Analyzing the improvement of estate governance and management in Jordan using blockchain

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CHRONICLE	ABSTRACT
	The potential for transforming the estate management industry through the resolution of common inefficiencies, lack of transparency, and security concerns is presented by the use of blockchain technology into estate governance. The purpose of this article is to clarify how incorporating blockchain technology would affect estate operations and governance. This study is based on quantitative information that was collected from 317 estate management professionals using a 5-point Likert scale questionnaire. SmartPLS4 analysis demonstrates that blockchain governance has a statistically significant and robust influence on estate governance in Jordan. The impact of Blockchain Governance on Jordanian Estate Management appears to be negligible and unimportant. Furthermore, there appears to be a negligible and insignificant correlation between Jordanian estate management and estate planning methods. In-depth analysis of these theories is done in this article, which also offers insights into how blockchain technology affects estate governance dynamics and how it can affect Jordan's estate management procedures. The consequences go beyond theoretical understandings; they promote the use of blockchain technology in estate governance frameworks as a game-changing means of ensuring the safe, transparent, and effective administration of frozen estates in Jordan and elsewhere.

1. Introduction

Blockchain technology's revolutionary potential is sometimes likened to that of the World Wide Web. The foundations of blockchain technology have been applied to several different kinds of applications in just a few years, in addition to the original cryptocurrency uses. These include asset management, finance, insurance, and medical/health. From the perspective of these kinds of applications, blockchain improves data quality by making it transparent, immutable, and consistent (Yli-Huumo et al., 2016; Paik et al., 2019). Moreover, a transformative shift has reshaped governance and management practices across various sectors, driven by the fusion of technology with traditional industries (Dwivedi et al., 2021). In addition, the adoption of blockchain technology has sparked significant interest in revolutionizing various sectors, including estate governance and management (Graglia & Mellon, 2018; Jarah et al., 2022; Zobi et al., 2023). A prime example of this evolution within estate management is the integration of blockchain technology. Initially conceived as the foundation for cryptocurrencies, blockchain has evolved into a robust, decentralized system facilitating secure and transparent transactions (Toufaily et al., 2021). In estate management, handling frozen estates presents a multifaceted challenge (Nordin & Ahmad, 2023). These frozen estates arise from legal disputes, uncertainties regarding estate administration, or challenges to the validity of a will (Nasrul & Salim, 2018). Such situations often lead to prolonged delays in asset distribution, imposing significant hurdles for

beneficiaries and the entire estate management process (Dong et al., 2022; Wafa'Q et al., 2022; Bernal-Chávez et al., 2023; Sun et al., 2023). Like many other areas, Jordan has recently struggled with the management of frozen estates, raising urgent questions about effectiveness, security, and transparency (O'Brien et al., 2022). The legal complexity that surrounds frozen assets in this region are exacerbated by uncertainty regarding legislation, conflicts of jurisdiction, and procedural obstacles. Effective estate administration and asset distribution are hampered by legal problems resulting from family disputes, arguments over asset distribution, or challenges to the validity of wills (Abdalla et al., 2022; Alezaibe, 2022; Abu Eyadah abd Al Khatib, 2022). These disputes can last for months or even years before being resolved (Janssens, 2019; O'Brien et al., 2022). Inadequate knowledge among people managing frozen lands makes these problems in Jordan much worse. Effective administration requires familiarity with applicable rules, probate law, and property rights (Nasrul et al., 2021). A transparent approach is provided by integrating blockchain technology with frozen estate management (Zhang et al., 2022; Khamdit & Worapun, 2023; Lozano-Fernández, 2023).

Another essential component that blockchain brings to frozen estate management is security. It is extremely difficult for outside parties to access or manipulate due to its decentralized structure and complex data distribution. Furthermore, critical estate data and private information of stakeholders are protected by strong data encryption algorithms in blockchain (Zhang et al., 2020; Das et al., 2021). Recorded on the blockchain, smart contracts remove middlemen and automate several tasks (Li & Kassem, 2021). The decrease in paperwork expedites the transfer of assets, lowers administrative expenses, and improves overall efficiency (Rubel, 2021; Wafa'Q et al., 2022). Furthermore, real-time monitoring of frozen estates is made possible by blockchain-based systems, providing stakeholders with accurate and current information, and security (Jarah et al., 2022). The study examines how blockchain technology can transform estate management by addressing the legal, financial, and operational responsibilities associated with asset, estate and inheritance management. It is centered around transparency and efficiency. (Al-Matarna et al., 2022; Al-Zaqiba et al., 2022; Zubi et al., 2023). It can lead to Inheritance Risk Management (IRM) (Al-Obaidi, 2024). The use of blockchain technology has the potential to modernize and simplify estate administration, mitigating present issues and bringing about a period of efficient governance (Hamid et al., 2022; Abdul Aleem, 2022; Alflaieh, 2022; Omeish, 2022; Sawalha, 2022). Transparency is a key component of good governance, but traditional estate administration, with its many middlemen and onerous paperwork, frequently impedes it (Shubailat et al. 2024; Habtoor et al., 2019; Trinh & Le, 2022; Shatnawi et al., 2024). This problem is solved by the shared, decentralized record of real estate transactions provided by blockchain's immutable ledger structure. Its automation also speeds up transactions and eliminates duplication, greatly increasing the efficiency of estate administration. However, the purpose of this paper is to examine the possible consequences of using blockchain technology into estate administration, with a focus on security, effectiveness, and transparency.

