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A SYSTEMATIC LITERATURE REVIEW OF INDUSTRY 4.0 TECHNOLOGY APPLICATIONS IN MALAYSIAN ESTATE DISTRIBUTION

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Abstract

The dual legal system and the abundance of agencies responsible for inheritance, wills, Islamic asset management, and Muslim estate distribution in Malaysia often result in administrative delays and disputes. Against this background, Industry 4.0 technologies particularly blockchain have been recognized in both academia and practice as transformative tools for streamlining real estate and estate distribution processes. This study aims to evaluate the blockchain-based frameworks proposed in the reviewed studies. A systematic literature review was conducted on publications from 2019 to 2023 using Scopus and other databases, resulting in the inclusion of eighteen papers that met the defined quality and relevance criteria. The reviewed studies adopted methodologies such as interviews, theoretical, experimental, systematic literature review, case study, legal, and holistic approaches. Moreover, the proposed blockchain-based models in the reviewed studies were categorized into five types: digital land registration, inheritance, consensus algorithms, smart real estate buying or selling, and commercial real estate management frameworks. Based on these findings, the study further proposes a conceptual framework linking blockchain affordances (decentralized ledger, smart contract, integrity, transparency, security, immutability, interoperability, integrated, efficiency, cryptographic, and tamper-proof) to key challenges in Malaysia's dual legal estate distribution system (overlapping jurisdiction between Civil and Shariah High Court, lack of transparency about the entitlement of heirs, conflict of laws and rights, disputes in transfer of ownership, and data fragmentation between agencies that reduce efficiency). This framework provides a theoretical and policy-relevant foundation for future model development aimed at achieving a more transparent, efficient, and Shariah-compliant estate administration process.

Keywords: Dual legal system, blockchain technology, estate distribution, systematic literature review, Malaysia

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INTRODUCTION

Asset distribution, which is also referred to as estate distribution, is the act of separating and transferring a deceased person's assets and properties, which is also referred to as the estate, to the legitimate recipients or heirs (Richards, et al., 2011). The laws of intestacy, which vary by jurisdiction, govern how an estate is distributed when a person dies without a valid will or testament. However, the distribution of Muslim estates in Malaysia is complex and time-consuming, often leading to disputes and delays.

Under Malaysian law, three administrative bodies namely, the Civil High Court, Amanah Raya Berhad, and the Estate Distribution Section of the Director General of Lands and Mines can issue permission to handle a decedent's inheritance (Azmi & Mohammad, 2015). Due to the dual legal system and the abundance of agencies serving as administrative authorities, estate distribution in Malaysia for inheritance, wills, waqf, harta sepencarian, and Islamic asset management is complex, ineffective, and inefficient (Mohamad Al-Bakri, 2011; Anuar et al., 2023). By issuing specific authorization letters and orders that vary depending on each case, these institutions play a significant role in the estate administration process. Regarding the jurisdiction over movable and immovable assets, there is a loophole in inheritance law that leads to unduly long delays in estate administration and distribution (Nasrul et al., 2021).

This research aims to conduct a systematic literature review of previous studies on the applications of blockchain technology in real estate transactions, with a view to identifying those that have the potential for a blockchain-based model or framework applicable to ease the distribution of Muslim estate in Malaysia. This study uniquely contributes to the body of knowledge by bridging the gap between blockchain-enabled real estate systems and the specific procedural and legal requirements of Muslim estate distribution in Malaysia, offering insights into how decentralized technologies can enhance transparency, efficiency, and trust in Islamic inheritance processes.

The specific objectives to achieve this aim to examine the types of blockchain-based frameworks proposed by the screened papers. The remaining part of this paper will be structured into four sections: firstly, the literature review section; secondly, the methodology section; thirdly, the results and discussion section; and lastly, the conclusion section.

LITERATURE REVIEW

The real estate industry globally faces persistent challenges of inefficiency, lack of transparency, high transaction costs, and limited trust among stakeholders due to the involvement of multiple intermediaries (Yartagadda & Gampala, 2020; Saari et al., 2022). In response, blockchain technology has emerged as a disruptive innovation that enhances transactional integrity, security, and

transparency. Since 2018, the Foundation for International Blockchain and Real Estate Expertise (FIBREE) has led global efforts to integrate blockchain into real estate by building a knowledge network that connects researchers, practitioners, and industry stakeholders (FIBREE, 2019).

