information about relative advantage of an innovation over current practices and objects. The faster and more reliable the communication system is, the quicker the rate of diffusion of an innovation.

### 2.8.2 Compatibility

Compatibility is the extent to which adopting the innovation is compatible with what people do (Kaasinen, 2005). It is the degree to which an innovation is perceived as consistent with consumer needs, values, and beliefs, previous ideas, and past experiences. It helps give meaning to the new idea and regard it as more familiar (Francesco, 2012). The more compatible the innovation the better are the chances of adoption. For instance, a firm which wants to introduce a new line of operations will find it suitable to have technology that doesn't a much impact on the existing lines of operation.

If the new line disrupts the existing operational lines, it may increase the cost involvement and the firm may scrap the deal. However, one shall not blank out this possibility that too much compatibility can sometimes be a problem as the users may find it unworthy to try an innovation or might not perceive it to be an innovation.

### 2.8.3 Complexity

Complexity is the degree to which an innovation is perceived as relatively difficult to understand and use (Roger, 2003). In contrast to other attributes, this attribute has an inverse impact on the rate of adoption of an innovation. According to (Roger, 2003), the simpler the innovation the greater the rate of adoption. This may not hold good in all situations as some high-tech products are perceived more advantageous because of their complexity. It must be pointed out though that quite often the rule of simplicity does help the diffusion of an innovation.

For instance, it was reported that farmers in the Sudan did not accept new irrigation practices instituted by the agricultural department as the use of those practices involved a great deal of direction and precision which were too difficult for the farmers to follow (Barnett, 1953).

### 2.8.4 Observability

Observability is the easiness with which the results of an innovation are not only visible but their communication to the prospective users. Here again communication systems play a crucial role. The more neatly a communication system is able to share the results of an innovation, the faster its rate of adoption. For instance, companies launching new products often advertise the comments and reviews of the customers who have adopted/purchased their innovations.

This creates a sense of assurance among potential users to adapt to an innovation. Moore and Benbasat (1991) found the observability construct quite complex, so they divided the construct into a result demonstrability construct and a visibility construct. While demonstrability means the ease of presentation of working and features of an innovation, visibility defnes the degree of exposure to public notice.

Result demonstrability is the tangibility of the results of using the innovation, including their Observability and Communicability (Moore & Benbasat, 1991). Visibility is the degree to which others can see that an innovation is being used (Benham& Raymond, 1996).

Both these constructs ultimately measure the degree of observability of an innovation. O'Connor (2007) found that high visibility and demonstrability of internet services prompted more users to take up internet connections.

### 2.8.5 Trialability

Trialability is the degree of examining or testing a new innovation before actually adopting to it. Trialability describes how easily potential adopters can explore innovation (Ullah, Al-Rahmi, Alzahrani, Alfarraj & Alblehai, 2021) A simple example of trialability is the test drive offers by the automobile companies where prospective customers can have a real life feel of the product before the actual purchase. It gives the prospective users a sense of sureness to adapt to an innovation. Trialability determines whether an innovation will be adopted or rejected by the prospective users.

### 2.8.6 Further Attributes of Innovation

Tornatzky & Klein (1982) identified five more attributes of an innovation. This included *cost, communicability, divisibility, profitability*, and *social approval*. It is argued that communicability is a synonym of observability and divisibility is proximate to Triability. Price and profits are not always key factors for adoption of an innovation while social approval is somewhat dependent on the previously discussed attributes.

Other researchers have extended Roger's work (Barnes & Huf, 2003), suggesting additional factors for the model. Image as the degree to which adoption and use of the innovation is perceived to enhance one's status. Trust is the extent to which the innovation adopter perceives the innovation provider to be trustworthy. The next section provides the summary and conclusion of this chapter.

## 2.9 SUMMARY AND CONCLUSION

This chapter discusses the evolution of FR, with a thorough discussion of the specified aspects of FR which are moving towards real-time FR. Since this study is looking at the conceptual framework, which is a world-wide recognised document, it is useful to do some jurisdictional comparisons in terms of the 'preparedness' of companies evolving to real-time FR using BT.

The study is fortified by one-to-one interviews on stakeholders' understanding of FR perceptions on the use of BT as a platform in supporting real-time accurate, verified FRs', using IDT theory at the macro and micro level will be able to analyse how the gap in the literature provides an opportunity for this study to expand the literature on the accountability and governance of a Blockchain and real-time FR, and the trait consensus-based verification which supports it. In light of this, it is also useful to review the methods used in conducting the study. The data collection method used is extracting information from the literature review and one-to-one interviews, which will be discussed thoroughly in Chapter 3.

# CHAPTER 3: METHODOLOGY

## 3.1 INTRODUCTION

The aim of this chapter is to describe the methods and procedures used in this research and how data is analysed as well as the overall research approach of this research to address the research objectives and questions identified in Chapter 2. The research questions and research objectives of this study and where these are situated in the research paradigm are discussed in detail. As such, the research questions (from Section 1.5) which will guide the investigation are as follows:

1) What are the governance and accountability issues related to applying Blockchain Technology in Financial Reporting?
2) How does the consensus-based verification trait of a Blockchain achieve real-time Financial Reporting?

The study adopts the phenomenology approach, which has shed light on hitherto unnoticed phenomena of human experience, reframed philosophical questions, and permeated thought in almost every branch of science. Phenomenology is often considered central to the interpretive paradigm (Clark, 1998; Denzin & Lincoln, 1998; Koch, 1995). A discussion is on the ontological and epistemological stances that provide the justification for selecting the phenomenology approach for this study is undertaken. Thereafter, a detailed research procedure in which this approach is applied ensues.

The remaining of this chapter is organised firstly on the types of research paradigms explained, the chosen research paradigm by the researcher, which is interpretive paradigm, the ontological and epistemological aspects of this research method, the research objectives and questions, research methods, research design, research sampling and research data collection, NVIVO Version 12, categorisation of the interview data, research validity and reliability, limitation of analysis and summary and conclusion of the chapter.

## 3.2 RESEARCH PARADIGM: THE INTERPRETIVE PARADIGM

There are three approaches to academic research, which are positivism, interpretivism and critical theory. The first approach, positivism assumes that reality exists independently of humans and not mediated by senses and governed by immutable laws. Positivists sit on the realism paradigm, and they strive to understand the social world like the natural world. Secondly, the interpretivists approach which believes in socially constructed multiple realities, where truth and reality are created, not discovered. The interpretive approach is subjective as it is not possible to know reality as it is because it is always mediated by senses.

Finally, the critical theory approach assumes that a reality exists, but has been shaped by cultural, political, ethnic, gender and religious factors which interact with each other to create a social system.

Interpretivists believe that knowledge and truth emanate from the interaction between multiple and, at times, competing realities. The need for absolute truths, precision, and generalisable findings give way to exploratory studies focused on understanding how and why social actors perceive or understand a phenomenon (Chua 1986). As a result, interpretive accounting researchers employ different theoretical frameworks and methods to study what Hopwood (1987) terms the 'accounting craft': how it develops, is applied, or understood. Most interpretive theories draw from the social and political sciences (see Gray, Kouhy, and Lavers 1995; Deegan 2013; Parker 2007) and usually rely on qualitative methods to avoid what they see as the reductionist trappings of traditionally positivist techniques (Ahrens et.al., 2008; Broadbent and Unerman 2011).

According to Willis (1995) interpretivists are anti-foundationalists, who believe there is no single correct route or method to knowledge. Walsham (1993) further argues that in the interpretive tradition there are no 'correct' or 'incorrect' theories. Instead, they should be judged according to how 'interesting' they are to the researcher as well as those involved in the same areas. They attempt to derive their constructs from the field by an in-depth examination of the phenomenon of interest.

This study utilises the interpretive paradigm, where the researcher will be using one-to-one interviews in obtaining their perceptions of SFRs on the real-time FR in the time of BT. SFRs have been defined in both Chap 1 and 2 of this study as preparers of financial reports, auditors, and users including investors, analysts, regulatory bodies, government, creditors, financial institutions, financial press, Information Technology (IT) analysts and others] that are deemed relevant in gathering information on real-time FR. Their perceptions are crucial in developing the framework of real-time FR using BT as a platform.

The study acquires an understanding of the challenges faced by SFRs in the use of real-time financial data, the potential accountability and governance issues, costs, resistance (Blockchain Anxiety) and any concerns that poses as a hurdle to the growth of the accounting profession towards adoption of BT. The study will focus on one of the traits of the Blockchain-consensus-based verification and how this trait will ensure verified, transparent, accurate real-time financial data, and how this can save time, costs, and better management of resources. The study will address one of the challenges faced by FR highlighted by the Financial Reporting Council (FRC) 2018, "The difficulty of identifying a single source (for users) of credible, up to date/prompt Company reporting across multiple companies and jurisdictions".

This study will achieve addressing the challenges; single source, credible, up to date/prompt FR by obtaining views and perceptions of stakeholders of FR on the current software utilised and the challenges faced by them in the potential solutions that BT provides in achieving real-time FR.

Besides the one-to-one interviews, information and evidence for this study will be gathered from various sources such as regulatory bodies, official government documents and websites, BT use cases, Blockchain interest groups, standards setters, and publication of the Big 4 on the increasing use of BT.

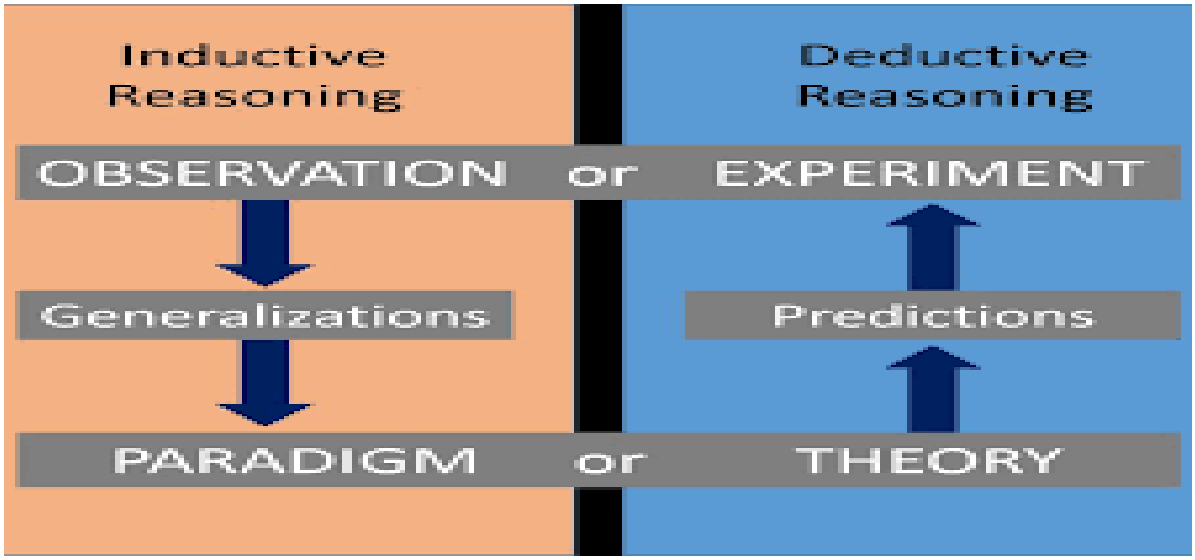


**Figure 3.1- The flow diagrams of inductive and deductive reasoning (Source: Karaman, 2015)**

This study is situated in the interpretivist paradigm. It should be reiterated here that this study aims at understanding the underlying issues and challenges in the accountability and governance or utilising BT in financial reporting, the Blockchain trait consensus-based verification and how it achieves flexibility and single source information in real-time FR and understand the perceptions of users and preparers of financial reporting.

As depicted in Figure 3.1, qualitative research utilises both inductive and deductive reasoning, with distinct purposes. Inductive reasoning takes center stage initially. This study initially analyses specific observations, interview data, or focus group transcripts. By identifying recurring themes and patterns within this qualitative data, they inductively build towards potential explanations or nascent theories. Subsequently, deductive reasoning is employed to refine these nascent theories. The research then consults the literature reviews draws upon the IDT theory to strengthen the emerging explanations, ensuring the findings are grounded in a broader academic context.

Table 3.1 below provides the characteristics of interpretivism, used in this study, categorised into the purpose of the research, the nature of reality (ontology), the nature of knowledge, the relationship between the inquirer and the inquired-into (epistemology) and the methodology used (Cantrell, 2001). This paradigm is suitable for the study as it this research aims to interpret the perceptions of the internal and external users of FR on their direct or indirect experience of utilising BT in their day-to-day operations. The challenges faced in the process of transitioning into the use of blockchain, the concerns arising from utilising BT and other areas concerning the adoption of BT is gathered accordingly and interpreted with a thematic analysis in Chapter 4.

| Feature | Description |
|---|---|
| Purpose of Research | An analysis of how BT will address the current challenge of real time financial reporting, how the SFRs will move to their new roles with BT. |
| Ontology | ➢ There are multiple realities.<br>➢ Reality can be explored, and constructed through human interactions, and meaningful actions.<br>➢ Discover how people make sense of their social worlds in the natural setting by means of daily routines, conversations and writings while interacting with others around them. These writings could be text and visual pictures.<br>➢ Many social realities exist due to varying human experience, including people's knowledge, views, interpretations, and experiences. |
| Epistemology | ➢ Events are understood through the mental processes of interpretation that is influenced by interaction with social contexts.<br>➢ Those active in the research process socially construct knowledge by experiencing real life or natural settings.<br>➢ Inquirer and the inquired-into are interlocked in an interactive process of talking and listening, reading, and writing.<br>➢ More personal, interactive mode of data collection. |
| Research Method | ➢ Process of data collected by one-to-one interviews.<br>➢ Research is a product of the values of the researcher, as an interpretation of the data collected and analysed. |

**Table 3.1: Characteristics of Interpretivism: Source: (Linder & Cantrell, 2001)**

In empirical research, the assumptions on ontology, epistemology, and perceptions of the society and the role of the investigator are often merely implicit (Laughlin, 1995).

(Hussey and Hussey, 1997) emphasised the importance for researchers to recognise and understand the ontological and epistemological orientation within the research paradigm as it can determine the entire course of the researcher's project. It is crucial for researchers to decide on these matters prior to conducting any study as they will be aware of potential biases in the approach employed prior to embarking on the empirical work. In relation to this study, it is crucial that the assumptions in the theoretical framework are made explicit; for instance, this study looks the governance and accountability issues facing real-time FR and the users and preparers perceptions of FR in the time of BT. The theories are then mapped to the findings (and vice-versa) via an iterative process.

It is again crucial that the assumptions in relation to the theoretical framework are recognised as they assist the researcher in identifying the choice of research methods (Eisenhardt, 2002). To reiterate, this study is based primarily on users' and preparers' perceptions of real-time FR in the time of BT, supported by secondary data. Since assumptions influence the methodological choice of the researcher the ontological and epistemological assumptions underpinning this study will be discussed further.

The next section explains the ontology and epistemology perceptions in providing perceptions of the study. The study will be in an inductive-deductive paradigm, adopting a flexible mode in data derivation and interpretation. This justification behind this chosen method will be explained in the Ontological and Epistemological assumptions in Sections below.

In summarising the discussion so far, this study adopts a combination of the inductive paradigm of research and theory. The theory is used as a basic guide of the research. Following the analysis of the outcome of the study, the theory will then be refined further and combined with another theory, where relevant. Elements of bias are reduced by undertaking the other methods of data collection as well as gathering data from other various sources in a Triangulation process.

Triangulation refers to the use of multiple methods or data sources in qualitative research to develop a comprehensive understanding of phenomena (Patton, 1999). The researcher will be using the one-to-one interview method in gathering data for this study. These methods are further discussed in the Research Methods Section 3.6 below.

However, it is also important to highlight that the subjective dimension adopted in this research is not based on the extremely subjective dimension located at the end of the subjective-deductive spectrum. Undertaking such an extremely subjective approach is not suitable for this study, not because of any fundamental flaws in the methodology itself, but rather due to its incompatibility with the research questions posed in this research. In this case, the primary research questions highlighted in Chapter 1 are mainly aimed at studying the governance and accountability of a Blockchain, real-time FR supported by BT and the users' and preparers' perceptions of future roles in financial reporting.

## 3.3 ONTOLOGICAL AND EPISTEMOLOGICAL ASPECTS

Ontological and epistemological aspects concern what is commonly referred to as a person's world view which has significant influence on the perceived relative importance of the aspects of reality. Two possible worldviews are: objectivistic and constructivist. These different ways of seeing the world have repercussions in most academic areas; yet none of these views is superior to the other.

Both may be appropriate for some purposes and insufficient or overly complex for other purposes. Also, a person may alter his or her views depending on the situation. This study makes use of elements from both views and considers them as complementary.

### 3.3.1 Ontological Assumptions

The ontological evaluates the form and nature of reality and therefore, what is there that can be gathered from the study. Some research favours more towards realism (Ting-Toomey, 1984, Lincoln and Guba, 1985).

According to Schwandt (2001) ontology "is concerned with understanding the kind of things that constitute the world". Schwandt stresses that ontology is seeking meaning by understanding the reality., Gough (2002) defines ontology as: "What is the nature of the 'knowable' (or 'reality')?". Similarly, Gioia and Pitre (1990) stated that ontology focuses on understanding natural occurrences (as cited in Ruona & Lynham, 2004). As the ontology of the interpretivism paradigm is "experienced world" (Habermas, 1972; Lather, 1991), perceptions of the participants are as an integral part of this research.

The aim of this study is to seek understanding whether BT attributes influence accountable, real-time financial reporting. This points the study towards the phenomenon under study as an independent and single reality. In other words, it accepts the knowledge claims by understanding different respondents' interpretation of their level of acceptance on the utilisation of BT in Real-Time FR. In order to establish the reliability towards utilising BT in financial reporting, the accountability and governance challenges is discussed. For example, if a real world is assumed, then what can be known about it is how things really are and how things really work (Robson, 2002).

At the same time, the researcher considers the internal act of consciousness, which refers to the rhythm and relationship between phenomenon and self (Langdridge, 2007; Moustakas, 1994) Then only those questions that relate to matters of real existence and real actions are admissible; other questions, such as those concerning matters of aesthetic or moral significance, fall outside the realm of legitimate scientific inquiry and therefore they are not considered in this research. In making an ontological assumption, the researcher must take a stand on what constitutes reality and how it is defined, constructed, explained, and discovered. LeCompte et. al., (1993) argue that reality can be explained in terms of the four-dimensional research paradigm. The next section will discuss the epistemological assumptions in this study.

### 3.3.2 Epistemological Assumptions

Epistemological assumptions refer to the way a researcher views the world and conveys the understanding as knowledge to others (Burrell and Morgan, 1979).

This effectively can be interpreted as an attempt to take accounting analysis a step away from the positivist perspective by incorporating social factors in its studies (Neu, 1992).

This assumption holds that the knowledge in research is obtained by acknowledging the fact that accounting is socially constructed and is engulfed in its socio-historical context.

Epistemology according to Schwandt (2001) is "the study of the nature of knowledge and justification". In consonance with Schwandt, Gioia and Pitre (1990) describe epistemology as basic understanding about knowledge structure of the phenomenon (as cited in Ruona & Lynham, 2004). To be more specific, the epistemology of the interpretivism paradigm as mentioned is: "Empathetic; Observer inter subjectivity". Thus, researchers stress on the aspect of epistemology which focuses on the knowledge about the phenomena and the rationale behind the study. According to Lather (1991) and Habermas (1972), the epistemology of the interpretivism paradigm is "multiple truths." Thus, researchers attempt to find more than one explanation for the phenomenon under consideration. Instead of having one answer, the researchers focus on seeking multiple answers.

However, it is also important to note that critical accounting researchers often use their analysis to critique the prevalent social structure and thus promote radical change (Ryan et. al., 2002). In this regard, Laughlin (1995) contends that a call for social change is not deemed to be essential following an analysis: he argues that researchers can make a stand with regards to the current social status either to maintain the status quo, show a strong case for change, or remain open to both ideas of supporting the current social structure opposing it.

While this study appreciates and thus attempts to take into account the stakeholders perception of FR in the time of BT, which ideally places the study in the 'critical perspective' group, following the call from Laughlin (1995); it is important to highlight here that the view of 'change' adopted in this instance is 'Medium'-which means that the researcher opts to be open in accepting the current social status as well as being open to the challenging status quo. This position will be discussed further in the concluding chapter.

The following section explains how recognition of the assumptions and therefore making a clear choice in research methodology is important in this research. This is done by linking the Research Methodology and Research Method by attempting to determine its relevance to this study.

### 3.3.3 Research Method

This study is a qualitative study in the interpretive paradigm, under the inductive-deductive dimension, and the justification for it is explained further in the paragraphs below. The next section will expand on the four-research dimensions. This study is under the inductive-deductive dimension and how the researcher arrived at this dimension is articulated in the following section.

## 3.4 PHENOMENOLOGY

The researcher aims to take a phenomenological approach in reaching the essence of the individuals' lived experience of the phenomenon while ascertaining and defining the phenomenon (Cilesiz, 2010). The purpose is to understand and describe a specific phenomenon in- depth and reach at the essence of participants' lived experience of the phenomenon, depicted in Figure 3.

The researcher uses a phenomenological reduction from the perceptions garnered from the one-to-one interviews, in arriving the outcome space with the interpretation of data. It is essential to highlight the compatibility of the research objectives, research questions, research methods, theories, and sampling strategy in contemplating the overall research design (Robson, 2002) which will be discussed in the following sections.

Based on this perspective, it is useful to reiterate that the subjective dimension of this research related to the interpretation of data and not seeing the subject of investigation through the world view of the research participants. This viewpoint is adopted to ensure compatibility of all the research components described above.

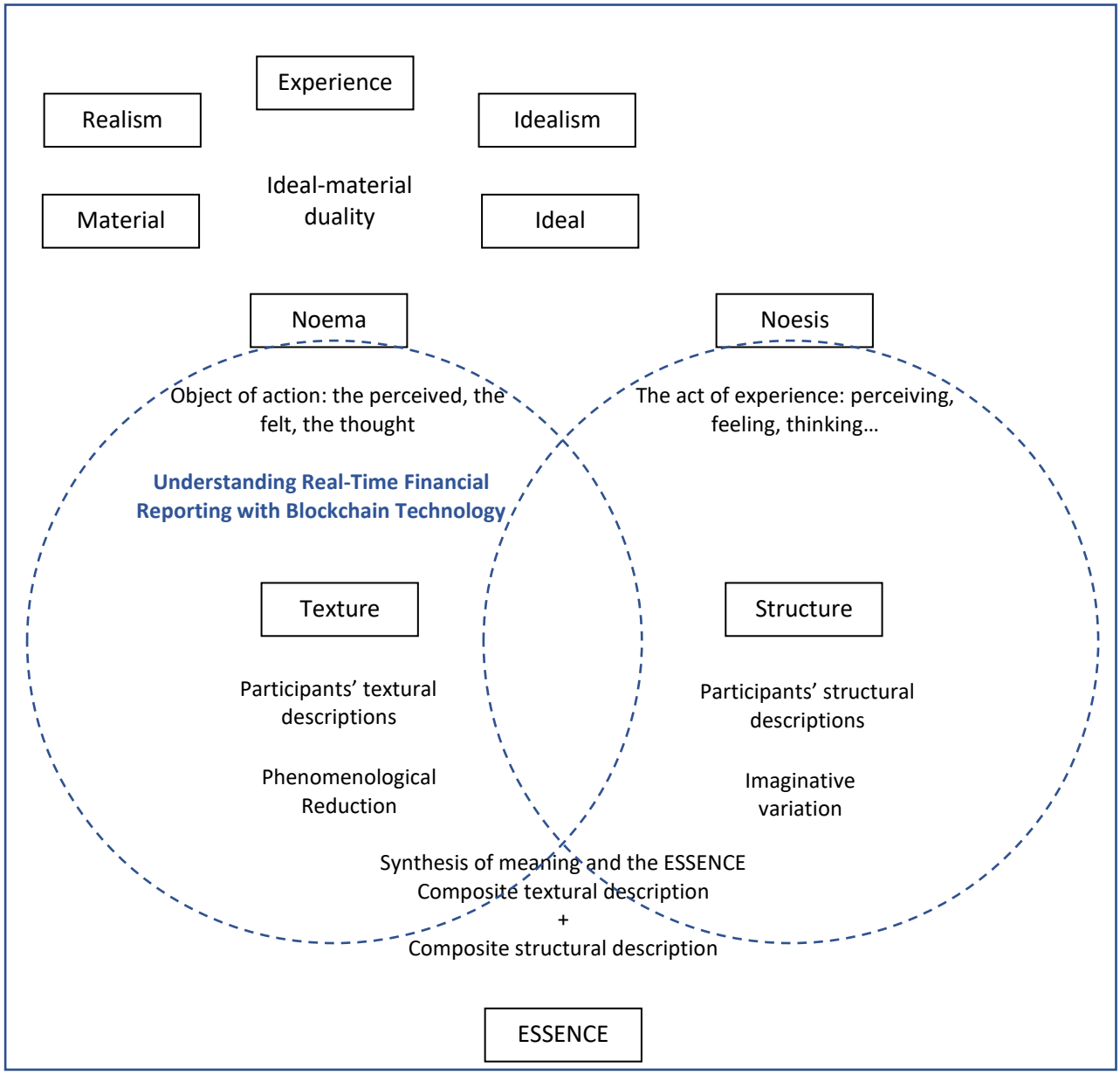


**Figure 3.2: The Phenomenological Concept of Experience (adopted from: A phenomenological approach to experiences with technology: current state, promise, and future directions for research, Source: Cilesiz, 2010)**

Figure 3.2 provides a depiction of where this study is placed within the phenomenological concept of experience of this study. This study is placed in the transcendental interpretation of a noema within the "appearance-object" schema. A phenomenological reduction is conducted to in describing the strata of an intentional act of consciousness.

Phenomenological research has its origins from a 20th century European philosophical movement. Oiler Boyd (2001) described some of the movement's common beliefs: "Perception is original awareness of the appearance of phenomena in experience. It is defined as access to truth, the foundation of all knowledge. Perception gives one access to experience of the world as it is given prior to any analysis of it. Phenomenology recognises that meanings are given in perception and modified in analysis…". These philosophers frequently understood their work as "an effort to get beneath or behind subjective experience to reveal the genuine, objective nature of things" (Schwandt, 2002).

Despite differences within the phenomena logic movement that have shaped research traditions, the methods of phenomenological research have much in common. These methods are used to study areas where little is known or to explore sensitive content. The researcher has recruited or will recruit potential research participants who have lived the phenomenon in question and are willing and able to describe their experiences.

Research participants may write of their experiences but are more often interviewed. Successful interviewing requires engagement and sensitivity. Creswell (1998) posits that the best criteria to determine the use of phenomenology is when the research problem requires a profound understanding of human experiences common to a group of people. Existing literature (Kyale & Brinkman, 2009: Marshall & Rossman, 2010) agree that the phenomenological interview should be open or semi-structured. These two types of interviews allow the researcher to address the phenomenon thoroughly, providing a space of aperture for the informants to express their experiences in detail and approaching reality as faithfully as possible. The detailed descriptions or interpretations brought by the participant in the profound-phenomenological interview should be as representative of experienced reality as possible. The focus of the phenomenological interview is the description of the meanings of phenomena (Rubin and Rubin, 2012).

These authors point out that that it is recommended to carry out additional interviews in order to verify the information obtained, allow the participant the opportunity to provide further detail or expand on the information offered and, lastly, for the participant's final approval.

The next section discusses the compatibility of the research objectives, research questions and the concluding theory that have been discussed that has been deliberated in Section 2.7 of Chapter 2).

## 3.5 THE RELATIONSHIP BETWEEN THEORY AND RESEARCH QUESTIONS

### 3.5.1 Research Objectives &and Research Questions

To reiterate the research objectives, the study aims to understand the issues surrounding accountability and governance issues in utilising BT in real-time financial reporting, to understand the BT trait consensus-based verification on how it contributes towards flexibility and single source information in real-time FR as well as the views of SFRs in utilising BT in real-time financial reporting. These objectives and the questions arising from it are framed with the concluding theories that the researcher has examined in Section 2.8 above. The concluding theories are explained briefly in the following sections as a link with the research method to be used in this study.

### 3.5.2 Aligning Research Questions & Theoretical Framework

The researcher emphasises that the choice of theories for this study is not entirely based on the theories upheld prior to conducting the study, but rather is arrived after thoroughly analysing the phenomenon investigated by mapping the theories to the findings as part of an iterative process. Refining and combining theories following the empirics demonstrate a strong connection between the theories and the analysis of results of the study. Aligning of the theories to the research questions is depicted in the Figure 4.1.

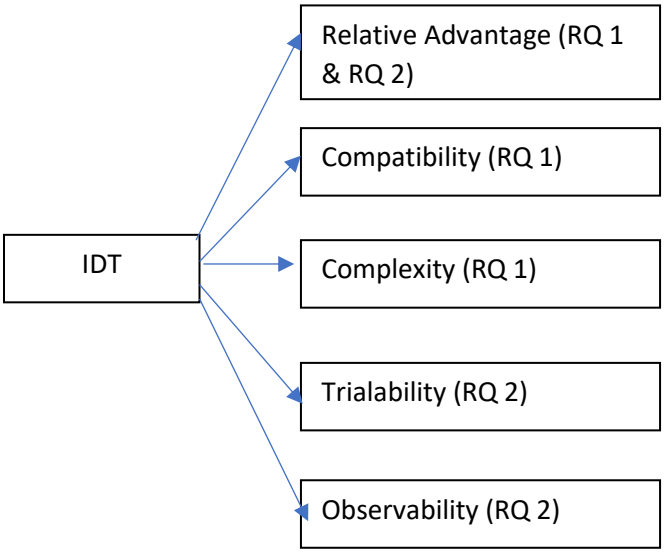


**Figure 4.1: Summary of Theory Descriptions based on RQ 1 and RQ 2**

Figure 4.1 outlines the concepts in the Innovation Diffusion Theory (IDT) adoption. It identifies four key factors that influence adoption: relative advantage, compatibility, complexity trialability, and observability. Each factor is measured through corresponding research questions (RQ). Relative advantage is assessed through research question 1 and 2, compatibility and complexity through research question 1, while trialability and observability is solely measured by research question 2. The figure suggests that researchers should consider these five factors when investigating the adoption of IDT in qualitative studies.

Ferreira and Merchant (1992) support the assertion that in the field of research, researchers who are caught by surprise by their data collection will often have to adjust their theoretical framework accordingly. Both advise researchers to be more open-minded and not to be too rigidly confined to the theoretical framework developed, especially in the early stages of the study. It is observed through this study that emerging technology such as Blockchain, and its use cases are still at an infancy stage. There are limited use case discussions and evidence of BT in financial reporting.

Therefore, this compels the researcher to use IDT in obtaining a more useful and meaningful explanation of the phenomenon based on the descriptive characteristics mentioned above. In relation to this research, it is crucial to note that the ontological assumptions that uphold extreme of these theoretical presumptions are not pursued. The study will be based on the premise that the reality is very much context-dependant; which brings the researcher to be in search of the reality and, looking at the psychological dimension, where thoughts are influenced by social settings (Ryan et.al., 2002; Walsham, 2006). Prior research is important as a guide to this research.

The study will be taken at a methodological stance midway between the inductive and deductive approach. Hence the study will be utilising IDT explained by its simplicity and validity in terms of theoretical attributes, empirical foundation, and general applicability to technology adoption issues in diverse domains). The next section will explain the research methods and research design of this study.

## 3.6 RESEARCH DESIGN

These were logically and appropriately applied to reach the required level of detail to give robust results. It became apparent that a qualitative approach that aimed to generate technology acceptance and theoretical insights through one-to-one interviews was appropriate for this study. As will be demonstrated, the method will produce findings supported by the framed theories, adding to the established body of knowledge.

With reference to this study, which is based on the chosen methodological standpoints discussed in the earlier in the previous sections, it is envisaged that a qualitative approach with a flexible research design will be the most appropriate choice of research method.

It will be useful to note in this circumstance that accounting researchers who adopt IDT in conducting flexible methods of research with a qualitative design (Tinker, 1980; Merino & Neimark, 1982; Tinker, 1984; Cooper & Sherer, 1984; Hopwood, 1985; Hopper and Powell, 1985; Roberts & Scapens, 1985; Chua, 1986; Laughlin and Lowe, 1990; Broadbent and Guthrie, 1992; Broadbent and Laughlin, 2003a; 2005a; 2005b).

In this study, the flexible research design will be used. Since the study seeks to understand clearly the demand for real-time FR utilising BT from the perception of stakeholders of FR, it is perceived that online one-to-one individual interviews will assist the study in obtaining in-depth knowledge of the phenomenon under the study.

The researcher will also be using individual interviews to probe the answers of the respondents and at the same time, observe the behaviour and body language of the respondents. Unlike administering questionnaires, interviewees are more likely to readily answer live questions and provide responses which contribute toward rich data. The research will also be able to probe more in depth, based on a response provided by the interviewee. The following section provides a more detailed discussion on the research design of each research method chosen here.

The interview participants were chosen based on the categories that fall under the stakeholders of financial reporting. They were segregated into internal and external participants which comprised of preparers of financial reports, auditors, internal auditors, selected financial institutions in Malaysia, the financial press and media in Malaysia, IT personnel tasked with designing a Blockchain platform for accounting and internal control transactions, investors, risk analysts, regulatory bodies in relation to FR standards and compliance, tax professionals, professional bodies and creditors.

The research method chosen is phenomenology as this study aims to understand perspectives of the issues surrounding accountability and governance in applying BT in financial reporting, the trait of the Blockchain that contributes towards real-time FR and the stakeholder's perspectives of the use of BT in FR.

Phenomenology is the study of structures of consciousness as experienced from the first-person point of view. Phenomenology as a discipline is distinct from but related to other key disciplines in philosophy, such as ontology, epistemology, logic, and ethics. Phenomenology has been practised in various guises for centuries, but it came into its own in the early 20th century in the works of Husserl, Heidegger, Sartre, Merleau-Ponty and others. Phenomenological issues of intentionality, consciousness, qualia, and first-person perspective have been prominent in recent philosophy of mind. The qualitative research interview seeks to describe and explore the meanings of central themes in the life world of the subjects. The main task in interviewing is to understand the meaning of what the interviewees say (Kvale, 1996). A qualitative research interview seeks to cover both a factual and a meaning level, though it is usually more difficult to interview on a meaning level (Kvale, 1996). Interviews are particularly useful for getting the story behind a participant's experiences. The interviewer can pursue in-depth information around the topic. Interviews may be useful as follow-up to certain respondents to questionnaires, e.g., to further investigate their responses (McNamara, 1999). Figure 5 shows the research design adopted using phenomenology.

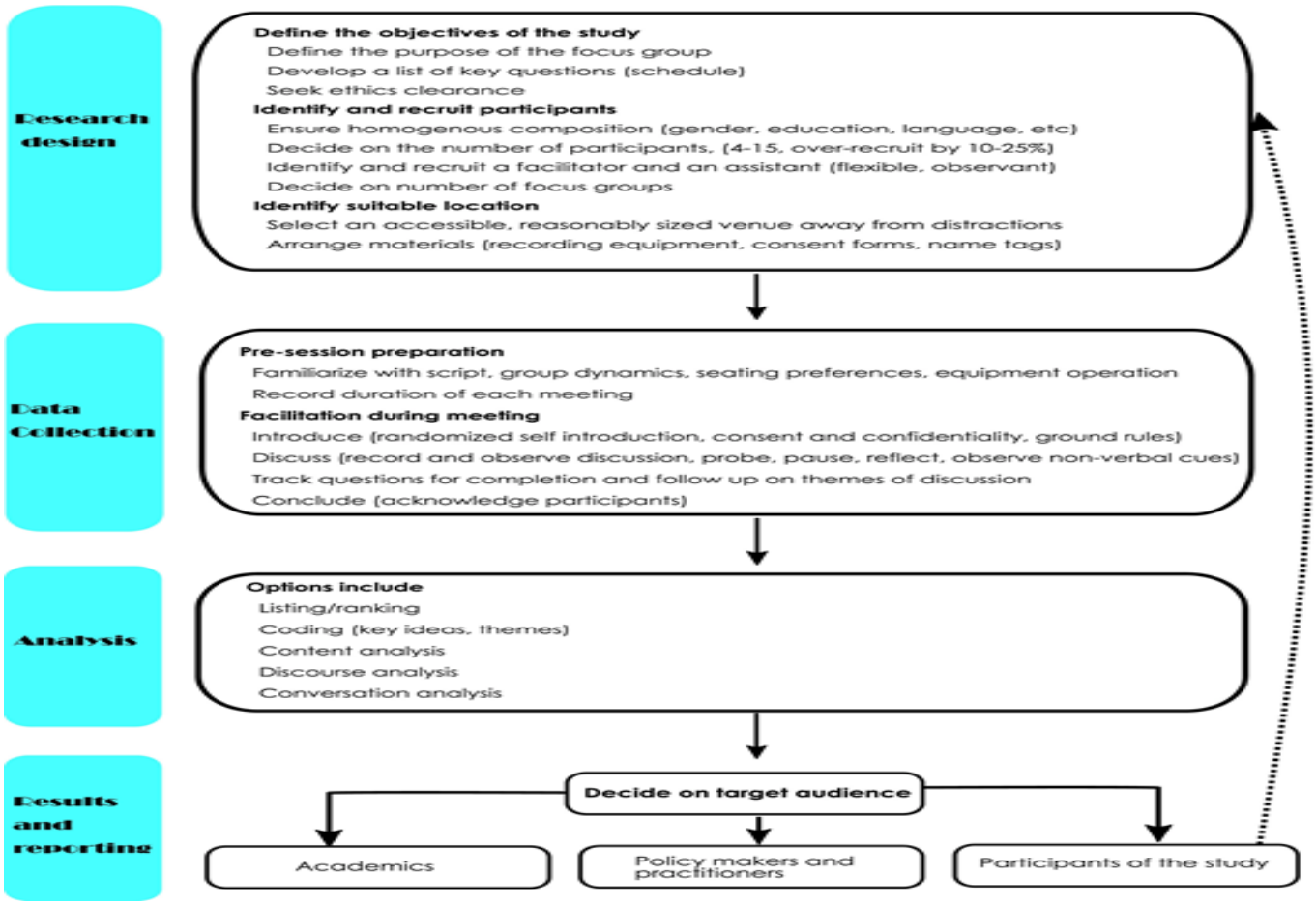


**Figure 3.3: Research Design**

### 3.6.1 Choice of One-to-One Interview Method

Figure 3.3 above provides the overall research design of the study encompassing the specific steps and purpose in data collection, analysis and results and reporting.

Based on a comparative analysis of one-to-one interview methods which are Informal Conversational Interview, General Interview Guide Approach and Standardised Open-Ended Interview, the researcher has selected the General Interview Guide Approach as the choice of interview method.