The integration of blockchain into the real estate sector aligns with the broader transformation of the Fourth Industrial Revolution (Industry 4.0), which emphasizes digitalization through cyber-socio-physical systems (Schwab, 2016). Industry 4.0 technologies such as Artificial Intelligence (AI), Machine Learning (ML), the Internet of Things (IoT), and blockchain enable interconnected systems that automate, track, and verify complex processes (Mitchell, 1997; Parekh et al., 2020). Blockchain, in particular, provides a secure and immutable ledger that enhances traceability, auditability, and automation in property-related transactions. Within this paradigm, Building Information Modelling (BIM) integrated with blockchain has been proposed to improve documentation, transparency, and lifecycle management of built assets, thereby significantly easing the transfer and inheritance of estates (Ganter & Lützkendorf, 2019).

Moreover, real estate conveyancing is increasingly adopting blockchain and smart contracts a phenomenon referred to as “proptech” (Nasarre-Aznar, 2018). Proptech innovations demonstrate how blockchain can redefine real estate market operations by automating the verification and transfer of ownership. More broadly, digital technologies such as blockchain, AI, and IoT have the potential to increase market transparency, improve liquidity, and reduce transaction costs, thereby positively influencing the value of investment assets (Trofimov et al., 2016).

Empirical evidence across different jurisdictions supports these benefits. In Finland and the Netherlands, blockchain applications in land conveyancing and commercial property transactions have improved data accuracy, transparency, and trust while reducing intermediary costs (Kaczorow, 2019; Wouda & Opdenakker, 2019). Kim and Huh (2020) proposed a Legacy Inheritance Blockchain Model to address legal uncertainties in estate inheritance, while Chen et al., (2021) developed a Blockchain-Based Online Will system that automates property distribution and dispute resolution. These studies illustrate blockchain’s dual potential to enhance transactional efficiency and legal compliance in estate management processes.

In the Asia-Pacific region, blockchain adoption is rapidly expanding through platforms such as BrickX, KASA, ADDX, and Minterest, which have successfully digitized real estate investment and tokenized assets in Australia, South Korea, and Singapore (Chow & Tan, 2022). In Malaysia, Jasimin et al., (2023) highlighted blockchain’s potential in managing commercial office buildings, while Anuar et al. (2023) emphasized its role in consolidating fragmented estate distribution processes under a single digital platform.

Similarly, Abdulkader and Kumar (2023) and Ullah and Al-Turjman (2023) proposed blockchain-based frameworks for commercial real estate and smart property transactions, aiming to enhance transparency, efficiency, and data integrity.

Despite these developments, a major research gap remains in the application of blockchain to Muslim estate distribution (Faraid) within Malaysia's dual legal system, where inheritance matters are governed simultaneously by Civil and Shariah Courts. Existing studies have primarily focused on transactional, inheritance automation, or commercial real estate contexts but have yet to integrate Islamic legal principles, institutional coordination, and technological interoperability within a single framework. Therefore, this study advances the literature by systematically reviewing blockchain applications in real estate and proposing a conceptual framework tailored to Malaysia's socio-legal and Shariah context to facilitate a transparent, efficient, and compliant estate distribution process.

METHODOLOGY

A comprehensive review was conducted to synthesize current and prior studies on blockchain technology in real estate transactions and estate distribution, with a view to identifying gaps specific to the Malaysian context. This was done in line with the view of Petticrew and Roberts (2006) that states systematic literature review is "a set of scientific approaches in reporting, previous studies with the expressed purpose of reducing the error of bias, through identifying, appraisal, and synthesizing of all relevant studies in whatever paradigm so as to provide an answer to some set of questions".

Search Strategy

The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher et al., 2009). A structured database search was conducted primarily in Scopus, complemented by manual searches of Google Scholar, SpringerLink, and ScienceDirect to identify additional relevant studies. The search was restricted to publications between 2019 and 2023 to capture the most recent advancements in blockchain applications in real estate and estate distribution. The search string combined relevant keywords using Boolean operators as follows:

("Blockchain Technology" AND "Real Estate") OR ("Blockchain" AND "Estate Distribution") OR ("Blockchain" AND "Property Transactions").

Filters were applied to limit the search to English-language publications in peer-reviewed journals, conference proceedings, and book chapters. A total of 239 records were retrieved initially (234 from Scopus and 5 from other sources).

Inclusion and Exclusion Criteria

The inclusion and exclusion criteria were developed to ensure the relevance and quality of the selected studies.

The inclusion criteria include: studies published between 2019 and 2023, publications written in English, studies that focus on blockchain applications in real estate, property management, or estate distribution, and Peer-reviewed journal articles, conference papers, or book chapters with full-text availability.

The exclusion criteria are: papers without full-text access, publications not directly related to blockchain technology or real estate, and non-English or duplicate records.

Screening and Selection Process

The selection process followed four sequential phases: identification, screening, eligibility, and inclusion, as presented in Figure 1 (Adapted PRISMA Flow Chart). After removing duplicates and irrelevant items, 216 records were screened based on title, abstract, publication year, and language. Nineteen (19) full-text papers were then reviewed for relevance, out of which one (1) was excluded during the quality assessment stage. Consequently, eighteen (18) papers were included in the final systematic review.

Data Extraction and Coding Procedure

Data from the included studies were extracted and coded using a standardized template developed for this review. Each study was coded for:

1. Publication details: author(s), year, publisher, and source type.
2. Research focus: blockchain application domain (e.g., real estate, inheritance, or land administration).
3. Methodological approach: interview/focus group, theoretical, experimental, case study, literature review, legal, or holistic approach.
4. Proposed framework/model type: digital land registration, consensus algorithm, inheritance system, smart property transaction, or commercial real estate management model.

The authors manually cross-checked the coding process to ensure consistency and accuracy. A qualitative synthesis approach was adopted to identify common patterns, methodological trends, and emerging research

directions relevant to blockchain adoption in real estate and Muslim estate distribution.