The researcher will choose the General Interview Guide Approach in the one-to-one interview with the SFRs as this method will provide flexibility in the questions, and the researcher will be able to throw curve-ball type questions in between and expect the interviewees to be more flexible in their answering technique and not rigid in their response, compared to a standardised method.

Participants will feel more comfortable and able to articulate their responses in a more relaxed manner, and this will motivate them to reveal more data that con positively contribute to this research.

As this study aims to understand perceptions, this method will be able to provide a wider scope of information that ranges from advantages and limitations of utilising BT in financial reporting. The one-to-one interview method may potentially cause extreme differing views. The researcher must be able to channel the interpretations of the discussion fairly and provide the exact views of each interviewee. It is certain that this method will provide greater ease of coding the information, which will be explained in the following sections.

The next section will explain the research sampling and research data collection for the study.

## 3.7 RESEARCH SAMPLING & RESEARCH DATA COLLECTION

The interviews were conducted on SFRs listed below, as these SFRs have been identified as those who are preparers and users of financial reporting. Preparers consists of accountants consisting of preparers of management accounts and all those involved in the preparatory stage of financial reporting. The users are those involved in the financial statement post publishing of the financial report. The sampling is done as provided in Table 5 in Section 4.1.2 to ensure equal distribution of perceptions from all SFRs.

Also, for preparers of financial reporting, various industries are selected to obtain the perceptions of real-time FR with BT. The researcher will be conducting one-to-one interviews with each of the SFRs as listed below:

Saturation is a crucial concept that is determined in this qualitative research, when conducting interviews. It refers to the point at which new interviews yield no significant new themes or insights. The research achieves saturation by continuously analysing the interview data. When repetitive themes emerge, and no novel information arises from subsequent interviews, saturation is likely to be attained. This signifies sufficient data collection for robust analysis and the ability to draw meaningful conclusions from this qualitative study (Saunders, Sim, Kingstone, Baker, Waterfield, Bartlam, Burroughs & Jinks, 2018).

| **Stakeholder of Financial Reporting** | **Age/Work Experience** | **Gender (M/F)** | **Job Title/Position** | **BT Experience (years)** |
|---|---|---|---|---|
| Preparers of financial reports (Malaysian Public Listed Companies) | 48/12 | F | Senior Manager, Finance | 1 |
| Auditors (The Big 4) | 52/18 | M | Partner | 2 |
| Selected Financial Institutions (in Malaysia) | 50/9 | M | Head, Group Tax | 1 |
| Financial Press/Media (in Malaysia) | 38/4 | F | Finance columnist | 1 |
| IT Personnel tasked in designing BT platform (Big 4) | 42/11 | M | IT Programmer | 4 |
| Investors (of companies adopting BC in FR) | 51/8 | M | Venture Capitalist | 1 |
| Risk Analyst (Malaysian Public Listed Companies) | 46/14 | F | Manager, Risk & Compliance | 2 |
| Regulatory bodies (Involved in BT governance) | 47/6 | M | Head, Governance & Conduct | 1 |
| Creditors (Involved in BT purchasing transactions) | 39/10 | F | Manager, Accounts Payable | 3 |
| Small Medium Enterprise | 36/5 | M | Owner/Manager | 2 |

**Table 3.2: Demographics of the Interview Respondents**

Table 3.2 provides the demographics of the interview respondents, providing their age, gender and position and role within their respective organisations.

Besides interviews of SFRs, the researcher also focused on collection of data from other sources such as journals and articles. These sources provided various information such as attestations and support, and reflective opinions towards the perceptions provided by the interviewees of this study. The researcher will be using the NVivo software to interpret and code the analysis of the data required. The next section will explain the NVivo method of analysis. There were twenty interviews conducted with internal and external stakeholders on a one-to-one session online.

## 3.8 NVIVO VERSION 12

Given the innovations in software technology, electronic techniques of data coding are gradually being employed more to obtain rigour in dealing with such data. Moreover, using a computer basically "ensures that the user is working more methodically, more thoroughly, more attentively". Thus, qualitative researchers are encouraged to pursue employing this tool as much as possible in their works. NVivo, a Qualitative Data Analysis (QDA) computer software package produced by QSR International, has many advantages and may significantly improve the quality of research. Analysis of qualitative data has become easier and yields more professional results. The software indeed reduces a great number of manual tasks and gives the researcher more time to discover tendencies, recognise themes and derive conclusions.

The researcher is convinced that this method is appropriate and in line with interpreting the findings of this study on the use of BT in real-time FR.

## 3.9 CATEGORISATION OF INTERVIEW DATA

A purposeful sampling method was employed in the study as participants who have experience with adoption of BT would have experienced the support-seeking phenomenon.

This enabled the study to have internal and external stakeholders of FR to share richer descriptions of their experiences and conceptions of the phenomenon (Patton, 2002). According to Trigwell (2000), pre-selection of participants with rich conceptions of realities means that they are able to manifest extreme variations in the ways they have experienced the phenomenon. Therefore, this study focuses on the ways internal and external stakeholders of FR perceive real-time FR with BT.

According to Bruce et al. (2004), there should be a sufficient number of participants in a research project to capture variations in people's perceptions 15 to 20 interviews are considered as adequate to reveal the breath of variations and to be within a manageable depth of descriptions (Trigwell, 2000). In traditional qualitative research, researchers halt the number of participants once the information reaches a saturation point when no new category emerge (Morse, 1994). However, in phenomenology, 15 to 20 interviews have proven to be adequate to attain saturation of categories (Dunkin, 2000; Trigwell, 2000). In this study, saturation of categories occurred with 18 participants when the researcher noted that no additional aspects of categories were emerging in the process of abstracting the categories of description.

The purpose was not to achieve a representative sample of internal and external stakeholders but rather, the purpose was to capture the variations in participants' experiences and to achieve saturation in aspects of categories. Therefore, in this study sampling halted at 18 participants. The interview questions are provided in the Appendix Section. The questions asked are derived from the research questions and in addition, to understand the current positioning of all SFRs in adoption of technology, and in particular BT.

## 3.10 RESEARCH VALIDITY & RELIABILITY – A QUALITATIVE APPROACH

Generally, every researcher should ensure that the methods used in conducting research are valid and reliable. Validity refers to accuracy in measuring a concept whilst reliability means consistency from one measurement to the next (Gilbert, 2001).

Although both validity and reliability are essential in ensuring the credibility of the research, such characteristics are more appropriate to positivistic rather than qualitative research (Lincoln and Guba, 1985). Hence, it is proposed that for qualitative research, the more appropriate attributes would be 'credibility' and 'dependability' (Crede, 1978). In order to achieve Crede, Denzin (1978b) proposes that researchers make use of multiple and different sources, methods and investigators and theories. With regard to this, prior sections discuss how this study uses various sources and methods (interview responses and publications, as discussed) in order to analyse the interview responses.

Macdonald (2001) suggests that theories triangulation is the most difficult to undertake, whilst others are of the view that such a task is epistemologically contestable (Lincoln and Guba, 1985). It is therefore necessary to briefly summarise the theoretical framework from the previous chapter in relation to triangulation. This study uses IDT to reflect the iterative processes of matching theories with the observations presented in empirics, as suggested by Humprey and Scapens (1996).

Having discussed the methodological issues in this section, the following section discusses limitations of the research approach which includes one-to-one interviews.

## 3.11 SUMMARY AND CONCLUSION

To conclude, the literature discussed in this chapter highlights the importance of the methodological aspects of this study as this enables the researcher to recognise the limitations of the researcher's own work. The chapter discusses the methodological and methodical concerns as raised by previous literature in the context of this research, also noting the respective limitations. Accordingly, as this study is based on the one-to-one interview method with specific focus on a particular context, the following chapter will provide the findings and interpretation of the study.

# CHAPTER 4: FINDINGS AND INTERPRETATION

## 4.0 INTRODUCTION

This Chapter discusses the findings based on the analysis of the interview data and interprets these findings in the light of Innovation Diffusion Theory (IDT). The discussion in this chapter is organised as follows:-

1. Section 4.1 provides an overview of the project and responded profile and selection process.
2. Section 4.2 presents a composite textual and structural description of the participants' conceptualisation of the accountability and governance factors, that contribute towards the adoption of BT as a platform for Real-time Financial Reporting, based on RQ1.
3. Section 4.3 presents the participant's understanding on the characteristic(s) of a Blockchain and which enables FR process to be Real-time, based on RQ2.
4. Section 4.4 provides a summary of emerging themes and key insights of RQ1 & RQ2.
5. Section 5.5 provides the conceptual framework of the research with the respondents discourses based on RQ1 and RQ2.

The analysis and discussion based on the theories and models is followed by the final objective of this study, which is to represent the theories and models in an outcome space. The outcome space closely represents "perception of the reality of an object is dependent on a subject" (Moustakas, 1994).

## 4.1 OVERVIEW OF THE STUDY

The purpose of the study is to understand the use of the disruptive technology BT in taking the FR process to the next level, of being reliable, flexible, accurate and real-time. Real-time information in an accurate and reliable form can be made available to users of financial statements. The purposeful sampling is to select 20 respondents who are stakeholders (defined in the research objectives section 1.5) of financial reporting. A general description of participants' demographic characteristics was explained in Section 3.7 in Chapter 3, while a more comprehensive description of each respondent is presented in this chapter for the convenience of the reader.

The researcher uses pseudonyms in the form of respondents' number to maintain anonymity and confidentiality. This chapter provides an overview of findings and classifies them according to the research objectives and theories relative to the understanding of the research questions. Point of saturation justification is provided in Section 3.9.

Triangulation (refer to Section and 3.2) method is used as the practice of using multiple sources of data or multiple approaches to analysing data to enhance the credibility of a research study. In this study, the researcher used interviews and aligned them with written archives, articles, and journals. There is a navigation and surveying of contexts from multiple perspectives from internal and external stakeholders of financial reporting, that leads to a more comprehensive understanding of the phenomenon of interest.

### 4.1.1 Textual Description of the Participants' Demography and One-to-One Interview Method

The one-to-one interview questions was designed based on RQ1 and RQ2. There are 20 interview respondents in this study which comprise of internal and external SFRs. The one-to-one interview conducted was divided into two sections, based on the two research questions.

The respondents are SFRs, ranging from internal and external stakeholders consisting of preparers of financial reports, auditors, and users including investors, analysts, regulatory bodies, government, creditors, financial institutions, financial press, Information Technology (IT) analysts and others. Each interview was conducted online for approximately 60 to 90 minutes. The questions were asked in an order of RQ1 and RQ2, and curve ball type questions were asked as the interview progressed, based on the responses from the participants. There was an equal distribution of internal and external SFRs.

This will give an equal balance of views from an internal perspective of handling transactions in preparation of management accounts and financial reports, and external users of financial reporting, who are users of financial reports. Responses were transcribed and then coded into the NVIVO software, and the findings and outcomes were generated accordingly.

There were 187 pages of transcripts, that were read and coded to abstract the similarities and variations of the participants' ways of experiencing and understanding the support-seeking phenomenon.

The coded transcripts were then converted into nodes and sub-nodes that are depicted in Figure 9 and 10 in Chapter 4. The interviews reach saturation point at interview 18. Please refer to Section 3.9 above, on the saturation point. The following section provides the description of the list of emerging themes from the research.

### 4.1.2 Respondents Profile

The respondents profile was selected based internal and external SFRs as they are preparers and users of FR. There was almost equal distribution of internal and external respondents, comprising of 8 internal stakeholders consisting of preparers of financial reports, internal auditors, IT personell tasked in designing a BT platform for the organisation, risk analyst and a tax professional.

The external stakeholders are individuals who are users of FR, comprising of 12 users of FR, who are auditors from the Big 4, selected finncial institutions in Malaysia, the financial press and media in Malaysia, investors and regulatory body, tax professional from a regulatory body, professional bodies and creditors.

There are more categories of users compared to preparers of the respondents, hence that is why there are samples for external shareholders chosen. The respondents have been selected on the basis that these stakeholders will have first hand information and exposure towards the adoption and implementation of any new prospect, in this context for FR or processes that contribute towards financial reporting, as well as the governance of FR within an organisation, as an internal or an external user.

| Category | Internal/ External | Respondent Code Interview Respondent (IR) | No. of Respondents |
|---|---|---|---|
| **Preparers of Financial Reports** | **Internal** | **IR 1 & IR 2** | **2** |
| **Auditors (Big 4)** | **External** | **IR 3, IR 4 & IR 5** | **3** |
| **Internal Auditors** | **Internal** | **IR 6 & IR 7** | **2** |
| **Selected Financial Institutions in Malaysia** | **External** | **IR 8** | **1** |
| **Financial Press/Media in Malaysia** | **External** | **IR 9** | **1** |
| **IT Personnel tasked in designing BT platform** | **Internal** | **IR 10** | **1** |
| **Investor (of a company adopting BC in FR)** | **External** | **IR 11** | **1** |
| **Risk Analyst** | **Internal** | **IR 12, IR 13** | **2** |
| **Regulatory Bodies** | **External** | **IR 14** | **1** |
| **Tax Professionals** | **Internal/External** | **IR 15 & IR 16** | **2** |
| **Professional Bodies** | **External** | **IR 17, IR 18 & IR 19** | **3** |
| **Creditors** | **External** | **IR 20** | **1** |
| **Total** | | | **20** |

**Table 4.1: Interview Respondents' categorisation**

Table 4.1 above provides the interview responders categorisation based on the internal and external stakeholders, and each are provided with a Interview Respondent (IR) Code.

### 4.1.3 Emerging Themes

Based on analysis of the interview data, several themes emerge. These themes are captured in nodes that contain selected quotes of the respondents that support to these themes. Despite varied professional backgrounds, based on internal and external users of financial reporting, respondents emphasised the significance and importance of Real-time Financial Reporting . The need for Real-time Financial Reporting is inevitable and forms part of an evolution.

The respondents remained focused on providing relevant examples by including their prior or emerging experiences in developing or utilising a Blockchain platform, integrating BT in their day-to-day operations, as well as enthusiastic in finding ways to embrace BT. Chapter 3 has detailed the methods, theories, and models for identifying the themes. Themes align with the following research questions:

1) What are the governance and accountability issues related to applying Blockchain Technology (BT) in financial reporting?
2) Which trait of a Blockchain achieves real-time Financial Reporting?

### 4.1.4 List of Theories and Aligning with Research Questions

With reference to Section 3.5.2, IDT forms the basis for developing a conceptual framework (Figure 4 & Figure 6) to guide the interpretation of the perceptions of stakeholders of FR towards the use of BT in real-time financial reporting. IDT is used to analyse the participants' perspectives based on the characteristics (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability and (5) observability, which have been explained earlier. Each of these characteristics are analysed based on the participants' perspectives of the different stages that they are in, pre-adoption and adoption of BT. Each respondent is then grouped into five phases of the technology innovation distinguished by the group of users: innovators, early adopters, early majority, late majority and laggards (Rogers, 1962).

With reference to Section 3.4 above, this study is a based on a phenomenological approach, which is a based on the respondent's philosophic attitude towards the most basic human truths that are accessible through inner subjectivity and perspectives towards the environment that they operate in.

The emerging themes from the outcomes of the interviews are then supported with journals and articles. The following sections will provide the theory building summary findings and interpretation of each objective, emerging themes and gaps arising from the study.

### 4.1.5 Theory Building through Coding, Categorising & Theme Development

Figure 4.2 provides the theory building and the concepts arising from the interviews and literatures that were reviewed. It provides a holistic view into the connectivity between the perspectives gained from the sampling of individuals representing SFRs.

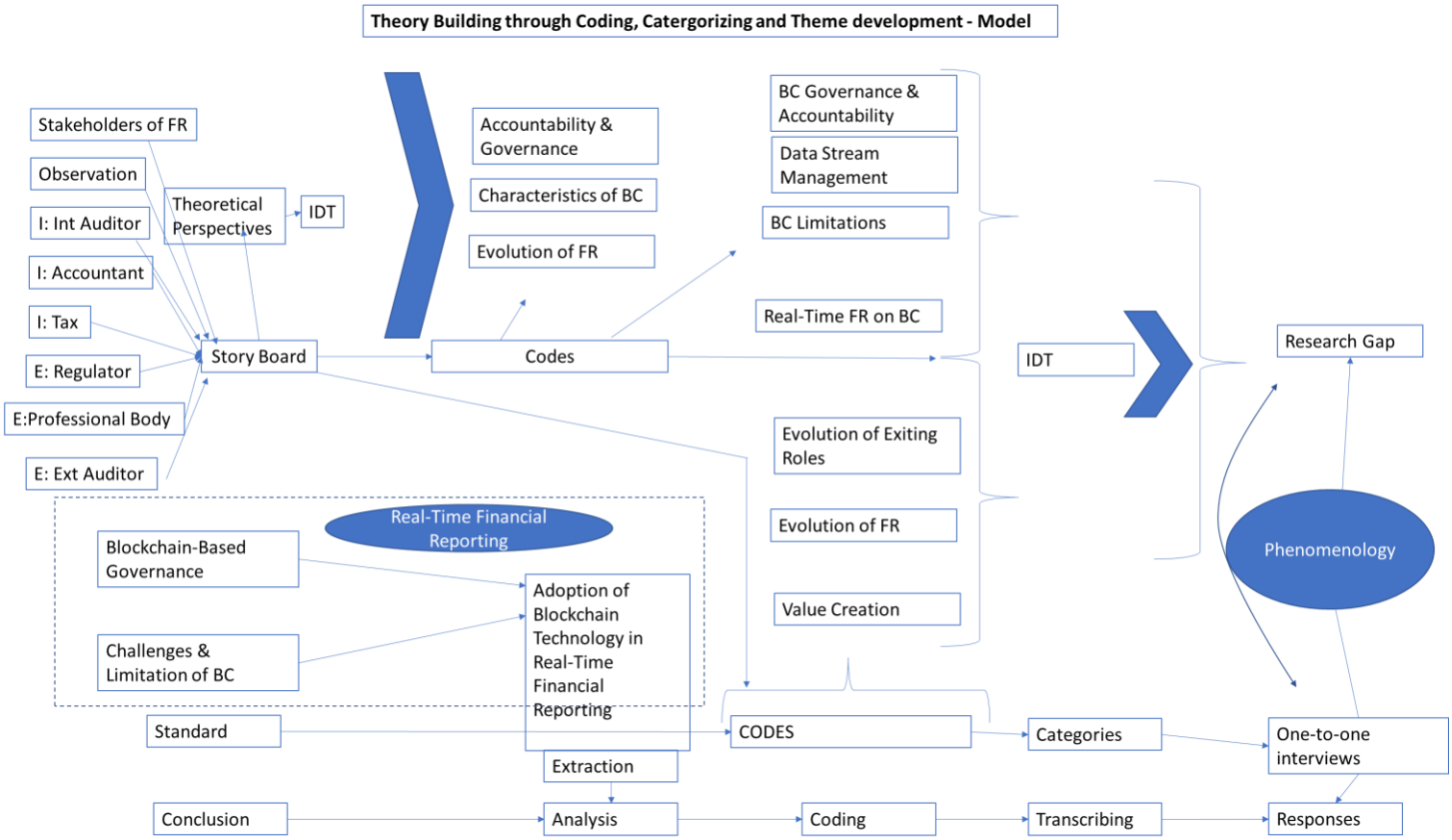


**Figure 4.2: Theory Building through Coding, Categorising & Theme Development – Model**

Figure 4.2 provides a summary of the theory to theme development of this study. Far left top of the diagram indicates the internal and external stakeholders of financial reporting. The data gathered from the interviews are gathered and transcribed on a story board and supported with the theory IDT for interpretation purposes. The data is then segregated via coding on RQ1 and RQ2 and coded via a thematic analysis, accordingly, based on the key emerging themes from the qualitative data.

Surprise elements that were derived through probing and further deliberation were narrated based on the outcomes received. Figure 4.2 takes the reader through the theory building, categorising and theme development of the study.

### 4.1.6 Tree Diagrams & Analysis of Transcripts

Two tree diagrams were prepared by the researcher, depicting the Emerging Themes (ET) arising from the coding of interview questions, which are based on RQ1 and RQ2. The ET are then further expanded to Nodes (N) and Sub-Nodes (SN), arising from the responses of the interview and curve-ball type questions posed to the respondents. The analysis of the findings and interpretation of this research is guided by the ET, N and SN, supported with relevant journal and articles. Other ET arising from the study is covered after RQ1 and RQ2 are discussed.

## 4.2 RESEARCH QUESTION 1: ACCOUNTABILITY & GOVERNANCE OF BT IN REAL-TIME FINANCIAL REPORTING

This section presents a composite textual and structural description of the participants' conceptualisation of the accountability and governance factors that contribute towards the adoption of BT as a platform for Real-time Financial Reporting. Before analysis of themes, a brief description addresses the research question one the concept of accountability and governance. The participants understood the concept of accountability from multiple perspectives. The conceptual understanding of accountability and governance revealed their knowledge of the importance of having a reliable method of understanding the importance, challenges, and limitations of utilising BT in Real-time Financial Reporting. The participants often stressed the importance of proper governance, even prior to information or data getting streamed into a Blockchain, and information that is passed to the block and churned out. It is a holistic process that involves a lot more parties, than just the accounting and finance team. The conceptual understanding of the external factors such as standards, guidelines, and influence of stakeholders of FR has been assessed.


**Figure 4.3: Analysis of Transcripts: Accountability and Governance of BT in Real-time Financial Reporting (RQ:1)**

The Tree Diagram is designed by the researcher, based on the emerging themes from RQ1. Figure 4.3 provides the five (5) themes arising from the analysis of transcripts from RQ1 which are provided below.

(a) Views of BT and it's uses in Financial Reporting (FR)

(b) Limitations of Blockchain (BC)

(c) Trust and transparency issues in Real-Time (RT)

(d) Blockchain-Based Governance

(e) Accounting software and other types of systems (Current)

The above themes are generated from the research questions and the responses of the interviewees are categorised based on these themes. The respective nodes and sub-nodes generated from these themes are articulated by the researcher in the following sub-sections below.

### 4.2.1. Emerging Theme: (a) Views of BT and its' uses in Financial Reporting:

Prior to the analysis of themes, a brief description addresses the research question on the concept of BT. The participants understood the concept of BT from multiple perspectives, based on their reading, webinars and use cases such as cryptocurrency. The conceptual understanding of BT revealed a good understanding and positivity towards the evolution of technology being embraced by the participants. The participants often stressed the importance of embracing technology such as BT and how it can make a difference in the FR process, especially in enabling the information to be in real-time. Considering the significance of the participation of preparers (internal stakeholders) and users (external stakeholders), Blockchain is a peer-to-peer system that eschews the role and power of centralised control over transactions, their record-keeping and access to these records (Upadhyaya, Mukhuty, Kumar & Kazancoglu, 2021).

The experiences of the participants were influenced by the environment that they perform their day-to-day operations in, be it healthcare, information technology development, tax practitioners, regulators professional standard setters, external and internal auditors, manufacturing, and other SFRs. The development of ideas about the use of BT were enriched by participation in various activities that are directly or indirectly involved with their role within the organisation. General views of BC as depicted directly from the participants.

#### *4.2.1.1.N1: General Characteristics*

Generally, a Blockchain is a particular kind of database that functions as a public ledger for recording transactions without requiring any third party to independently verify each of the blocks. Peer-to-peer (P2P) networks are used to expand the nodes of the Blockchain. Blockchain is composed of data units that are connected to one another in creating an unbroken chain of unchangeable records.

In order to prevent a single point of failure, the ledger is kept on a copy on each machine on the Blockchain network. Blocks are permanently added in a sequential manner and are unchangeable.

The first Block of a Blockchain, often known as the "Genesis block", contains the first transactions and serves as its foundation. A hash, which is an alphanumeric string depending on a particular block's timestamp, provided to the block and it is then sequentially added to the chain. Quotes from the participant as follows reiterates this.

*IR1: "A sequence of events which is interconnected right where one thing will happen after the* other"

*IR17: "Best way to understand how a blockchain works is by analysing a 'Smart Contract'"*

*IR18: "Blockchain links devices together. You have a system where you don't need anyone to perform a transaction on the ledger"*

As Blockchain is a disruptive technology, perceived acceptance of the technology is firstly important to analyse as technological advances have always played a vital role in business, prior to perceived usefulness. Advances in technology also expand knowledge. However, as long as it is *not accepted or used*, technology has little application. Therefore, understanding technology is of great importance and the acceptance of the change in technology, or an integration with a current system or software will further encourage the adoption of BT, provided additional benefits by integrating it with the existing system or software is viable.

As it can be seen from the responses above, the willingness to accept BT is apparent, irrespective of the industry the respondent is from. According to the goals of the principles of accounting and FR, information must have certain features such as accurate, reliable, and transparent to be applicable to users. BT has the potential to provide these features. As a result, the positive effect of BT on the quality characteristics of information will confirm the usefulness of this technology in the field of accounting and FR (Salvara & Taminen, 2009). The views align to Car (1999) who considered the acceptance of technology as a technology selection for the use for an individual organisation.

The respondents overall articulated the general characteristics of BT by using examples of its characteristics from use cases of Blockchain, particularly in the areas of supply chain management, healthcare and cryptocurrencies. The examples provided are patient care management system, processes related to purchasing on a supply chain as well as buying and selling of cryptocurrencies. Being from the accounting and finance background, they used examples such as a tool for reliable storage and carrying out processes. An example of a response can be seen below:-

*IR3: "I think one of the things about this technology, this is just based on my reading on the traits and the characteristics of a blockchain. I would say blockchain gathers information and it stores. And it transforms into a useful tool. The blockchain you cannot make changes you know, once you do a transaction, that's it. It's going to be there for ever and ever".*

The specific characteristics that were pointed out by the respondents can be summed up to immutability, transparency and decentralisation.

#### *4.2.1.1.1.SN1.1: Immutable*

As immutability is one of the most common characteristics of BT, it did not come as a surprise to the researcher that almost all respondents mentioned this characteristic as one of the main characteristics of a Blockchain. Immutability increases the overall efficiency of many businesses by providing them with an opportunity to maintain a full historical record of their business processes. Just like business processes, similar internal processes within an organisation contribute towards the preparation of internal accounts, auditing, and preparation of financial reports. Below is a respondent's view on the characteristic immutability (Rahardja, Hidayanto, Lutfiani, Febiani, Aini, 2021).

*IR9: "The characteristic immutability makes it impossible to falsify, manipulate or alter any information on a Blockchain, which makes it perfect to be used in an accounting and auditing environment".*

Blockchain's immutability is contributed by data residing in blockchains are tampered proof, where they can neither be removed nor mutated. However, this append-only data structure signifies the permanent storage and availability of the stored information to everyone in the Blockchain network.

The character of Blockchain is that it is a distributed ledger, all data is copied to network participants (nodes), and the data contained in the Blockchain are connected to one another, so if an individual intends to alter data in the node, it will not be possible as it will alter the previous data. Data that has been created cannot be altered (immutable) and can only be added (append only).

Immutability is a form of permanence. The value of data or variables that cannot be changed is known as immutability. Immutability or irreversibility in the education sector data such as student profiles that resides on the Blockchain can never been tampered with, and historical data cannot be erased or altered.

#### *4.2.1.1.2.SN1.2: Transparency*

However, this level of transparency, albeit desirable in some contexts, contradicts several privacy requirements and data protection rights, especially when personal data is at stake (Politou, Casino, Alepis & Patsakis, 2021).

The character transparency makes information easily traceable and recorded systematically in a secured manner, as proclaimed by two examples of respondents comments below:-

*IR4: "It enhances transparency, and you can't change anything that has been recorded there. Therefore, there is a certain level of integrity"*

*IR12: "So, we are having the technology in place, which is popular to everyone, if I put the address of every single party, I can see what are the transactions behind this address. Without knowing the person, the only address will be date and time, and transaction amounts. So, this is transparency, so truly, let us make it this way. Number one, we are putting the record in a network, open to everyone and this network all communicating with each other using specific algorithm, which is the hashing algorithm, to tamper and keep the data in very secured platform. To say that data is distributed in a network, in a decentralised way. That is number one, number two, the participant within the network is everyone and we don't know anyone"*

Traceability is an important criterion in accounting processes as the need to revert to previous transactions does arise in day-to-today operations, as well as financial audits. As mentioned by some of the respondents in the area of supply chain, there are many use cases of Blockchain, and traceability is emphasised in ensuring transparency is exercised at all times.

According to (Sunny, Undralla & Pillai, 2020) Blockchain-based traceability solutions can tackle the shortcomings of centralised traceability solutions. Firms have already started incorporating Blockchain into their supply chain activities in order to improve transparency through tracking and tracing all the events that occurred.

*IR15*: "*It does not need monitoring and self-sustaining"*

Achieving truly transparent governance in Blockchain requires a multi-pronged approach as follows:

(i) Promoting Openness and Inclusivity: Governance processes should be open to participation from all stakeholders, not just select groups or individuals.

(ii) Developing Robust Standards and Best Practices: Clear guidelines and standards for transparency and accountability within Blockchain governance are essential.

3 Encouraging Regulatory Collaboration: Regulatory bodies need to actively engage with the Blockchain community to develop informed and balanced regulations that facilitate transparency without stifling innovation.

4 Investing in Education and Awareness: Raising awareness about the potential and challenges of Blockchain governance is crucial for informed participation and meaningful accountability.

#### *4.2.1.1.3.SN1.3: Decentralised*

According to (WViriyasitavata, Anuphaptrironga & Hoonsopon, 2019) Blockchains that have been deployed retains intrinsic benefits that BT provides. Blockchains operate on a Peer-to-Peer (P2P) network with different degrees of decentralisation. Multiple nodes on the Blockchain protect the integrity of the ledger through consensus mechanisms, and data are stored in a Blockchain as a transaction that is immutable, even in situations where some nodes are faulty or acting maliciously.

To summarise the respondents' views on the Blockchain characteristic decentralisation, recording of accounting transactions over the last ten years has moved away from being centralised, and now cloud based and dispersed, depending on levels of verifiability and authority. BT is viewed to continue the evolution towards decentralisation as this characteristic supports the transfer of control and decision-making from a centralised entity (individual, organisation, or group thereof) to a distributed network.

With decentralisation in a Blockchain, all nodes share obligations and freedom. This helps to automatically analyse and process the workflow and dependencies as all project/program information is captured and analysed. BT also offers room for verification and traceability, as it ensures that storage of data is encrypted in nodes.

This provides the program team with clear transparency as they can see the progress of each milestone in the program. In addition, the Key Performance Index (KPI) is tracked and evaluated for each task. The stakeholders cannot hide the information according to the nature of the system. The element uses cryptography to ensure that the blocks of information are not altered and corrupted. The same can be implemented in program management in any industry as the information cannot be hidden, hacked, or lost.

Two main approaches exist in governance mechanisms of a Blockchain in decentralised decision making:

(i) *On-Chain Governance*: Decisions are encoded into the Blockchain's smart contracts. Stakeholders vote with their tokens, and changes requiring a specific majority approval get implemented automatically. This ensures transparency and trust but can be slow and inflexible.

(ii) *Off-Chain Governance*: Decisions are made through community discussions, forums, and proposals. Consensus is reached through social processes and implemented through updates or soft forks (compatible changes). This is faster and more adaptable but can be subject to manipulation and lacks automatic enforcement.

#### *4.2.1.2.N2: BT Prospects*

If the centralised data store is compromised, the Metaverse applications, from real estate to digital items, are at a significant danger. Many blocks will contribute to data dissemination as a result of the implementation of BT, hence improving data availability in Metaverse applications such as crucial monitoring and life support alerts.

The decentralised structure of BT enables data scientists in the Metaverse to collaborate and work on data purification, hence drastically lowering the time and expense required to label data and prepare datasets for analysis.

The decentralised structure of BT will shorten the time required to identify and categorise data, while providing data scientists with a collaborative platform. In addition, the Blockchain enables data reliability, transparency, and accessibility in the metaverse. The information is encrypted within each block of the Blockchain.

A distributed ledger that relies on consensus helps ensure that data in the metaverse is resistant to manipulation and duplication. However, additional research is required to overcome the issue of latency, as any newly added data must be replicated across the Blockchain. A hard fork is a possibility that must be considered despite the fact that Blockchain prevents data modification. Sharing data on centralised data exchange platforms places at risk the sensitive and private data of Metaverse data owners.

In the conventional sharing environment, data is very variable, resulting in increased latency and decreased data availability. Scaling dynamic data is more difficult than scaling the immutable data. Many uses in the Metaverse, such as healthcare, traffic optimisation, media, and entertainment, will create vast quantities of data in real time. As the demand for real-time data develops in a typical data-sharing environment, data adaptability becomes a concern.

BT can improve the transparency and accuracy of transactions in crypto exchanges, education, and other metaverse applications. Programs such as governance and finance produce a decentralised, unchangeable record of all transactions, which can be viewed by stakeholders. Hence, increased data transparency benefits the stakeholders of the Metaverse. Blockchain will enable applications and their users to comprehend how third-party programmes like Thunderbird, The Bat, and Pegasus can handle data and prevent grey market transactions, hence boosting user confidence.

Moreover, the data owner will have complete control over the data. Likewise, data audits can benefit from distributed ledger technology. Hence, Blockchain minimises the time and cost associated with confirming the data. Smart contracts increase data sharing's adaptability. Often, they are used to automate the execution of a contract so that both parties can be certain of the conclusion without contacting a third party or wasting time. Smart contracts can be programmed heterogeneously on a Blockchain. Hence, programmes such as Nmusik, Ascribe, Tracr, UBS, and Applicatur will gain.

The utilisation of BT will increase the adaptability and flexibility of the Metaverse's data. A Blockchain must replicate copies of data down the chain, delaying the transmission of data. As the population of the Metaverse grows, the number of blocks must expand as well, necessitating the utilisation of enormous computational resources.

As a result, transaction costs for validating shared transactions are increased for users. Future versions of Blockchain will have to address this issue so that Blockchain can enhance the core technologies in the metaverse that enable users to engage in social and commercial activities without fear of repercussions (Mourtzis, Angelopoulos & Panopoulos, 2023).

IoT devices will be able to communicate and store real-world data across various virtual worlds using BT. Blockchain systems necessitate a substantial amount of computational power to function. Because a small group of miners controls the majority of the network's overall mining hash rate, blockchains are susceptible to attack. In the absence of governance, it is impossible to authenticate IoT data before it is published on the Blockchain in the metaverse.

On a distributed transaction book, smart contracts in the metaverse may violate the law. Because of BT's anonymity, it is difficult to trace all IoT transactions involving malicious Metaverse services. Despite the multiple advantages of blockchain's automated operations, it is challenging to determine which parties are responsible for particular behaviours. The Blockchain should be governed so that the Metaverse can expand.

Encryption capabilities of Blockchain and transparency of historical data enable digital twins that are immune to attacks and can securely share data across many virtual worlds. With an intelligent distributed ledger, digital twins in the virtual world can share data. Using an intelligent distributed ledger, real-world objects are recorded on the Blockchain and synchronised with their digital siblings in the Metaverse.

Also, the utilisation of digital twins on a Blockchain will aid in the resolution of privacy and data security issues. It will be feasible to track sensor data and construct high-quality digital twins in the Metaverse by combining Blockchain and AI. Every action of the digital twin in the metaverse is recorded as a transaction on the immutable and consensus required Blockchain (Xu, Lee, Barth & Richey, 2021).

The future of big data analytics holds great promise for Blockchain. On the Metaverse, users will have complete control over their personal information and financial transactions. The Blockchain eliminates the need for a third party to receive and designate trustworthy data. Certain concerns, including consensus models, block mining costs, and transaction verification, continue to be difficult. Blockchain offers solutions that need significant modifications to existing systems or their entire replacement.

Thus, changing the entire system is difficult and time-consuming. Despite the fact that Blockchain integration with the Metaverse is still in its infancy, these challenges will be rectified in the future, clearing the way for a number of exciting new opportunities. As quoted by respondents below:

*IR9: "It has made the Metaverse possible"*

*IR10: "A powerful technology with high consumption of energy, expensive and eases processes*

Today, numerous networks and Blockchains have been developed for specific applications and services under the umbrella of various community organisations and government departments; Therefore, the connection of existing and new chains is necessary to drive the development of new technologies in the Metaverse.

Cross-chain is offered as the final way to enable interoperability across different chains, enabling users to successfully execute transactions (of both value and information) between Blockchain networks. Users might, for instance, transfer data from an Ethereum Blockchain to a Polygon Blockchain and vice versa.

This interoperability method is also accelerating the growth of completely decentralised systems with cross-chain bridges. Omni-Chain, which is defined as a Blockchain-as-a-Service (BaaS) platform for interacting with a variety of enterprise networks, can provide blockchain-based applications and services (including asset management, Smart Contract, Transaction Management, and Shared Data Ledger) with many valued advantages, such as greater transparency, increased security, enhanced traceability, and enhanced efficiency (Ou, Huang, Zheng, Zhang, Zeng & Han, 2022).

#### *4.2.1.2.1.SN2.1: Data Analytics & SN2.2: Data Efficiency*

Data analytics is the process of using technology and statistical methods to analyse large amounts of data and extract useful insights. It is used in many different industries, from healthcare to finance to marketing, to help organisations make more informed decisions. However, traditional data analytics systems have several limitations, including concerns about data privacy, security, and trustworthiness. BT offers a potential solution to these issues.

At its core, a Blockchain is a digital ledger that records transactions or data entries in a secure and immutable way. Each block in the chain contains a unique hash value that links it to the previous block, creating a chain of blocks that cannot be altered without also altering the entire chain.

This makes it very difficult for malicious actors to manipulate the data stored on the blockchain, as any changes to one block would be immediately detectable by all nodes in the network. One potential application of BT in data analytics is in the creation of decentralised data marketplaces.

These marketplaces would allow individuals and organisations to share data with each other in a secure and transparent way, without having to rely on centralised intermediaries. This could help to address some of the concerns around data privacy and security that have arisen in recent years, as users would be able to retain more control over their data and how it is used (Narwane, Raut, Mangla, Dora, Narkhede, 2023).

As the number of internet-connected devices increases daily, the volume of data saved in third-party places such as the cloud also grows at an accelerated rate. This introduces new obstacles, such as threats of data leak from prying third parties. Because the data is not housed within the organisation's network perimeter, traditional security solutions, such as firewalls, are incapable of resolving this problem with big data. Utilising Blockchain to store large amounts of data has the potential to solve this problem. The encrypted and decentralised storage of data in the Blockchain network makes unauthorised access to the data extremely difficult.

*IR7: "How it works basically I understand in simple terms, they actually collate information in one chain. Then they integrate with each other to come up with the useful information".*

There is a likelihood that people will manipulate the records in big data to bias the prediction of big data analysis in their favor.

The Blockchain's immutability ensures that it is practically difficult to alter the data stored on its network. If someone wishes to alter the data on the Blockchain network, they must alter the data on at least 50 percent of the network's nodes, which is practically difficult. Moreover, the immutability of the Blockchain assures the integrity of the data held on its network.

Due to the fact that Blockchain records every transaction, it enables real-time analysis of massive amounts of data. A summary of Blockchain services in the context of big data. Financial institutions can process transactions, including significant sums, in near real-time because to the massive data analytics embedded into the Blockchain. In addition, banks may monitor data changes in real-time, enabling them to make choices such as stopping transactions in real-time.

Integrating Blockchain with large data sets enables service providers to share data with other parties with minimal risk of data leakage. When the huge amount of data generated by the various sources are saved in the Blockchain, it is no longer necessary to repeat the analysis of the data because each experiment is recorded in the Blockchain.

Data scientists spend a great deal of effort on data integration since different sources collect data in different formats. Utilising Blockchain to store data can increase the data's structure and completeness, hence enhancing its quality. Consequently, data scientists may create more accurate predictions in real time by utilising high-quality data.

There are numerous cloud-based services available for storing and accessing files from any computer, regardless of location. Individuals and organisations are hesitant to store sensitive data on a third party-managed system. Even if encrypting files before cloud storage is one of the solutions, cloud providers still face security challenges (Singh, Manjhi & Tiwari, 2022).

Electronic information systems are currently utilised most frequently in medical treatment. Every day, large quantities of data such as medical photographs, medical records, and diagnostic reports are generated. Electronic medical information can impact treatment, and medical academies communicate patient experiences. If shared medical patient data is illegally exploited, the patient's confidentiality is jeopardised. Certain methods should be implemented to restrict access to medical records. The Blockchain embedded into the Interplanetary File System (IPFS) solves these types of security issues. IPFS is a decentralised storage platform meant to solve the problem of duplicate files.

It establishes a unique hash value for the stored file, allowing the user to locate the file using the hash address. Before medical data is saved in the cloud, it is encrypted using an attribute-based algorithm.

The user's private key is linked to their attributes, while the ciphertext is linked to their policy. The age of big data poses a danger to consumer privacy in a number of digital contexts. By collecting, analysing, and managing a massive amount of personal user information, third-party organisations benefit from managing user data. Without the users' knowledge, these third-party services are susceptible to security breaches and data breaches. Blockchain offers a variety of answers to the problems that user data faces. On the Blockchain, user transactions are not susceptible to privacy concerns, and individuals have authority over their personal information.

The details of when, by whom, what and what personal data is disclosed in each transaction. Blockchain privacy solutions based on crypto privacy methods are emerging to allow users to remain unidentified and gain control of their personal information during their digital transaction on the ledger. A Blockchain-based data protection system was developed for the secure exchange of big data from drones.

The proposed system applies the number theory-based cryptosystem to encrypt the data and thus has a low computational fee for decryption, encryption, and key generation.

*IR8: "It has systematic control over the data. And then the most important thing is I think it can handle like a lot of data huge amount of data"*
*IR9: "For me as of now I have not seen any company using this, adopting this in accounting, YET. Except for business like for example Bitcoin. There are also a few. But for accounting, none. However, I felt this can be done for data analytics purpose. Whereby we combine all the information, where all the data are integrated in one place".*

A potential use case for BT in data analytics is in the creation of secure, decentralised data sharing networks. These networks could be used to share data between different organisations, such as healthcare providers or financial institutions, without the need for a centralised authority. This could help to improve the speed and efficiency of data sharing, while also ensuring that sensitive information remains secure and confidential.

In addition to these use cases, BT can also be used to improve the accuracy and reliability of data analytics systems. By creating a tamper-proof and immutable record of all data entries, BT can help to prevent data fraud and manipulation, while also providing greater transparency and accountability. This can be particularly useful in industries such as finance and healthcare, where accurate data is essential for making informed decisions.

BT is also used to improve the quality of data used in analytics. By creating a decentralised network of data providers, BT can help to ensure that data is collected from a diverse range of sources, reducing the risk of bias and ensuring that the data used in analytics is more representative of the population as a whole. This can be particularly useful in fields such as public health and social policy, where accurate and representative data is essential for making informed decisions.

One potential challenge in using BT for data analytics is the issue of scalability. As the amount of data stored on the Blockchain increases, so does the computational power required to process and verify transactions. This can create bottlenecks in the network, leading to slower transaction times and higher fees.

To address this challenge, researchers within specific industries are exploring new approaches to BT, such as sharding and sidechains, which can help to increase the scalability of the network while maintaining its security and decentralisation.

Another challenge is the issue of interoperability. While BT offers many potential benefits for data analytics, it is not yet widely adopted in many industries. This can create challenges in terms of interoperability, as different organisations may be using different Blockchain platforms or protocols. To address this challenge, researchers are exploring new approaches to standardising BT, such as the use of interoperability protocols and cross-chain communication protocols. The use of BT in data analytics holds great potential for the future provided the challenges and limitations are addressed accordingly (Al-Rakhami & Al-Mashari, 2022).

Data efficiency and analytics are critical elements for effective Blockchain governance. Finding the right balance between transparency, privacy, and practicality requires innovative solutions and collaborative efforts. Addressing these challenges and harnessing the potential of data analytics will lead to more robust, sustainable, and trustworthy Blockchain ecosystems.

#### *4.2.1.3.N3: BT Industry Use*

BT is used in various industries that the respondents are directly or indirectly participants of. These use in these specific industries are articulated in sections below.

*(i) Finance*

The finance industry was the first to recognise the potential of BT. The decentralised nature of BT provides a secure and transparent way of recording financial transactions. Blockchain can be used for various financial applications such as payment processing, asset management, and identity verification.

One of the most significant applications of BT in finance is cryptocurrency. Cryptocurrencies like Bitcoin, Ethereum, and Litecoin have gained immense popularity in recent years. They allow users to transfer value without the need for intermediaries like banks. Cryptocurrencies have also gained acceptance as a store of value and as an investment asset (Faturahman, Agarwal, Lukita, 2021).

Apart from cryptocurrencies, BT is also being used for remittances. Remittances are a significant source of income for many developing countries. Blockchain-based remittance services are faster, cheaper, and more secure than traditional remittance services.

*(ii) Healthcare*

The healthcare industry is another industry that can benefit from the use of BT. One of the primary benefits of BT in healthcare is data security. Healthcare data is highly sensitive, and any unauthorised access can lead to serious consequences.

BT can provide a secure and transparent way of storing healthcare data. Blockchain-based healthcare systems can also reduce the risk of fraud and ensure the accuracy of medical records.

Apart from data security, BT can also be used for drug supply chain management. The drug supply chain is complex and involves many stakeholders. BT can provide a secure and transparent way of tracking drugs from the manufacturer to the patient. This can help reduce the risk of counterfeit drugs and ensure patient safety.

*(iii) Supply Chain Management*

The supply chain is another industry that can benefit from the use of BT. The supply chain involves various stakeholders, including manufacturers, distributors, and retailers. BT can provide a secure and transparent way of tracking goods from the manufacturer to the end consumer. This can help reduce the risk of fraud, increase transparency, and improve supply chain efficiency.

Apart from tracking goods, BT can also be used for product authentication. Counterfeit products are a significant problem in many industries, including fashion, electronics, and pharmaceuticals. BT can provide a secure and transparent way of authenticating products, which can help reduce the risk of counterfeit products.

*(iv) Real Estate*

The real estate industry is another industry that can benefit from the use of BT. Real estate transactions are complex and involve many intermediaries. BT can provide a secure and transparent way of recording real estate transactions. This can help reduce the risk of fraud, increase transparency, and reduce transaction costs.

Apart from transaction recording, BT can also be used for property management. Property management involves many stakeholders, including property owners, tenants, and property managers. BT can provide a secure and transparent way of managing property records and transactions, which can help reduce the risk of fraud and increase transparency.

*(v) Energy*

The energy industry is another industry that can benefit from the use of BT. The energy industry is undergoing a significant transformation, with the increased use of renewable energy sources and the growing demand for energy storage solutions. BT can provide a secure and transparent way of recording energy transactions, which can help reduce the risk of fraud and increase transparency.

Apart from transaction recording, BT can also be used for energy trading. Energy trading involves buying and selling energy between different stakeholders. BT can provide a secure and transparent way of recording energy trades, which can help reduce the risk of fraud and increase transparency.

As a new enabling technology in the Internet age, no matter what financial and economic format is combined with the development of new business models, the ultimate goal of Blockchain is to effectively use new Internet technologies such as big data and cloud computing, integrating financial information resources, the purpose of which is to improve operation efficiency and promote service quality of the financial system by analysing the information data and updating the financial system according to the needs of the markets and customers.

Cross-border payments generally refer to the transnational and transregional transfer of funds between two or more countries or territories through international trade, international investment and other international claims and debts with specific settlement instruments and payment systems.

The traditional cross-border payment is based on the banking system, which has the characteristics of time-consuming, high cost, more committed funds and low security, but all these bottlenecks can be effectively overcome if we apply Blockchain to cross-border payments to reconstruct the credit system and expand the payment limit.

The application of BT in the field of cross-border payments has a very high impact potential and its development is divided into three phases. BT will improve the payment system by providing a solid structure for cross-border transactions and eliminating expensive intermediate costs, gradually weakening or changing the business model of existing payment industries.

For example, American Express FX International Payments is partnering with Ripple, a provider of global enterprise Blockchain solutions, to make Blockchain payments commercially available. Business-to-business payments platform Veem confirms that its Blockchain system is able to provide more real-time data, even for small business customers.

Blockchain patenting activity in the US includes applications filed by major financial institutions and big tech companies like Amazon.com and Blockchain-focused startups like Coinbase, and some companies are filing for Blockchain-related patents to protect the digital asset.

*IR11: "Something that is very instantaneous, where you can get things out of it in a matter of seconds. Flexible and can be built with other technologies such as Artificial Intelligence"*

The researcher would like to highlight that even though IR11 has provided a general description of BT, it is a leading point into RO2, as it mentions the characteristic ***instantaneous***, which is ***real-time***.

*IR12: "It is actually a very solid platform that has been introduced to restructure the financial institutions, which is currently encountering a lot of issues"*

After digital currencies and money transfer, the registration and management of digital assets is one of the largest Blockchain applications in development. BT can record, transfer, and verify ownership of assets (home, car, stocks, bonds, mortgages, and insurance) and verify the integrity and authenticity of sensitive documents or records (e.g., passports, visas, driver's licenses, etc.) birth and death certificates, voter registration, contracts, wills, patents and medical records).

An exemplary implementation of digital asset registries for identity services is the State of Illinois Blockchain-based birth registry project, which demonstrated how digital assets can be uniquely identified and registered and identified that digital assets carry exclusive rights to works of creative authorship, including fictional works, lend, non-fiction, music, choreography and architecture.

#### *4.2.1.3.1.SN3.1: Healthcare*

As one of the respondents was from the healthcare industry's accounting division, the respondent articulated the use case of BT in the area of patient care and billing management system, which is currently being researched and tested on a prototype to be integrated with the accounting and FR system.

Healthcare applications of Blockchain, due to increasing legal standards like the Health Insurance Portability and Accountability Act of 1996, Blockchain will have stricter needs for authentication, interoperability, and record sharing (HIPAA). On the basis of existing BT, researchers from both academia and industry have begun studying healthcare applications. Smart contracts, fraud detection, and identity verification are among these applications.

Data provenance is critical for healthcare to establish a level of trust in healthcare data by providing complete information about its creation, access and transmission. Blockchain ensures the provenance of healthcare data by enabling changes to data to be traced from its origin to its current form. Storing historical health records on the Blockchain can increase trust for data validation and auditing purposes.

Blockchain can provide secure provenance of healthcare data by protecting healthcare systems from unauthorised access and modification. It also enables reliable traceability in the healthcare industry. Blockchain uses a time-stamping process that calculates hashes of the record of origin, which are transmitted to consensus nodes that ensure a consistent ledger of all valid transactions is maintained.

Today, most healthcare data management systems are manual and lack intelligent coordination and integration capabilities. Also, they are vulnerable to data breaches and unauthorised modifications. Consequently, such limitations hamper the review process and its quality. BT enables healthcare facilities to manage their data in a verifiable, tamper-proof and permanent manner, thereby proving the trustworthiness of stored healthcare data.

This allows auditors to easily verify the transactions conducted on Blockchain platforms. Blockchain-based healthcare data verification can help improve the quality of patient services and keep healthcare facilities in compliance with indispensable legal requirements and regulations. It can also help to avoid unnecessary data redundancies.

Over the past decade, many healthcare organisations have fallen victim to avoidable cybersecurity attacks. A large number of healthcare industries use manual systems that rely on a centralised infrastructure for handling digital medical records. Such systems are quite outdated and therefore easily modified for fraudulent purposes. Also, medical records can be lost in the event of natural disasters as centralisation is vulnerable to the single point of failure. Blockchain can help eliminate the risk of data theft or misuse through the immutability feature based on cryptographic principles.

Health data stored on the Blockchain is also protected from damage from natural disasters or the collapse of medical facilities, as the same data is stored in multiple locations, so there is no single point of failure.

Blockchain-based DNA data storage can allow individuals to own and control their data. This eliminates the need for third-party owned centralised databases that are highly vulnerable to hacking. Because individuals' data is securely stored on Blockchain networks, they can share their data with anyone for medical research, public health studies, and drug development.

Blockchain can help adequately provide trust, security, and privacy in telehealth systems. It can help to establish a seamless data exchange without intermediaries, which increases consumer confidence in telehealth systems. It enables physicians to store detailed medical histories, treatment and procedure records, and laboratory results in a decentralised, accessible, traceable, and immutable manner. One of the biggest hurdles to bringing BT to telehealth systems is that it can increase costs for patients who already live in remote areas where resources are very limited. Blockchain-based smart contacts and cryptographic keys can help minimise errors previously caused by human negligence. Blockchain also reduces the time it takes to collect patient data.

The outstanding advantage of BT can result in mitigating the risk of data breaches by malicious hackers or a fraudulent healthcare insider. A private digital ledger is used to record and time-stamp every moment of access to patient medical data. The cryptographic hash functions create an immutable audit trail of patient data.

Unlike traditional systems, the infrastructure of BT eliminates the need for a third party when ordering medical equipment. Every transaction step in the supply chain is stored in the Blockchain platform. The unique identifier of each medical device allows the Blockchain to make it traceable, leading to an improvement in patient safety.

The Blockchain-based platform also enables integration between all actors involved in the supply chain, enabling the design of a secure and traceable platform for medical devices in hospitals.

Scalability is one of the biggest challenges that can limit the mainstream adoption of public Blockchains in the healthcare industry. Apparently, traditional transaction networks are capable of processing thousands of tps. For example, Visa can process more than 1,700 to 2,000 tps. However, Ethereum Blockchains lag far behind in terms of transaction speed, as they can only process around 20 transactions per second. With private Blockchains, the lack of scalability is not such an issue as the processing nodes operate under the trusted parties.

The problem of scalability can be addressed in a number of ways. One of the possible solutions is the Lightning Network, which aims to add the second layer to the primary Blockchain network to enable faster transactions.

Another possible solution is to use a sharding technique that helps to shard transactions and distribute them between the Blockchain nodes. This way, each node does not have to download and store the entire Blockchain state, which allows for faster transaction speeds through parallelisation. Another challenge is ensuring that BT is compliant with country privacy laws (eg. Health Insurance Portability and Accountability Act of 1996 [HIPA] and General Data Protection Regulation [GDPR]) and regulations. Additionally, the lack of clarity around compliance is another challenge preventing organisations from adopting this technology. Blockchain rules and regulations are still in their infancy. These rules and regulations are expected to be mature, meaning organisations will need to monitor the changing regulatory environment.

Healthcare organisations should raise questions directly with regulators and make suggestions about regulations. Blockchain regulations vary from country to country. For example, Singapore and Switzerland use regulatory tokens to speed up the adoption of BT; while US regulation is dependent on individual states rather than the federal government. In the EU, privacy regulations are hampering the adoption of public BT.

Although China has banned cryptocurrencies, they support regulations to allow the widespread adoption of Blockchain applications. To make Blockchain a mainstream technology, the healthcare industry needs to work with regulators to streamline Blockchain policies and practices. In order to realise the full potential of BT in healthcare, the challenges related to interoperability must be addressed. Interoperability plays a crucial role in enabling interaction between different Blockchain networks. Although the lack of standards in the Blockchain facilitates developers, it poses major challenges in terms of communication due to the lack of interoperability.

The main problem for interoperability is the existence of multiple Blockchain networks based on different consensus models, transaction mechanisms, and smart contract functions. One way to address this challenge is to use existing standards in Blockchain networks. For example, IBM and Microsoft use GS1-based data standards to enforce interoperability in their blockchain-based supply chain operations. Another solution is to develop new standards. For example, the Enterprise Ethereum Alliance (EEA) launched a standard version of the Ethereum Blockchain. In current healthcare systems, most organisations, hospitals and pharmaceutical companies do not share their information with patients.

Also, it is very difficult for patients to verify the accuracy of the data. Health data tokenisation can help revolutionise the healthcare industry. It is a process that makes it possible to create a digital representation of health data and to grant specific usage rights for certain health services. It allows users to access and retrieve their health data without decrypting or re-encrypting it.

Tokenisation allows patients to retain and share their medical record information with others, reducing the cost of medical treatment by delegating authority to store and own data from central intermediaries (e.g. insurance companies, hospitals, pharmaceuticals). When sharing such data with a research institution, patients can be rewarded with tokens that can be used to settle medical bills. Tokenisation is a prerequisite for deploying or adopting Blockchain-based solutions in the healthcare industry. However, enabling tokenisation has become a very challenging issue due to the lack of regulatory clarity for tokenised assets and a trusted method to ensure consistency between the on-chain crypto tokens and the underlying off-chain assets. Immutability is one of the key features of BT. Therefore, it is important to ensure that the health data that needs to be transferred to the Blockchain is correct.

The healthcare organisations that look to implement Blockchain-based solutions find themselves in one of three situations, e.g. if they have a paper register, a digital register or a destroyed register. Most existing health data registers contain inaccuracies for various reasons (e.g. price discrimination, competition in the insurance market, human and administrative errors, tax avoidance, etc.). Therefore, healthcare data registries need to be cleaned and brought up to date before storing data on Blockchains.

Especially in the case of natural disasters that have led to the loss of sensitive health data in traditional healthcare systems, a Blockchain registry is very beneficial. Such a solution stores health data on a distributed platform that is exemplary immune to physical destruction.

Blockchain has the potential to reshape and transform the healthcare industry by bringing significant improvements in operational efficiency, data security, healthcare workforce management and costs. However, the integration of healthcare systems on the Blockchain brings with it some technical challenges that need to be addressed.

***4.2.1.3.2.SN3.2: Supply Chain***

Blockchain is a system that stores and distributes data based on databases among all network users that are members of interest groups. All participants have real-time access to detailed transaction details. Historically, transaction data was held in a centralised hub system and information was exchanged with transaction participants. BT enables the sharing of any information based on decentralisation, security, and intelligent execution. In other words, all participants have sequential access to transaction information via peer-to-peer networks (refers to decentralisation). Also, when transactions are conducted using signatures, security is enhanced and eventually, transparency is maintained.

Consequently, operational issues can be resolved expeditiously and constructively (security). In addition, once a transaction is registered in the system with a user's validated signature, it does not change. This property is known as immutability. Considering all of these advantages, it is anticipated that this technology would assist numerous industries. It has a significant impact on supply chains, where information transmission is crucial.

Supply chain management is the process of shipping, storing, and delivering goods from the location of raw materials to production and the final consumer. Within a supply chain system based on Blockchain, it is simple to trace the whereabouts of items in real time. Traceability is the ability to track every piece of information in real time. On Blockchain, for instance, container cargo management and transaction document processing data can be recorded and shared. Using BT, all transaction information may be validated in real time by appropriate parties along the freight transportation channel. Hence, a Blockchain-based supply chain provides greater transparency.

It is understood that the Blockchain system reduces the possibility of counterfeiting or unlicensed goods being circulated in a region. This is due to the fact that Blockchain is a decentralised ledger system. Numerous businesses, like the food industry, utilise this capability for their BT-based supply chains. Namely, BT can manage inventory effectively while tracking freight and recording and maintaining cargo history.

As a result, consumers can have confidence in the goods, as all parties engaged in the transaction can exchange and verify all information. The influence of these fundamental functions on supply chain operations and objectives is beneficial.

BT simplifies the contracting process for supplier chains. Historically, the contract between seller and purchaser was intricate. With a smart contract, Blockchain eliminates redundant and complicated papers. A smart contract is a transaction log that enables automated document execution and control. This approach simplifies the procedure in which all essential parties must verify the agreement using digitally signed papers within the Blockchain system.

#### *4.2.1.3.3.SN3.3: Cryptocurrencies*

The popularity of using digital currencies, namely cryptocurrencies for virtual transactions, is increasing. Bitcoin is the most widely used cryptocurrency. Bitcoin uses a Blockchain system to store transactions. Digital currency transactions can take place securely due to the Blockchain system. BT is registered in Bitcoin cryptocurrency transactions; the goal is to allow users to conduct transactions directly and eliminate third-party intermediaries. Some of the quotes from the respondents stated below:

*IR5: "Heavily used for cryptocurrencies and sees a potential of it being used more in other platforms such as voting and public administration. There needs to be proper adoption, especially in taxation"*

IR13: *"You talk about crypto, number 1, when it comes to crypto, people are scared as it is not regulated, and people can lose money. I mean even today you look at what happened at Bank X right, people's accounts were wrongly debited and all that. But because it is in such a regulated industry and all that, it was very quickly rectified. With bitcoin and cryptocurrency, people don't know right"*

*IR1: "There are predictions that cryptocurrency will see the end to its life cycle and replaced by something else, because of all the downsides we are seeing and all"*

The most popular use of BT is in Cryptocurrencies. It is the way the most well-known (and contentious) application of Blockchain. Digital currencies (or tokens) like Bitcoin, Ethereum, or Litecoin are examples of cryptocurrencies. These currencies can be used to pay for products and services. Cryptocurrencies can be used to pay for anything from your lunch to your future house, just like a digital version of currency. Online transactions are always tracked and secured because, unlike cash, cryptocurrencies employ Blockchain to serve as both a public ledger and an improved cryptographic security system.

For instance, although the terms "Bitcoin" and "Blockchain" are sometimes used interchangeably, they nonetheless relate to different things. In 2009, Bitcoin, a distributed ledger-based cryptocurrency system, became the first Blockchain application.

#### *4.2.1.4. Summary of Key insights for Emerging Theme: Views of BT and its uses in FR*

The key insights from this emerging theme on views of BT is that BT has a strong potential to grow in its' use cases in various industries. However, the use of BT in FR is still at an infancy stage but evidence of plans of adoption is present based on a number of views above. In summary, decision-making and accountability is crucial, in defining clear roles and responsibilities within the governance framework for blockchain-based Real-time Financial Reporting is essential. Establishing accountability mechanisms for data management and decision-making is crucial.

Next, on dispute resolution mechanisms, there should be efficient and credible mechanisms for resolving disputes arising from Blockchain transactions are necessary to maintain trust and stability in the financial system. On the regulatory landscape, the regulatory uncertainty surrounding Blockchain, and digital assets can pose challenges for adoption in financial reporting. Active dialogue between industry players and regulators is essential for developing clear and supportive regulations.

**4.2.2. Emerging Theme: (b) Limitations of a BC:** Participants shared their interpretation of accountability and governance, and the importance of it in the context of FR. The participants job roles and responsibilities as well as their working environment was one of the factors to determine the type of experiences that participants expressed. Respondent 1, 3, 7 and 15's interpretation of the governance of a Blockchain is "fundamentally all participants of a BC will be in control and govern the BC." IR5, IR11 and IR13 illustrated "where decisions are made together on a BC and everyone who is part of the BC accounts for that decision". Majority of the participants mentioned participatory use of BC is feasible as long as all participants are convinced that the information that is 'fed' into a BC is governed. The BC is self-governed and does not need any form of monitoring.

Hence, the participants presented that generating concepts leads to increased use of BT and in more processes moving forward.

Respondents also highlighted potential challenges in terms of accountability and governance. As the Blockchain is supposed to be self-governed, the governance of the Blockchain lies with the block. Respondents recommend a standard, law, or regulation to govern what gets on to a block and what does not. Despite its many advantages, however, BT is not without its limitations. The limitations highlighted by the respondents are collectively highlighted based on the areas below.

*i) Scalability*

One of the most significant limitations of BT is scalability. While Blockchain networks like Bitcoin and Ethereum can handle a limited number of transactions per second, they struggle to scale to meet the demands of global adoption. The current processing capacity of the Bitcoin network is around seven transactions per second, which is far from sufficient for mass adoption. The Ethereum network, on the other hand, is able to process around 15 transactions per second, which is slightly better but still insufficient to support a global-scale application.

The scalability challenge stems from the fact that BT requires all nodes in the network to reach a consensus on the validity of each transaction. This consensus mechanism leads to delays in transaction processing and increases the time and cost of transactions. Furthermore, as more nodes join the network, the processing capacity of the Blockchain network decreases, making it difficult to scale.

*ii) Energy Consumption*

Another significant limitation of BT is its energy consumption. Blockchain networks like Bitcoin and Ethereum rely on proof-of-work (PoW), which requires miners to solve complex mathematical problems to validate transactions and earn rewards.

This process requires a vast amount of computing power and electricity, which has raised concerns about the environmental impact of BT.

According to IR12, there is evidence of research that confirms the Bitcoin network consumes more energy than entire countries like Switzerland and Chile. The energy consumption required to mine Bitcoin has also led to high transaction fees, making it impractical for small transactions.

*iii) Security*

While BT is often touted as being secure, it is not immune to security threats. One of the most significant security threats to Blockchain networks is the 51% attack, where an attacker gains control of more than 50% of the network's computing power. With this control, the attacker can manipulate the blockchain's transactions, reverse previous transactions, and double-spend their funds.

Another security concern is the risk of smart contract vulnerabilities. Smart contracts are self-executing contracts that run on Blockchain networks and can be programmed to automate transactions based on certain conditions. If a smart contract is poorly written or contains a bug, it can be exploited by attackers, leading to significant financial losses.

*iv) Interoperability*

Another limitation of BT is its lack of interoperability. Different Blockchain networks use different protocols, which makes it challenging for them to communicate with each other. This lack of interoperability makes it difficult to build decentralised applications that can interact with multiple Blockchain networks. To overcome this limitation, various initiatives, such as the Interledger Protocol and Polkadot, have been developed to enable Blockchain networks to communicate with each other. However, achieving interoperability remains a significant challenge for the Blockchain industry.

*v) Regulation*

Finally, BT faces regulatory challenges in many countries. While BT is designed to be decentralised and operate outside the control of governments and financial institutions, this lack of central control has led to regulatory challenges in many countries. Governments around the world are struggling to develop a regulatory framework that can balance the benefits of BT with the risks associated with it.

Furthermore, some Blockchain applications, such as cryptocurrency, have been linked to illegal activities such as money laundering and terrorist financing. As a result, many governments have taken a cautious approach to BT and are implementing strict regulations to mitigate these risks.

#### *4.2.2.1.N4: Standards/Laws/Regulations*

Financial regulation is a strong guarantee of the security of financial information on the internet, but the advent of Blockchain finance and economics brings with it a decentralised, networkless internet system that has greatly increased the relevance and effectiveness of financial regulation. At present, people have relatively little understanding and acceptance of Blockchain, and it is difficult to identify genuine and effective Blockchain financial products. It is difficult for regulators to block many anonymous customer accounts and understand the whereabouts of funds.

The lack of a centralised system has made money laundering, fraud and tax evasion easier for criminals, but made national oversight more difficult. At present, in addition to bitcoin as the first cryptocurrency, which is relatively hot at home and abroad, other applications of Blockchain finance and economics such as P2P finance, third-party payments and other areas of internet finance are in the exploration phase, which needs to be further developed and improved. Transactions only allow eight transactions per second, which has a big gap with the current third-party payment called Alipay, which supports thousands of tps. The Blockchain creates a credit guarantee from a trusted intermediary through a program algorithm, but its information is irreversible, making it difficult for the system to collect debt, and once the private key password is lost or leaked, it results in irreparable loss of customer assets.

IR12 raised the principle of integrity in relation to accountability and governance. The respondent raised a concern as to whether accountability is an issue on the Blockchain. The respondent is unable to reason on how a Blockchain works as she does not have a coding background, but convinced that it is simple, and will help simplify processes.

IR18 brought in the smart contracts angle within legal perspectives, and this should not raise any concerns on governance and accountability. Respondent 18 questioned that if there is a standard on governance of the Blockchain, to what extent is it going to be enforced.

According to IR3, Blockchain is a platform to transact. If there is a need to send an email, there should be an Internet connection. The respondent emphasise that Blockchain is viewed as the internet here in this context. The Blockchain will enable the process of the e-mail being sent but will not have any control over the content of the e-mail. Therefore, Blockchain is not going to help to govern the information by assuring the reliability of the information, but it's only going help with the transmission process.

Standards are not only a passport for the development and application of Blockchain in the financial and economic industry, but also the basic guarantee that the industry is normative and orderly. The standard battle for the application of Blockchain has just started, the BT provider called Chain has collaborated with the world's leading financial institutions such as Citigroup, Fidelity, First Data and MUFG and has already announced the Chain Open Standard. This standard has made a breakthrough in financial Blockchain consensus model, private data encryption, smart contract operation, scalable data model and is used by some leading financial companies.

However, it is a complex and arduous task to develop standards that are applicable in all countries to accommodate different cultures and financial systems. Therefore, all countries must work hard together step by step to promote Blockchain finance and economy from superficial to deep.

Financial oversight is the use of power to ensure that financial innovation evolves properly and to provide escort protections for Blockchain finance and the economy. At a minimum, regulators must consider the following four questions:

(1) In which direction should regulatory reform go? The division rule or the mixed rule?

(2) How to reconcile the privatisation of proceeds and the cost of socialisation?

(3) How can the interests of depositors be protected?

(4) How to get regulatory approvals?

So, what regulators should do first is to develop relevant standards and regulations that attempt to apply BT’s means of prevention to the detection of Internet value delivery. To improve the quality of Blockchain financial and economic services, they can consider using smart contracts to track criminal activities effectively.

Second, since the new technology will have a profound impact on the monetary system in different countries, the regulation and control of monetary policy will not keep up with the changes in the situation, so the regulators should keep up with the times and constantly improve the regulatory measures to strengthen the international oversight of Blockchain finance and international cooperation committed to creating a unified global regulatory regime to eliminate cross-border crime.

Finally, the supervision of financial institutions engaged in financial derivatives should be strengthened, government agencies must set the minimum capital of financial institutions authorised to engage in derivative transactions and require disclosure of their accounting standards and internal control risk measures to ensure high quality information disclosure measures.

BT is considered a disruptive innovation after the steam engine, electricity, and the Internet. As we all know that steam engines and electricity emancipated productivity, the internet has changed the way information is delivered. In this way, Blockchain is likely to change the way value is delivered as a trust-building engine. BT has solved two main problems of the digital economy. Once the assets are digitised, their entire flow can be found through the chain. The other is that the zero-cost trust has really been built under the anonymous society, which brings new opportunities for the current Internet economy.

Although the decentralised nature of BT has been a boon to many financial and business industries, it has encountered many obstacles in its application and development.

Therefore, BT is a double-edged sword for traditional economic and financial development, which places higher demands on regulators' data processing and risk response capabilities. So, what we need to do is to explore the application environment of Blockchain finance and economics from the perspective of technology, applicability, regulation, supervision, etc. with the goal of benefiting the entire society.

As BT continues to mature and gain wider adoption, it has become increasingly important to establish governance standards that ensure its integrity and effectiveness. For BT, governance standards are necessary to ensure that the network remains secure, transparent, and functional. These standards can include technical protocols, rules, and policies that guide the behavior of the network's participants.

IR3, IR13 and IR15 emphasised the importance of governance standards and key considerations for developing effective governance frameworks by individual industries, including the accounting fraternity, in developing standards and guidelines. While decentralisation provides many benefits, such as increased security and transparency, it can also create challenges for governance.

Without clear governance standards, it can be challenging to ensure that all participants follow the same rules and that the network operates in a consistent and reliable manner. Effective governance standards can help to address these challenges by providing a framework for decision-making and ensuring that all participants have a clear understanding of their roles and responsibilities. These standards can also help to build trust and confidence in the network, which is essential for widespread adoption.

When developing governance standards for BT, there are several key considerations that should be considered as articulated by the respondents. These considerations are listed as follows.

*i) Consensus Mechanisms*

Consensus mechanisms are the rules by which decisions are made on a Blockchain network. There are several different types of consensus mechanisms, each with its own strengths and weaknesses. The choice of consensus mechanism can have a significant impact on the governance of the network.

For example, proof-of-work (PoW) consensus mechanisms, which are used by Bitcoin and other cryptocurrencies, require network participants to perform complex mathematical calculations in order to validate transactions and earn rewards. This can create significant barriers to entry for new participants and may lead to centralisation over time.

In contrast, proof-of-stake (PoS) consensus mechanisms, which are used by Ethereum and other Blockchain platforms, allow participants to validate transactions based on the amount of cryptocurrency they hold. This can make it easier for new participants to join the network and can help to promote decentralisation.

*ii) Governance Models*

There are several different governance models that can be used to manage a Blockchain network. These include:

- On-chain governance: In this model, decisions are made using the Blockchain itself. This can include voting mechanisms, smart contracts, or other forms of decentralised decision-making.
- Off-chain governance: In this model, decisions are made by a separate entity or organisation that is responsible for managing the network. This can include a foundation, a consortium, or a community-led organisation.
- Hybrid governance: In this model, both on-chain and off-chain mechanisms are used to make decisions. This can help to balance the benefits of decentralisation with the need for centralised decision-making.

Each governance model has its own advantages and disadvantages, and the choice of model will depend on the specific needs and goals of the network.

*iii) Participation and Incentives*

Effective governance standards should encourage active participation by all network participants. This can be achieved through the use of incentives, such as rewards for participating in the consensus process or for contributing to the development of the network.

*iv) Standards & Regulation*

It has shown significant potential to revolutionise the way businesses operate and interact with their customers. However, as with any new technology, Blockchain presents new challenges and risks that need to be addressed. One way to mitigate these risks is through the implementation of standards and regulations.

Standards are important as BT offers many advantages, such as decentralisation, transparency, and immutability. However, it also presents several challenges, including security risks, scalability issues, and regulatory compliance. Standards and regulations can help mitigate these challenges and ensure that BT is used in a safe and effective way.

Standards provide a common language and framework for the development, implementation, and interoperability of Blockchain solutions. They define technical requirements, guidelines, and best practices that ensure the reliability, security, and interoperability of Blockchain-based systems. Standards also facilitate the integration of Blockchain with existing systems and enable seamless communication between different Blockchain networks.

Regulations, on the other hand, provide a legal framework for the use of BT. They establish rules and requirements that govern the use, storage, and transfer of digital assets, such as cryptocurrencies and tokens. Regulations also ensure compliance with anti-money laundering (AML) and know-your-customer (KYC) requirements and protect investors from fraud and scams.

The Blockchain industry is still in its early stages, and standards and regulations are still evolving. There is currently no global standard or regulatory framework for BT. Instead, different countries and organisations have developed their own standards and regulations, which can vary significantly.

For example, the European Union's General Data Protection Regulation (GDPR) imposes strict rules on the use of personal data in Blockchain solutions. In contrast, some countries, such as Malta and Switzerland, have established regulatory sandboxes to encourage the development of Blockchain solutions without hindering innovation.

Similarly, different organisations have developed their own Blockchain standards. For example, the International Organization for Standardization (ISO) has developed a set of Blockchain standards, including ISO/TC 307, which provides a common framework for Blockchain and distributed ledger technologies. The Hyperledger project, which is hosted by the Linux Foundation, has also developed a set of open source Blockchain standards and tools.

Despite the importance of standards and regulations in the Blockchain industry, there are several challenges that need to be addressed. These include:

*i)* *Lack of Consensus:* The Blockchain industry is still fragmented, with different organisations, countries, and stakeholders having their own views on how BT should be developed and regulated. This lack of consensus can hinder the development of global standards and regulations.

*ii)* *Technology Complexity*: BT is complex and constantly evolving, which makes it difficult to develop and implement standards and regulations that keep up with the pace of innovation.

1. Interoperability: Interoperability between different Blockchain networks is crucial for the widespread adoption of BT. However, achieving interoperability requires the development of common standards and protocols, which can be challenging.
2. Jurisdictional Issues: BT operates across borders, which can make it difficult to establish consistent regulations across different countries and jurisdictions.
3. Resistance to Change: Some stakeholders may resist the development of standards and regulations, seeing them as a hindrance to innovation and the decentralised nature of BT.

Standards and regulations are essential for the development and adoption of BT. They provide a common language and framework for the development, implementation, and interoperability of blockchain-based solutions.

#### *4.2.2.2.N5: Complex Business Environment*

Blockchain is an innovation in Internet financial technology that includes cryptology, computer science, artificial intelligence and other disciplines of integrated cutting-edge technology with high development costs and high development effort. The Blockchain gets on the bill every ten minutes and runs slower. The capacity of each block is only 1 megabyte (MB) and the online transactions only allow 8 tps, which has a big gap with the current third-party payment called Alipay, which supports thousands of transactions per second.

Blockchain creates a credit guarantee from a trusted intermediary through a program algorithm, but its information is irreversible, making it difficult for the system to collect debt, and once the private key password is lost or leaked, it results in irreparable loss of customer assets.

Although the technical logic of the Blockchain is clear and theoretically difficult to crack violently, there is still the possibility of the data being tampered with by taking large numbers of zombies' hostage or by the workings of a union cluster. So technical risks like hackers have to deal with expanding the scope and quantity of the Blockchain.

The classification of Blockchain finance and economy in the global world is very difficult due to the large cultural differences and liberal democracy. Using some sort of virtual currency as an equivalent to achieve real-time global liquidation is to some extent a challenge to central bank legal tender and the right to payment.

Legal tender is backed by national credit, but the virtual currency credit is the mathematical algorithm, which is difficult to reflect the financial will of a single country. Taking bitcoin as an example, only a few countries like Japan, Germany and the United States currently recognise the legal status of bitcoin, most countries cannot accept its monetary properties, especially China. Therefore, the further application and development of BT in the global financial and economic sphere must weigh the interests of all countries in order to reach a consensus.

According to IR4, the Blockchain will be very useful in a complex business environment where transactions involve many subsidiaries, and there are complex intercompany transactions. Also, there are other sources of income from supplies of pharmaceutical items, etc. Therefore, a Blockchain will be ideal in maintaining the FR process, as it has already been adopted in the patient management system.

There should not be any problems with R&D designing a solution for the accounting and finance team. Discussions should already be in the process. In Malaysia for example, it will ease listing requirement application and reporting to Bursa.