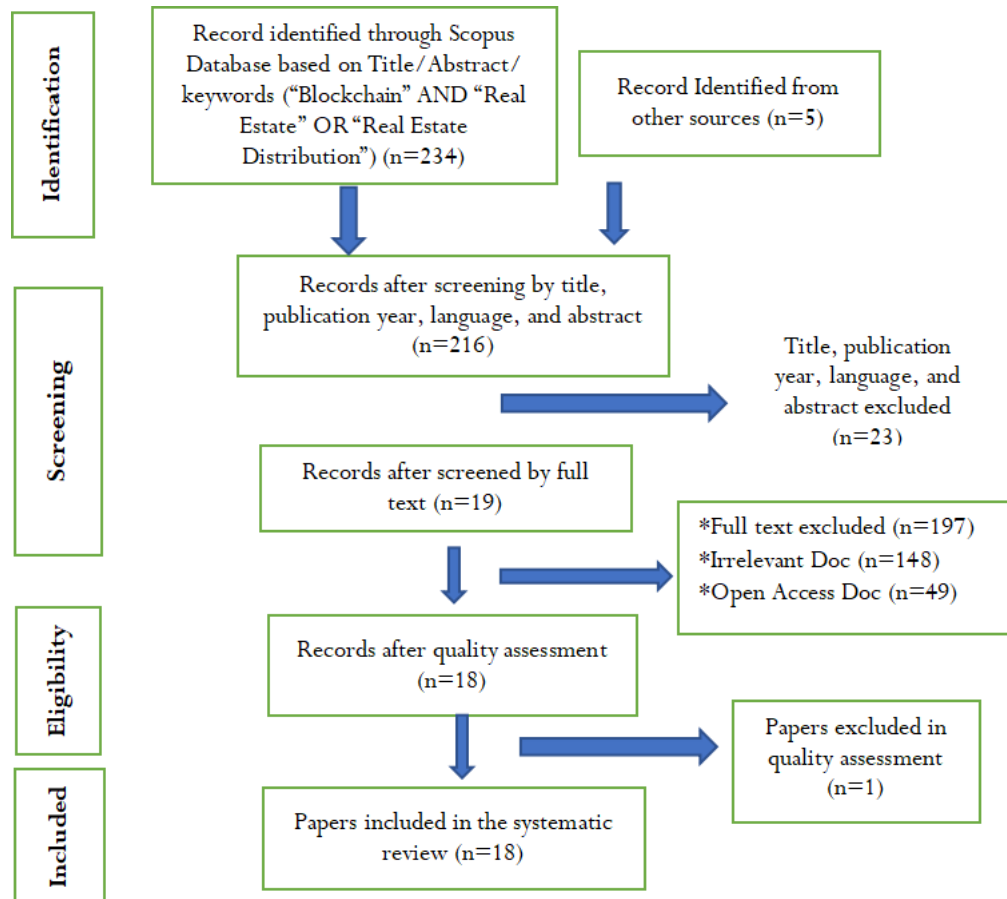


Figure 1: PRISMA Flowchart for the Selection Process
Source: Adapted from Moher et al., (2009)

RESULTS AND ANALYSIS

A systematic review of contributions to knowledge from various research on Industry 4.0 technology was conducted to propose a blockchain-based model or framework to ease Muslim estate distribution in Malaysia. This section details the results and approaches adopted in each study reviewed on blockchain technology applications in real estate transactions and estate distribution.

Illustration of Papers by Year of Publication

Eighteen (18) papers were identified as relevant and useful for the study, out of the initial two hundred and thirty-four (234) papers identified from the Scopus online database and other sources. These eighteen papers comprise journal articles, conference proceedings, and book chapters. Moreover, the years 2020 and 2023 have the highest number of publications, with five (5) papers each and a percentage rate of 27.78%, followed by 2021 with four (4) papers and a percentage rate of 22.22%. Meanwhile, the years 2019 and 2022 recorded three (3) and one (1) publications, with percentages of 16.67% and 5.56%, respectively, from the included papers. This statistical information is illustrated in Figure 2.

The steady increase in publications from 2019 to 2023 indicates a growing academic interest in applying blockchain to real estate management and asset distribution. Notably, 2020 marked a turning point when blockchain research shifted from purely theoretical exploration to more experimental and framework-oriented studies, reflecting a maturing interest in practical implementation. However, the relative decline in 2022 suggests a temporary slowdown, possibly due to global economic disruptions and reduced institutional research funding during the post-pandemic period.

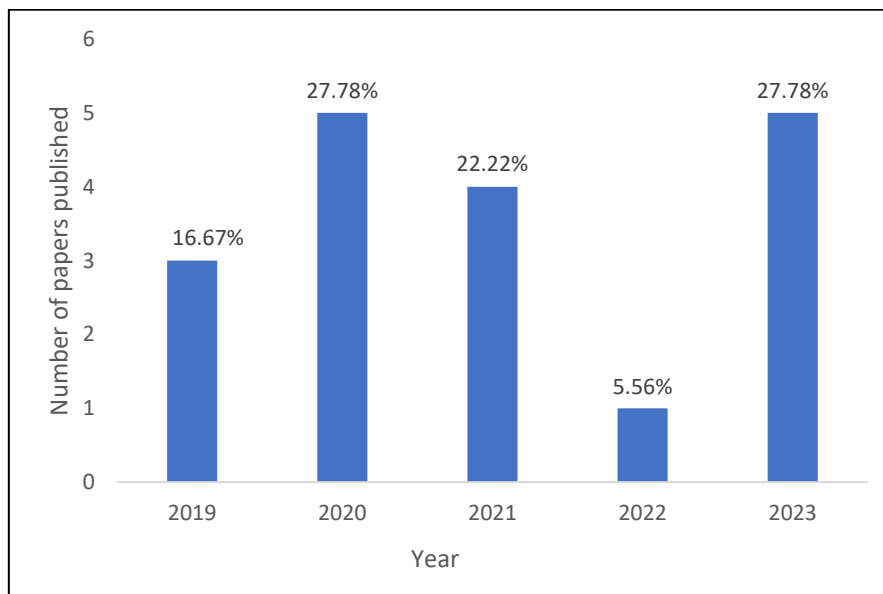


Figure 2: Papers Publication Graph

Illustration of Screened Papers Distribution

The final list of papers considered from the digital library after the exclusion and inclusion criteria is eighteen (18), between the years 2019 and 2023. As shown in Figure 3, Emerald Group Publishing Limited has the highest number of publications, with 5 papers, followed by MDPI and Sciendo, each with 3 publications. On the other hand, Springer Science, Institute of Electrical Publishing, Taylor and Francis, Nova Science Publishers, KeAi Communications, International Journal of Supercomputing, and the Malaysia Institute of Planners each have one publication.