#### *4.2.2.3.N6: Segregation of Duties*

IR2 feels that accountability should not just lie with one or a certain group of individuals, and rather the entire participants of the Blockchain. As FR is evolving, the respondent feels that it is getting more and more complex. There needs to be specific coding done on roles and accountability within the nodes. The financial report that comes out should still understand who is responsible for which section of the report.

IR2 has been exposed to the concept of FR with Blockchain for the first time. According to IR2, it all depends on the information that is being disclosed. There is information that is deemed to be private to certain organisations and requested by some parties such as regulators' rights. And I think there could be some current governance issue around that in terms of how the information would be displayed and disclosed.

Companies need to map what they intend to achieve from the information that is churned out of a Blockchain. Also, information should be flexible to be made beyond law and regulatory standards, that could be more towards investor relations.

All parties that form the functionalities of an organisation need to be brought in, pulling things together and looking at sustainability of information, which cuts off many different areas within the organisation. This can take the operations beyond functional and operational to more strategic. Coherence and compliance with the law at the same time will be challenging. Mapping of information of which goes onto a public chain, which goes on to a private chain, is crucial.

IR7 emphasised that there should not be a concern in terms of accountability on a Blockchain, as there will be clear segregation of duties. IR7 referred to the 'RASI Model' which is currently used within her organisation and strongly supports the use of this model in expediting BT in Real time Financial Reporting. The RASI chart defines responsibilities, major milestones, and timelines in key tasks and major areas of responsibility. It is a high-level assessment of the work that people are expected to move forward. IR7 elaborated:

*"RASI defines roles of who is responsible, who is accountable, who is consulted and who is informed. So, as long as in any role that we do, and especially in accounting roles.*

*It gives clarity to the person who is accountable. If this is implemented on managing a blockchain, there is no room for a blame game".*

Segregation of duties (SoD) is a fundamental principle of internal controls that aims to reduce the risk of fraud, error, or abuse by ensuring that no single person has complete control over a transaction from start to finish. The idea behind SoD is to divide the responsibilities for different aspects of a business process among multiple individuals, thereby preventing any one person from having the ability to carry out an unauthorised or fraudulent transaction. With the advent of BT, SoD can be implemented in a more efficient and effective manner than ever before.

The idea behind SoD is to divide the responsibilities for different aspects of a business process among multiple individuals, thereby preventing any one person from having the ability to carry out an unauthorised or fraudulent transaction. With the advent of BT, SoD can be implemented in a more efficient and effective manner than ever before.

BT is a distributed ledger system that enables secure, transparent, and tamper-proof record-keeping of transactions. The use of cryptographic algorithms and consensus mechanisms ensures that the data on the Blockchain is immutable, meaning that once a transaction is recorded, it cannot be altered or deleted. This makes Blockchain an ideal tool for implementing SoD, as it allows for the division of responsibilities to be encoded in the software itself, ensuring that transactions are executed according to predefined rules and that no single person has complete control over the process.

One example of SoD in BT is the use of smart contracts. Smart contracts are self-executing contracts with the terms of the agreement between buyer and seller being directly written into lines of code. These contracts allow for the automation of transactions, removing the need for intermediaries and reducing the risk of fraud. In the context of SoD, smart contracts can be used to divide the responsibilities for different aspects of a business process among multiple parties.

For example, in a supply chain scenario, a smart contract could be created to ensure that the process of tracking and verifying the authenticity of goods is divided between multiple parties. The contract could specify that one party is responsible for verifying the authenticity of the goods, while another party is responsible for recording the verification on the blockchain. This ensures that no single party has complete control over the process and that the transaction is executed according to predefined rules.

Another example of SoD in BT is the use of permissioned Blockchains. Permissioned Blockchains restrict access to the Blockchain to a predefined set of participants, allowing for greater control over the execution of transactions. This ensures that only authorised parties can execute transactions on the blockchain, reducing the risk of unauthorised access and fraud.

In a permissioned Blockchain scenario, different parties could be assigned different roles with specific permissions. For example, one party could be responsible for verifying the authenticity of a transaction, while another party could be responsible for recording the transaction on the Blockchain. This ensures that no single party has complete control over the process and that the transaction is executed according to predefined rules.

In addition to smart contracts and permissioned Blockchains, BT can also be used to implement other forms of SoD, such as the separation of duties between those who initiate a transaction and those who approve it. For example, a Blockchain-based accounting system could require that all transactions be initiated by one party and approved by another, ensuring that no single individual has the ability to carry out unauthorised transactions.

Overall, the use of BT can greatly enhance the implementation of SoD in business processes. By enabling the division of responsibilities to be encoded in the software itself, BT ensures that transactions are executed according to predefined rules and that no single individual has complete control over the process. This reduces the risk of fraud, error, or abuse, and enhances the overall security and transparency of the business process.

However, it is important to note that the implementation of SoD in BT is not without its challenges. One challenge is the complexity of designing and implementing smart contracts that accurately reflect the different roles and responsibilities of each party in the business process. Another challenge is the need for ongoing monitoring and auditing to ensure that the Blockchain system is functioning as intended and that there are no security or compliance issues.

To summarise, respondents believe that budgetary constraints, regulatory constraints (law, regulation, codes, and standards), investor buy-in are the major limitations in adoption of BT. The entire stakeholder ecosystem has to be educated accordingly. The adoption of BT is not in the hands of one party or individual. It has to be a contribution from the community.

#### *4.2.2.4. Key insights for Emerging Theme (b): Limitations of BC*

Key insights of emerging theme (b) is on the lack of awareness of the potential of BT in FR and resistance in adopting a new technology like BT in the governance of FR, can be summarised as follows:

*(i) Scalability and Transaction Throughput*

Public Blockchains, often envisioned for real-time reporting, currently lack the transaction processing power to handle the voluminous data streams generated by financial institutions. This bottleneck can lead to delays, hindering the true real-time nature of reporting.

Private Blockchains offer faster speeds but sacrifice the decentralisation and transparency crucial for public financial reporting. Finding the right balance between speed and transparency remains a challenge.

*(ii) Data Privacy and Security Concerns*

While Blockchain guarantees data immutability, privacy concerns arise when dealing with sensitive financial information. Anonymisation techniques and controlled access mechanisms need to be robust to prevent unauthorised access or manipulation. Security vulnerabilities remain a real threat, as evidenced by past hacks and exploits. Ensuring robust security protocols and constant vigilance against cyberattacks is paramount.

*(iii) Regulatory Uncertainty and Evolving Standards*

Existing accounting and auditing standards have not fully adapted to the nuances of blockchain-based financial reporting. This lack of clear regulatory frameworks creates uncertainty for companies and hinders widespread adoption. Standard-setting bodies and regulators need to collaborate with industry stakeholders to establish clear guidelines and procedures for blockchain-based financial reporting.

*(iv) Governance Structures and Dispute Resolution*

Defining clear roles and responsibilities within the governance framework for Real time Financial Reporting with BT is crucial. Establishing accountability mechanisms for data management, decision-making, and potential errors is essential. Efficient and credible mechanisms for resolving disputes arising from Blockchain transactions are necessary to maintain trust and stability in the financial system.

*(v) Lack of Interoperability and Integration*

The fragmented nature of the Blockchain landscape, with various platforms and protocols, hinders seamless data exchange and interoperability. Standardised data formats and protocols are crucial for smooth integration and reporting consistency. Integrating Blockchain solutions with existing financial systems and infrastructure can be complex and require significant technological adjustments.

### 4.2.3. Emerging Theme (c): Trust and Transparency issues emerging from BC:

IR1 angled in Blockchain in gamification and the angle of meetings in a metaverse to reflect the accountability of a Blockchain. He added that the confidence has increased on Blockchain adoption within their organisation as the company has invested in a plot of virtual land on Decentraland as well as in the Metaverse. This indicates the direction of the company and gives more confidence towards adoption of a disruptive technology like Blockchain.

As a Metaverse stores large amounts of data, BT decentralises storage and validates data processing through nodes. It helps ensure data safety and security. Some other participants shared their perspectives of non-fungible tokens (NFT), which is related to product-authentication on a Blockchain-based platform. The participants related this example in support that Blockchain is a reliable platform and is transparent and at the same time. It is self-governing and needs more of monitoring and feedback rather than a standard or governance guidelines.

The respondents shared their understanding and opinion towards governing a Blockchain and the level of trust embedded in a Blockchain.

#### *4.2.3.1.N7: Security*

Data security and confidentiality are very important when exchanging data. The Blockchain uses a hash model for node storage. Hash is a technique for converting an original message (plain text) into random code to prevent it from being hacked. Hash functions convert any text or file into text strings of the same length. Any given input still produces the same output length.

*IR4: "Oracle has just introduced cloud system and organisations like mine, we are very careful about security. Even cloud is already super hard for us to accept you know. What more BT".*

*IR12: "The accountability, the governance. Look at how the accounting fraternity has evolved over the years. I think the governance and all we can build in, the security, all that we can but is there an appetite at the top level that's a big question mark.*

By using BT, data security issues are solved as the data that enters the Blockchain through the encryption process becomes random codes and is no longer the same. Then the data is distributed to all nodes or users in the Blockchain environment. BT has an advantage in terms of security, because Blockchain is a ledger that records open transactions and uses a decentralised database that is distributed around the world without going through third-party intermediaries.

Initially, Blockchain was only used for encrypted digital currency transactions like bitcoin, but research on digital currencies continues, BT is increasingly developed, this technology addresses existing technologies such as network topologies, cryptography and consensus algorithms and is not just for transactions.

#### *4.2.3.1.1.SN7.1: Risk Management*

Blockchain security is part of the risk management process of an organisation that utilises BT in their day-to-day operations. New perspectives in the supply chain disruption risk management examine how to combine BT with other digital technologies can manage and predict disruptions and lead to resilience and robustness of the supply chain. When automating tasks, the general IT risks still apply, as we know from regular IT audits. The difference is that these are now focused on a different object.

The IT auditor will need to focus more on the management of risks associated with digitalisation. Professionals in internal audit are also responsible for recognising the dangers brought by Blockchain algorithms and ensuring that their organisation's controls are well-designed and functioning properly to manage such risks.

In contrast to people, who can omit a process step or execute a transaction inconsistently, an algorithm conducts the operation without bias or deviation, providing a high level of accuracy. Yet, Blockchain algorithms can potentially offer problems if the proper controls and monitoring are not in place. For instance, due to the consistency of an algorithm's activities, any error becomes a systemic and pervasive issue inside the business process and dataset. Or, if there is a change to a business process but the Blockchain algorithm has not been updated to reflect this change, it may fail to execute or introduce inaccuracies.

If someone acquires unauthorised access to an algorithm or the programme in which it is included, it can be modified or utilised for unauthorised processing. Implementing Blockchain governance and associated controls in advance should aid in effectively mitigating risk. Governance encompasses additional facets, particularly compliance, legal, and human. These additional regulatory and legal considerations have little bearing on algorithm control. Several factors contribute to the development of an algorithm.

The benefits of BT in risk management has been articulated by respondents and compiled into the main areas below.

*i) Increased Transparency*

One of the most significant benefits of BT in risk management is its ability to provide increased transparency. The decentralised nature of the Blockchain means that all participants in a transaction can view the data. This transparency can help reduce the risk of fraud and corruption by making it easier to detect and prevent fraudulent activities.

*ii) Improved Traceability*

BT also improves traceability, making it easier to track the movement of assets and products. This is particularly important in industries where products are sourced from multiple suppliers, as it can be challenging to trace the origin of the product. BT allows for a clear and immutable record of the product's journey, making it easier to identify the source of any problems or issues.

*iii) Increased Efficiency*

Another benefit of BT in risk management is increased efficiency. BT can automate various processes, reducing the need for manual intervention. For example, smart contracts can be used to automate contract management, reducing the risk of errors and improving efficiency.

*iv) Reduced Risk of Data Breaches*

The decentralised nature of BT also reduces the risk of data breaches. Traditional databases store data on a central server, making them vulnerable to cyber-attacks. BT, on the other hand, distributes the data across multiple nodes, making it much harder for hackers to access the data.

*v) Reduced Counterparty Risk*

Counterparty risk refers to the risk that a party to a transaction will not fulfill their obligations. BT can reduce counterparty risk by using smart contracts. Smart contracts are self-executing contracts that automatically execute the terms of the agreement when certain conditions are met. This eliminates the need for intermediaries and reduces the risk of default.

*vi) Improved Auditing*

Auditing is an essential part of risk management, as it allows companies to identify potential risks and ensure compliance with regulations. BT can improve auditing by providing a clear and immutable record of transactions. This makes it easier to audit transactions and ensure compliance with regulations.

*vii) Improved Compliance*

Compliance is another critical aspect of risk management. Companies must comply with various regulations and laws to avoid legal and financial penalties. BT can improve compliance by providing a clear and immutable record of transactions. This makes it easier to ensure compliance with regulations and laws.

BT has the potential to revolutionise risk management by providing increased transparency, improved traceability, increased efficiency, reduced risk of data breaches, reduced counterparty risk, improved auditing, and improved compliance. While there are still challenges to be overcome, including regulatory and legal issues, the benefits of BT are clear. As the technology continues to develop, it is likely that there will see more widespread adoption of BT in risk management.

***4.2.3.1.2.SN7.2: Trust***

The participants emphasised the accountability and trust of a Blockchain is important to ensure the FR process utilising a Blockchain is trustable, especially in the context of real-time. The majority of the respondents emphasised the different categories of a Blockchain, which are public, private and hybrid are important in performing different processes in recording accounting transactions. Different categories contribute to different levels of trust heralded on a Blockchain. IR7 emphasised a public Blockchain will not be ideal in a FR application. It has to be either on private or a hybrid Blockchain.

The underlying principle of trust in BT is one of the key reasons for its widespread adoption and success. Trust is crucial in any transaction or exchange of information, and BT provides a means to establish and maintain trust among parties involved in a transaction without the need for intermediaries or third parties.

The principle of trust in BT is rooted in the fundamental design of the Blockchain. A Blockchain is a distributed ledger that is maintained by a network of nodes or computers, each of which contains a copy of the ledger.

When a new transaction occurs, the nodes on the network work together to validate the transaction and add it to the ledger. Once a transaction is added to the ledger, it is immutable, meaning that it cannot be altered or deleted. This creates a transparent and tamper-proof record of all transactions on Blockchain.

The transparency and immutability of the Blockchain create a high level of trust among parties involved in a transaction. Each party can verify the authenticity and validity of the transaction by checking the Blockchain ledger. Since the ledger is distributed and decentralised, it is not controlled by any single entity, making it more secure and less vulnerable to fraud or cyberattacks.

Another key feature of BT that reinforces trust is the use of cryptographic algorithms to secure the data on the blockchain. Each block on the Blockchain is linked to the previous block using a cryptographic hash function. This creates a chain of blocks that is secured using complex mathematical algorithms, making it extremely difficult to alter or manipulate the data on the Blockchain. Additionally, each transaction on the Blockchain is encrypted using a public key cryptography system, ensuring that only authorised parties can access the data.

The use of smart contracts is another feature of BT that reinforces trust. Smart contracts are self-executing contracts that are programmed to automatically execute when certain conditions are met. They are stored on the Blockchain and can be accessed and verified by all parties involved in a transaction. This eliminates the need for intermediaries or third parties to oversee and enforce the terms of the contract, reducing the risk of fraud or errors.

The principle of trust in BT is further reinforced by the use of consensus algorithms. Consensus algorithms are used to ensure that all nodes on the network agree on the state of the ledger. There are several types of consensus algorithms, including proof of work (PoW), proof of stake (PoS), and delegated proof of stake (DPoS).

PoW is the most commonly used consensus algorithm and involves a complex mathematical problem that must be solved by nodes on the network to add a new block to the Blockchain. PoS and DPoS are newer consensus algorithms that use a different approach to validate transactions and secure the network.

The use of consensus algorithms ensures that the Blockchain is transparent and trustworthy, as all nodes on the network must agree on the state of the ledger before any new transactions can be added. This eliminates the risk of fraud or errors and ensures that the data on the Blockchain is accurate and up to date.

The principle of trust in BT is also reinforced by the use of digital signatures. Each transaction on the Blockchain is signed using a digital signature, which ensures that the transaction is authentic and has not been tampered with. Digital signatures are generated using a private key that is known only to the owner of the account. This ensures that only authorised parties can access and modify the data on the Blockchain.

In conclusion, the principle of trust is fundamental to the success and adoption of BT. The transparency, immutability, and decentralisation of the Blockchain create a high level of trust among parties involved in a transaction, eliminating the need for intermediaries or third parties to oversee and enforce the terms of the transaction.

#### *4.2.3.2.N8: Cryptography*

*IR7: "Ya so nobody can actually go in and do some changes, tamper because it was like a time stamp. People cannot manipulate the system. Because at the end of the day if they did, the chain will be distorted.*

*IR6: "Ya so nobody can actually go in and do some changes, tamper because it was like a time stamp. People cannot manipulate the system. Because at the end of the day if they did, the chain will be distorted. Something like that Everybody will get a notification and it is easily accessible. And it is transparent, you are done and dusted. And that is the characteristic which I feel was quite interesting. Because of course system is subject to tamper and manipulation. These are the characteristics that BT can actually mitigate risk".*

Respondents gain confidence on a Blockchain as cryptography is used, as a method of ensuring communication is only between parties who are able to decrypt and encrypt messages, in preventing third party accessing the transfer of information. This is necessary in the transmission of accounting information, as certain information such as approval of claims has to be private and confidential between two to three parties.

In a Blockchain, the output value, known as a hash, is used as a unique identifier for a block of data. The hash of each resulting block is the same as the hash of the previous block. In addition, the block hash is dependent on the data contained in the block, which means that any changes to that data require a change in the block hash. Therefore, each block created from the hash is based on the data contained in that block and the hash of the previous block. These hash markers play an important role in ensuring the security and immutability of Blockchain. Server users cannot duplicate and falsify data due to the different transcripts in each block. The use of BT can manage the collected data well, and the data is not easily forged.

A hash function is a fixed-length mathematical function that converts variable-length input into a binary sequence. This feature is used in various security applications and internet protocols. Some examples of its use are message authentication, digital signatures, and storing passwords. Hash functions in Blockchain are used as a technique to secure and validate data. Motion data, which is added first, is packed into a data block before being converted using a hash function.

The hash function on the Blockchain uses the hash value of the previous block to perform the new block hash calculation. Therefore, each block is connected like a chain, where changes in the data in one block affect the next blocks. Checking the validity of data can also be done simply by comparing the hash values between blocks. A hash chain is a collection of blocks of data linked together by a hash function. One of the key elements that ensure the security of BT is cryptography, which is a technique used to secure communication and data from unauthorised access or modification. The principles of cryptography and algorithms used in BT as explained by the respondents can be grouped into the following headers.

*i) Cryptography Principles*

Cryptography is an ancient technique used to protect confidential information from unauthorised access. It involves the use of mathematical algorithms to encrypt data in such a way that only authorised individuals can access it. The two primary methods of cryptography are symmetric key cryptography and public key cryptography.

*ii) Symmetric Key Cryptography*

Symmetric key cryptography is a method of encryption that uses the same key for both encryption and decryption. In this method, the sender and receiver share a secret key, which is used to encrypt and decrypt the message. The sender encrypts the message using the secret key, and the receiver decrypts the message using the same key. This method is faster than public key cryptography, but the main disadvantage is that the key must be shared between the sender and receiver, which can be risky if the key is intercepted by unauthorised individuals.

*iii) Public Key Cryptography*

Public key cryptography is a method of encryption that uses two different keys, a public key and a private key. The public key is used to encrypt the message, and the private key is used to decrypt the message. The sender uses the receiver's public key to encrypt the message, and the receiver uses their private key to decrypt the message. This method is slower than symmetric key cryptography, but it is more secure because the private key is not shared with anyone.

*iv) Hash Functions*

Hash functions are another important aspect of cryptography in BT. Hash functions are mathematical algorithms that convert any input data into a fixed-size output, which is known as a hash. The hash function takes an input message of any length and produces an output of fixed length. The output is usually represented in hexadecimal format.

One of the primary functions of hash functions in BT is to ensure data integrity. When data is added to a Blockchain, it is hashed, and the hash value is added to the block. If any part of the data is modified, the hash value will change, which will alert the network that the data has been tampered with. This ensures that the data on the Blockchain is immutable and cannot be changed without detection.

*v) Digital Signatures*

Digital signatures are a critical aspect of cryptography in BT. A digital signature is a mathematical scheme that is used to verify the authenticity of digital documents or messages. A digital signature is created using a private key, and it can only be verified using the corresponding public key. Digital signatures are used to ensure that transactions on the Blockchain are legitimate and have not been tampered with. Some examples of cryptography algorithms in BT is articulated below.

*vi) SHA-256*

SHA-256 is a cryptographic hash function that is used in Bitcoin and many other Blockchain technologies. It takes an input message of any length and produces a fixed-size output of 256 bits. SHA-256 is a one-way function, which means that it is computationally infeasible to reverse engineer the original message from the hash.

*(vii) Elliptic Curve Digital Signature Algorithm (ECDSA)*

ECDSA is a cryptographic algorithm that is used to create digital signatures. It is based on the mathematics of elliptic curves and is used in many Blockchain technologies, including Bitcoin and Ethereum. ECDSA is a more efficient algorithm than other digital signature algorithms and requires less computation power.

*(viii) Advanced Encryption Standard (AES)*

AES is a symmetric key cryptographic algorithm that is used to encrypt data. It is used in blockchain.

#### *4.2.3.2.1.SN8.1: Data Privacy & SN8.2: Data Consistency*

The way Blockchain works is when new data is stored in a block, and inside that block it uses a hash function that identifies the block and its contents in the form of a unique code. The Blockchain is formed from previous blocks which carry historical information in each block. Blockchain records information or transactions that cannot be changed. Once the Blockchain receives new information, the cryptographic hash takes that data and converts it into a unique code. This unique code can detect fraud. So that all transactions using Blockchain become safer and more transparent. When making a transaction, there is public access without having to log in first, so the transaction can be seen by everyone.

### *4.2.3.3. Key insights for Emerging Theme (c): Trust & Transparency issues in RT*

As accounting and FR is a highly regulated field, trust vested in the technology used is crucial. The current issues faced with the legalisation of cryptocurrencies has triggered some level of discomfort and hesitation amongst industry players on the reliability of BT in an important area such as FR are summarised as follows:

*(i) Data Privacy and Anonymity*

Public blockchains: While transparency is lauded, sensitive financial data on public chains can pose privacy concerns. Balancing transparency with anonymisation for individuals and institutions requires sophisticated privacy-preserving techniques, still under development.

Selective Transparency: Access control mechanisms limit full transparency. While authorised parties can access details, the public may only see aggregated data, potentially hindering the desired level of transparency.

*(ii) Immutability and Error Correction*

Data Correction Conundrum: Blockchain's immutability guarantees historical accuracy, but mistakes become permanent scars. Mechanisms for correcting errors post-recording, without compromising integrity, are crucial but remain a challenge.

Forking Dilemma: Blockchain forks, where the ledger diverges, create conflicting versions of the truth. Clear governance structures and protocols for handling forks are essential to maintain trust in real-time reporting.

Transaction Bottlenecks: Public blockchains may not handle the high volume of real-time financial transactions efficiently. Scalable solutions like private blockchains or sharding are needed but come with their own drawbacks and complexities.

Resource-Intensive Architecture: Consensus mechanisms used to validate transactions can be resource-intensive, hindering the real-time speed and cost-effectiveness needed for financial reporting.

*(iii) Evolving Ecosystem and Standards*

Emerging Technology Challenges: Integrating Blockchain with existing financial systems and adapting accounting standards to cater to its nuances are ongoing challenges. Regulatory uncertainty surrounding digital assets complicates the adoption process.

Lack of Interoperability: Different Blockchain platforms lack standardised data formats and protocols, hindering seamless data exchange and hindering real-time reporting across diverse systems.

**4.2.4. Emerging theme (d): Blockchain based governance:** The process on a block is self-governed. Respondent 12 indicated that IT individuals have exclaimed that there is no need to worry about a Blockchain, as it is self-governed.

However, in the context of FR, where it is information and not just processes, if inaccurate information (referred to as 'garbage' by the respondent) into a Blockchain, the inaccurate information will continue to pass through the block. Therefore, source information of what gets into a block is very important. There should be accountability on the data stream of how information is fed into a Blockchain. Therefore, there needs to be a good link up with a good data stream, method, and analytics. There should be a highly sought-after analytics method. Then there can be ensured accuracy throughout the block, and what comes out of it.

#### *4.2.4.1. N9: Trust*

Trust in records relates to the sub-dimensions of reliability of records (how records were created and who created them) and authenticity of records (depending on the creation process and how the identity of records is maintained). BT has the ability to address trust issues in economic transactions and free trading partners from the need to implement mechanisms to signal or convey trust.

BT is considered a game changer not only for its potential to alleviate trust issues in economic transactions, but also for its ability to provide a cheaper, more secure, and more efficient solution for sharing data. The first adopters of BT were financial institutions, who saw its potential to improve escrow transactions or the settlement of securities. The trust-building capabilities inherent in BT are transforming the way financial services are delivered, eliminating the need for intermediaries.

A Blockchain is a group of cryptographically encrypted blocks of information tied together in a chain. It is an encrypted database shared, verified, and run by a network of participants who have their own immutable version of the ledger.

The network of participants guides and supports transactional activities through the computationally achieved consensus mechanism, replacing the intermediaries traditionally needed to create trust between trading partners and providing the basis for trustless economic transactions.

BT requires actors not to trust their human peers or institutions, but the technology itself. Such properties of BT are known as trusted trust or trust-by-computation, capable of revolutionising economic transactions that are traditionally based on mutual trust between human agents.

In summary, the trust architecture of BT allows transactions to be automated based on self-enforcing rules. It makes the whole process inherently error-free and secure, reducing the need to trust trading partners, ensuring transactions take place in a consensual manner.

With this in mind, an exploration of how Blockchain affects trust relationships between trading partners in trade finance represents a valuable opportunity to better understand the dynamics of interpersonal and technology trust, as well as the promises and challenges associated with technology as the foundation of a trustless economy transactions.

BT requires actors not to trust their human peers or institutions, but the technology itself. Such properties of BT are known as trusted trust or trust-by-computation, capable of revolutionising economic transactions that are traditionally based on mutual trust between human agents.

IR1 refers to a restaurant and how they have smart method of food ordering system. There's a lot of development on LinkedIn on the differences between a private and a public Blockchain. A decision on whether to use private, public or hybrid and in what situations should it be relevant, needs to be established.

Trust is a crucial aspect of any financial transaction or exchange of assets. In traditional financial systems, trust is established through intermediaries such as banks or financial institutions. These intermediaries act as trusted third parties and facilitate transactions between parties by validating the identity of the parties involved, maintaining records of transactions, and ensuring that funds are transferred securely.

In contrast, BT eliminates the need for intermediaries and instead relies on a decentralised network of nodes that verify transactions and maintain a ledger of all transactions on the network. This network is open and transparent, meaning that anyone can join the network and participate in the verification process. The verification process is based on a consensus mechanism, which is a set of rules that govern how transactions are verified and added to the Blockchain.

There are several consensus mechanisms used in BT, including Proof of Work (PoW), Proof of Stake (PoS), and Delegated Proof of Stake (DPoS). PoW is the most commonly used consensus mechanism and involves miners solving complex mathematical problems to validate transactions and add them to the blockchain. PoS and DPoS, on the other hand, rely on validators who hold a stake in the network to verify transactions and maintain the Blockchain.

As mentioned above cryptography is also an essential aspect of BT that helps to establish trust. Each transaction on the Blockchain is encrypted using public-key cryptography, which involves the use of a public key and a private key. The public key is used to encrypt the transaction, while the private key is used to decrypt the transaction. This ensures that only the intended recipient can access the transaction data.

Furthermore, cryptography is used to establish the authenticity of transactions and to prevent fraud. Each transaction is signed using the private key of the sender, which is then verified by the network using the sender's public key. This ensures that the transaction is authentic and that it has not been tampered with. Another important aspect of BT that helps to establish trust is immutability. Once a transaction is added to the blockchain, it cannot be altered or deleted. This means that the transaction history on the Blockchain is permanent and transparent, making it impossible for any party to manipulate the data on the Blockchain.

In summary, the principle of trust in BT is established through the use of cryptography, consensus mechanisms, and decentralised networks. These technologies enable secure and transparent transactions without the need for intermediaries. The use of consensus mechanisms ensures that transactions are verified and added to the Blockchain in a trustless manner, while cryptography ensures that transactions are secure and authentic.

The immutability of the Blockchain ensures that the transaction history is permanent and transparent, establishing trust between parties on the network.

BT has the potential to revolutionise various industries, from finance to healthcare, by enabling secure and transparent transactions without the need for intermediaries. However, there are still challenges that need to be addressed, such as scalability, interoperability, and regulatory compliance. Nevertheless, the principle of trust remains a fundamental aspect of BT that will continue to drive innovation and development in the years to come.

#### *4.2.4.1.1.SN9.1: Verifiability*

IR6 explains that how a whole Blockchain works is basically smart contracts which is which is being deployed inside. So, there should be an effective data stream of information that goes into a Blockchain. As quoted by IR7 below:-

*"If you don't control what gets into a blockchain, it's going to be a rubbish-in-rubbish-out situation if it's going to be rubbish, the smart contract is rubbish itself and the outputs can be rubbish itself. So, whoever's going to deploy a particular contract that needs to be validated, needs to ensure a good data stream into a blockchain".*

According to IR1, it the design and type of Blockchain used is important. Many Blockchains are generally decentralised. The number of validators for a transaction needs to be established.

It takes the top 20 people to validate a transaction. For a FR Blockchain you need to create it on a platform like Ethereum or Cardano or any other suitable platform. The control needs to be decided.

Principle wise, Blockchain is supposed to be decentralised like in nature supposed to be decentralised in self-governing. But the important thing is to get the number of validators. The profile of all those validating. And whether there can be an authenticator and validator, these can be designed on a private Blockchain. This way bodies like AOB should be a node on the block. Accounting and finance is a highly regulated industry and everything goes back to the IRS. There might be a situation where in a network for FR a Blockchain network, we will start pointing fingers at each other. There might be a potential blame game. If 50% have agreed, will the 50% be held responsible for validating something incorrectly.

While reducing the cost of verification has economic implications mainly on the intensive margin of production (improving existing applications), reducing network costs on the extensive margin (new applications) is more consequential: Bitcoin was the first digital platform to use decentralised bootstrapping without resorting to investments through an intermediary or planner. As early adopters and investors experimented with the cryptocurrency in hopes that the network would grow in users, security and value, the underlying token was appreciated and created the positive feedback loop needed to attract subsequent groups of users.

This organic diffusion process uses powerful incentives similar to the venture capital model to reward early adopters for taking risks and devoting their time, effort and capital to a new platform. The same incentive system is now being used by startups to raise capital and reduce switching costs for the user base and developer community of established digital providers. This allows them to compete in a context where network effects strongly favor established players.

Markets facilitate the voluntary exchange of goods and services between buyers and sellers. In order for an exchange to take place, key attributes of a transaction must be verified by the parties involved. In the case of a personal exchange, the buyer can usually directly assess the quality of the goods and the seller can check the authenticity of the cash. The only intermediary involved in this scenario is the central bank, which issues and supports the fiat currency used in the exchange.

If a transaction is conducted online instead, one or more financial intermediaries mediate it, for example by verifying that the buyer has sufficient funds. Intermediaries add value to marketplaces by reducing information asymmetry and the risk of moral hazard through third-party verification. This often includes imposing additional disclosures, monitoring participants, maintaining trusted reputation systems, and enforcing contractual clauses.

As markets grow in size and geographic reach, verification services become more valuable as most parties do not have pre-existing relationships but rely on intermediaries to ensure the security of transactions and enforce contracts. In the extreme case where verification costs are prohibitively high, markets falter and profitable trading does not occur. Brokers usually charge a fee in return for their services.

These costs are exacerbated when intermediaries gain market power, often as a result of the information advantage they develop over transaction parties through their intermediation services. Transactions through an intermediary always involve some level of disclosure to third parties and increase the likelihood that the information will be disclosed later reused outside of the original contractual agreement. Transparency allows the owner's identity to be kept secret using cryptographic techniques such that the identity is encrypted, and the owner's identity is only represented by a hash.

As more and more economic and social activity goes digital, data backup has become more problematic and information leakage is becoming more common. Classic examples include stealing social security numbers (e.g. Equifax hack) and credit card details (e.g. Targets data breach) or licensing customer data to advertisers. BT can prevent information leakage by allowing market participants to verify transaction attributes and enforce contracts without disclosing the underlying information to third parties. This allows an agent to verify that some information is true (e.g. without full access to all background information (e.g. previous transaction records): That is, the technology enables verification of transaction attributes in a manner in which privacy is maintained.

The principle of verifiability is a foundational concept in BT. At its core, the principle states that any action or transaction on a Blockchain network must be verifiable by anyone with access to the network. In other words, the transparency and immutability of the Blockchain must ensure that all participants can confirm the authenticity and validity of any data or transaction recorded on the network.

The principle of verifiability is essential to ensuring the integrity of Blockchain systems. Unlike traditional databases, which rely on central authorities to validate and authorise transactions, Blockchain networks are decentralised and distributed. Every participant on the network has a copy of the Blockchain ledger, which contains a complete record of all transactions and data on the network.

This decentralised structure means that the Blockchain must be able to verify the authenticity and validity of every transaction without relying on any central authority. Instead, the Blockchain uses a consensus mechanism to ensure that all participants agree on the accuracy and authenticity of every transaction recorded on the network.

The key features of BT that enable the principle of verifiability are explained below.

i) Cryptographic hashes

   Blockchain networks use cryptographic hashes to create a unique digital fingerprint of every block of data or transaction recorded on the network. These hashes are created using complex mathematical algorithms that are designed to be irreversible and impossible to predict.

   By using cryptographic hashes, the Blockchain can ensure that every block of data or transaction recorded on the network is unique and cannot be altered without being detected. This helps to ensure the integrity of the Blockchain and prevent any unauthorised changes or modifications.

ii) Digital signatures

Blockchain networks use digital signatures to verify the authenticity of every transaction on the network. Digital signatures are created using public-key cryptography, which involves the use of two keys: a public key and a private key.

When a participant creates a transaction on the Blockchain, they use their private key to generate a digital signature that verifies their identity and authorises the transaction. Other participants on the network can then use the sender's public key to verify the digital signature and confirm the authenticity of the transaction.

(iii) Consensus mechanisms: Blockchain networks use consensus mechanisms to ensure that all participants on the network agree on the accuracy and authenticity of every transaction. Consensus mechanisms are designed to prevent any single participant from controlling the network or altering the Blockchain without the agreement of other participants.

There are several different consensus mechanisms used in Blockchain networks, including PoW, PoS, and DPoS. Each of these mechanisms has its own strengths and weaknesses, but all save the same purpose, which is to ensure that all participants on the network agree on the validity and accuracy of every transaction recorded on the Blockchain.

By using these features, Blockchain networks can ensure the principle of verifiability, allowing all participants to confirm the authenticity and validity of every transaction on the network. This transparency and immutability are critical to ensuring the trustworthiness and security of Blockchain systems.

In addition to the principle of verifiability, Blockchain networks also rely on several other fundamental principles to ensure their integrity and security, as follows.

1. Decentralisation: Blockchain networks are designed to be decentralised and distributed, meaning that there is no single point of failure or control. This helps to ensure that the network is resilient to attacks and that no single participant can manipulate the network for their own benefit.

2. Immutability: Once data or transactions are recorded on the blockchain, they cannot be altered or deleted. This helps to ensure that the Blockchain is tamper-proof and that all transactions recorded on the network are permanent and irreversible.

3. Transparency: Blockchain networks are transparent, allowing all participants to view the entire history of transactions and data on the network. This transparency helps to ensure that all participants can verify the authenticity and validity of every transaction on the network.

#### *4.2.4.2.1.SN10: Transparency*

According to IR2, integrating diverse financial data formats across entities and jurisdictions onto a single Blockchain raises concerns around standardisation and privacy. Lack of unified standards for data representation and classification could hinder interoperability and comparability, jeopardising the core benefits of transparency. Additionally, ensuring user privacy while maintaining transparency requires innovative solutions, as sensitive financial information needs to be balanced with public accessibility.

IR4 echoes this by emphasising, while Blockchain offers inherent transparency by making data immutable and traceable, concerns remain about the true nature of "transparency" achieved. Data stored on a public Blockchain might only be partially transparent, with sensitive details obscured or encrypted. Additionally, complex financial transactions may require interpretation and context, which the technology alone cannot provide. This necessitates robust accounting standards and human expertise to ensure meaningful transparency for stakeholders.

Despite these challenges, ongoing research and development are addressing these concerns. Efforts are underway to standardise data formats, develop energy-efficient consensus mechanisms, and engage regulatory bodies to create enabling frameworks. Moreover, continuous dialogue with stakeholders is crucial to build trust and establish best practices for utilising Blockchain's potential to enhance financial transparency responsibly.

Public Blockchains might only reveal transactional data, not the underlying context or interpretation crucial for understanding complex financial activities. This partial transparency could be misleading without additional information and expertise. While transparency is valued, complete financial data exposure can raise privacy issues for companies and individuals. Balancing these competing interests requires finding solutions like privacy-enhancing technologies or restricted access models.

Transparency does not automatically translate to comprehension. Stakeholders might lack the financial literacy or expertise to decipher and interpret the vast amount of data available on the Blockchain. Effective communication and data visualisation tools are essential for meaningful transparency.

#### *4.2.4.2.2.SN10.1: Digitisation of Records*

A common example used by respondents on digitisation of records with BT is on land registration and record management. Digitisation has pushed verification costs towards zero for many types of transactions. When the relevant information is digital, BT contributes to this process by enabling free verification. Of course, at the interface between an offline recording and its digital representation, Blockchain applications still face significant friction and last-mile costs. This explains why, despite claims from tech enthusiasts about the value of using the technology in a variety of applications including supply chain surveillance and digital identity, use cases outside of cryptocurrency and FinTech (settings where vital information and assets are digital) have been extremely limited.

The connection between online on-chain activities recorded on a Blockchain and offline off-chain events poses major challenges that cannot be addressed without complementary innovations. For example, a Blockchain like Bitcoin's can be used to inexpensively verify ownership and exchange of its native digital assets. While this technically allows anyone to send and receive bitcoin globally without using an intermediary or being censored, the actual ability to spend bitcoin to buy goods and services offline still creates last-mile problems.

The digitisation of records in BT has the potential to revolutionise the way records are stored, shared and secured, bringing numerous benefits to individuals, organisations and society as a whole. Traditionally, records have been kept in physical form or on centralised databases that are controlled by a single authority. This approach has several drawbacks, such as the risk of loss or damage to physical records and the possibility of data breaches or tampering with centralised databases. In contrast, BT offers a decentralised and secure way to store and share records that is resistant to tampering and provides a high degree of transparency and accountability.

The key feature of BT that makes it well-suited for record-keeping is its distributed ledger system. Each participant in a Blockchain network has a copy of the ledger, which contains a record of all transactions that have taken place on the network. When a new transaction is added to the ledger, it is validated and verified by the network through a consensus mechanism, such as proof of work or proof of stake, before being added to the Blockchain. Once a transaction is added to the Blockchain, it is immutable and cannot be altered or deleted without the consensus of the network.

This system of distributed ledger and consensus makes BT an ideal solution for digitising records. Instead of relying on a centralised authority to maintain and validate records, a blockchain-based record-keeping system can leverage the power of the network to achieve consensus and ensure the integrity and security of records. This can help to eliminate the need for intermediaries and reduce the risk of errors, fraud or corruption in record-keeping processes.

The benefits of digitising records in BT are manifold. First and foremost, it offers a high degree of security and immutability. The use of cryptography and consensus algorithms ensures that records are protected from unauthorised access or tampering, making it virtually impossible to alter or delete records without the consensus of the network. This can help to improve the accuracy and reliability of records, particularly in areas such as medical records, land registry, or financial transactions.

Second, digitising records in BT can improve the efficiency and speed of record-keeping processes. Since BT allows for real-time validation and verification of transactions, records can be updated and shared instantly without the need for intermediaries or manual processing. This can help to reduce the time and cost associated with record-keeping, as well as improve the accessibility and convenience of records for individuals and organisations.

Third, the use of BT can help to promote transparency and accountability in record-keeping processes. Since each participant in a Blockchain network has a copy of the ledger, the system is inherently transparent and auditable. This can help to improve trust and confidence in records, particularly in areas such as voting, government records or supply chain management, where transparency and accountability are critical.

Finally, the use of BT can help to promote innovation and collaboration in record-keeping processes. Since BT is open-source and decentralised, it encourages collaboration and innovation among participants in the network. This can help to drive the development of new record-keeping applications and services that are more efficient, secure and user-friendly.

While the benefits of digitising records in BT are clear, there are also some challenges and considerations that need to be taken into account. One of the main challenges is the issue of interoperability and standardisation. Since there are multiple Blockchain platforms and protocols, it can be difficult to ensure interoperability and standardisation of records across different platforms. This can lead to fragmentation and siloed record-keeping systems, which can undermine the benefits of BT.

#### *4.2.4.3.N11: Accountability*

Current FR practices pose a challenge of being inflexible when more disclosure is requested from a specialised industry such as manufacturing. Evolution to disruptive technology is essential to ensure continuous information and involvement. This needs to reach out to the organisation at large, and not just the accounting and finance team. Things keep changing and evolving and keeping up is key. There needs to be an update of knowledge. A perspective from the theoretical side of things points towards how things are being implemented, looking at acquisition and execution side of things.

The Blockchain concept revolves around ledger technology that enables people to securely conduct transactions in an automated manner. The technology has been applied in modern urban ecosystems. Sectors that BT has revolutionised include healthcare, energy trading, real estate, and supply chain. The healthcare system is complex, and its sustainability has been tested during the Covid-19 era. However, countries that had already implemented the system were able to manage through the situation. BT has also had a positive impact on energy trading platforms by ensuring transparency and efficiency. This includes options contracts for commodities as prices are monitored by market participants and decisions based on market trends can be more easily made. In addition, smart transportation has become popular, especially in smart cities, alleviating the sector's shortcomings. At the governmental level, population data analysis will help governments and organisations to decide whether to improve or expand the transit system and will also help them to decide whether to deploy more technological solutions to the transportation system or not.

Like the introduction of any new disruptive technology, Blockchain applications have some challenges that need to be considered and addressed. All of these challenges were theoretically and empirically identified as the technology was implemented across multiple disciplines. The concerns center on the proper use of Blockchain in different governance models and its alignment with different regulations and laws. It is also important to note that there is a lack of education among stakeholders, whether government agencies or private companies.

The knowledge gap between private and governmental institutions is large, so it is very important to bridge the gap by bringing both parties together through seminars, workshops and conferences and increasing cooperation for both in the upcoming programs. It is also important that governments and stakeholders are open and resilient about changing their standards and regulations over time.

The introduction of BT in program management offers various advantages. The first benefit is the restoration of the distrust that has existed between program participants.The ever-growing distrust among program stakeholders is unhealthy as it limits their effectiveness and negatively impacts desired outcomes. BT has features that c an solve the problem that leads to restoring trust among different stakeholders. Security is one of the key elements that must be a top priority in any organisation. Protecting data from cyberattacks is critical to ensure continuity of functions within the organisation.

Governance in project and program management encompasses all the key elements that determine the success of a program. Governance is always formed with the needs and goals of the organisation. There are eight elements that drive how a program governance framework is created, implemented, monitored, and controlled.

The seven key elements affecting the effectiveness of the project fall into two main categories: the alignment with the governance of the organisation and the monitoring and control of the governance plan. Alignment with an organisation's governance means that the project environment is fully understood, which ensures proper alignment of established governance. Alignment is critical prior to program launch when defining the project governance framework, roles and responsibilities, and stakeholder engagement plan. Monitoring and control of the governance plan takes place throughout the program’s lifecycle.

In this phase, the program manager ensures that the governance framework is monitored and controlled through appropriate meetings, proper reporting, active risk tracking and issue management. The ultimate goals of many projects and programs have not been met due to a lack of governance and difficulties in defining what governance is and how it can be monitored and controlled of functions within the organisation.

*(i)* *Governance Model*: Choosing the right model is critical to the success of the program. Defining a compatible governance model that aligns the needs of the organisation will help achieve the desired missions required for the program in terms of baseline, cost, time, risk, and stakeholder engagement and expectations.

*(ii)* *Accountability and Responsibility*: Assigning roles and responsibilities is very important for any project or program as everyone will know what to oversee and deliver.

*(iii)* *Stakeholder Engagement:* The needs and expectations of stakeholders are very important to the program team as their non-adoption of the program outcomes will have a significant impact on the program's success.

*(iv)* *Stakeholder Communication*: After identifying all stakeholders in the program, a clear communication plan needs to be created to outline how and when deliverables and milestones will be communicated to stakeholders throughout the program lifecycle.

*(v)* *Risk and Problem Management*: Risks will always be associated with projects and programs, but the main concept of risk is how to deal with them once they have arisen. Risk is to be expected at any stage of the program but establishing a plan for dealing with different types of risk early in the process will give the program team additional resilience to respond appropriately.

*(vi)* *Assurances*: This is the blueprint that ensures all risks are effectively managed and also ensures KPIs are set for program performance.

*(viii)* *Project Management Control Process*: This task is critical as it monitors the status of all program deliverables and provides the right window to act. This task is activated throughout the program life cycle.

Despite the attention and effort that the program management industry devotes to governance and its importance to the success of the program, there are still challenges related to its effective application. The key governance elements were effectively drafted for implementation, but during execution some of these elements can prove very difficult to implement.

Stakeholder engagement and communication plan is one of the most difficult tasks as it depends on the expectations and needs of other parties. Sometimes governance teams come from an operationally oriented industry that is completely different from the project and program management industry, and as such have created operational governance members some uncertainty to deal with that can jeopardise the achievement of overall goals.

*(i)* *E-governance*

Electronic governance is the implementation of ICT in the project or program governance, which will result in better governance through simple process creation and efficient communication with various stakeholders. In the program 'Advances in Internet of Things' management, the uses of e-governance focus on decision-making, management, services, and transactions.

*(ii)* *Decision-making*

Electronic governance will bring all stakeholders and connect them via online portals, which provides clearer and stronger accessibility to information. As a result, more transparency is created, and efficient decision-making will take place among the stakeholders.

*(iii) Management*

Electronic governance helps in managing programs and project teams efficiently as the execution will be monitored through various online channels. This helps in creating more transparency and efficient governance for large projects.

*(iv) Services*

Conducting services online is one of the main features e-governance provides. Accessibility to the online platforms will result in better delivery of different kinds of services to the stakeholders.

*(v) Transactions*

The application of the internet eases the transactions between firms and individuals. Using online payment channels to perform transactions has helped companies to reduce costs compared to traditional transactions and it increases the marginal profit due to the high level of exposure.

*(vi) Blockchain and E-governance*

Blockchain brings an innovative and disruptive solution that helps in shifting the focus from a centralised system to distributed system that is efficient and transparent to all participants in the system. Furthermore, it stores data and executes any required process on a decentralised basis. The Blockchain helps multiple participants to transact and interact with each other even if they are not well known to each other. Those participants can be individuals, firms and corporations, or governments. BT has provided various solutions to the common problems related to e-governance. Trust and transparency, efficiency, availability and data security are the main features that Blockchain enables in terms of e-governance.

*(vii) Data security*

Cyber security is one of the challenges that governments and companies face against cyber-attacks. Blockchain was developed to encrypt data exchanged between parties. Also, it provides an extra layer of security for the data as it facilitates digital certification and signature for every single transaction.

*(viii) Blockchain and Procurement Management*

Procurement and order management is an essential process in the program management cycle; Ensuring compliance with packing slips and invoices is important to ensure suppliers are paid on time. In previous years, this process was managed and operated manually, resulting in a high level of inefficiency. Typically, suppliers are not paid on time due to inefficiencies, putting their cash flow at risk. BT replaces all manual processes with distributed digitised forms and improves the overall process and timely releases the certified payment. Also, it processes the right decision-making regarding the right products to buy and creates uninterrupted communication channels with all stakeholders involved.

*(viii) Blockchain and Financial Management*

The financial aspect of program management is very important to align with the established governance of organisations. Overdue payments cause great difficulties for businesses and make it difficult for them to survive. Blockchain enhances all financial transactions as it provides an instant payment protocol. Cryptocurrencies like Bitcoin and Ethereum can be used as alternative types of currencies that are secure, readily available, and have lower fees.

*(ix) Blockchain and Contract Management*

Contract management is critical in the initial stages of any project or program as it comes with higher risks of uncertainty. Stakeholders spend an enormous amount of time on contract planning to ensure feasibility and smooth implementation throughout the program lifecycle. Blockchain via smart contracts solves the concerns attributed to contract management and scheduling. Smart contracts are computer-programmed contracts that automatically process if/then scenarios. These contracts work with the support of the data stored in the Blockchain.

For example, the old traditional bidding systems for the contracts will be adapted and supported by smart contracts in a way that ensures price competitiveness, accountability and a reward system for the work done.

*(x) Challenges*

Like the introduction of any new disruptive technology, Blockchain applications have some challenges that need to be considered and addressed. All of these challenges were theoretically and empirically identified as the technology was implemented across multiple disciplines. The concerns center on the proper use of Blockchain in different governance models and its alignment with different regulations and laws. It is also important to note that there is a lack of education among stakeholders, whether government agencies or private companies.

The knowledge gap between private and governmental institutions is large, so it is very important to bridge the gap by bringing both parties together through seminars, workshops and conferences and increasing cooperation for both in the upcoming programs. It's also important that governments and stakeholders are open and resilient about changing their standards and regulations over time.

The decentralised nature of Blockchain makes it difficult to tamper with data, which ensures that transactions are transparent, immutable and secure. However, with great power comes great responsibility, and accountability is crucial when it comes to BT.

Accountability is the act of being answerable for one's actions or decisions. In the context of BT, accountability involves ensuring that all actors involved in the Blockchain ecosystem are responsible for their actions and that they can be held liable for any misconduct. This is particularly important in the case of public Blockchains, where anyone can participate in the network and contribute to its development.

One of the primary benefits of BT is its decentralised nature, which means that it is not controlled by any central authority. Instead, the Blockchain is maintained by a network of nodes, each of which has a copy of the entire Blockchain. This means that there is no central point of control, and all transactions are transparent and verifiable by anyone in the network. However, this also means that there is no central authority that can be held accountable for the actions of the network as a whole.

To address this issue, Blockchain developers have created various mechanisms to ensure accountability in the Blockchain ecosystem. These mechanisms include are articulated as follows.

*i) Smart contracts*

Smart contracts are self-executing contracts with the terms of the agreement between buyer and seller being directly written into lines of code. They allow for the automation of transactions and the enforcement of rules without the need for intermediaries. Smart contracts can be used to ensure that all parties involved in a transaction are held accountable for their actions. For example, a smart contract can be programmed to release funds only when certain conditions are met, ensuring that both parties fulfill their obligations.

*(ii) Consensus mechanisms*

Consensus mechanisms are used in Blockchain networks to ensure that all nodes agree on the state of the Blockchain. These mechanisms ensure that transactions are validated and added to the Blockchain in a secure and transparent manner. They also ensure that any malicious actors attempting to manipulate the network are identified and prevented from doing so. Consensus mechanisms such as proof-of-work and proof-of-stake are designed to ensure that all nodes in the network are accountable for maintaining the integrity of the Blockchain.

*(iii) Transparency*

BT is inherently transparent, which means that all transactions are visible to anyone in the network. This transparency ensures that all actors in the network can be held accountable for their actions. For example, if a transaction is found to be fraudulent, it can be traced back to the actor responsible for initiating the transaction. This transparency also helps to prevent corruption and fraud, as all transactions are visible to the public.

*(iv) Reputation systems*

Reputation systems can be used in Blockchain networks to ensure that actors are held accountable for their actions. These systems allow participants in the network to rate each other based on their behaviour, which can be used to determine their trustworthiness. Reputation systems can be used to prevent malicious actors from participating in the network and to ensure that all actors are held accountable for their actions.

*vi) Governance structures*

Governance structures can be used in Blockchain networks to ensure that all actors are held accountable for their actions. Governance structures can be used to establish rules and regulations for the network, to enforce these rules, and to ensure that all actors are held accountable for their actions. Governance structures can also be used to resolve disputes and to ensure that the network operates in a fair and transparent manner.

In addition to these mechanisms, there are also various legal and regulatory frameworks that can be used to ensure accountability in the Blockchain ecosystem. For example, existing laws such as contract law, property law, and tort law can be applied to Blockchain transactions. There are ongoing discussions on laws and regulations developed specifically for Blockchain.

#### *4.2.4.3.1.SN11.1: Blockchain responsibility*

This opinion can be summarised that the governance of the Blockchain should be actually on what goes onto the block, rather than, governing the Blockchain, as the Blockchain is self-governed. There is no room for change, or alteration without igniting an alarm to the entire block. It is interesting to note that Respondent 6 added that *"fraud is something you can never perform on a Blockchain"*.

According to IR6, there will be resistance from many agencies on Blockchain due to the fact that it can detect corruption. It is also good to be used by the Inland Revenue Services (IRS) as every single transaction that is made has a proof and record.

BT is considered a disruptive innovation after the steam engine, electricity, and the Internet. As we all know that steam engines and electricity emancipated productivity, the internet has changed the way information is delivered. In this way, Blockchain is likely to change the way value is delivered as a trust-building engine. BT has solved two main problems of the digital economy: once the assets are digitised and their entire flow can be found through the chain; The other is that the zero-cost trust has really been built under the anonymous society, which brings new opportunities for the current Internet economy.

Although the decentralised nature of BT has been a boon to many financial and business industries, it has encountered many obstacles in its application and development. Therefore, BT is a double-edged sword for traditional economic and financial development, which places higher demands on regulators' data processing and risk response capabilities. So, what we need to do is to explore the application environment of Blockchain finance and economics from the perspective of technology, applicability, regulation, supervision, etc. with the goal of benefiting the entire society.

Governance-wise, the organisation is accountable for the core processes it supports. Nonetheless, Blockchain usage is typically integrated into the functionality of an application. As soon as an organisation begins working with AI, it collaborates with the IT department to install this new programme, connect it to existing apps, and construct an infrastructure on which the algorithm may conduct processes securely.

This begs the question of who owns and is responsible for the Blockchain algorithm and its behaviour. Understanding the roles and duties of the algorithm is crucial. In addition to cost reduction and process efficiency, robotisation brings concerns regarding its control. What does the use of the Blockchain algorithm for internal controls in the process mean after, for example, the separation of duties as we know it is not feasible? The regular risks such as development, administration, and maintenance as well as access security remain relevant to the algorithm.

There are various IT governance frameworks that can provide guidance on this aspect. COBIT (Control Objectives for Information Technologies) is an example of a guidance framework that can be used in the development of a governance framework for the use of Blockchain.

#### *4.2.4.4. Key insights for Emerging Theme (d): Blockchain-based Governance*

In a highly regulated field such as FR which involves approvals from government agencies, especially if the company is a public listed company, there is a need to be governance guidelines which specifies the acceptance of financial reports which are generated via a Blockchain network. The governance guidelines need to be developed guided by the following challenges.

*(i) Scalability and Transaction Throughput*

Public blockchains: Public blockchains like Ethereum currently have limited transaction throughput, often experienced congestion and slowing down processing times. This makes them unsuitable for handling the high volume of transactions required for real-time updates in large organisations.

Private blockchains: Private blockchains offer higher throughput but sacrifice decentralisation and transparency, compromising some of the core benefits of BT. Finding the right balance between speed and decentralisation is crucial.

*(ii) Latency and Data Immutability*

Conflicting goals: Balancing real-time updates with the immutability of Blockchain data presents a challenge. While immutability ensures security and auditability, it can hinder live adjustments for errors or corrections in real-time reporting.

Potential for forking: Forks (divergences) in the Blockchain can create inconsistencies in financial records, requiring reconciliation processes that introduce delays and disrupt real-time data availability.

*(iii) Data Privacy and Security Concerns*

Transparency vs. confidentiality: Achieving real-time transparency on the Blockchain might expose sensitive financial information. Secure data anonymisation techniques and controlled access mechanisms are crucial for balancing transparency with privacy.

Cybersecurity vulnerabilities: Blockchain systems are not immune to cyberattacks, and ensuring the security of data stored on the ledger is essential to maintain trust and data integrity in real-time reporting.

*(iv) Technological immaturity and Regulatory Uncertainty*

Evolving technology: BT is still evolving, and its integration with accounting systems and financial practices requires further development and standardisation. This can lead to challenges in implementing real-time solutions with existing infrastructure.

Regulatory ambiguity: The lack of clear regulations and legal frameworks surrounding Blockchain and digital assets creates uncertainty for financial institutions and hinders widespread adoption for real-time reporting.

*(v) Cost and Technical Expertise*

Implementing and maintaining blockchain-based systems can be expensive, requiring significant upfront investments and ongoing technical expertise. This can create barriers for smaller organisations and hinder widespread adoption. Training and upskilling personnel to effectively manage and analyse Blockchain data is crucial for real-time utilisation. The lack of readily available skilled professionals can pose a challenge for some organisations.

**4.2.5. Emerging Theme (e): Accounting and other types of systems (current):** Most respondents indicated that they use SAP or Oracle in their day-to-day operations. Respondent 1 uses Oracle. Currently it works, perhaps compatibility in the next 10 years. It will be useful to be integrated with current systems used within SMEs. This will be an evolution of the current software used.

***4.2.5.1.N12: Compatibility***

According to IR4, many of the processes towards the generation of internal management accounts of their organisation is done manually. BT can link up these processes and speed up consolidation. The respondent connects this with sustainability efforts. Moving to digitalisation is part of sustainability efforts of the organisation. Moving to digitalisation will ensure the company is taking measures towards sustainability and Blockchain is undoubtedly, one of them.

According to IR4, his organisation has a customised accounting software which is derived from an established software. It generates the monthly management accounts every month, right and at the same time the consolidation system as well. There are many areas that are still being managed manually and there needs to be a linking bridge to link the data sets. BT can potentially be used as the patient management system is already utilising BT, for the type of tests that a patient needs to undergo, the results of the test, and how the system is managed.

A concern was raised by IR4 as an x-auditor, the main concern is audit trail. With BT the respondent is concerned if there is going to be an audit trail, and how the respondent is going to view the audit trail. A complete trail with all the transactions and participants of the block is required to view the trail that needs to be established.

As indicated by IR4:-

> *"How will the completeness be analysed and will there be a method to track all 1000 line items of a balance sheet? Can there be visibility of transfers from trial balance to balance sheet. And how to track an exception. What is the exception report that can be generated? The permanent adjustment was not correctly taken up or the current adjustment was not correct. Taken up. And then the last thing is of course the security. It must be convincing".*

IR6 use case of Blockchain is the R&D of their organisation in trying to develop a drone technology system, where the drones have an AI capability, and being developed on a Solidarity BT platform. Look at a use case of drone technology in a farming example, there are multiple types of data sets that can be collected. As data varies, there are sensors that can be used in obtaining data, connected to a Blockchain. The data fed in will be rewarded with cryptocurrency, on a public Blockchain.

Majority of the respondents' expectation is that companies are ready to begin their venture with Blockchain, but they first need time to think about it and digest the entire 'know-how' prior to embarking on it as a solution for current challenges with financial reporting. The type of Blockchains used are key in establishing the level of governance that needs to be vested onto a Blockchain.

Roberts (2020) emphasises that governance techniques at the micro, meso, and macro levels are intertwined, and that it is impossible to investigate one level of governance in isolation from the others. The distinction between public and private Blockchains is the data infrastructure's ownership. The distinction between permissionless and permissioned systems lies in the read, write, audit, and commit constraints imposed on network members.

In the former, anyone can participate in the network and validate the transactions taking place in the platform, and in the latter, only selected entities are authorised to validate the transactions. Based on the overall responses from the interviews, the overall feedback indicates that structuring a set of governance guidelines in managing a Blockchain for Real time Financial Reporting will enable a smoother process with lesser red tapes.

It will provide a clearer pathway towards individual roles and processes. These classifications are not exclusive to each other, and it is possible to have a public and private Blockchain with varying degrees of permission models.

BT has the potential to revolutionise the way we store and transfer data, especially in the financial industry. However, not all applications are compatible with BT, and it is important to understand the factors that determine compatibility.

One of the key features of BT is decentralisation. This means that there is no central authority that controls the data, and every participant in the network has an equal say. This is achieved through a consensus mechanism, which ensures that all participants agree on the state of the ledger. This makes BT ideal for applications that require transparency, security, and trust, such as financial transactions, supply chain management, and voting systems.

Another important feature of BT is immutability. Once a transaction is recorded on the blockchain, it cannot be altered or deleted. This ensures that the data is tamper-proof and can be trusted. However, this also means that mistakes or errors cannot be corrected, and there is no way to delete sensitive data once it has been recorded. This makes BT unsuitable for applications that require the ability to modify or delete data, such as medical records or legal documents.

Compatibility with BT also depends on the scalability of the application. BT is still in its early stages, and the current infrastructure is not capable of handling large-scale applications. For example, the Bitcoin network can only handle a maximum of seven transactions per second, while Visa can process up to 24,000 transactions per second. This means that BT is not suitable for applications that require high transaction volumes, such as online shopping or social media.

Another factor that determines compatibility with BT is the level of privacy required. While BT provides a high level of security and transparency, it does not guarantee privacy. All transactions on the Blockchain are visible to all participants, and anyone with access to the Blockchain can see the details of each transaction. This makes BT unsuitable for applications that require a high level of privacy, such as medical records or personal data.

Furthermore, the regulatory environment is another important factor to consider when determining compatibility with BT. Many industries, such as finance and healthcare, are highly regulated, and any new technology must comply with these regulations. BT is still largely unregulated, and there are no clear guidelines on how it should be used. This means that any application that uses BT must be carefully designed to ensure compliance with existing regulations.

In conclusion, compatibility with BT depends on several factors, including decentralisation, immutability, scalability, privacy, and regulatory environment. While BT has the potential to revolutionise many industries, it is not suitable for every application. Developers must carefully consider the requirements of their application and the limitations of BT before deciding to use it.

#### *4.2.5.1.1.SN12.1: Advantages of current software*

The respondents who are practicing accountants and auditors summarise the benefits of current software, XBRL in financial reporting. XBRL uses tags to define each data point, ensuring consistency and clarity across reports. This facilitates easier understanding and comparison by investors, analysts, and regulators.

XBRL files are machine-readable, enabling automated analysis and data aggregation across different companies and periods. This allows for efficient trend analysis and benchmarking. Manual data entry errors are minimised, improving data integrity and reliability. This increases trust in financial information and reduces the risk of misinterpretations.

Overall, XBRL enhances the quality and efficiency of financial reporting, promoting transparency and better financial analysis for various stakeholders. It offers a significant step towards data-driven decision-making and building trust in the financial system. XBRL's structure and standardisation can play a crucial role in integrating financial data onto a Blockchain. Tagging data elements using XBRL standards ensures consistency and facilitates efficient data storage and retrieval on the Blockchain.

This creates a powerful combination. Immutability of Blockchain combined with XBRL's clear data definitions creates a highly secure and transparent reporting system.

Automated data extraction and analysis of XBRL reports can be seamlessly integrated with Blockchain processes. XBRL tagging within Blockchain transactions simplifies auditing and regulatory oversight.

The adaptability of XBRL to Blockchain offers a compelling vision for the future of financial reporting. By marrying structural clarity with tamper-proof data storage, this integration can pave the way for a more secure, transparent, and efficient financial system. However, addressing scalability, privacy concerns, and regulatory uncertainty remains crucial for this vision to become reality.

#### *4.2.5.1.2.SN12.2: Disadvantages of current software*

IR12 indicated the weaknesses in the current accounting systems:-

*IR12: "So when we talk about accounting system as I mentioned, accounting system is a tool for you to manage and structure your financial movements. And at the end of the day when there is proper auditing, from outsider comes to monitor your financial flow, they will understand throughout the year what you have done, what you want to do, how did you do the spendings, spending gone to the right or wrong way. So that is what the entire system is doing.*

*And those software and the tools, are a good thing to be, in helping the organisation, especially the large ones to manage and organise the financial flow. But as always glitches are there. There is a system fail or the server fails, and the entire accounting system stops. The entire organisation stops functioning".*

Regulatory and compliance considerations pose significant barriers to the integration of BT with current software systems. The evolving regulatory landscape surrounding Blockchain applications introduces legal uncertainties and compliance burdens for businesses. Ensuring adherence to data protection regulations, anti-money laundering laws, and financial regulations complicates the integration process and may deter organisations from adopting blockchain-based solutions, especially processes that lead up to financial reporting.

#### *4.2.5.1.3.SN12.3: Integration with Blockchain*

IR17 discusses the softwares compatibility with the current softwares used, and potential integration.

*IR17: "Currently we have an accounting system that we are using now, Oracle, SAP, UBS accounting and we have the one which is tailored or on the shelf right now. So that kind of software doesn't integrate with Blockchain yet. We don't have in Oracle and SAP but this technology has not been embedded there, in terms of the accounting system that we have right now. It could be that, it is not useful but maybe people are taking some time to understand how is this going to be a return in investment"*

*IR20: "To be honest with you until now there is no accounting system that is compatible with the BT and I haven't come across any one of it"*

In recent years, businesses across different industries have been exploring the potential of integrating BT into their operations to improve security, transparency, and efficiency. The benefits and challenges of existing softwares and infrastructure integrating with BT is explained below.

*i) Enhanced Security*

The use of BT can significantly enhance the security of transactions and data. It employs cryptography to secure data, making it nearly impossible to hack or tamper with the system. Each transaction is verified and validated through consensus algorithms, which eliminates the need for intermediaries and the associated security risks. This makes it an ideal solution for businesses that deal with sensitive information or financial transactions.

1. Transparency and Accountability

   BT is transparent by design, which means that all transactions are visible to every participant in the network. This makes it easier to track and verify transactions, ensuring that they are executed accurately and without fraud. This feature can be particularly useful for supply chain management, where transparency and traceability are critical.

2. Efficiency and Cost Reduction

   By eliminating intermediaries and automating transactions, BT can significantly improve the efficiency of business operations. It reduces the need for manual verification and reconciliation, which can be time-consuming and expensive. This can lead to significant cost savings for businesses in the long run.

3. Increased Trust and Reliability

   The use of BT can increase trust and reliability between parties in a transaction. The immutable nature of the ledger ensures that records cannot be altered or deleted, which makes it easier to build trust and confidence among participants.

*ii) Ways to Leverage BT*

1. Cryptocurrency: Cryptocurrency is the most well-known application of BT. It enables digital transactions without the need for intermediaries like banks or financial institutions. Cryptocurrencies like Bitcoin and Ethereum have gained mainstream popularity, and many businesses are accepting them as a form of payment.
2. Supply Chain Management: BT can be used to track the movement of goods in a supply chain, from the point of origin to the point of consumption. This can help ensure transparency and traceability, making it easier to detect and prevent fraud, counterfeit products, and other illegal activities.
3. Digital Identity: BT can be used to create secure digital identities that can be used for various purposes, including voting, banking, and access control. This can help reduce identity theft and fraud, while also improving the efficiency of identity verification processes.
4. Smart Contracts: Smart contracts are self-executing contracts that are programmed to execute automatically when certain conditions are met. They can be used to automate complex business processes, such as supply chain management, insurance claims, and financial transactions.

5. Decentralised Applications (DApps): Decentralised applications are software applications that run on a Blockchain network. They can be used to create a wide range of applications, including financial services, social networks, and gaming platforms. DApps are designed to be transparent, secure, and decentralised, which makes them ideal for businesses that want to offer their customers more control over their data and transactions.

*(iii) Challenges of Integration with BT*

While there are many benefits of integrating with BT, there are also some challenges that businesses need to consider. These include:

1. Scalability: BT is still relatively new, and it can be challenging to scale it to accommodate large numbers of users and transactions. This can result in slow transaction times and high fees.
2. Regulatory Uncertainty: The regulatory environment around BT is still evolving, which can make it difficult for businesses to navigate the legal landscape.

#### *4.2.5.2. Key insights for Emerging Theme (e): Accounting software and other types of systems (Current)*

Currently there are no softwares that are being merged with BT but there are use cases of this in organisations, which participants are confident will eventually be the way to go, should BT provide an enhancement and better cost efficiency. However, from the feedback provided by the respondents, there are potential adaptation strategies that can be considered.

i) *Phased Approach:* Gradually integrating Blockchain features into existing systems can mitigate disruption and allow for learning and adaptation.

(ii) *Collaboration and Standardisation:* Industry-wide collaboration is crucial to establish common data formats and protocols, facilitating seamless integration and compliance.

(iii) *Regulatory Clarity:* Clear and supportive regulations from government bodies can encourage adoption and reduce uncertainty.

(v) *Invest in Skills Development:* Upskilling personnel in BT and its accounting applications is vital for successful implementation.

### 4.2.6. Summary of Emerging Themes from Accountability and Governance of a Blockchain

The participants expressed the fundamental importance of understanding the benefits and the interoperability of a Blockchain. Understanding the application of a Blockchain was expressed as being important to be able to apply it in the context of FR. The participants also interpreted the importance of governance and accountability in FR.

As arriving at a transparent and accurate financial report is a challenge. Furthermore, preparing it on a Blockchain with the real-time principle in place is even more challenging. The majority of the participants also expressed their day-to-day operations and how they view Blockchain as a solution provider to enhance the processes they are involved in.

The participants' reaction towards acceptance of a Blockchain was very visible coming from the knowledge that they have gained from reading articles, online webinars on Blockchain 101, you tube videos and use cases within or external to their organisation. The participants also highlighted shared visions of the importance of data that is streamed into a Blockchain.

For example, inaccurate information that is channeled into a Blockchain causes the information to continue being posted as inaccurate information throughout the Blockchain. The participants highlighted how governance is more importantly exercised at the point of data streamed into a blockchain. That is where governance is needed. The participants' conceptions of democracy conveyed the meaning of diversity of thoughts and actions for protecting their liberty and freedom for personal growth.

The understanding of the concepts of Real-time Financial Reporting and the governance of information in and throughout a Blockchain was crucial to understand the integrity and dependability towards a financial report that is generated via a Blockchain. There are four different approaches, namely, centralised, semi-centralised (or hybrid), polycentric, and decentralised forms of governance. This can be implemented on a Blockchain network for Real-time Financial Reporting.

Centralised governance refers to situations in which a specific group of individuals or organisations make governance decisions, and the decision-making processes can be organised via off-chain or on-chain methods. Some governance decisions (e.g., conflict resolution) are made only by a centralised board of directors, while others (e.g., regarding the network of users or platform functions) can be made with extra transaction processing by the platform users. Here, the effect of user votes on the actual implementation of choices can differ.

*(i) Interoperatability Standards and Governance Mechanisms*

For FR processes to be on a Blockchain, there is a need for new interoperability standards and governance mechanisms. The use of Blockchain solutions requires new interoperability standards between different information management systems, and the development of legitimate governance in the FR process, editing and use of data. Furthermore, BT may bring increasing levels of effectiveness and efficiency, but political and administrative legitimacy of this technology remain as key concern (Salamon, 2002), and the impact of this technology on equity, accountability, and democracy is far from clear for the moment (Bullock, 2019; Barth and Arnold, 1999).

*(ii) Cultural Transformation*

Data verification and implementing effective BT solutions often require a cultural transformation in administrative processes. This cultural transformation includes changing work habits in system operations and in managerial processes (Bean, 2020). The effective usage of digital solutions proposed by BT depends on the openness of data and exchange of information inside and outside of administrations (European Commission, 2020).

Transformation toward openness can be more challenging in siloed organisations. Another challenge is that such transformations may inherently be resisted in some administrations due to incumbent employees of the accounting division distrusting the new techniques, which may contribute to low alignment.

Blockchain's potential for trust and transparency in Real-time Financial Reporting is undeniable. However, acknowledging its limitations and actively working towards solutions is crucial. Technological advancements, collaborative efforts to create robust privacy-preserving techniques and standardised protocols, and regulatory clarity are critical steps in realising blockchain's transformative potential. While shadows remain, by continuously innovating and addressing these limitations, stakeholders of FR can move closer to a future where Blockchain illuminates Real-time Financial Reporting with trust and transparency.

### 4.2.7 Key Insights & Reflection Summary

In summary, the perceived acceptance of the technology was represented with respondents' expressions of realities to denote the respondents' understanding of BT was discussed in terms of their views from their own experiences with BT, from their day-to-day tasks or from readings, trainings, videos and other forms of observation of the technology.

Majority of the respondents have accepted BT as a way forward with a behavioural intention (BI) of utilising Blockchain based on their positive attitude (A) towards furthering their understanding and application of BT.

Perceived usefulness of BT was represented with the respondents' intention of embracing Blockchain further, by making investments in R&D projects utilising BT in fuelling growth and automation. Most respondents perceived Blockchain to be self-governed and there should be no trust and accountability issues arising from a Blockchain based solution in an organisation, provided an accurate data stream is channelled into a Blockchain.

## 4.3 RESEARCH QUESTION 2: BLOCKCHAIN TRAITS AND THE PRINCIPLE OF REAL-TIME

This section presents the participant's understanding on the characteristics of a Blockchain and which one(s) enables FR process to be real-time. The understanding of the respondent on their perspective of each character, and what convinces them that these characteristics will provide accurate, transparent, Real-time Financial Reporting.

The Tree Diagram in Figure 4.4. shows the emerging themes from RQ2.

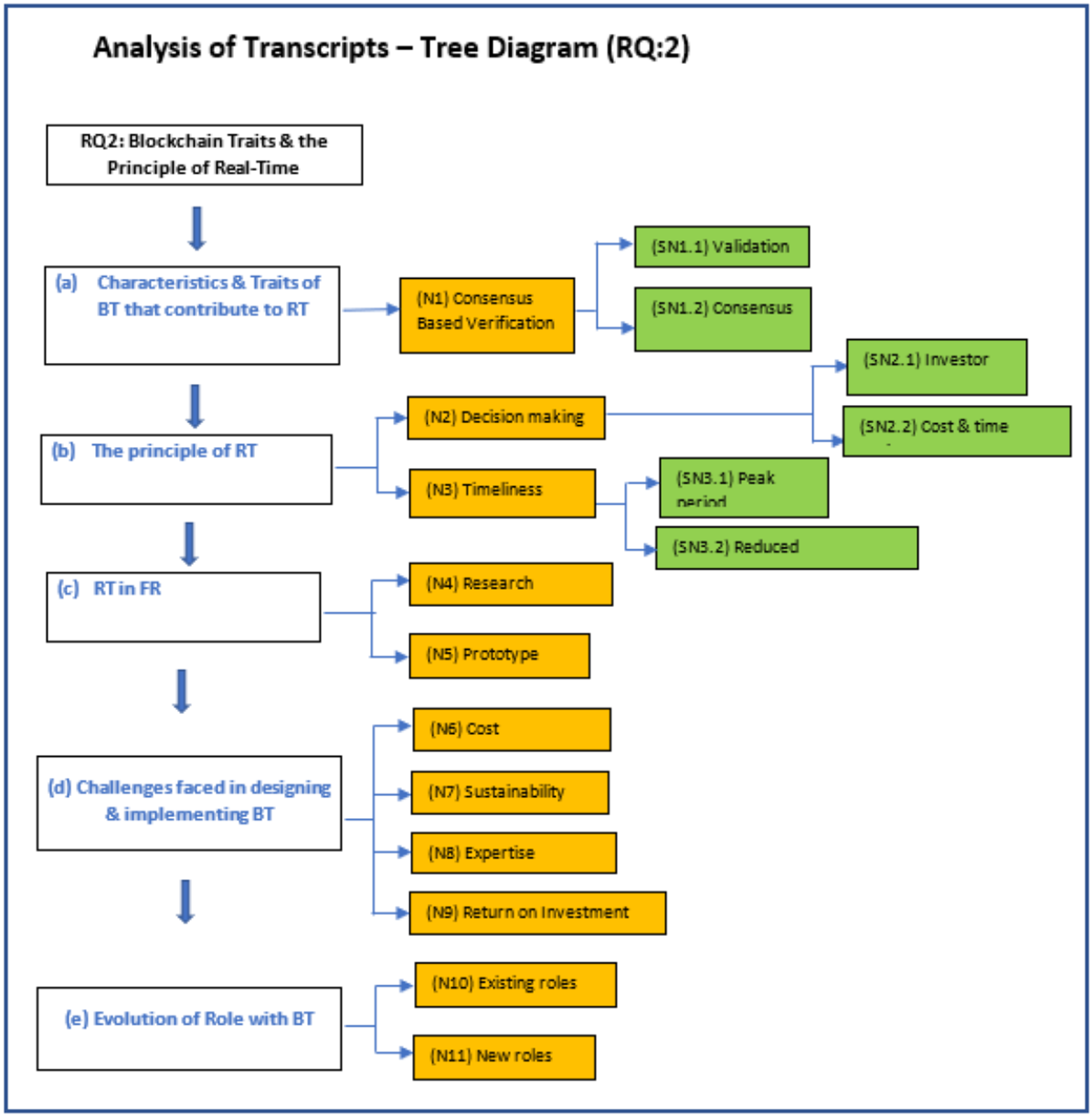


**Figure 4.4: Analysis of Transcripts (RQ:2)**

The Tree Diagram depicts the emerging themes from analysis of responses to RQ2. Figure 4.4 provides the five (5) themes arising from the analysis of transcripts from RQ2 which are provided below.