This distribution indicates that most blockchain-related studies in real estate are disseminated through multidisciplinary and technology-driven publishers rather than domain-specific property journals. The dominance of MDPI and Emerald suggests a preference for open-access, practice-oriented journals that facilitate global visibility for emerging blockchain frameworks. Regionally, the reviewed papers were predominantly authored by researchers from Asia (China, India, Malaysia) and Europe (Estonia, the UK), with limited representation from Africa and the Middle East, highlighting the need for contextualized research on Islamic inheritance systems and on land governance in developing economies.

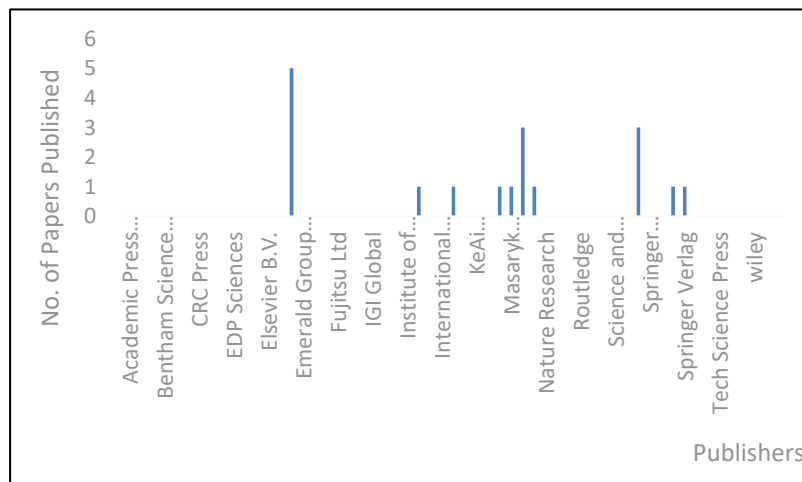


Figure 3: Papers Publication Graph

Analysis of Paper Review by Methodology

Table 1 summarizes the methodologies adopted across the eighteen reviewed studies. The studies were classified into eight methodological categories:

experimental, systematic literature review, case study, theoretical, traditional literature review, legal, holistic, and interview-based approaches.

A significant proportion (33.33%) adopted experimental designs, reflecting an emphasis on testing blockchain prototypes, simulation environments, and smart contract algorithms. The use of systematic reviews and case studies (16.67% each) indicates growing attention to comparative and integrative analyses rather than isolated proofs of concept. However, legal, theoretical, holistic, and traditional literature review approaches were underrepresented (5.56% each), suggesting limited exploration of regulatory harmonization and ethical implications critical aspects for Muslim estate administration in Malaysia's dual legal system.

Comparatively, studies conducted in Western contexts (e.g., Estonia and the UK) tend to employ empirical and technical frameworks, focusing on interoperability and data integrity, whereas Asian studies, including those from Malaysia and Indonesia, lean toward conceptual and normative approaches, emphasizing legal compatibility with Islamic principles. This methodological divide underscores a gap in cross-regional empirical validation of blockchain-based inheritance systems.