1. Characteristics and traits of BT that contributes to Real-time
2. The principle of Real-time
3. Real-time in Financial Reporting
4. Challenges faced in designing and implementing BT
5. Evolution of role with BT

The above themes are generated from the research questions and the responses of the interviewees are categorised based on these themes. The respective nodes and sub-nodes generated from these themes are articulated by the researcher in the following sub-sections below.

The Tree Diagram depicts the emerging themes from analysis of responses to RQ2. Figure 4.4 provides the five (5) themes arising from the analysis of transcripts from RQ2 which are provided below.

(i) Characteristics and traits of BT that contribute to Real-Time (RT)

(ii) The principle of RT

(iii) RT in Financial Reporting (FR)

(iv) Challenges faced in designing and implementing BT

(v) Evolution of Role with BT

The above themes are generated from the research questions and the responses of the interviewees are categorised based on these themes. The respective nodes and sub-nodes generated from these themes are articulated by the researcher in the following sub-sections below.

### 4.3.1. Emerging theme (a): Characteristics & traits of a Blockchain that contribute to real-time:

The majority of respondents presented mixed responses on understanding the characteristics and traits of a Blockchain and how they gained experiences and believed these traits could be solutions in automating processes within their organisations.

They focused their ideas and thoughts towards utilising Blockchain in providing solutions to their day-to-day responsibilities, be it simple solutions such as transferring payments to a vendor out of the country or level of authority in signing a claim cheque. Most of the respondents' described a thorough understanding on the characteristics of a Blockchain but unable to point out specifically which characteristic contributes to the principle of real-time. In other words, it is perceived that all characteristics of a Blockchain are equally important in generating the principle of real-time.

The characteristics that were mostly described by the participants was immutability or the fact that the information stored on a Blockchain is unalterable. The use of a Blockchain was an organisational interest of participants whose organisations are moving towards adoption of disruptive technologies, or at least thinking about adoption of BT in specific.

Currently, the respondents are convinced that Blockchain is thriving in various industry spaces such as supply chain management, financial services, healthcare and voting process. Participants exclaimed the R&D process that contributes towards the design of a Blockchain requires a thorough understanding of the principles underlying each astounding characteristic of a Blockchain. This will in return contribute towards Blockchain being an efficient solution towards enhancing processes in terms of time and cost and enable more productive solutions to their respective organisations.

#### *4.3.1.1.N1: Consensus-Based Verification*

Consensus models are the key component of the Blockchain framework with several important properties. The efficiency and scalability of the Blockchain system are directly related to the consensus model. The consensus model primarily serves as a process reference for adding and updating a new block to a Blockchain.

For a new data transaction on the Blockchain, the consensus model represents the process between nodes on a Blockchain network to eventually agree on a single value. Best practice for an estimated 10% of vital global gross domestic product data is stored using BT. Blockchain works in a distributed environment and supports tamper-proof ledgers with decentralised, transparent, and immutable functions.

In Blockchain, it is not possible to remove or delete data from the ledger and since its distributed data is accessible to all nodes and therefore each node must verify data integrity. Blockchain has an architecture that allows all unknown and untrusted parties to interact with each other in a very transparent environment without intermediaries or trusted third parties.

#### *4.3.1.1.1.SN1.1: Validation*

BT can be used for data validation by creating a secure and transparent ledger that can verify the integrity of data. This can be done by creating a blockchain-based database that records all transactions and changes to the data, creating a tamper-proof and immutable record. Any changes to the data would require consensus from the network, ensuring that the data is accurate, consistent, and reliable.

One example of using BT for data validation is in supply chain management. The supply chain for many products can be long and complex, involving multiple suppliers, manufacturers, distributors, and retailers. Each step in the supply chain requires data to be collected and verified, such as product origin, manufacturing processes, shipping routes, and delivery times. A Blockchain-based supply chain management system could record all of this data in a secure and transparent ledger, ensuring that the data is accurate and consistent at each step in the supply chain. This could help to prevent fraud, counterfeiting, and other issues that can arise in supply chain management.

Another example of using BT for data validation is in identity verification. Identity verification is a critical process for many applications, such as banking, voting, and government services. BT can be used to create a decentralised identity verification system that can securely and transparently verify a person's identity. This can be done by creating a Blockchain-based database that records all identity information and changes to that information. This would create a tamper-proof and immutable record that can be used to verify a person' identity.

BT can be safely divided into two main groups: with permission and without permission. Achieving this agreement globally is to share the data across all nodes in the Blockchain network. Obviously, this is a very challenging task in a decentralised environment. The consensus model needs to be flexible on several points, Delay in messages, network partitioning, corrupted messages, node failure, messages arriving out of order. The protocol should be designed to deal with selfish and malicious nodes. There are already models for these problems. In general, these consensus models are designed to ensure that the affected nodes in the Blockchain network have a consensus with the state and content of the chain. The three key properties of these consensus models are articulated below.

*(i)* *Safety:* A consensus model is accepted as secure if all connected nodes produce consistent output and are valid with respect to the rules of the protocol.

*(ii)* *Liveness:* A consensus model would be accepted as live if all participating nodes in the consensus model produce value.

*(iii)* *Fault Tolerance:* The consensus model is fault tolerance when it is able to recover after the failure of participating nodes on the Blockchain.

When choosing a Blockchain platform, the security of the consensus model is always the most important factor that determines and maintains the integrity of the content of the block on the Blockchain. Choosing the wrong consensus model can result in an unstable Blockchain.

There are several failures associated with the consensus model, with the expected outcomes when the consensus model fails include dominance, Blockchain forks, consensus failures, and poor performance (efficiency).

*(i) Proof Based Consensus Model*

The proof-based consensus models are mainly used in the public or permissionless blockchain. The key concept of the evidence-based consensus model is to provide enough evidence of the work done in competition with other nodes to get a chance to add a new block to the blockchain. There are a handful of evidence-based consensus models available in the literature such as PoW and PoS and other variants created independently.

1. PoW-based Consensus Model

The PoW model is used extensively in cryptocurrencies like Bitcoin. It is also one of the popular consensus validation techniques for Blockchain transaction verification. In the PoW consensus protocol, the miner solves a complex cryptographic puzzle to get a chance to append the next block to the Blockchain and receive the reward for their work done and energy consumed. Each node must prove that it has done enough work to get a chance to append the next block to the Blockchain. Therefore, it is called the proof-of-work model. At this point it should be mentioned that the difficulty of the cryptographic puzzle is dynamically controlled by the Bitcoin process.

2. PoS-based Consensus Model

The PoW model is used extensively in cryptocurrencies like Bitcoin. It is also one of the popular consensus validation techniques for Blockchain transaction verification. In the PoW consensus protocol, the miner solves a complex cryptographic puzzle to get a chance to append the next block to the Blockchain and receive the reward for their work done and energy consumed. Each node must prove that it has done enough work to get a chance to append the next block to the Blockchain.

Therefore, it is called the proof-of-work model. At this point it should be mentioned that the difficulty of the cryptographic puzzle is dynamically controlled by the Bitcoin process Blockchain network. Selecting the publishing node based on the number of coins is not fair across all nodes, as the node with more coins always gets the chance to publish, and the same node can have dominant control over the Blockchain network.

Several PoS variants have been proposed with the implementation of the relevant stake size to decide whether the node will add a new block to the Blockchain, e.g. Blackcoin and Peercoin.

3. DPoS Consensus Model

DPoS model is a variant of PoS model. The main difference between them is that the PoS is direct democratic while DPoS is democratic representative based. DPoS gives stakeholders the right to find their representative to generate, validate and verify the new block. If only a few selected nodes validate the block, the validation process would be fast. This would have a direct impact on the block verification and transaction confirmation processes. Delegates are responsible for agreeing block size and block interval. Additionally, nodes should not be a problem for dishonest delegates as they have the right to vote out delegates. Bitshares uses DPoS as the backbone.

4. Round Robin Consensus Model

Round Robin (RR) consensus model is typically used in permissioned blockchain. It allows nodes to take turns generating blocks one at a time. Round robin has long been associated with distributed system architecture. When a node is scheduled to publish a next block and it is not yet its turn, the system would set a specific time limit for that node to avoid a system halt. The system gives the next available node in the queue a chance to publish its new block.

The nodes in this model would ensure that each has its own turn and no nodes can publish dominant blocks. RR is more convenient than a cryptographic puzzle and uses less power. The RR approach is considered more suitable for the permissioned Blockchain as it requires a lot of trust between nodes. In the permissionless Blockchain, the dishonest nodes would add more and more nodes to increase the publication rounds or chances.

5. Proof of Authority or Proof of Identity Consensus Model

The PoA or PoI-D model does not believe in the full disclosure of nodes. It works entirely on nodes with known connection to real world information. In this model, to be published, blocks must prove their identity and should be verifiable on the Blockchain network. Basically, the publish nodes expose their identity and reputation as a publish node. The reputation of the publish nodes is directly linked to the behavior of the publish nodes. Any malicious activity by publishing a node can damage the node's reputation on the Blockchain network. Node reputation would increase if it trades in a way that Blockchain users agree with. Nodes with lower reputation are less likely to get a chance to publish a new block. Therefore, it is important for publish nodes to maintain a high reputation. This model is preferred in the permissioned Blockchain as it requires a lot of trust on the nodes.

6. Proof of Elapsed Time Consensus Model

The PoET model selects random leaders via election protocol. It is also known as the SGX-based random voting model. In this model, a leader is chosen to add the next block to the Blockchain. In choosing the random leader, this model deals with untrusted nodes and open-ended participants. In order to use the consensus model efficiently, the leader election should be distributed among the most available nodes. It should assure other nodes that the leader selection was done properly, and no manipulation took place throughout the selection process. This requirement can only be met by TEE by keeping security constant in the random selection of leader nodes.

Any node responsible for validation or mining should be running the TEE with Intel SGX. Each miner asks for the running code within the TEE for a wait time and the miner with the least wait time becomes the leader node. The TEE function can prevent tampering by internal or external sources. The only downside with this consensus model is that it requires a special hardware implementation.

*(ii) Voting Based Consensus Model*

The voting-based consensus models are mainly used in private permissioned blockchains or consortium blockchains. In this type of model, all nodes should share their data with transaction verification to add a new Blockchain before making the final decision. The main difference between the voting-based model and evidence-based consensus model is that the nodes are independent, one can join and leave the verification network at any time. In the voting-based consensus model, all nodes come together to verify the content of the transaction, along with maintaining the common ledger.

1. Practical Byzantine Fault Tolerance Consensus Model

Practical Byzantine Fault Tolerance Consensus (PBFT) models are used to tolerate Byzantine faults. It is mainly used in permissioned Blockchains like Hyperledger as it can manage up to 1/3 malicious Byzantine replicas. In practical PBFT, the next block is accepted in a round-robin process. In each round, certain processes must be followed to select a primary node. The practical PBFT model process is divided into 3 clearly defined phases: prepared, prepared and committed. For state change, node should have at least 2/3 votes from all nodes. It ensures that all nodes are recognisable and familiar with each individual node. Based on PBFT, the Stellar Consensus (SC) model is a variant of the Byzantine Agreement Protocol. In PBFT, each node must query other nodes. While in SC it allows another participant to choose which sentence of another participant to rely on.

2. Ripple Consensus Model

In this model, each node must create a unique node list (UNL). All Ripple nodes are part of UNL and are considered reliable nodes that all other nodes can rely on. No node may go against UNL. The Ripple network encourages all nodes to communicate with different nodes available in this UNL to reach consensus on the network. Each node in the UNL should make 40% of the overlap with all other nodes. In the Ripple network, consensus could be reached in a few rounds, where all nodes understand the responsibility for assembling the transaction with the state of the candidate set in a known data structure and broadcast its candidate sets to nodes in the current UNL.

Nodes are responsible for validating the transaction, voting for a specific transaction and submitting the votes to the network based on the results of the collective voting. Each node filters out its candidate set and transactions that receive the highest votes are carried over to the upcoming consensus round.

Immediately after reaching the 80% votes of candidates set by each node available in the UNL, that particular set of candidates becomes the ledger in Ripple Term. Another round of consensus would start with the new and pending transaction that could not be accepted. Network-wide consensus can only be reached after each sub-network has reached consensus.

3. Tendermind Consensus Model

Tendermind is another variant of the PBFT model that mainly works on permissionless Blockchain. In this model, clients have the privilege of directly creating a new transaction for the nodes. The clients in this model use the Gossip protocol to transmit the transaction for the validator nodes. Within the Brach broadcast pattern, progress would be with the external validation situation, requiring validating nodes to gossip the transaction before giving the right to include the transaction in the block. The key difference between Tendermind and PBFT is that the leader node is continuously rotated to the right. Tendermind adopts the PBFT view changing mechanism into the general case pattern. Here it shows that it is waiting for a timeout and validating nodes are waiting for the leading node to transmit the first message in the bracha broadcast pattern. which is more relevant to the view, change the timer to PBFT. When the timer expires, validating nodes vote for a null block and validating nodes continuously participate in the Bracha broadcast message pattern. Tendermind suffered from many problems and the obvious one was Livelock, which featured locking and unlocking of votes through node validation. However, this model has an additional mechanism that does not explain the cited report limiting the occurrence of livelocks.

Consensus models are essential to the Blockchain as they directly affect the scalability and efficiency of the Blockchain. Evidence-based models are typically used in the permissionless Blockchain, while voting-based is used in the permissioned Blockchain.

The limitations in the existing consensus models contribute to some critical issues in supporting fast and timely online transactions. The existing proof-of-based models seem to support open participation, but they are not suitable for real-time applications where instant transaction finality and high transaction rates are the main requirements.

They also suffer from high power consumption issues. On the other hand, the voting-based models are designed for the limited number of participants in the Blockchain network and do not allow to scale beyond twenty peer nodes. Blockchain consensus models have a direct impact on Blockchain performance and scalability such as low latencies, instant transaction finality, and low node consensus performance. Limitations in the existing consensus models are becoming a critical issue in supporting fast and timely online transactions in Blockchain implementation.

#### *4.3.1.1.2.SN1.2: Consensus*

As described by IR7, traditional financial reporting relies on centralised databases managed by specific entities. In this scenario, trust hinges on the reputation and security practices of the central authority. Blockchain, however, operates on a distributed ledger, where each participant maintains a copy of the entire transaction history. This eliminates the need for a central authority but necessitates a mechanism for reaching agreement on the "true" state of the ledger.

Consensus mechanisms provide this agreement by employing different algorithms and processes. They typically involve participants competing to solve complex computational puzzles or validating transactions based on predefined rules. Once a block of transactions is validated by the majority of participants, it gets added to the Blockchain, and all copies are updated accordingly.

Although challenges exist, consensus mechanisms are being actively researched and improved. Emerging options like Proof-of-Stake offer more energy-efficient alternatives, while hybrid models blend different mechanisms for optimal performance.

As this technology matures and regulations adapt, Blockchain with robust consensus mechanisms could become a transformative force in ensuring trust and accuracy in financial reporting.

#### *4.3.1.2. Key insights for Emerging Theme (a)*

BT is the most appropriate disruptive technology that can generate accurate 'real-time' information, and this is a requirement in organisations moving forward for fast decision making. In summary the characteristic and trait consensus-based verification contributes to faster verification and data sharing via consensus mechanisms like Proof-of-Stake (PoS) and Proof-of-Authority (PoA) enable rapid verification of transactions and updates, facilitating near-real-time data sharing. This eliminates the need for intermediaries and time-consuming verification processes, streamlining information flow. On the decentralised control and scalability, the distributed nature of Blockchain makes it immune to single points of failure, minimising downtime and disruption to real-time information flow. As the network expands, its capacity to handle data and transactions increases, making it well-suited for managing large-scale, real-time information streams.

The challenges and consideration that is required to address the above to ensure seamless real-time information data transmission is on the potential on scalability. While newer consensus mechanisms are improving, some blockchains still struggle with high transaction volumes, which can hinder real-time applications. In addressing technical complexity, the implementation and maintenance of Blockchain systems can be complex and require specialised expertise. In terms of regulation, the legal and regulatory landscape for Blockchain is still evolving, creating uncertainty for some applications.

**4.3.2. Emerging Theme (b): The concept and principle of real-time:** Real-time is usually referred to the actual time during which a process or event occurs.

***4.3.2.1.N2: Decision making***

IR6 explains that the definition of real-time differs for every individual. It very much depends on the individual's role within the organisation. Two of the most important features that lead to the popularisation of BT applicable to decision-making systems:

*(i)* *Incorruptibility* – local changes to the data cannot change the history and validity of the chain, as this creates inconsistencies between the changed Blockchain and all others present on the network modes.

*(ii)* *Transparency* - this is provided by the sharing of data between all nodes of the network, so anyone can monitor the validity of transactions and the entire history of transactions at any time. Firstly, BT was used in the cryptocurrency systems, in particular, to keep a ledger for transactions, but its purpose has steadily shifted to other areas such as decision-making. In traditional settings, new transaction lists stored on the ledger contain a reference to the old, hashed transaction list, making them mutually validating.

Various approaches showed how this concept can also relate to decision making, since a complete list of decisions can be maintained, providing support for future decisions, which can be made by analysing past data with artificial intelligence or big data in order to make certain ones to extract patterns and thus a better solution.

The block types of the decision Blockchain and their structure provide the perfect framework to implement a Proof of Authority (PoA) algorithm suitable for decision making. The Decision Blockchain contains the following block types:

1. Definition block - this block is considered a primitive block because it can be used to define other block types, but also can define concepts, mechanisms, abstract objects that can be used as a reference in other blocks.

2. Action Blocks - This block can be used to define actions between objects, entities or other blocks.

3. Resource Block - this type of block allows tracking of all kinds of resources over the Blockchain network (money, personnel, materials, etc.)

4. Key Agent Block - this block stores personal information of key agents, so this is the identity block for the PoA Mechanism. To become a DA, an individual must voluntarily reveal their identity in order to gain rights to generate and validate decision blocks.

5. Voting Block – With this block type we store different types of votes cast by the decision makers. These are the supported voting types:

a) Vote of Trust Block - this voting type is cast by an existing decision maker to another decision maker to increase their trust rank, each decision maker only has one vote of trust which they can cast or keep for themselves.

b) Vote of Validation Block (up-vote) – this voting type is used for all types of decision blocks, you can either validate a specific decision or a new decision maker.

c) Vote of Invalidation Block (down-vote) – this type of vote opposes a specific decision block.

6. Feedback Block – this type of block can be added by any type of Decision Blockchain Network users to provide feedback on a specific decision block.

PoA as a viable and efficient technological solution for Blockchain decision-making, but also from the global trends affecting the development of the technology and the ideologies involved in decision-making in general, we are migrating to a decentralised or hybrid model for decision-making, where the decision-makers, but also those directly or indirectly involved or affected by the decisions taken, actively participate, either by investing financially (Proof of Stake) or by investing their own reputation linked to their identity (Proof of Authority). According to respondent 12, neither total centralisation nor total decentralisation would be the right answer, but a combination and a balance of both would be.

As decision making is an integral part of any organisation or individual's life. From simple choices such as what to eat for breakfast to more complex decisions such as investment strategies, decision making affects an organisation’s lives in many ways. Following are some of the ways BT can help with decision making:

*i) Data Collection and Verification*

One of the most significant challenges in decision making is the quality of data. The accuracy and reliability of data can significantly affect the outcome of a decision. BT can help with this by providing a secure and transparent way to collect, store, and verify data.

With BT, data can be collected from multiple sources and stored on a decentralised ledger. This means that the data is available to all parties involved in the decision-making process, and any changes to the data are immediately visible. Additionally, because Blockchain is decentralised, it is challenging to tamper with data, ensuring the data's integrity.

*ii) Smart Contracts*

Smart contracts are self-executing contracts with the terms of the agreement between buyer and seller being directly written into lines of code. The code and the agreements contained therein exist on a decentralised Blockchain network. Smart contracts can help with decision making by automating decision-making processes.

For example, let's say a company wants to automate its hiring process. With a smart contract, the company can set the criteria for hiring and have the contract automatically evaluate candidates based on their qualifications. The contract can then make a decision on which candidate to hire, making the decision-making process faster and more efficient.

*(iii) Decentralised Decision Making*

Traditional decision-making processes are often centralised, with a few people making decisions for the entire organisation or group. This can lead to bias and inefficiencies, as not everyone's input is considered. With BT, decision making can be decentralised, with everyone involved having a say in the decision-making process.

For example, a decentralised autonomous organisation (DAO) is an organisation that operates through rules encoded as computer programs called smart contracts. These rules can be programmed to ensure that all members of the organisation have a say in decision making, making the process more democratic and transparent.

*(iv) Improved Accountability and Transparency*

One of the key benefits of BT is its transparency. All transactions on the Blockchain are visible to all parties involved, and any changes made to the data are immediately visible. This level of transparency improves accountability and ensures that decisions are made based on accurate and reliable data.

For example, let's say a company wants to make a decision about whether to invest in a particular project. With BT, the company can collect data about the project, including its financial performance, and store it on the blockchain.

***4.3.2.1.2.SN2.2: Cost & time savings N3: Timeliness***

In addition, IR15 raised a concern about trusting information in real time.

> *"Would you trust information if I tell you that it is real-time? Would you take information from a financial report in that duration or that speed, would you take it as it is? I think there is these questions around the trustworthiness of information taking it as it is"*

Some of the respondents related the fact of information being real-time, to social media platforms. Social media platforms are a good example of how information can be real-time, as every individual registered on a social media platform is given an equal opportunity to post up and share stories, such as on Facebook and LinkedIn.

Respondents were concerned that as much as the fact that information can be shared on real-time sounds exciting and much needed, there is a chance that the information posted can be fake and it continues being channeled through the social media platform as fake information, reaching out to all subscribers in an inaccurate manner.

Therefore, respondents emphasised that until and unless there are clear guidelines that contributes to confidence of information Blockchain platform, especially in the context of real-time financial information, . Participants strongly perceive these areas should be looked at prior to designing a Blockchain from end-to-end.

*"For some, it can be 24 hours, some people 12 hours. It's called real time as well.*

*Therefore, real-time is subjective".*

Based on interview responses and an examination of the pros and cons of implementation and use, it was determined that the primary advantages of using BT were cost reduction, trusted product features such as food safety and traceability, easier and faster transactions, and other operational advantages.

Among the identified obstacles are the existing under-regulation of information sharing, information security, privacy, and control of Blockchain transactions, as well as a lack of enough human capital and organisational flexibility. Additional aspects of the study include the immaturity of BT and the absence of its characteristics in current ERP systems and other supply chain management systems. The enterprise resource planning (ERP) component of the business can also expand its modules to handle tracking and tracing. Integration with legacy systems and business processes is an additional concern. Additional limiting concerns include low network readiness, low penetration, technology expenses, a lack of best practises, and limited employee experience and competence, particularly for small and medium-sized businesses.

Distributed ledger technologies are not independent systems. Although Blockchain is simple to implement, interconnecting systems requires specialised knowledge. Moreover, implementation issues, the adaptability of BT, and its impact on supply chain processes will be explored.

Moreover, implementation issues, the adaptability of BT, and its impact on supply chain processes will be explored. The grouping could be used to classify firms that view this solution as innovative and join as platform provider partners, as well as to summarise the lessons learnt. The networking of Blockchain with existing IT systems and Industrial 4.0 solutions, as well as the mapping of competitive applications, are areas of growth.

The largest global and European platform service providers using the framework developed through expert interviews and discovered that IBM's Hyperledger Fabric and Ethereum are the most popular supply chain platforms were compared. The feasibility of their SC application is determined by the platform characteristics, and the integrability is determined by the use of different programming languages, according to a comparative analysis of the BC platforms. Speed and power consumption are thus very dissimilar.

Data accessibility, authorisation, smart contract support, consensus protocol, hash function, in-memory data structure, secondary storage, programming languages, transactions per second (TPS), and transaction fees are the characteristics that govern BC application and optimisation. A clearly defined consensus protocol is able to guarantee the safety and fault tolerance of Blockchain systems.

One of the primary ways in which BT can lead to cost savings is through the automation and streamlining of manual processes. Many financial and accounting processes are currently manual, time-consuming, and prone to errors. By using BT to automate and streamline these processes, businesses can significantly reduce the time and resources required to perform these tasks.

For example, BT can be used to automate and streamline the process of reconciling bank statements. Traditionally, this process involves manually comparing bank statements with internal financial records, which is time-consuming and prone to errors. With BT, however, this process can be automated and streamlined, reducing the time and resources required to perform this task and increasing accuracy.

Another area where BT can lead to significant cost savings is in the area of supply chain management. Supply chain management is a complex process that involves multiple parties, including suppliers, manufacturers, distributors, and retailers. By using BT to track and manage supply chain transactions, businesses can significantly reduce the time and resources required to manage the supply chain, while also improving transparency and reducing the risk of fraud and errors.

In addition to supply chain management, BT can also lead to cost savings in the area of payments and transactions. Traditional payment and transaction processing methods are often slow, costly, and prone to errors. With BT, however, payments and transactions can be processed quickly and securely, reducing the time and resources required to manage these processes.

One of the primary benefits of BT in the area of payments and transactions is its ability to eliminate intermediaries. Traditionally, payments and transactions require intermediaries such as banks, which charge fees for their services. With BT, however, these intermediaries can be eliminated, reducing the cost of payments and transactions and increasing the speed and efficiency of the process.

Another area where BT can lead to cost savings is in the area of compliance and auditing. Compliance and auditing are essential for businesses and organisations to ensure that they are operating in accordance with relevant laws and regulations. Traditionally, compliance and auditing involve a significant amount of manual work, which can be time-consuming and costly.

With BT, however, compliance and auditing processes can be automated and streamlined, reducing the time and resources required to perform these tasks.  One of the primary benefits of bt in the area of compliance and auditing is its ability to provide a tamper-proof record of transactions. BT uses a distributed ledger system that is secure and transparent, making it easy to track and verify transactions. This can significantly reduce the time and resources required to perform audits and compliance checks, while also increasing accuracy and reducing the risk of fraud and errors.

In addition to these areas, BT can also lead to cost savings in a wide range of other areas, including identity management, data management, and asset tracking. By using BT to automate and streamline these processes, businesses can reduce the time and resources required to manage these tasks, while also improving accuracy and reducing the risk of fraud and errors.

Overall, BT has the potential to make significant cost savings for businesses and organisations in a wide range of industries. By automating and streamlining manual processes, reducing the need for intermediaries, and improving transparency and accuracy, BT can help businesses to operate more efficiently and effectively, while also reducing costs and increasing profitability. As BT continues to evolve and mature, it is likely that we will see even more ways in which it can lead to cost savings and improve the bottom line for businesses and organisations.

One of the most important characteristics of BT is its timeliness. The timeliness of BT refers to its ability to process transactions in a timely manner. In other words, it is the time it takes for a transaction to be processed and added to the blockchain. The time it takes for a transaction to be processed can vary depending on a number of factors, including the size of the transaction, the number of users on the network, and the consensus mechanism being used.

One of the main reasons why timeliness is important in BT is because it determines the speed at which transactions can be processed. In traditional financial systems, transactions can take days to process, and they often involve intermediaries such as banks or payment processors. With BT, transactions can be processed in a matter of minutes or even seconds, without the need for intermediaries. This is because the Blockchain network operates 24/7, and transactions can be processed at any time, day or night.
Another reason why timeliness is important in BT is because it affects the security of the network. In a Blockchain network, all transactions are validated by the network through a consensus mechanism. If a transaction is not processed in a timely manner, it can create a backlog of unprocessed transactions, which can slow down the network and make it vulnerable to attack.

This is why it is important for Blockchain networks to have a fast and efficient consensus mechanism, such as proof-of-work or proof-of-stake, to ensure that transactions are processed in a timely manner and the network remains secure.

Furthermore, timeliness is also important for the scalability of BT. As more users join the network and more transactions are processed, the network needs to be able to handle the increased demand. If transactions take too long to process, it can create a bottleneck in the network, which can slow down the entire system. This is why it is important for Blockchain networks to have a high level of scalability, which means they can handle large volumes of transactions in a timely manner.

In conclusion, the concept of timeliness is a crucial characteristic of BT. It determines the speed at which transactions can be processed, affects the security of the network, and is important for the scalability of Blockchain applications. As BT continues to evolve and be adopted in various industries, it is important to ensure that it remains timely and efficient in order to achieve its full potential.

#### *4.3.2.2.1.SN3.1: Peak period*

IR6 raises on financial reporting deadlines and peak periods. Peak periods and deadlines are a common challenge for many businesses, especially those in industries that experience high demand at certain times of the year. For example, retailers often face increased demand during the holiday season, and tax professionals experience high demand leading up to tax filing deadlines.

In order to manage these peak periods and meet deadlines, businesses need efficient and reliable systems in place. BT offers a solution to this challenge.

BT can help businesses manage peak periods and deadlines in several ways, articulated as follows.

*i) Increased Efficiency*

One of the key advantages of BT is its ability to automate processes and eliminate intermediaries. This can greatly improve efficiency, as it reduces the time and costs associated with manual processes. For example, blockchain-based smart contracts can automate the process of verifying and executing agreements, reducing the need for manual intervention and minimising the risk of errors or delays.

*ii) Improved Transparency*

BT provides a transparent and secure record of all transactions, which can be accessed by authorised parties. This can help businesses to manage peak periods and deadlines more effectively, as it provides real-time visibility into the status of transactions and processes.

This can help businesses to identify bottlenecks and issues more quickly and take corrective action to resolve them before they impact the business.

*(iii) Increased Security*

BT provides a high level of security, as each transaction is recorded on multiple computers across the network. This makes it extremely difficult for hackers to manipulate or corrupt the data, as they would need to simultaneously attack multiple computers in the network. This can help businesses to manage peak periods and deadlines more effectively, as it reduces the risk of data breaches or cyberattacks.

*(iv) Streamlined Payment Processes*

BT can help to streamline payment processes by eliminating intermediaries and reducing transaction times. This can be particularly beneficial for businesses that experience high volumes of transactions during peak periods, as it can help to ensure that payments are processed quickly and accurately. This can also help to reduce the risk of payment fraud or errors.

*(v) Better Collaboration*

BT can facilitate better collaboration between different parties in a transaction or process. This can help businesses to manage peak periods and deadlines more effectively, as it enables all parties to work together more efficiently and transparently. For example, blockchain-based supply chain management systems can enable manufacturers, distributors, and retailers to collaborate more effectively, reducing the risk of delays or bottlenecks in the supply chain.

Peak periods and deadlines can be challenging for businesses, but BT offers a solution. By providing increased efficiency, improved transparency, increased security, streamlined payment processes, and better collaboration, BT can help businesses to manage peak periods and deadlines more effectively. As BT continues to evolve and mature, we can expect to see more businesses adopting it to address a wide range of challenges and opportunities.

#### *4.3.2.2.2.SN3.2: Reduced intermediaries*

Intermediaries are responsible for verifying and documenting transactions to ensure sales processes between sellers and buyers are conducted legally and the relevant parties receive commissions for their services. Currently, businesses like Uber, Lyft, and Airbnb are acting as middlemen by guaranteeing the dependability of their drivers or homeowners. Creating economic value for themselves is another goal of intermediaries.

However, the intermediaries themselves are not always trustworthy. Customer trust in intermediaries has become a major concern for many people for a number of reasons, including the high fees intermediaries charge or the fact that they sell user data. Reducing the need for intermediaries is one of BT's trends. Blockchain should be strived for, to reduce dependence on intermediaries in several areas, such as the corporate sector.

First, there is the smart contract, which is used to enable an increased level of disintermediation. This type of contract is self-enforcing and self-executing and consists of an encrypted program that creates an agreement between multiple parties.

Smart contracts are capable of influencing businesses due to their ability to encourage higher levels of disintermediation and more efficient project execution, and they lay the foundation for the development of decentralised autonomous organisations (DAOs).

DAOs are a group of organisations that when combined can effectively function as a single entity that can be managed and implemented over a Blockchain with little or no human intervention. For example, DAOs enable taxi companies to operate and own self-driving cars and use smart contracts to pay for fuel, insurance, repairs, parts, collect payments, and save on investments in new cars.
It is another example involving the provision of accommodation services over a universal sharing network, where a business can use smart contracts for ventures in the sharing economy that can impact businesses like Airbnb. Smart contracts can also help businesses automatically place orders, perform operations, and make payments without the need for approvals.

By using these contract escrow features, two unknown parties can participate in a transaction based on trust. The role of the application is to automate some minor tasks, for example programming a hotel room key, but this could be extended to large and complex transactions depending on the nature of the transaction. Such upgrades could range from purchases to paying salaries and other payments to issuing rewards and points and supply chain management.

#### *4.3.2.3. Key insights for Emerging Theme (b)*

The BT characteristic consensus-based verification contributes to the principle of real-time and all the other characteristics of BT such as immutability and transparency contribute to ensuring information is transferred accurately, in real-time can be summarised as follows:

(i) *Scalability and Performance:* Processing high-volume financial transactions in real-time requires robust Blockchain infrastructure and efficient consensus mechanisms.

*(ii)* *Privacy Concerns:* Balancing transparency with data privacy requires careful consideration and implementation of anonymisation techniques and access control mechanisms.

*(iii)* *Regulatory Frameworks:* Existing financial regulations may need adaptation to accommodate real-time reporting and digital assets.

The principle of Real-time Financial Reporting with BT holds immense potential to revolutionise the financial landscape. While challenges remain, the benefits of enhanced transparency, efficiency, and trust outweigh the hurdles. As technology evolves and regulatory frameworks adapt, we can expect to see the transition towards a future where financial data is not just historical records, but a dynamic, living reflection of economic activity.

**4.3.3. Emerging Theme (c): Importance of real-time financial reporting:** Real-time Financial Reporting enables all stakeholders to view and access their financial data and reports, as it is happening – in real time. IR1 perceives and reiterated several times throughout the interview that there is a need to look beyond merely the characteristics of a Blockchain in producing a real-time financial report.
Real-time Financial Reporting is beyond just figures, and includes disclosures, estimates and judgement, which keep evolving. Respondent 18 echoed this by requesting an explanation from the researcher on how an impairment, for instance, is accounted for on a Blockchain.

Majority of the participants raised concerns whether the real time information arising from a Blockchain reflects the current business environment a business is in an able to keep information accurate and flexible, and at the same time real-time.

IR13 raised a concern on whether the fluidity in a business environment may affect the real-time information, on a Blockchain. As, judgement and estimates are crucial in a FR environment, and this may potentially affect the reliability on a Blockchain for FR.

IR8 expressed that regardless of the characteristics of a Blockchain which provides accurate and reliable information, should there be no 'integrity' among the participants, none of the characteristics of a Blockchain will even matter. The confidence of the information being channeled through a real-time platform needs to be established, more importantly than the characteristics itself.

He further addresses that more nodes and more computers handling a Blockchain enables it to process information faster. IR5 emphasises that any trait that keeps the FR to be 'scandal free' should be the one that contributes to Real time Financial Reporting. Participation in online webinars, reading articles on Blockchain and keeping updated with the updates on how Blockchain is providing real-time solutions is crucial, emphasised IR12.

But more importantly, those involvements will give an idea to accounting and finance practitioners on the possible challenges faced with getting information in real-time and how to address them IR6 exclaims as follows: -

*"Blockchain is secure, transparent, and immutable. It is the perfect platform to trust real-time information. BT has remarkable means of being instantaneous".*

Relative advantage is the IDT criteria that interprets the perception that BT adoption, paired with the existing interorganisational information technologies, such as ERP, SAP and Oracle enable the current FR process to perform better in terms of cost, quality, speed, and flexibility.

Further, looking at compatibility, perceptions of Blockchain's relative advantage may differ depending upon the size of the organisation, and the resources availability to adopt BT. The intention to adopt BT will be higher when the focal firm perceives that it and key supply network partners will receive a relative advantage for its use vs when only the focal firm or when only the SFR will benefit exclusively. To maximise Blockchain's benefits, all SFRs, regardless of size and jurisdiction, must make an effort in finding avenues to adopt Blockchain in FR.

IR6 views FR as putting together a set of transactions and collating them. Participants expressed that they are convinced that they are convinced Blockchain will be able to achieve the principle of Real-time Financial Reporting, given the right design of it, and more importantly control and monitoring over the data that streams into a Blockchain. IR2 emphasised that Blockchain can be a perfect solution to the current problems faced in FR currently, which are some of the entry processes that are done in a manual manner which fails to meet the requirement of a financial report being timely and accurate.

#### *4.3.3.1.N4: Research*

The development of the Blockchain application project in the financial and economic fields has been heavily claimed by the international financial giants; research and development of related projects are currently being pushed forward continuously. However, the application of Blockchain finance and economy in different countries is still in its infancy, there is not only a weak basis of the relevant research, but also rather complicated difficulties that arise in the implementation process. Therefore, all countries should consider setting up a government key laboratory for Blockchain finance, led by the central bank or other authorities according to their own country's research and development strength. Research and development should be intensified in the fields of cross-border payments, cross-bank settlement of banks, digital currency, securities issuance and data notes. Countries and governments should build a series of general-purpose application service platforms to provide the appropriate payment for financial companies aiming to find a reliable solution by combining the unique characteristics of the financial system and BT.

There are many different types of topics from BT research to the application level of the financial industry, which objectively increases the complexity and coordination difficulties of technical cooperation in the Blockchain. Financial market participants, technology companies, regulators and other bodies need to strengthen communication and coordination to create an effective, durable, and deep cooperation mechanism.

The central bank should actively promote the connection and cooperation between domestic and foreign upstream and downstream industries to realise autonomous control in technology application and ensure the security of financial information.

The leading companies and industries are responsible for forming alliances to provide a benchmark for global Blockchain finance and economics. The government, financial institutions, technical service providers, universities and research institutes are all major participants in the complicated systematic project of Blockchain finance and economy, all sorts of problems and difficulties can only be solved when all parties work together to form strong synergies.

#### *4.3.3.2.N5: Prototype*

Some case study examples are provided by the respondents IR 7,11,14,16 and 17 to articulate the prototypes created.

*(i) Estonia*

Estonia is one of the pioneer governments that tested Blockchain when it launched in 2008. Blockchain implementation came in 2012 when the government asked all its sectors to maximise the benefits of using Blockchain in their operations and management. Due to the efficiency and correct use of the Blockchain, the Estonian e-governance structure became one of the most efficient and resilient structures and helped the Estonian government to achieve its goals in its programs. One of the biggest programs has been to support all services provided by the government through the use of Blockchain. The Estonian government has operated its services using a Blockchain infrastructure in such a way that end-user data has been secured and encrypted.

For example, for any application for any of the services provided by the government, the users only have to enter their ID and the applications are processed based on the BT, which uses the database for all verifications and processes the necessary actions. Financial services and public services as well as medical services were efficiently handled for the applicants. As a result, the Estonian government achieved many advantages and benefits, whether financial or strategic, by implementing Blockchain (Semenzin, Rozas, Hassan, 2022).