Table 1: Paper Review by Methodology

No.	Research Methodology	Frequency	Percentage (%)
1	Focus Group Discussion/Interview	3	16.67
2	Theoretical	1	5.56
3	Experimental	6	33.33
4	Systematic Literature Review	3	16.67
5	Case study	2	11.11
6	Traditional Literature Review	1	5.56
7	Legal	1	5.56
8	Holistic	1	5.56
	Total	18	100

Illustration of Paper by Proposed Framework/ Model

Fourteen (14) of the eighteen (18) reviewed papers proposed blockchain-based models capable of transforming real estate transactions and estate distribution into more transparent and digitized systems. These frameworks were grouped into five main categories (Table 2):

1. Blockchain-based Digital Land Registration Models (28.6%): focus on transparent, tamper-proof property record systems integrated with national cadastral databases.
2. Blockchain-based Smart Real Estate Buying/Selling Models (28.6%): designed to automate property transactions and payment verification through smart contracts.
3. Blockchain-based Commercial Real Estate (CRE) Management Models (14.3%): emphasize real-time data sharing and risk mitigation in large property portfolios.
4. Blockchain-based Inheritance Models (14.3%): propose distributed ledgers for estate division and Shariah-compliant inheritance validation.
5. Consensus Algorithm Models (14.3%): address transaction security, latency, and removal of intermediaries.

Compared with land registration and transaction models, the dominance of blockchain applications in property administration highlights their technological maturity, while the limited focus on inheritance frameworks reflects an early-stage research area. Few studies integrate Islamic jurisprudence or Malaysian estate administration protocols, revealing a critical research gap that this review seeks to address.

Overall, the findings reveal a strong global movement toward digital transformation of real estate through blockchain, yet a lack of contextual adaptation to the unique religious, legal, and cultural realities governing Muslim estate distribution in Malaysia. Future research should thus emphasize hybrid frameworks combining blockchain with Islamic legal principles, GIS integration, and institutional collaboration to enhance transparency, efficiency, and legitimacy in estate distribution.

Table 2: Paper by Proposed Framework/ Model

No.	Proposed Blockchain Model/Framework	Frequency	Percentage (%)
1	Blockchain-based digital land registration model	4	28.6
2	Consensus algorithm-model	2	14.3
3	Blockchain-based inheritance model	2	14.3

No.	Proposed Blockchain Model/Framework	Frequency	Percentage (%)
4	Blockchain-based smart real estate buying/selling model	4	28.6
5	Blockchain-based commercial real estate (CRE) management model.	2	14.3
	Total	14	100

Conceptual Framework

Since Malaysia has dual legal system comprising Islamic and Civil laws, in matters of inheritance of Muslims, the conflict between rules of substantive and procedural laws of the two systems is possible. As long these rules are different they conflict, and as long as they are not in line with Muslim personal law, Muslim beneficiaries of an estate are denied their rights, in accordance with the provisions of the Federal Constitution of Malaysia.

A system may treat one thing as property or right or powers, and the other may not do so. This is so because there is express conflict of rules to that effect or there is an ambiguity of rules, or an apparent silence of the rules. Hence, a property may not be an estate of a deceased under one legal system while it could be so under another for the same reasons. The two systems may recognize different rights, powers, or restriction thereof, which consequently may result in conflicting claims to the estate in the Civil or/and Shariah Courts.

Overlapping agencies could be one of the estate distribution challenges whenever the claiming process has been made in multiple agencies. In this case, the claimant confused over the multiple agencies jurisdiction (Azmi & Muhammad, 2015). Other issue relating to overlapping agencies is found in *Abdul Shaik bin Md Ibrahim & Anor v. Hussein bin Ibrahim & Ors.* [1999] 5 MLJ 618, the first issue is a matter of declaration whether the Registration of Adoption Act 1952 (a federal law) was applicable to Muslims and the second issue was relating to custody (state matter). The court held that the former fall within the jurisdiction of Civil High Court while the second issue was within the jurisdiction of Shariah High Court. All these could be cumbersome procedures since it was conducted in the two adjudicative agencies.

Besides, lack of transparency about the entitlement of heirs of a deceased. Issues may be complicated and conflicting when the judge has to decide as to whether he has to rely on the principles of Islamic or Civil law. In *TM Feroze Khan & Ors v Meera Hussain TM Mohamed Mydin* [2006] 3 CLJ 616, the judge erred to hold that “the applicability of Islamic law is subject to the Civil law and here there are no preserving rules of Islamic law in the applicable land law and the law of trust that govern this case” (p. 625). The contention was

whether the subject property was subject to trusts or hibah. Had the judge considered the above provision of the Federal Constitution, and had explored the Islamic law of waqf and hibah, such a mistake could be avoided. The case may have been no more binding, in light of *Latifah bte Mat Zin v Rosmawati bte Sharibun & Anor* [2007] 5 MLJ 101.

The conflict of laws and therefore the conflict of rights are illustrated in cases where purposive effort was made by civil court to avoid the application of Islamic law. In *Abdullah Sani Bin Jaafar (Suing As Administrator Of The Estate Of The Late Datuk Jaafar Bin Hussain, Deceased, And On Behalf Of Himself As Beneficiary) V Mohamad Bin Bakar & Anor* - [1997] 5 MLJ 477 the judge excluded the application of Islamic law to an estate to which a creditor had claim. He thought that the Syariah court had no jurisdiction over the case under s 10(2) of the Sabah Enactment because a claim by a creditor against the estate of a deceased does not come within the ambit of s 10 (2) (b) (viii), for inheritance is claimable 'through genetic descent' while creditor of the estate of the deceased is not claiming it through genetic descent but only for a debt due from the estate of a deceased. He mislead himself to presume that 'all claims by one Muslim against another for a debt [can] be filed in the civil court' while ignoring the main cause of action that is the claim in the case before him involved a claim to an estate of Muslim that was considered property of heirs and was subject to Muslim law. Such claim could be determined only if it is contested by heirs under Islamic law including incidental questions relating to claims of creditors, and other beneficiaries under an instrument of wasiyah or waqf. Obviously, if one had to follow this ruling, estates will be claimable only by those recognized under faraid system, which is an absolute misrepresentation of Islamic law.

Disputes may occur in transfer of ownership as been seen in the case of *Haji Osman bin Abu Bakar v. Sayed Noor bin Sayed Mohamed* [1952] MLJ 37, it also held that, when the landowner died before the completion of transfer of ownership, the legal personal representative of such deceased person was the trustee for the purchaser. The purchaser was entitled to the possession of land. The question however may be raised if on evidence it is proved that the transaction was valid under Islamic law but the deceased had failed to take aforementioned steps about the registration of the transaction. Non-recognition of which will lead to the exclusion of the claimant.

Estate distribution challenges include data fragmentation between agencies that reduce efficiency. Among the data/ documents that need to be submitted for the estate distribution procedure are death certificates, marriage documents, divorce papers, change of religion letters, heirs identification cards provided by the Department of National Registration, faraid certificates issued by the Shariah High Court, as well as documents of the deceased's assets that include all his property including land grants from the Land office, account bank

statement, unit trusts, salaries and others from different agencies (Zulkafli & Ahmad, 2016; Muhammad Saifullah, 2020).

Using blockchain, the ledger in the smart contract is copied between different nodes, simultaneously eliminating the possibility of falsifying records (Alharti, 2021). Chen et al. (2021) introduced blockchain technology with the characteristics of decentralized, open, anonymous, and times of interruption, which simultaneously can maintain the integrity of the content of data. The hybrid blockchain architecture is distinguished because it is not publicly accessible yet retains the benefits of blockchain technology, such as integrity, transparency, and security (Anuar et al., 2023).

Blockchain technology also has the characteristics of immutability that it cannot be altered once the records are generated into the block and uploaded into the chain (Chen et al., 2021). Besides, blockchain affordances include interoperability that able to integrate all operations into one platform to enhance efficiency. According to Popov (2016), smaller networks may face security limitations, while large-scale applications demand high transaction speeds and robust cryptographic to create tamper-proof. Thus, real estate or estate distribution applications, in particular, require solutions that balance these demands to ensure seamless integration and widespread adoption.