*(ii) UAE*

One of the first nations to incorporate Blockchain into strategic initiatives and plans is the United Arab Emirates (UAE). By using the Blockchain platform to process 50% of government transactions, the Emirates Blockchain Strategy 2021 hopes to save approximately 11 billion dirhams. Both public and private sectors worked together to propose those initiatives.

The government has created the regulatory framework through the Ministry of Artificial Intelligence that enables both government entities and private companies or startups to follow and adhere to. The framework focuses on four main pillars: residence happiness, global entrepreneurship, government efficiency, and advanced legislations. The below picture depicts the disciplines and fields where Blockchain deployment was applied. The case studies present the deployment of Blockchain in program management and how it helps organisations achieve their strategic objectives and goals. Also, it is important to note that the program management and the deployment of Blockchain were tested and experimented with through pilot projects in future labs and government innovation hubs. The outcome of the experiments and the deployment will be further applied in a broader scheme.

*(iii) Public Sectors*

When the concept of Blockchain was introduced, many governments went a step further and embraced the new technology. They later developed their own strategies and changed their regulations to adapt to the new technology.

As a result, a tremendous transformation towards efficiency and competitiveness took place in these governments. It has also gained knowledge and expertise that has put these governments on the radar for benchmarking as they have successfully adopted Blockchain into program governance.

*(iv) Smart Dubai*

Smart Dubai is a government agency in Dubai responsible for transforming the emirate of Dubai into one of the smartest cities in the world, backed by strong infrastructure. In addition, Smart Dubai supports collaboration between the public, private and academic sectors to design and implement the framework for all innovation and technological initiatives. Smart Dubai introduced its centralised payment system known as Dubai Pay in 2003. The centralised payment gateway included more than 40 companies and enabled them to process their payments online. In 2018, the total number of transactions exceeded 10 million applications worth around 16 billion dirhams.

Despite the fact that the system was considered to be an intelligent system since all transactions were processed online, there was a major issue with payment reconciliation. Each entity manually entered all the numbers into their accounting trackers, which took additional time and generated additional costs. The advent of Blockchain has given Smart Dubai the task of solving the problem of payment reconciliation as it is a lengthy and costly process that every single business struggles with. Smart Dubai's program development was to address payment reconciliation by enabling instant payment reconciliation for all businesses, dispute, and claims resolution, automating and improving the financial process, and providing transparency to financial records.

Smart Dubai has successfully completed the development of the payment reconciliation program in parallel with other stakeholders such as Dubai Electricity and Water Authority (DEWA), Emirates NBD, Knowledge & Human Development Authority (KHDA) and Avanza (Blockchain solution provider) in time to meet all the set goals and achieve objectives.

Upon completion of the project, Smart Dubai handed the system over to the Ministry of Finance to ensure all stakeholders and users involved had a clear understanding of the services provided in the new payment system. The Blockchain was used to manage the delivery results and e-governance and decision-making were achieved during the development phase, so the product was developed and tested by the program management team and then launched for official use.

*(v) Abu Dhabi Digital Authority*

The Abu Dhabi Digital Authority is the responsible party for driving the digital transformation of businesses in Abu Dhabi and the legislative body that enacts new rules and regulations for the development of new technologies within the emirate. The agency's intention is to build a secure, Blockchain-powered data exchange platform for businesses and external organisations in Abu Dhabi. The Blockchain platform is designed to connect multiple Blockchain systems together to facilitate all communication between stakeholders. This minimises the complexity of any Blockchain system, promotes interoperability and forms the basis for all future Blockchain projects.

The goal of the program was to build a platform that would enable government actors to share data and information with other government agencies and private companies, conduct transactions efficiently, and improve government services. The project was developed through a government sandbox, which is the testing laboratory for new technologies.

Prior to the development phase, Blockchain awareness sessions were conducted for the teams and the project was implemented using a top-down approach. There were many challenges associated with the development.

Little clarity about standards and interoperability. Integrating uniform standards into the Blockchain is a major challenge as each entity has its own set of standards and regulations that may conflict with the standards of other stakeholders. Designing the right governance model for the Blockchain to connect all stakeholders without conflict is still an R&D.

*(vi) Ministry of Health and Prevention*

The Ministry of Health is responsible for providing health services to all UAE citizens. In order for the ministry to improve its services to everyone, it has introduced innovative technologies as part of its improvement strategies. Illegal organ donation is one of the challenges faced by the healthcare community as it is very difficult to secure and ensure the registers. Therefore, the Ministry of Health has developed a project to prevent illegal organ donation in the UAE. The project was developed in partnership with Dhonor Healthtech to develop an organ registry platform using Blockchain. Due to the complexity of the program development, it was decided to divide the program into three phases. Each phase has its own processes and systems.

It was crucial to bring all stakeholders together during the development phase and ensure their consent was given. The program was managed and developed via Blockchain and smoothly fulfilled all the goals of the organisation and its stakeholder's process.

Private sector Emirates NBD is one of the leading banks in the UAE and worldwide. They have offices in Saudi Arabia, Egypt, India, Singapore, China and Turkey. The bank has set up a Future Lab where it develops all of its innovative digital projects. The Future Lab works with regulators, customers and governments to accelerate the implementation of their projects.

Emirates NBD has developed a check fraud reduction program using BT The development of the program started in early 2017 with bank advisors and the Central Bank of the UAE. Blockchain was used to achieve efficiency and transparency during the development phase.

*(vii) DP World*

DP World is a leading supply chain company specialising in cargo logistics and port terminal operations. The company's portfolio consists of more than 150 companies in 46 countries. The supply chain and logistics challenges have been on the radar for a decade and due to the complexities of management and operations, there have not been major shifts in the supply chain ecosystem. The inefficiencies have always been part of the challenges supply chain companies face.

As a leader in the supply chain industry, DP World has been involved in researching and identifying technological solutions that will disrupt the industry and create significant value for all market participants. Building a logistical trading platform based on Blockchain, which facilitates data exchange and automates all processes and smart contracts, was the main goal for the development of DP World.

The project or program development aims to build an approved Blockchain platform that supports cargo owners in their businesses by improving data flow and process integration. The ultimate goals in building the platform were to increase merchant confidence, reduce logistical lead time, and enable digitisation and data-driven decision-making.

DP World developed the program in collaboration with cargo owners, financial institutions, and other entities. Initially, development was in pilot mode to ensure the product's performance, after which it went into official use.

There were challenges due to unconventional project management requirements, be it in the approval process or roles and responsibilities for each party. Therefore, prior to program development, DP World conducted several stakeholder workshops to try to avoid some of the conflicts that might arise during the development phase. They leveraged Blockchain for traceability, transparency, and data-driven decision-making.

#### *4.3.3.3. Key insights for Emerging Theme (c)*

The principle of Real time Financial Reporting is crucial to ensure that decision making process, budgeting and strategic planning can take place instantaneously and throughout the year, as and when required. This will be possible if FR information is accessible instantaneously and current financial standings of the organisation can be evaluated as required. BT makes Real time Financial Reporting possible with proper governance and protocol. Blockchain solutions achieves confidentiality, verifiability, automisation, transparency and disintermediation and this is made possible with Real time Financial Reporting.

However, there are some probable bottlenecks that can hinder and hurdle these solutions to be achieved effectively. These are traceability, digitalisation, compliance, and stakeholder management. These bottlenecks are not impossible to address and overcome, but require specific measures, steps and a process protocol in ensuring the smooth flow of an effective process that results in financial information produced in a financial report that is reliable and transparent. The emphasis on using BT in Real time Financial Reporting is very much on the governance of the BT and the processes involved prior to transposing information into a Blockchain.

### 4.3.4. Emerging theme (d): Challenges faced in designing or utilising Blockchain Technology (current):

Majority of the respondents of the interviews have not designed a Blockchain based solution within their organisation. Only IR6 has used BT in the R&D department of his organisation, for the purpose of drone development. The respondents have started thinking about Blockchain, reading and following or subscribing to online channels on Blockchain 101. They understand the benefits overall, and very interested to see how it can be utilised towards their own roles within their respective organisations.

Majority of the respondents' organisations are using Oracle within their organisation. Oracle accounting software offers a full suite of tools necessary for efficiently managing organisation's financial needs. Information stored within the system is both safe and easily accessible, making it available only to those who should have access.

Some key features include **"**Dashboard, Single Click Process Social and Mobile Tools and Easy Reporting". The participants view Oracle as highly compatible with BT as the features of the software can has the potential to be further enhanced with a Blockchain. A number of participants are also utilising SAP software and indicated willingness to explore further potential of this software's interoperability with Blockchain.

#### *4.3.4.1.N6: Cost*

Ethereum is a global open-source platform for decentralised applications. It is a specific Blockchain-based software platform that makes it possible to create and run smart contracts and distributed applications (DApps). Ether is the cryptocurrency asset used on the Ethereum Blockchain. To some extent, Ether is the fuel for running distributed applications over Ethereum.

According to IR 4, with this cryptocurrency it is possible to make payments to other accounts or to the machines that perform the requested operation. Ether thus enables running DApps, enabling Smart Contracts, generating tokens during Initial Coin Offerings (ICOs), a way of funding using cryptocurrencies, and also making standard P2P payments), To (receiver), Gas (fees payable for performing operations), data and input (message) and value (transferred Amount in white). A consensus algorithm is a process by which all peers of the Blockchain network reach a common agreement on the current state of the distributed ledger.

Therefore, consensus algorithms achieve reliability in the Blockchain network and create trust between unknown peers in a distributed computing environment. Proof of Work (PoW) is a consensus algorithm that aims to solve a costly and time-consuming mathematical puzzle for a new block to be added to the Blockchain while being easy to verify for other nodes.

Smart contracts are pieces of code in which logic is implemented. Ethereum offers a Turing-complete programming language. Solidity that allows programs to be created and run on Blockchain. When users send the transactions, the part of the code is executed.
Execution of a smart contract occurs when a miner inserts a transaction into a block and upon arrival it is re-executed by each recipient of that block. These are open to all other users and cannot be undone once the transactions have been completed.

In this way, Blockchain's virtues of immutability and cryptographically provided security are further reinforced by the effectiveness of smart contracts. The Ethereum network is generally written using the Solidity programming language. This Solidity-based smart contract is compiled with Ethereum Virtual Machine (EVM) bytecode and then executed and deployed on the Ethereum Blockchain.

The overall cost of supply chains is impacted by numerous pertinent costs like warehousing and transportation. Supply chains powered by Blockchain enable cost-effective inventory management. From the beginning to the end of a process, logistics is involved, converting wasteful losses into gains. The supplier must regularly forecast demand in order to produce and purchase inventory on time because inventory in particular represents the largest cost. The cost of stock-outs will rise if the company has more inventory than there is demand for. Companies must cover lost sales costs if they manage less inventory. Therefore, the traceability and security features of the Blockchain-based supply chain increase cost-efficiency.

#### *4.3.4.2.N7: Infrastructure*

The adoption of BT has been on the rise in recent years, and its potential to revolutionise various industries has been widely recognised. However, the successful implementation of BT requires a robust infrastructure that can support its unique features and functionalities. The infrastructure required is listed as follows.

*i) Distributed Computing Network*

The distributed computing network is an essential component of the infrastructure required for BT. It is the backbone of the blockchain, and it is responsible for storing and maintaining the ledger of all transactions. The distributed network is composed of nodes that are distributed across different locations, and they work together to validate transactions and ensure that the ledger remains accurate and up-to-date. Each node in the network stores a copy of the ledger, and they communicate with each other to reach a consensus on the validity of transactions.

*(ii) Consensus Algorithm*

The consensus algorithm is another critical component of the infrastructure required for BT. It is responsible for ensuring that all nodes in the distributed network agree on the validity of transactions. The consensus algorithm uses a set of rules and protocols to verify transactions, and it ensures that all nodes reach a consensus on the state of the ledger. There are several types of consensus algorithms, including PoW, PoS, and DPoS.

*(iii) Cryptographic Security*

Cryptographic security is a fundamental requirement for BT. It is necessary to ensure that the transactions on the Blockchain are secure and tamper-proof. Cryptographic security is achieved by using various cryptographic techniques such as digital signatures, hash functions, and encryption. These techniques ensure that the transactions are secure and that they cannot be modified or tampered with.

*(iv) Smart Contracts*

Smart contracts are self-executing contracts that are stored on the Blockchain. They are programmable contracts that can automatically execute when certain conditions are met. Smart contracts are a critical component of the infrastructure required for BT because they allow for the automation of various processes. They can be used for a range of applications, including supply chain management, asset tracking, and decentralised finance.

*v) Interoperability*

Interoperability is essential for the successful implementation of BT. It is necessary to ensure that different Blockchain networks can communicate with each other and share data. Interoperability is achieved through the use of standards and protocols that allow for the seamless exchange of information between different Blockchain networks. Interoperability is critical for the development of decentralised applications and the growth of the Blockchain ecosystem.

*vi) Scalability*

Scalability is another critical requirement for the infrastructure required for BT. As the number of transactions on the Blockchain increases, it becomes essential to ensure that the network can handle the increased load. Scalability is achieved through the use of various techniques such as sharding, which allows the network to be divided into smaller parts, and sidechains, which allow for the execution of transactions outside the main Blockchain.

*vii) User Interface*

A user interface is a critical component of the infrastructure required for BT. It is necessary to ensure that users can interact with the Blockchain in a user-friendly and intuitive way. The user interface should be designed to provide users with easy access to the functionalities of the Blockchain, including the ability to view and manage transactions, create and execute smart contracts, and manage their digital assets.

*viii) Regulatory Framework*

A regulatory framework is necessary for the successful implementation of BT. It is necessary to ensure that the use of BT complies with relevant laws and regulations. The regulatory framework should be designed to ensure that the Blockchain ecosystem operates in a secure and transparent manner while protecting the rights of users. In conclusion, the infrastructure required for the use of BT is multifaceted and complex. It requires a distributed computing network, a consensus algorithm.

#### *4.3.4.3.N8: Sustainability*

One of the most pressing questions surrounding BT is whether it is sustainable in the long term. In general, sustainability refers to the ability of a technology or system to meet the needs of the present without compromising the ability of future generations to meet their own needs. In the case of BT, sustainability refers to the ability of technology to operate in a way that is environmentally, socially, and economically responsible, and that can be maintained over the long term.

One of the key factors that will determine the sustainability of BT is its energy consumption. BT requires a significant amount of computing power to maintain the distributed ledger, verify transactions, and ensure the security of the network. This computing power requires a lot of energy, and this energy consumption has led to concerns about the environmental impact of BT.

However, it is important to note that not all Blockchain platforms are created equal when it comes to energy consumption.

Some Blockchain platforms, such as Bitcoin, are known to be particularly energy-intensive, while others, such as Ethereum, are working on transitioning to a more energy-efficient system. Additionally, there are emerging Blockchain platforms that are specifically designed to be more energy-efficient, such as the Proof of Stake (PoS) system used by platforms such as Cardano and Polkadot.

Another factor that will determine the sustainability of BT is its ability to support social and economic development. BT has the potential to disrupt traditional industries and create new opportunities for economic growth and innovation. However, for this to happen, it is important that the benefits of BT are accessible to all, and that the technology is not used to perpetuate existing power structures or exacerbate social inequalities.

To this end, there are efforts underway to ensure that BT is developed in a way that supports social and economic development. For example, some Blockchain platforms are focused on creating decentralised financial systems that are accessible to people who have been excluded from traditional financial systems, such as those living in poverty or in countries with unstable economies.

Another factor that will determine the sustainability of BT is its ability to address issues of data privacy and security. One of the key advantages of BT is that it allows for the creation of a secure, tamper-proof record of transactions that is difficult to hack or manipulate. However, this advantage can be undermined if BT is not developed in a way that prioritises data privacy and security.

To address these concerns, there are efforts underway to develop Blockchain platforms that prioritise privacy and security. For example, some platforms are exploring the use of zero-knowledge proofs, which allow for the verification of transactions without revealing any sensitive data. Additionally, there are efforts underway to develop Blockchain platforms that are interoperable with other systems, which could help to reduce the risk of data breaches and increase the overall security of the network.

Overall, the sustainability of BT will depend on a range of factors, including its energy consumption, its ability to support social and economic development, and its ability to address issues of data privacy and security. While there are certainly challenges that need to be addressed, there are also many promising developments underway that suggest that BT has the potential to be a sustainable and responsible technology that can support long-term social and economic development.
As BT continues to evolve and mature, it will be important to remain vigilant and proactive in ensuring that it is developed in a way that supports sustainability.

The social sustainability of the supply chain based on Blockchain is impacted. Blockchain specifically makes it possible for supply chains to manage secure information, and the immutable feature guards against corruption for all parties involved, including people, governments, and organisations. because the supply chain based on Blockchain can only have authorised parties change the data. Additionally, supply chains rely on trustworthy suppliers when they buy goods. Blockchain keeps a transparent log of all transactions throughout the process, encouraging security from moral vendors. Social problems in the gemstone industry have been brought to light in the context of the Blockchain-based supply chain.

The supply chain for this industry is expanding, particularly in the area of procurement. There is a lot of discussion about the unethical sourcing practices that might violate human rights in the diamond industry. They also note that by verifying supplier operations and averting potential ethical sourcing problems, the blockchain-based supply chain enables the establishment of a transparent process (e.g. child labor and human trafficking).

***4.3.4.4.N9: Return on Investment***

IR1 explains the importance of performing a cost-benefit analysis of using a blockchain. The cost will look more and beyond just FR. The cost difference between a public and a private Blockchain was raised during the interview. The company has set up a division to investigate Blockchain and crypto and have invested in a centre of excellence. A lot of the work that is being done at R&D level and accounting and FR is surely one of them.

According to IR7, with a background from the pharmaceutical industry, the industry is a very highly regulated industry. Therefore, the pharmaceutical industry will most likely be slow adopters of Blockchain in FR as there are a myriad of compliance issues that need to be looked at prior to implementing a disruptive technology like Blockchain within their organisation.
IR10 emphasised that any measures of driving change require to commence with a detailed change management process. And any change management that aims to bring clarity is usually not well accepted by the employees immediately, but over time it does.

> *"Employees always look at the intended outcome. If an existing software can provide us real-time financial reporting, then why do we need a Blockchain?"*

IR13 added that if there are more nodes and more computers handling the blockchain, it can be very costly to the organisation. This may not be a cost-effective solution at this juncture when the organisation has more important priorities such as Post Covid-19 recovery plans, compared to implementing real-time financial reporting, what more on a Blockchain.

IR17 added that lack of education and training in the area of disruptive technologies is a crucial area that needs to be addressed in organisations:-

*"Lack of knowledge and understanding the works of BT is the biggest barrier of entry for this technology. First upskilling is needed. Then plan to expedite".*

IR18 raised a challenge that accountants within an organisation can potentially face is to decide on which tasks should be automated through Blockchain. The decisions toward adoption of Blockchain are not only managerial or technological decisions and not limited to how the Blockchain platform is created and governed. Regulative, social, economic, and political factors toward the involvement of human agents in administrative processes are to determine the extent of available automated solutions can be implemented in FR. This goes beyond a software. The share of responsibilities and the determinants on the role division is a challenging task that needs to be researched in prior to an implementation plan.

The emergence of BT has brought about significant changes in the financial industry, including FR. FR is a critical aspect of any business operation, as it involves the preparation of financial statements that provide valuable information about the company's financial performance. BT has several benefits for financial reporting, including increased accuracy, transparency, and efficiency.

One of the main benefits of using BT in FR is increased accuracy. FR is a complex process that involves the collection, processing, and analysis of large amounts of data. Human error is a common problem in FR, and it can result in inaccuracies in financial statements. BT eliminates the need for intermediaries and intermediaries, which reduces the risk of human error.

Another benefit of using BT in FR is increased transparency. BT creates a tamper-proof record of transactions that can be accessed by all parties on the network. This ensures that all stakeholders have access to the same information, which promotes transparency and accountability. This can be particularly useful for businesses that operate in industries that require high levels of transparency, such as financial services and healthcare.

BT can also improve the efficiency of FR. FR is a time-consuming process that involves the collection and analysis of large amounts of data. BT automates many of the manual processes involved in FR, which reduces the time and resources required for financial reporting. This can help businesses to save money and streamline their operations (Dyball & Seethamraju, 2021).

In addition to these benefits, using BT in FR can also help businesses to comply with regulatory requirements. FR is subject to a range of regulations, including the Sarbanes-Oxley Act and the Dodd-Frank Act. BT can help businesses to comply with these regulations by providing a secure, transparent, and tamper-proof record of financial transactions.

The return on investment (ROI) of using BT in FR can be significant. While the initial investment in BT can be high, the benefits of increased accuracy, transparency, and efficiency can result in significant cost savings over time. For example, a study conducted by Accenture found that BT could reduce the cost of FR by up to 70% (Laroiya, Saxena & Komalavalli, 2020).

The ROI of using BT in FR can also be measured in terms of improved decision-making. FR provides valuable information that can be used to make informed decisions about business operations. The increased accuracy, transparency, and efficiency provided by BT can result in more accurate and timely FR, which can help businesses to make better-informed decisions. In addition, using BT in FR can also help businesses to build trust with stakeholders. FR is an important aspect of building trust with investors, customers, and other stakeholders. The increased accuracy and transparency provided by BT can help businesses to build trust with these stakeholders, which can lead to increased investment and customer loyalty.

Overall, the ROI of using BT in FR is significant. The benefits of increased accuracy, transparency, and efficiency can result in significant cost savings over time. In addition, using BT in FR can help businesses to comply with regulatory requirements, make better-informed decisions, and build trust with stakeholders. As BT continues to evolve and mature, it is likely that we will see even more benefits in FR and other areas of business operations.

#### *4.3.4.5. Key insights for Emerging Theme (d)*

Most of the challenges are associated with cost, availability of supporting infrastructure, Blockchain talent and training resources. These are the challenges that companies need to address. The main challenges associated with the adoption of BT are lack of adoption by other organisation and institutions, unable to employ talent with the necessary skills wo are able to manage and utilise BT, lack of trust among users, lack of financial responses to support BT structure, BT unable to adopt and integrate to the current system and software used. Broadly speaking, though, many of Blockchain's biggest challenges are just the growing pains that are common with any new technology.

In making the business case for adoption, Blockchain advocates will need to convince their organisations to take the kind of risks, form the kind of relationships and make the kind of trade-offs that are common in other areas of business.

Leaders can also take steps to ensure that their products are developed in the most efficient way possible. These include publishing case studies to highlight the advantages of Blockchain and forming strategic partnerships to navigate the Blockchain ecosystem. Given the benefits that organisations are already deriving from Blockchain and the increasing calls for visibility and transparency between organisations, Blockchain could someday be a powerful solution to some longstanding problems in the reporting of financial information.

**4.3.5. Emerging theme (e): Evolution of role with Blockchain Technology:** IR1 is convinced about Blockchain and supports the evolution towards adoption as he enjoys things to be done instantaneously and the speed of doing something instantaneously. By looking at how quickly transactions can be made via cryptocurrency transactions, he is convinced that there is a good chance of the adoption of Blockchain in Real time Financial Reporting in the near future.

***4.3.5.1.N10: Existing roles***

The fields of accounting and finance have undergone significant changes over the past few decades. With the advent of new technologies and the increasing complexity of the global business environment, the roles and responsibilities of accounting and finance professionals have expanded and evolved. The current roles in accounting and finance and how they have evolved over time are explained by roles as follows. The following are by IR7, 9, 10 and 12.

*i) Accountant*

The role of an accountant is to record, classify, and summarise financial transactions of a business or organisation. They are responsible for preparing financial statements, such as balance sheets and income statements, that provide an accurate picture of the company's financial health. They also help businesses manage their finances by providing advice on tax planning, investment strategies, and cost management.

*(ii) Financial Analyst*

A financial analyst is responsible for analysing financial data and providing insights to help businesses make informed decisions. They evaluate financial trends and metrics, create financial models, and make recommendations on investments and financial strategies. They may specialise in areas such as investment banking, risk management, or corporate finance.

*(iii) Auditors*

Auditors are responsible for reviewing and evaluating the financial records of a company to ensure compliance with accounting standards and legal requirements. They also provide recommendations for improving financial operations and reducing risks. Auditors may work for accounting firms or within the finance department of a company.

*(iv) Tax Accountant*

A tax accountant is responsible for preparing tax returns and ensuring compliance with tax laws and regulations. They also provide advice on tax planning strategies to help businesses minimise their tax liability. Tax accountants may specialise in areas such as international taxation or tax planning for individuals.

*(v) Financial Manager*

Financial managers are responsible for managing the financial operations of a company, including budgeting, forecasting, and financial reporting. They also provide advice on financial strategy and investment decisions. Financial managers may work in a variety of industries, such as banking, insurance, or healthcare.

*(vi) Investment Banker*

Investment bankers provide advice and assistance to companies and governments on financial transactions such as mergers, acquisitions, and public offerings. They help businesses raise capital by underwriting and selling securities and provide advice on investment strategies and risk management.

*(vii) Chief Financial Officer*

The Chief Financial Officer (CFO) is the senior executive responsible for managing the financial operations of a company. They oversee financial reporting, budgeting, and forecasting, and provide guidance on financial strategy and investment decisions. They also liaise with investors and stakeholders to ensure that the company's financial performance is transparent and sustainable.

*(viii) Risk Manager*

Risk managers are responsible for identifying, analysing, and managing risks that could impact a company's financial performance. They develop strategies to minimise financial risks and ensure that the company is compliant with regulatory requirements. Risk managers may work in a variety of industries, such as banking, insurance, or healthcare.

*(ix) Treasury Analyst*

Treasury analysts are responsible for managing a company's cash and liquidity, and ensuring that it has sufficient funds to meet its financial obligations. They also provide advice on investment strategies and financial risk management.

*(x) Financial Planner*

Financial planners provide advice to individuals on financial planning, retirement planning, and investment strategies. They help clients achieve their financial goals by developing personalised financial plans and providing guidance on tax planning, risk management, and estate planning.

In conclusion, the field of accounting and finance has a wide range of roles that offer unique opportunities and challenges. The roles and responsibilities of accounting and finance professionals have evolved over time, reflecting the changing demands of the business environment. As technology continues to advance, it is likely that new roles will emerge, offering even more exciting opportunities for those in the field.

Incident Reporting echoes this by strongly stating the fact that BT is going to be a big part of the mere future. The most challenging part is getting everyone to understand it and how to deploy it. Designing a Blockchain is not something that everybody can easily understand. It is extremely hard and challenging. There is a lot of misconception that the stability and volatility of cryptocurrencies are related to BT.

BT contributes to the fine reliability and transparency of the transaction and not the verifiability of the identity of the individual. For the use of it in FR and whether this is part of the evolution, unquestionably yes. But for the evolution to take place, cost-benefit needs to the established as part of a larger ecosystem.

As previously stated, the organisation developing the algorithm bears the primary responsibility for the quality and trust in the control of the algorithm. By confirming that the Blockchain is functioning as intended and by raising important issues that are in the public interest, auditors can further increase this trust. There is always a person behind the (development of) systems, so the auditor focuses heavily on them when making an assessment of the (IT) organisation and the associated (IT) control measures.

In a way, Blockchain could be said to be an extremely rapid form of change management, with a permanent feedback loop that offers the ability to learn.

Algorithms' fundamental function is to apply calculation rules so that they can be changed, and decisions can be made. However, it is also important to take into account the data used, the methods used in the development, and the (continuous) optimisation of the algorithm. This goes beyond simply comparing the algorithm with the organisation and management practices surrounding it. Therefore, the assessment framework and, by extension, the audit approach, should also include these management, process, and content aspects (Mahmud, Islam, Ahmed & Smolander, 2022).

***4.3.5.2.N11: New roles***

The field of accounting and finance has undergone a significant transformation in recent years, largely due to the rise of BT. This revolutionary technology has opened up new avenues for accounting and finance professionals to operate more efficiently and effectively and has given rise to new roles that require skills in BT. In the finance and accounting industries, BT is being used to automate and streamline a range of processes, from auditing and compliance to FR and transaction processing. The new roles that are created must and should support these tasks.

One of the most significant new roles in accounting and finance that involves skills in BT is that of the Blockchain accountant. Blockchain accountants are responsible for managing the financial records and transactions of companies that use BT. They must be well-versed in BT and its underlying principles and must be able to work with a range of different Blockchain platforms and protocols.

Another new role in accounting and finance that involves skills in BT is that of the Blockchain auditor. Blockchain auditors are responsible for ensuring the accuracy and integrity of financial records and transactions that are stored on Blockchain platforms. They must be able to analyse Blockchain data and identify any discrepancies or irregularities and must be able to provide assurance to stakeholders that the financial records and transactions are accurate and reliable.

A third new role in accounting and finance that involves skills in BT is that of the Blockchain compliance officer. Blockchain compliance officers are responsible for ensuring that companies that use BT are in compliance with relevant laws and regulations. They must be well-versed in the regulatory landscape surrounding BT and must be able to develop and implement compliance policies and procedures that are specific to BT.

In addition to these new roles, there are also a range of other roles in accounting and finance that are being transformed by BT. For example, BT is being used to automate and streamline many of the manual processes that are involved in FR and transaction processing. This has led to the creation of new roles such as the Blockchain financial analyst, who is responsible for analysing financial data that is stored on Blockchain platforms.

Another area where BT is having a significant impact on accounting and finance is in the realm of tax reporting and compliance. BT is being used to create a secure, tamper-proof record of tax transactions, which can help to reduce the risk of fraud and ensure that companies are in compliance with relevant tax laws and regulations. This has led to the creation of new roles such as the Blockchain tax accountant, who is responsible for managing the tax records and transactions of companies that use BT.

Overall, the rise of BT has given rise to a range of new roles in accounting and finance that require skills in BT. These roles are diverse and multifaceted and require a range of different skills and expertise. As BT continues to evolve and mature, it is likely that we will see the emergence of even more new roles in accounting and finance that involve skills in BT.

#### *4.3.5.3. Key insights for Emerging Theme (e)*

Not only accountants and auditors, but all roles in an organisation will evolve with the adoption of BT. The new career roles arising in the BT space are Blockchain Developer, Blockchain Architect, Blockchain Administrator, Blockchain Project Manager, Blockchain UX Designer, Blockchain Quality Engineer, Blockchain Consultant, Blockchain Legal Consultant, Blockchain Analyst and Blockchain Engineer. There are also non-technical positions that do not require technical fluency in BT.

Some of the notable non-technical job roles in Blockchain deal with operations and design or working with other Blockchain-based businesses. Another notable entry among non-technical positions among jobs for BT refers to customer-facing roles. Customer support executives in Blockchain can utilise their business skills with an awareness of BT to resolve customer complaints.
These roles can typically be present in an accounting and finance environment, having a Blockchain Engineer or Architect as an IT cum accounting professional, and a Blockchain Analyst or Consultant being in internal audit, external audit or accounting advisory services.

Many companies which started to implement Blockchain technologies firstly used services from consultancy companies that are established with the purpose to help organisations in those implementations (for example Accenture, IBM, KPMG, Microsoft, Consensys, Chainsmiths). Other companies that want to do this implementation on their own are aware that forming a Blockchain implementation team is a key factor needed for success. It is important to emphasise that knowing Blockchain from technological perspective is not enough. It is necessary to know how to apply those technologies in organisation in order to create new value.

### 4.3.6. Summary of Emerging Themes from Blockchain Traits and the Principle of Real-Time

The respondents expressed the importance of understanding the power and strength of each characteristic of a Blockchain. As the characteristics of a Blockchain are fundamental towards the development of Blockchain platform for FR, with the principle of real-time, it is important that the designing team for a solution is aware of the collective characteristic of a Blockchain.

The respondents also interpreted the importance of governance and accountability in FR. Preparing a financial report on a Blockchain with the real-time principle in place is very complex and challenging, and it requires a thorough plan in place that is well tested and should consistently be examined for improvisation. The properties of persistency, validity, auditability, and disintermediation that Blockchain offers can significantly enhance contemporary business processes to achieve digitalisation, automation, and transparency, claim (Viriyasitavata & Hoonsopon, 2019).

As automation is key in ensuring information is real-time, the respondents provided positive responses towards BT being a perfect platform to facilitate information reliably for FR purposes. As transactions are posted to the Blockchain nearly as soon as they occur, BT provides nearly real-time transaction records and reconciliation of accounts.

Despite the respondents providing their perspectives that all characteristics of a Blockchain are equally important in contributing towards real-time financial reporting, there is evidence of research suggesting that the consensus-based mechanism is at the core of blockchain-based systems to coordinate the decentralised actions of users in deciding which information can be added to the Blockchain Tan, Mahula & Crompvoets, 2022. There are various consensus mechanisms that exist such as proof-of-work (PoW), proof-of-stake (PoS) and delegated proof-of-stake (DPoS). There are also proof-of-authority (PoA) systems, where a lower number of nodes or master nodes take the role of transaction validators.

According to IR9, each of these consensus mechanisms differs from the others in terms of advantages and drawbacks, as well as their propensity for centralised or decentralised governance structures. As accuracy and transparency was perceived as two important characteristics of a financial report, the respondents shared their common opinion on how any consensus mechanism that contributes towards these two characteristics will be the most important ones.

BT holds the promise of a new shared form of governance (Bridou & Stoelhorst, 2020; Lumineau et al., 2021). Shared governance forms do not rely on the service of intermediaries (e.g. coordinators, leadership positions, agents) and thus reduce cooperation networks to the essential core of stakeholders involved in value creation (Catalini & Gans, 2020).

In opposition to other stakeholder governance forms (e.g. hub-and-spoke governance or lead role governance), all stakeholders virtually have equal rights, and former trust in leadership positions is replaced by trust in the governance form. Shared governance forms facilitate knowledge sharing and integration through ongoing interactions between stakeholders. Consequently, a Blockchain-based shared governance "can handle a higher level of complexity than the lead role governance form, which in turn can handle more complexity than the hub-and-spoke form" (Bridoux & Stoelhorst, 2020).

How stakeholders communicate with one another is governed by the Blockchain protocol. Pereira, Tavalaei, and Ozalp (2019) state that the reduction of environmental and behavioral uncertainty that results from the open disclosure of these general conditions makes cooperation and the coordination of it easier. Additionally, the tamper-resistant design of the Blockchain enables stakeholders to monitor one another for the detection of potential fraud, which reduces ex post opportunistic behavior (Lumineau et al., 2021).

### 4.3.7. Key Insights & Reflection

Based on the system model and applications of the Blockchain, there are five outstanding characteristics of a Blockchain which are decentralisation, openness, non-repudiation, immutability, and transparency. Based on the responses from the interviews, it can be summarised that all the characteristics mentioned are equally important in contributing towards the principle of Real time Financial Reporting. As the characteristics are set in place to ensure accuracy and transparency throughout the Blockchain, they holistically contribute as an enabler for real-time information with BT.

In the discussion of theoretical perspectives, three of the five factors (relative advantage, comparability, and complexity) that influence adoption BT with IDT has been discussed in this section and the remaining two are discussed trialability and observability is discussed in the next section.

Each factor was represented with respondents' expressions of realities to denote the respondents' interpretation of adopting BT and further enhancing the existing softwares that are being utilised currently. Majority of the respondents are prepared for the adoption of BT and accepting of this disruptive technology to merge with the existing softwares in place. There is a positive acceptance of relative advantage as significant extension, or an enhancer of the current system used.

Compatibility towards values, experiences, and needs of the potential adopter's current technology strongly depends upon the design of the Blockchain to fit the existing software used. Respondents summarise that complexity is unavoidable with any disruptive technology; however, the similar complexity contributes to confidence building towards acceptance of BT.

Based on the responses received from the respondents on their experience in designing or utilising BT, only one participant indicated involvement, as mentioned in the description above. However, some respondents indicated that efforts have been made by their organisation in planning, upskilling, or electing representatives within their organisations at disruptive technology implementation committees by professional and regulatory bodies. Some respondents indicated development of centre of excellence for BT by their organisations. Most of the efforts are at infancy stages as mentioned by the respondents, however, developing fast.

In the discussion of theoretical perspectives, two descriptive characteristics from IDT, trialability and observability are discussed in this section. As mentioned above, there is hardly any involvement in trialability, except for R&D at this stage, as BT is still at an infancy stage within a specialised area such as FR. Use cases of Blockchain are increasing in various industries such as supply chain management and healthcare. Therefore, trialability and observability has not been observed.

## 4.4 SUMMARY OF EMERGING THEMES AND KEY INSIGHTS OF RQ1 & RQ2

Figure 4.5 summarises the emerging themes and key insights discussed above, based on the concepts and principles of IDT which are mapped to the respective research questions.

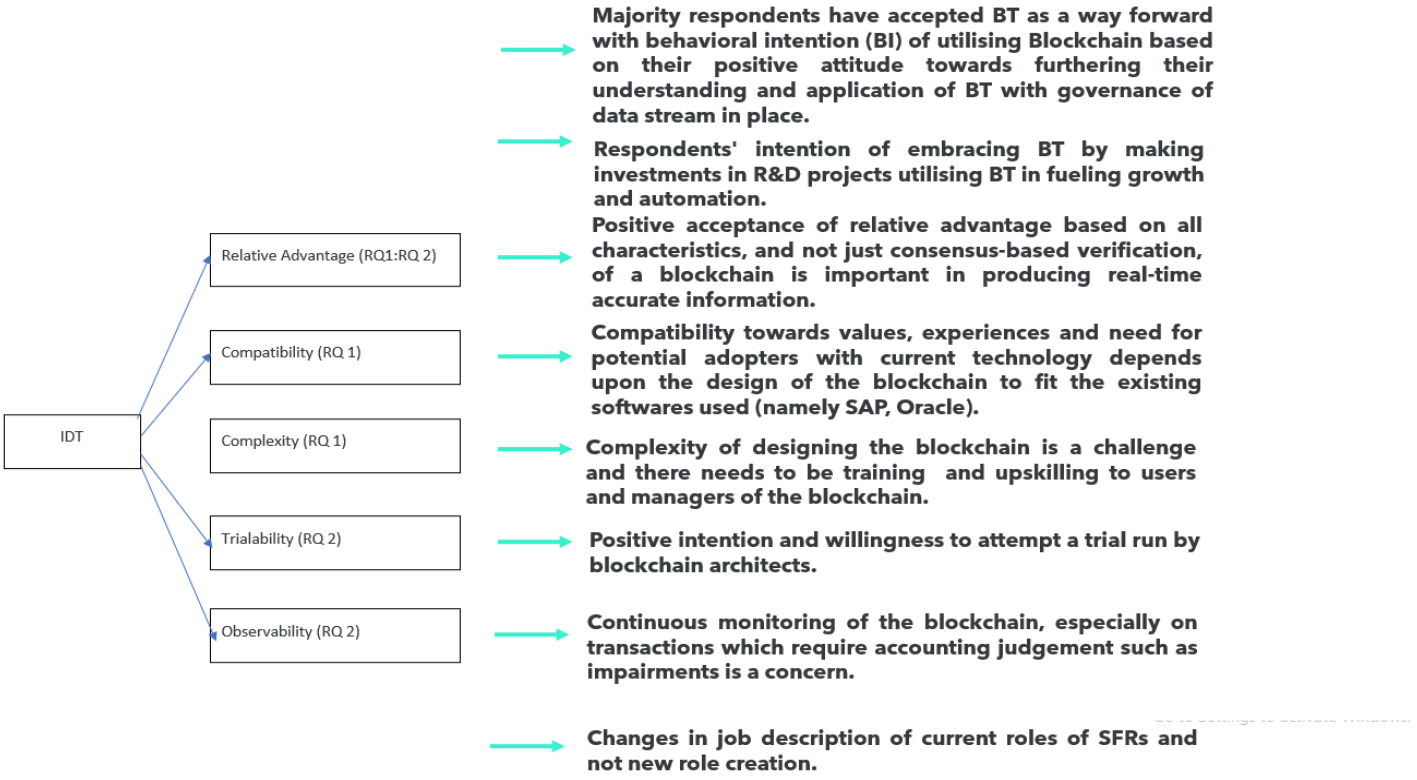


**Figure 4.5: Summary of IDT Theory of Descriptions based on RQ 1 and RQ2**

## 4.5 OTHER EMERGING THEMES

The first emerging theme that was outside of the scope of this research was that laws and regulations, specifically related to taxation are not keeping up with technological advancements in general. IR1 has articulated it below.