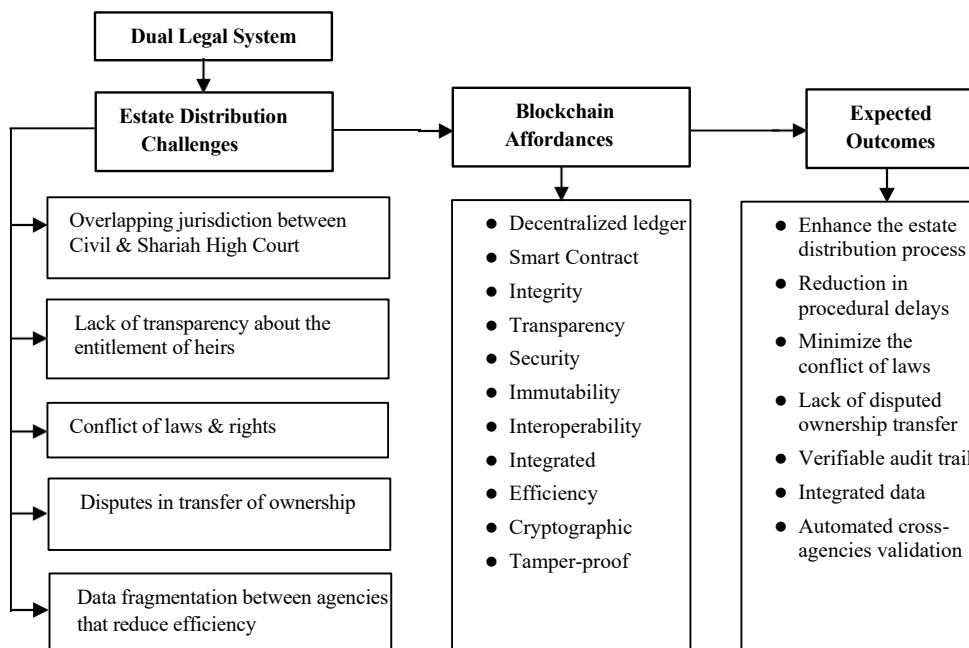


Figure 4: Conceptual framework linking blockchain affordances to estate distribution challenges under Malaysia's dual legal system.

Building on the systematic review's results, a conceptual framework in Figure 4 was developed to illustrate how blockchain's affordances such as decentralized ledger, smart contract, integrity, transparency, security, immutability, interoperability, integrated, efficiency, cryptographic, and tamper-proof can address key challenges in Malaysia's estate distribution process. The framework links these technological features to the persistent issues of overlapping jurisdiction between Civil and Shariah High Court, lack of transparency about the entitlement of heirs, conflict of laws and rights, disputes in transfer of ownership, and data fragmentation between agencies that reduce efficiency. By integrating blockchain into the estate administration workflow, the framework envisions a unified system that harmonizes institutional processes and enhances auditability. This framework extends the analytical findings by translating observed trends in blockchain applications into a localized, policy-relevant structure tailored to Malaysia's dual legal system.

CONCLUSION

This study employed a systematic literature review to synthesize recent research on blockchain technology in real estate transactions and estate distribution from 2019 to 2023. The reviewed papers utilized eight methodological approaches: interview (focus group discussion), theoretical, experimental, systematic literature review, case study, traditional literature review, legal, and holistic. Fourteen of the eighteen included papers proposed blockchain-based frameworks, categorized into five major purposes: digital land registration, consensus algorithm, inheritance, smart real estate buying/selling, and commercial real estate (CRE) management models. The results reveal growing scholarly and practical interest in blockchain applications within the real estate industry, but limited adoption of systematic literature review approaches.

This study contributes to knowledge by providing a structured synthesis that connects blockchain innovations to the unique administrative, adjudicative, and Shariah-compliant requirements of Muslim estate distribution in Malaysia. Furthermore, the proposed conceptual framework links blockchain's core affordances decentralized ledger, smart contract, integrity, transparency, security, immutability, interoperability, integrated, efficiency, cryptographic, and tamper-proof to the institutional and legal challenges in Malaysia's dual estate distribution system. This strengthens the study's theoretical and policy relevance while laying the foundation for a localized blockchain-based inheritance framework to guide future research and policy reform.

ETHICAL STATEMENT

This study relied exclusively on secondary data obtained from published scholarly sources; hence, no human participation or primary data collection was

involved, and ethical clearance was not required. All materials were properly cited to uphold academic integrity and ensure transparency. Data identification, selection, and synthesis followed systematic review procedures consistent with PRISMA guidelines. The authors declare that there are no conflicts of interest regarding the conduct or publication of this research.

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A Systematic Literature Review of Industry 4.0 Technology Applications in Malaysian Estate Distribution*

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