*IR1:" Income Tax regulators, they are not evolving. So the old general principle still apply, capital vs revenue, incurred, things like that. All that has not changes so, whatever you want to talk about today, tax laws are not keeping up with it"*

The second theme is BT will not be a priority for now, for not only adoption of BT in FR, but for adoption of BT in general. There are post Covid recession priorities that organisations are required to focus on and not a new technology adoption.

*IR10: "BT implementation in FR is not impossible, but it not priority, and it is not going to be of priority for a very long time as we are in the period of recovery from a 'covid recession', and it is going to take longer than expected to come out of it"*

The last theme that was discussed was on business strategy change, where real-time is necessary, but it is not that BT is the only technology that can expedite this. There are other technologies out there such as artificial intelligence and software's riding on other technological platforms that can produce the real-time factor.

*IR8: "Basically, definitely Blockchain a real time technology, it is good and as an accountant you need information real-time, definitely. Because as business change your decision change. Your business decision change. Let's say you have a business strategy, you need to do data analysis to understand transactions".*

A well-defined data building strategy is a foundational element for successful adoption of Real time Financial Reporting with BT. By prioritising data quality, governance, and security, stakeholders are able to unlock the full potential of BT and contribute to a more transparent, efficient, and trustworthy Real time Financial Reporting system.

The next section provides the conceptual framework of this study, The conceptual provides a comprehensive structure for understanding the complex relationships of BT, its traits, and the potential effects on various aspects of Real time Financial Reporting.

## 4.6 THE CONCEPTUAL FRAMEWORK

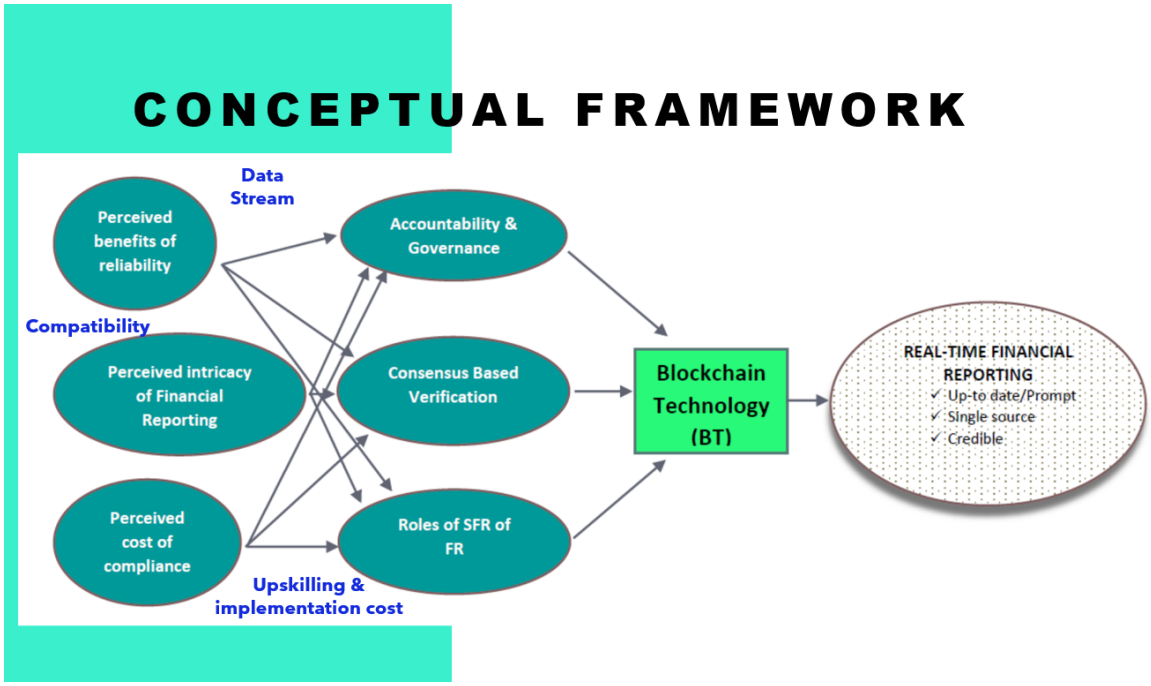


**Figure 4.6: Conceptual Framework of this Research**

The Conceptual Framework of this research arises from the perceptions and discourses of the respondents that have been interpreted with the theoretical stance based on IDT and the supporting literature. The framework focuses on achieving Real time Financial Reporting through the use of BT. The Data Stream represents the continuous flow of financial data generated by an organisation such as sale and purchases transactions, invoices and inventory updates. The perceived benefits of reliability of BT in Real time Financial Reporting are analysed based on the compatibility of existing accounting systems and software's utilised by the respondents. The increased trust and confidence in the accuracy and immutability of data due to Blockchain's tamper-proof nature is an attribute of reliability.

Real-time access to financial information, eliminates delays and improves transparency. All financial data consolidated on a single, shared ledger, reducing silos and discrepancies. The level of intricacy will depend on accounting standards requirements and the acceptance of BT as a platform in supporting transactions that are transposed into a financial report. The perceived cost of compliance relates to the implementation, integration, and maintenance cost of utilising BT.

Perceived intricacy refers to the perceived complexity of BT and the need for technical expertise to implement and maintain it.

The characteristic of a Blockchain consensus-based verification is discussed by majority of the respondents as the most important characteristic of a Blockchain that contributes to the principle of real-time information, reliable information. The consensus mechanism verifies and validates the accuracy of financial data. The roles of the stakeholders in FR are pointing more towards an evolution of exiting roles, rather than new roles. SFRs are destined to co-develop standards and guidelines for Blockchain-based financial reporting and collaborate with regulators to ensure that blockchain-based reporting meets regulatory requirements.

Current employees and future employees are expected to have knowledge of utilising and managing a technology such as BT and combine and integrate it with data analytics software as well as tools for fraud detection. The following sections illustrate the relationship between variables in the conceptual framework. It defined both objectives of this research and mapped out how they came together in drawing coherent conclusions.

### 4.6.1 Perceived Benefits of Reliability

The integration of BT into Real-time Financial Reporting brings about significant benefits in the realms of accountability and governance within organisations. BT's advantage lies in its ability to provide an unparalleled level of transparency through an immutable and decentralised ledger of financial transactions. This transparency fosters a culture of accountability by ensuring a clear and auditable trail of all financial activities, thereby enhancing trust among stakeholders.

Furthermore, BT enhances governance practices by reducing the risk of data manipulation and fraudulent activities. Real-time access to verified financial data enables stakeholders to have increased confidence in the accuracy and integrity of financial information, which in turn strengthens governance frameworks. By automating compliance processes and minimising the reliance on intermediaries for validation, BC streamlines governance procedures, improving efficiency and reducing the likelihood of errors or conflicts of interest in financial reporting.

The decentralised nature of Blockchain empowers Stakeholders of Financial Reporting with direct access to real-time financial information, promoting inclusivity in decision-making processes and fostering a culture of accountability throughout the organisation. Overall, the incorporation of BT in Real-time Financial Reporting contributes to improved accountability practices and governance standards. By leveraging BT's capabilities, organisations can enhance transparency, integrity, and efficiency in financial reporting, leading to stronger accountability and governance structures within the organisation.

To summarise, by enhancing transparency, accuracy, security, compliance, and trust, BC can revolutionise the way financial information is recorded and shared in today's digital economy. Organisations that embrace BT stand to gain a competitive advantage by demonstrating a commitment to sound governance practices and financial transparency.

### 4.6.2 Perceived Intricacy of Financial Reporting

Financial reporting plays a pivotal role in providing stakeholders with accurate and transparent information about an organisation's financial performance. The adoption of BT in financial reporting introduces a paradigm shift in how financial data is recorded, verified, and shared. One of the key features of BT is consensus-based verification, where network participants must agree on the validity of transactions before they are recorded on the Blockchain. This process ensures that only legitimate transactions are added to the ledger, enhancing the integrity and security of financial data. However, achieving consensus among a decentralised network of participants can be complex and time-consuming, especially in large-scale financial reporting systems with high transaction volumes.

BT introduces new challenges and considerations in terms of governance and accountability in financial reporting. While Blockchain enhances transparency and auditability, it also raises questions about the allocation of responsibilities and liabilities among network participants. Clear governance structures and protocols must be established to define the roles and obligations of stakeholders in the Blockchain ecosystem, ensuring accountability and regulatory compliance.

Stakeholders play a crucial role in ensuring the accuracy and reliability of financial information within a blockchain-based reporting system. From network validators to auditors, regulators, and users, each stakeholder has a vested interest in maintaining the integrity of the financial data recorded on Blockchain. Collaboration and communication among stakeholders are essential to address challenges such as data privacy, regulatory compliance, and data security within the Blockchain ecosystem.

In conclusion, the utilisation of BT in Real-time Financial Reporting presents both opportunities and challenges in terms of consensus-based verification, accountability, governance, and the role of stakeholders. While blockchain offers enhanced transparency, security, and efficiency in financial reporting, it also introduces complexities that require careful consideration and strategic management. By addressing these intricacies and fostering collaboration among stakeholders, organizations can unlock the full potential of BT to improve financial reporting practices and promote trust and integrity.

### 4.6.3 Perceived Cost of Compliance

The governance and accountability of BT in Real-time Financial Reporting hinges on a critical variable, the perceived cost of compliance. This variable captures the subjective assessment by organisations of the financial, human resource, and technological investments required to adhere to regulatory frameworks for blockchain-based reporting.

Perceived cost of compliance can significantly influence adoption and utilisation of BT. High perceived costs create a disincentive, particularly for smaller firms with limited resources. These costs encompass legal and regulatory uncertainty, evolving regulations surrounding Blockchain and digital assets that create ambiguity regarding compliance requirements. In terms of technological implementation, integrating BT with existing financial systems demands technical expertise and infrastructure upgrades. The perceived cost associated with these changes can act as a deterrent. Upskilling personnel to understand, operate, and audit blockchain-based systems necessitates training programs, further inflates perceived costs.

However, the perceived cost of compliance is not solely a financial burden. There are potential benefits to consider which are reduced operational costs involving streamlined workflows and automated processes facilitated by Blockchain can lead to long-term cost reductions. Real-time Financial Reporting with BT fosters trust with stakeholders, potentially reducing information asymmetry costs. Improved regulatory efficiency is improved with streamlined data access for regulators which reduces audit costs and improve overall regulatory efficiency. By addressing the perceived cost of compliance, the benefits of BT in Real-time Financial Reporting can be realised, fostering a more transparent and accountable financial ecosystem.

### 4.6.1 The Conceptual Framework and Innovation Diffusion Theory (IDT)

In this study, IDT offers a valuable framework for understanding the adoption and integration of BT in Real time Financial Reporting. The key concepts in IDT can be derived as firstly, Relative advantage, which is the perceived benefit of the innovation compared to existing practices. In the context of Blockchain, the potential to enhance transparency, security, and efficiency in Real time Financial Reporting can be seen as a relative advantage. Next is Compatibility, which refers to the degree to which the innovation aligns with existing values, norms, and infrastructure. While Blockchain offers significant potential, its compatibility with current regulations and accounting practices needs careful consideration.

Thirdly, Complexity which is the perceived difficulty or hurdle of understanding and using the innovation. The technical complexities of BT could pose a barrier to adoption for some stakeholders. Next is Trialability, which refers to the ability to experiment with the innovation on a limited scale. Pilot projects and sandbox environments can facilitate trialability and reduce perceived risk for financial institutions. Lastly is Observability, which is the visibility of the results of utilising BT. Successful implementations of Blockchain in financial reporting can serve as observable benefits, encouraging wider adoption.

Based on the responses derived interpreted in the above sections BT adoption in Real time Financial Reporting with the application of IDT can be categorised into

(i) Early adopters: Forward-thinking companies and tech-savvy individuals in accounting and financial audit are the first to embrace blockchain, driven by the potential benefits and compatibility of the organisation's innovative culture and preparing to be future-ready in utilising BT.

(ii) Mainstream adoption: As the technology matures, the relative advantage, compatibility with evolving regulations of accounting and auditing standards, and successful use cases become more evident, leading to wider adoption by mainstream accounting and financial institutions.

(iii) Diffusion channels: Accounting conferences, workshops, seminars, webinars and knowledge-sharing platforms can act as channels for diffusion, educating stakeholders and fostering collaboration in the area of Real time Financial Reporting with BT.

(iv) Change agents: Accounting and finance regulatory bodies, industry associations, and technology developers play crucial roles as change agents, promoting awareness, standardisation, and best practices in Real time Financial Reporting and BT.

In terms of challenges and future direction of adoption of BT in Real time Financial Reporting, the complexity of understanding the technology must be addressed. Educational initiatives and user-friendly interfaces are crucial to demystifying BT and facilitating its adoption. In regulatory adaptation, accounting and finance regulatory frameworks need to evolve to accommodate the unique characteristics of Blockchain-based Financial Reporting in real-ti,e without stifling innovation and ensuring governance of the financial reporting process. Finally, building trust and standards in accounting and finance for Real time Financial Reporting, by collaborating among SFRs in establishing trust in Blockchain-based Financial Reporting in real-time, and develop industry-wide standards and best practices.

All aspects of the interview feedback, comments and prospects of BT and the accountability and governance issues, Blockchain Technology integration challenges has been discussed and analysed thoroughly in the above sections. In conclusion, the conceptual framework presented highlights the multifaceted nature of leveraging BT in Real-time Financial Reporting.

The perceived benefits of reliability associated with Blockchain, such as enhanced transparency, accuracy, and security, offer promising opportunities for transforming traditional financial reporting practices.

However, the perceived intricacies of integrating blockchain into Real-time Financial Reporting underscore the challenges and complexities that organisations may encounter. Issues related to consensus-based verification, governance, and stakeholder involvement require careful consideration and strategic planning to ensure the successful implementation of BT. Balancing the need for accountability and regulatory compliance within a Blockchain ecosystem adds a layer of complexity that organisations must navigate effectively to realise the full potential of this innovative technology.

Moreover, the perceived costs of compliance associated with utilising BT in Real-time Financial Reporting represent a significant consideration for organisations. While Blockchain offers efficiencies in data management and auditability, the initial investment in technology infrastructure, training, and regulatory adherence may pose financial challenges. Organisations need to assess the long-term benefits against the upfront costs of implementing Blockchain solutions and develop strategies to mitigate financial risks while maximising the value derived from Blockchain adoption.

In essence, the convergence of reliability, intricacy, and compliance in the context of BT in Real-time Financial Reporting requires a holistic approach that balances risks and rewards. By embracing innovation, fostering collaboration among stakeholders, and adopting a proactive stance towards regulatory compliance, organisations can harness the transformative power of Blockchain to drive transparency, efficiency, and trust in the financial reporting process.

In conclusion to the conceptual framework meeting the objectives of the research, the implementation of BT in Real-time Financial Reporting introduces governance challenges due to decentralised control, potentially leading to discrepancies in data interpretation and regulatory compliance. Accountability concerns arise from the immutable nature of Blockchain records, necessitating transparent auditing mechanisms to ensure accuracy and integrity in financial disclosures.

The consensus-based verification trait of BT ensures that all network participants agree on the validity of transactions before they are added to the decentralised ledger. This real-time verification process facilitates immediate updating of financial data across the network, enabling timely and accurate Real-time Financial Reporting.

The contribution of the conceptual framework in practice in theory and practice is discussed in Section 5.4 in Chapter 5. Following the outcomes discussed, the next section provides the conclusion, implications, limitations and continuing and future research prospects of this study.

# CHAPTER 5: CONCLUSION

## 5.0 INTRODUCTION

This final section of the study provides the conclusion, implications, limitations and continuing and future research prospects of this study. This study brings to light that the idea of enabling Real time Financial Reporting with the adoption of BT. This chapter concludes the summary of the findings and the emerging themes that arise from each of the research objectives. The study presents findings on the study that focused on the SFRs perception of utilising BT as a platform for financial reporting. The implications are categorised to the groups of SFRs, based on their perspectives.

## 5.1 IMPLICATIONS OF THE STUDY

The following subsections will provide the overall analysis based on the research outcome on the categorisation of the respondents based on percentage on the five phases of technology innovation as explained in Chapter 2, and the implication of this study to internal and external Stakeholders of Financial Reporting.

### 5.1.1 Maturity level of Blockchain Technology Adoption in Financial Reporting

This research garnered perceptions of various stakeholders of financial reporting, both internal and external, which are provided in the following sections. IDT is used to interpret the responses of the interviewees and categorised into the five categories relative advantage, compatibility, complexity, triability and observability. The coded information has been transposed and interpreted based on these five categories in Chapter 4.

In addition, IDT illustrates illustrates the maturity of a technology regarding its adoption by the society over the time. According to Rogers' (1995) S-shaped adoption curve of innovators, early adopters, early majority, late majority, and laggards, the innovation and adoption happened after going through several stages including understanding, persuasion, decision, implementation, and confirmation. These have been explained in Chapter 2.

Therefore, based on the responses provided, the researcher has categorised the stakeholders of FR in accordance with these five phases in terms of adoption of BT in Financial Reporting. The categorisation is done by the researcher based on their responses to 'all' the interview questions.

| **Group of Users** | **Stakeholders of Financial Reporting** | **Percentage (%)** |
|---|---|---|
| Innovators | Internal Auditors<br>Financial Press/Media in Malaysia | 15% |
| Early Adopters | Auditors (Big 4)<br>Preparers of Financial Reports<br>Selected Financial Institutions in Malaysia<br>IT Personnel tasked in designing BT platform<br>Professional Bodies | 50% |
| Early Majority | Investor (of a company adopting BC in FR)<br>Risk Analyst<br>Creditors | 20% |
| Late Majority | -None- | 0 |
| Laggards | Tax Professionals<br>Regulatory Bodies | 15% |

**Table 5.1: Group of Users Categorisation based on IDT Phases of Technology Innovation**

It is evident from the table above that the biggest category consisted of early adopters (50%), who are individuals who provide positive insights about new products and services, seeking improvements and efficiency.

This group, consisting of auditors, preparers of financial reports, selected financial institutions in Malaysia, IT personnel tasked in designing the BT platform and professional bodies are a highly influential cluster, and are able to assist other groups of users in the adoption of BT within their operations. The challenges faced by this group points mainly to BT's decentralised nature that disrupts traditional auditing methodologies, internal control processes and regulatory compliance. As the distributed ledger system lacks a central authority, complicating audit trail verification and risk assessment this group face the challenge of ensuring the accuracy and completeness of transactions within Blockchain networks while maintaining integrity in the process leading towards the financial report preparation. The next major groups are the early majority group (20%), consisting of investor, risk analyst and a creditor, which are followers who will read reviews by earlier adopters about new products before purchasing. This group will be influenced by the early adopters in adoption and would be able to address the challenges of adopting BT by lessons learned from early adopters. The nascent stage of BT contributes to uncertainties regarding reliability, security, and scalability, further complicating governance, and accountability efforts. The concerns surrounding data privacy, cybersecurity, and potential vulnerabilities in Blockchain networks that necessitate robust risk management strategies. Investors face challenges in assessing the reliability and relevance of financial information presented on Blockchain platforms. The absence of centralized authorities in blockchain networks raises concerns about data accuracy, leading investors to question the credibility of reported financial data and the accountability of Blockchain-based reporting entities.

Accounting practitioners confront challenges in adapting existing accounting standards to accommodate blockchain-based transactions. The unique characteristics of Blockchain, such as smart contracts and decentralised autonomous organizations, challenge traditional accounting principles, requiring practitioners to revise reporting frameworks and accounting methodologies to ensure transparency and accountability. There is a group of innovators (15%) consisting of internal auditors and the financial press, who are still exploring new ideas and other disruptive technologies, not necessarily BT. The financial press plays a crucial role in disseminating information about corporate performance to investors and the public.

However, BC's decentralised nature may disrupt traditional sources of financial information, making it challenging for journalists to access accurate and timely data for reporting. Additionally, understanding the technical intricacies of BT requires journalists to possess specialised knowledge, further complicating the communication of Blockchain-related financial news. An equal percentage are for laggards (15%) who are most resistant in adoption of new products, and they consist of tax professionals and regulatory bodies. The professional bodies and regulators encounter hurdles in establishing comprehensive oversight frameworks for Blockchain-based financial reporting. The decentralised nature of BC complicates jurisdictional boundaries and raises concerns about regulatory arbitrage and enforcement. Regulators must collaborate across borders to develop unified standards for auditing, disclosure, and data privacy to mitigate risks associated with cross-border transactions and regulatory inconsistencies.

### 5.1.2 Implications to Internal Stakeholders of Financial Reporting

Internal stakeholders of financial reporting are individuals who are involved in the preparatory stage of financial reporting. They are individuals who are directly involved in the recording of transactions which transcribe into full-fledged sections in financial reporting. Internal stakeholders' perceptions were mostly towards the design, recording process, speed, training, and reliability of a Blockchain. Their concerns were on the design process of the Blockchain and how fast can a transaction be processed and authorised.

Accounting practitioners confront challenges in adapting existing accounting standards to accommodate Blockchain-based transactions. The unique characteristics of Blockchain, such as smart contracts and decentralised autonomous organisations, challenge traditional accounting principles, requiring practitioners to revise reporting frameworks and accounting methodologies to ensure transparency and accountability. By enabling a secure and tamper-proof ledger of financial transactions, BT ensures the integrity of financial data, thus reducing the risk of fraudulent activities.

This group was also concerned about the level of knowledge and understanding that accounting staff are required to have in ustilising Blockchain in day-to-day decisions. In addition, making adjustments such as impairments, amortisations and other type of transactions that rely on judgements were also a concern.

Overall, this group is ready to venture Real-time Financial Reporting with BT, provided the right support and operational procedures are in place. They are aware of the current problems of FR as mentioned in Chapter 1 and Chapter 2 of this study and believe that BT will be a solution to flexible financial reporting moving forward.

### 5.1.3 Implications to External Stakeholders of Financial Reporting

External stakeholders of financial reporting are categorised for the purpose of this study as individuals or organisations involved in making decisions from information derived from a financial report. Their concerns were on the governance and accountability, adoption rate, the reliability of utilising the information real-time. These were some of the biggest concerns highlighted as being in a position of repatriating information from the financial report, in real-time especially, governing standards and guidelines of utilising a Blockchain was a key area raised. As some of the respondents of this group represented regulatory bodies and professional bodies, there were some concerns raised as to which organisation is responsible in issuing these standards. This group is convinced that real-time financial reporting is the way to go moving forward, and BT is a convincing solution towards providing the right support in handling information real-time. More than the potential of adoption of BT altogether within organisation, there is more opportunity for integration with existing technologies and softwares used within the organisations. BT will support the existing system.

## 5.2 Concluding the Ontological and Epistemological Stance

With reference to Section 3.3, the study falls into the category of "critical perspective." Specifically, the researcher has chosen to adopt a "Medium" view of "change," meaning that the researcher is willing to be both open to challenging the status quo and accepting of the current social status.

To conclude the ontological and epistemological stance, the study assumes a social constructivist ontology. This means the reality of Blockchain's governance in Real-time Financial Reporting is not absolute but rather emerges from the lived experiences and interpretations of stakeholders. The existence of diverse stakeholders with varying perceptions and interpretations of Real-time Financial Reporting with BT is acknowledged. This perspective implies that reality is not fixed but rather shaped by the interactions and perspectives of different stakeholders involved.

The study employs a phenomenological approach. This means knowledge about the phenomenon (governance and accountability of Blockchain in Real-time Financial Reporting). The conclusion is derived from the subjective experiences of stakeholders, focusing on how they perceive and understand this new technology's impact. Understanding the governance of BT in Real-time Financial Reporting requires acknowledging and integrating the subjective perceptions of stakeholders. By adopting a phenomenological approach, the study uncovered the lived experiences and subjective interpretations of stakeholders, recognising the governance and accountability challenges involved in implementing BT in Real-time Financial Reporting.

### 5.3 Limitations & Future Research

The biggest challenge faced in this study, initially, was sourcing for articles related to use cases of BT. There were literally no articles on BT and FR and this contributed to the research gap of this study. Most of the articles were from the information technology front, which provided coding and challenges related to the design of a Blockchain. There were limited journals and the literature review comprised of use cases of BT in areas such as supply chain management and healthcare. Besides that, the articles related to cryptocurrencies and BT, especially on legalising cryptocurrencies.

However, since 2021 onwards there has been many journal publications on BT in distributed ledger technology. Beginning year 2022, there were more journals in the areas of accounting and finance, FR itself, to be specific. There is a lot of potential of future research based on the parameters set by the conceptual framework in this study.

Further research can be done one addressing the individual challenges of BT adoption and measures companies can take to minimise these challenges, such as cost and hiring of Blockchain talent.

The emerging themes can be used by organisations considering a move towards digital transformation, with BT being one of the areas of transformation. Any transition and adoption process comes with challenges, and these challenges are required to be addressed accordingly to ensure effective implementation. The thematic analysis nodes from Chapter 4 that can be directed to organisations as a step towards understanding the potential issues the organisations face with transitioning to Real time Financial Reporting with BT. BT requires specialised technical knowledge and expertise to develop and implement. Many organisations may not have in-house expertise in BT and may need to hire external consultants or partners to assist with the transition.

Organisations have legacy systems in place that are not compatible with BT. Migrating data and integrating with existing systems can be a complex process, and organisations may need to invest in upgrading their infrastructure to make the transition to Blockchain. While BT is often touted for its security features, it is not immune to cybersecurity threats. Organisations need to ensure that their Blockchain implementation is secure and may need to invest in additional security measures to protect against hacking and other attacks.

In discussing the limitations of the research methods, it is important to highlight that BT is an emerging area and its use case has been mostly in the area of cryptocurrencies in supporting bitcoins. Therefore, lack of literature and the use of secondary sources is challenging.

Majority of the respondents, more than half are 'indirect users' of BT. They are not part of or have not contributed towards the design and the functions of the BC utilised. The IT consultant was able to provide the perspectives of hurdles and challenges involved in the design of the Blockchain, as his expertise was related to the programming and coding of the Blockchain platform.

The regulatory challenge of utilising BT is yet to be discovered and established as there are no governance codes or internal control procedures to ensure compliance as of yet.

The use cases in accounting are still at its infancy as it is an emerging technology in accounting. The accountability and governance of BT is yet to be examined. There seems to be more use cases in health care, real estate, public sector, supply chain management and insurance compared to the accounting and finance sectors.

## 5.4 Contribution to Theory & Practice

Based on IDT, Roger and Shoemaker (1971) and Rogers and Beal (1957) had proposed five stages though which an innovation passes before an individual takes it into use.

| Stages | Purpose of the Stage | **Contribution of this Research** |
|---|---|---|
| The awareness stage | At this stage an individual gets to know about the being of an innovation. | **All participants of this research are aware of BT and the potential in FR** |
| The interest stage | At this stage the individual starts collecting specific data and information about the innovation. | **Less than 20% of participants have started to collect specific information about BT in FR** |
| The evaluation stage | At this stage the individual ascertains or fixes the value or worth of an innovation and decides whether to try it or not. | **Approximately 60% of participants have fixed the value but the decision of trying it has yet to be made** |
| The trial stage | At this stage a person takes the innovation into experimental use or applies it on a smaller scale. | **Not applicable in FR but in other industries such as drone technology** |
| The adoption stage | At this stage the innovation is taken into continual full-scale use and is given a favourable approval by the society members. | **Not yet but there is a potential if there are convincing factors towards the governance of a Blockchain platform** |

**Table 5.2 IDT Stages and Corresponding Contribution of this Research**

BT is able to facilitate Real time Financial Reporting in a Blockchain-based Financial Reporting, provided the information that is inserted into the Blockchain have been verified and accurate. The information that is fed into the Blockchain is more susceptible to alteration and tampering in comparison to information on a Blockchain. Should the process of vetting through the information to be passed through a Blockchain established, there should be no concerns of governance of the information on a Blockchain.

## 5.5 Concluding the Conceptual Framework

In conclusion, the conceptual framework provides the connection factors of integrating BT with Real-time Financial Reporting, focusing on its impact on accountability, governance of BT and the BT trait consensus-based verification in offering flexible, single-source information.

The benefits of BT in Real-time Financial Reporting can be concluded as enhanced transparency and accountability, as the immutable ledger of BT fosters trust by providing a clear audit trail for financial activities, reducing manipulation and fraud risks. In addition, real-time access to verified data strengthens governance by ensuring accurate financial information. An automated compliance processes also improve efficiency and reduce errors. In terms of stakeholder inclusivity, the decentralisation of BT empowers stakeholders with direct access to real-time financial information, promoting informed decision-making and accountability.

While ensuring data integrity, verifying transactions on a decentralised network can be complex and time-consuming, especially for high-volume systems. In governance and accountability structures, new concerns arise regarding responsibility and liability within the BT ecosystem. Clear governance structures are needed to define stakeholder roles and ensure compliance. Collaboration among network participants (validators, auditors, regulators and users) is crucial to address data privacy, security, and regulatory compliance challenges.

Overall, the conceptual framework highlights that the potential benefits of BT in terms of transparency, accountability, and improved governance need to be weighed against the challenges and perceived costs of implementation. The conceptual framework offers valuable insights for industry practitioners considering BT adoption in Real-time Financial Reporting by understanding BT's advantages. How BT can enhance transparency, accountability, and governance, potentially leading to a competitive advantage.

Besides that, BT's implementation challenges are outlined, and the complexities associated with consensus-based verification, governance structures, and stakeholder collaboration, allows for better planning and risk mitigation. Compliance costs highlights the perceived cost of compliance as a crucial factor for practitioners to consider when making investment decisions. By outlining both the benefits and challenges, practitioners are empowered to make informed decisions about resource allocation and BT implementation strategies.

## 5.6 Conclusion

Blockchain is a system for recording transaction activity across many distributed databases. Blockchain is a decentralised database, so there are no intermediaries in a transaction. Blockchain is immutable, meaning it cannot be changed. This is caused by cryptographic hash functions. The hash function is a function useful for shrinking and compressing a long input string into a shorter output string. Blockchain uses a hash function, so the entire Blockchain transaction cannot be altered or deleted. The hash connects each block to the previous block in the Blockchain.

The results of this research points towards the adoption of BT in Real time Financial Reporting in the future. The steps towards adoption, the challenges that individuals and organisations are going through are discussed thoroughly in Chapter 4, based on the categories and themes of theory and practice. As the study focuses not only on the use of BT in FR, but for the FR information to be available in Real-Time and to support value creation, integrated thinking and strategic planning and decision making, the governance and the transparency of information on a Blockchain is one of the key areas that influences the adoption and the acceptance of BT in FR by the internal and external stakeholders.

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## APPENDIX 1: INTERVIEW QUESTIONS

*Topic: A Phenomenological Understanding of Real-Time Financial Reporting (FR) with Blockchain Technology (BT)*

### Interview Questions

**Notes:**

1. Interviewees would comprise of the Stakeholders in Financial Reporting (SFR) [preparers of financial reports, auditors, and users including investors, analysts, regulatory bodies, government, creditors, financial institutions, financial press, Information Technology (IT) analysts and others] regarding real-time financial reports utilising BT, framed by an appropriate theory developed based on TAM, IDT and ST.

2. The set of interview questions will be repeated across various participants with minor modification.

***Research Question 1: To understand the issues involving accountability and governance in applying Blockchain technology in Financial Reporting.***

a) What is your view of Blockchain Technology and its uses in Financial Reporting?

b) Based on your experience with Blockchain Technology, how do you view issues of accountability and governance related to Blockchain Technology financial reporting in comparison to the current process/tool/ technology that you are currently utilising?

b) "Blockchain Technology is heralded for improving trust and can provide a new approach for creating transparency and promoting accountability in financial reporting". What do you think about this statement? Do you foresee any accountability issues in using BT in financial reporting?

c) What do you think of Blockchain-Based governance?

d) Can you describe the current accounting system/software that you are using within your organisation?

e) Do you think that the current accounting software that you are using within your organisation is compatible with Blockchain Technology?

***Research Question 2: How does the consensus-based verification trait of a Blockchain achieve real time Financial Reporting?***

a) What do you think of the traits/characteristics of a Blockchain?

b) Which trait do you think contributes to the real-time factor in a Blockchain?

c) Do you feel real-time is important in financial reporting?

d) Have you designed/utilised Blockchain Technology in your day-to-day operations?

e) What are the challenges faced in designing/using Blockchain Technology in your day-to-day operations?

f) Do you think Blockchain Technology will facilitate Real-Time Financial Reporting?

g) How do you think your role will evolve with Blockchain Technology?

h) Do you see a future for Blockchain Technology in Financial Reporting?

**Participants' Information Sheet**

**Title of Study: A Phenomenological Understanding of Real-Time Financial Reporting (FR) with Blockchain Technology (BT)**

**Objective:** To understand how accountable real-time financial reporting will be made possible with Blockchain trait(s) and the stakeholders of financial reporting perspective on future roles in financial reporting. There will be 20 one to one interview conducted with the following individuals: -

**Total number of individuals-20**

| Category | Internal/External | No. of Respondents |
|---|---|---|
| **Preparers of Financial Reports** | **Internal** | **2** |
| **Auditors (Big 4)** | **External** | **3** |
| **Internal Auditors** | **Internal** | **2** |
| **Selected Financial Institutions in Malaysia** | **External** | **1** |
| **Financial Press/Media in Malaysia** | **External** | **1** |
| **IT Personnel tasked in designing BT platform** | **Internal** | **1** |
| **Investor (of a company adopting BC in FR)** | **External** | **1** |
| **Risk Analyst** | **Internal** | **2** |
| **Regulatory Bodies** | **External** | **1** |
| **Tax Professionals** | **Internal/External** | **2** |
| **Professional Bodies** | **External** | **3** |
| **Creditors** | **External** | **1** |

**Procedures:** The partcipants will be required to provide their perceptions based on the individual role they play within their organisation on their views on real-time financial reporting with Blockchain Technology. There are 30 questions in the one to one interview.

**Right to Refuse or Withdraw:** Participation in the interview is completely voluntary and at any point if the interviewee would like to refrain from answering a particular question or provide an opinion on a statement, they are free to do so.

**Risks and Discomforts:** {For each procedure/activity that is part of the research, describe the immediate and long range discomforts/risks (physical, psychological, social, legal, and economic) and their consequences. Explain safeguards or precautions that will be taken to reduce the occurrence of adverse effects. Explain what treatment or assistance will be available if an adverse effect occurs. For example, in studies in which subjects are asked to discuss emotionally sensitive topics, the IRB requests that either an individual be present who can provide counseling assistance, or appropriate referral information be provided to subjects.}

**Benefits:** The participants will be able to understand the accountability and governance issues underlying the use of Blockchain Technology in real-time financial reporting. They will also be able to gauge the possible new roles or skills needed within their organisations and the accounting and finance ecosytem in the near future.

**Alternatives:** N/A

**Compensation:** N/A

**Anonymous and Confidential Data Collection:** Data collection will be anonymous.

**Confidentiality of records:** All information documented and recorded will be kept confidential, including the identity of the interviewee, their perception, views, their opinions, counter points, limitations will be kept confidential.

**Who to contact with questions:** Supervisor

## APPENDIX 2: EVOLUTION OF ACCOUNTING

| **Evolution of Accounting** | **(i)** | **(ii)** | **(iii)** | **(iv)** |
|---|---|---|---|---|
| Accounting: From its roots in ancient times to its modern equivalent | The earliest record of accounting was introduced by the agrarians of the Mesopotamian society, in tracking the growth and output of crops and herds. | | | |
| The Advent of Computers and Accounting-Software | (Kruglinski, 2009; "How Technology," n.d.) explains that towards the end of the twentieth century the accounting profession began to take on a whole new look. With programs such as Microsoft Excel an accountant now had an electronic spreadsheet. | The twenty first century accountants have strategic software applications in place to prepare for the future, such as Enterprise Resource Planning (ERP) systems. | ERP improves the business performance because management can get a full picture of how the business is performing at any given moment which can help with major business decision making (Laudon, et.al., 2006). | |
| Internet Financial Reporting (IFR) | The evolution of capitalism, industrialisation, and increased participation in capital markets led to modern financial reporting. | (Laudon & Laudon, 2006) explain that today's accounting professionals who understand the importance of the Internet will use the Internet for e-business. They use the Internet to execute major business processes in the enterprise. | (Torgerson, 2007) elaborates that not only does the client need to have proficient financial processes but the accountants themselves need software programs that keep track of clients' accounting information efficiently. | Accountants work with systems programmers to develop a digital process that will organise their client's history and all their documents. When the clients' data is input into the computer program the processing cycle gives the computer instructions on |

| | | | | |
|---|---|---|---|---|
| | | | | how to process the clients' data. |
| Technology Skills Required by Accountants | Accountants were pushed towards acquiring new skills due to the advancements that information technology has made on the accounting industry. Accountants needed to have a high level of computer and technical skills. | These skills became part of the knowledge, and abilities of the accounting professionals. The knowledge, skills, and abilities necessary for the entry-level accountant required the application and integration of information technology into the accounting process, as well as financial and managerial accounting principles (Dillon & Kruck, 2004) | The accounting industry is now evolving towards creating a new business language for future generations of accounting professionals. In comparing and contrasting the changes that have occurred with the use of technology in accounting throughout the ages, enterprise productivity has created career stability and many diverse opportunities in this successful industry of professional accountants (CPA, 2018). | Technology has changed accounting today. Bookkeeping is now automated. Since the first records were kept in America, bookkeepers have used a number of tools. |

**Table 2.1: Evolution of Financial Reporting**