2. Literature Review

Blockchain technology has become a disruptive force that offers several advantages to a variety of industries, including supply chains, finance, and healthcare ((Ababneh et al., 2022). To fully appreciate its enormous potential uses and ramifications, one must comprehend its basic features and operations (Aldeeb et al., 2022; Almarashdeh & Alzaqebah, 2023). Fundamentally, blockchain functions as a distributed ledger that is updated by several network nodes and is comprised of linked blocks that hold transactional data (Swan, 2015; Ahmed et al., 2023). Because of its decentralised structure, which depends on network users reaching an agreement to preserve ledger integrity rather than a single authority to authenticate transactions, the system is more robust and democratic (Ahmad et al., 2022; Alanazi, 2022).

These decentralised nodes, which are made up of a network of computers, servers, and laptops linked to the blockchain, are responsible for recording, verifying, and storing data blocks that are connected in chains. The blockchain algorithm encodes important transaction characteristics including sender, receiver, date, and time into an alphanumeric string called a hash, which uniquely identifies each block's many transaction records (Brito and Castillo, 2013; Salmon and Myers, 2019). Transactions are added to the chain when network users validate them using consensus techniques (Zle & Strazdia, 2018). Moreover, according to Alam et al. (2019) and Raval (2016), the decentralised nature of blockchain technology reduces the possibility of a single point of failure, hence improving the overall resilience of the system. Furthermore, the immutability of blockchain guarantees that data stored cannot be changed because any tampering would manifest itself through a modification of the hash (Vora, 2015; Hileman & Rauchs, 2017). According to Decker and Wattenhofer (2013), immutability preserves data integrity, fostering user confidence and enabling traceability in the event of illicit adjustments.

As blockchain technology developed, a number of models appeared, each suited to the needs and applications of particular industries. To customise blockchain to certain circumstances, it is essential to comprehend the characteristics and differences of these models. The main categories of blockchain models are private, hybrid, consortium, public permissionless, and private. Any network user can create and commit transactions on public permissionless blockchains, such as those used in Bitcoin and Ethereum, with verification by all or a subset of authorised nodes. Public permissioned blockchains, on the other hand, limit writing to approved nodes, guaranteeing commitment from all or a portion of these nodes. A subclass of public blockchains known as closed systems restrict some operations to approved parties, frequently jeopardising auditability and transparency. Scholars recommend adopting public blockchains with zero-knowledge proof to confirm transactions without disclosing sensitive data in order to overcome confidentiality problems in closed blockchains (Kosba et al., 2016). Private blockchains,

which promote efficiency and scalability, restrict membership to organisations, sometimes governed by corporations or consortiums (Siegfried et al., 2020). Private blockchains prioritise data security by emphasising privacy and secrecy, ensuring restricted access and transaction validation among authorised users (Christidis & Devetsikiotis, 2016; Habtoor et al., 2018; Altebainawi et al., 2019; Kan & Serin, 2022). They frequently function faster and more scalable than public blockchains, meeting the needs of large transaction volumes and low latency (Lu et al., 2019). Consortium blockchains improve privacy, scalability, and control by enabling a small number of users to collaboratively validate transactions. This strikes a balance. They provide the safe flow of sensitive data by encouraging collaboration and shared governance across reliable institutions (Isah et al., 2018; Aslam et al., 2021). Combining the benefits of public and private blockchains, hybrid blockchains provide data privacy, decentralisation, and transparency all at once. To enable smooth data exchange across networks, this architecture combines public and private components and gives organisations the ability to define data accessibility and control (Zubaidy et al., 2023; Arqawal et al., 2021; Casino et al., 2018; Ali et al., 2022; Alattass, 2023; Sudrajad et al., 2023). The possible uses of blockchain technology are greatly expanded by the diversity of blockchain models, which meet a range of use cases and market demands. Understanding the subtle differences between each blockchain architecture is necessary in order to choose the best one for a given set of applications. A legally enforceable instrument that controls asset administration and equitable distribution following a person's death, is the focal point of estate management in the Middle East. When the routine administration and distribution of estate assets are hampered or delayed by legal battles, challenges to the validity of the will, unpaid debts, or other complications, the situation is known as a frozen estate.

Beneficiaries and executors suffer because of these frozen estates' frequent settlement delays. Navigating the complex legal terrain during estate administration requires an understanding of the specifics of frozen estates within the context of wills. A thorough understanding of the legal frameworks and procedures associated with estate administration especially in the Middle East is essential for managing frozen estates. Major reasons of these conflicts include disagreements regarding entitlement, asset valuation, or the decedent's goals as outlined in the will (Ayuni et al., 2022; Isah et al., 2018; Ali et al., 2023; Ríos-Ríos et al., 2023). Administrators, beneficiaries, and executors need to be well-versed in all relevant laws and rules. The Middle East's asset recovery procedures must be transparent, accountable, and easy to follow thanks to the legal framework and enforcement practices that regulate the management and preservation of seized or frozen assets. In the Middle East, several organisations work together to govern frozen estates, including the Land Office, Amanah Raya Berhad, the High Court, and the Syariah Court. According to the legal framework, every institution has a specific responsibility for managing and keeping frozen assets (Nasrul et al., 2021). Inheritance disputes and estate administration are among the civil proceedings that fall under the jurisdiction of the Middle Eastern High Court. It supervises the distribution of estates, making certain that it complies with Islamic inheritance regulations or non-Muslim-specific laws. After receiving Grants of Probate or Letters of Administration for the dead person's estate, the High Court divides and administers the assets (Mohd et al., 2022). In Jordan, the administration and control of frozen estates are divided among many legal bodies, each with authority over certain facets. Working in tandem with the civil judicial system, the Syariah judicial handles cases pertaining to Islamic law, especially Muslim-owned frozen estates. Islamic inheritance laws, as outlined in the Quran and Hadith, control how Muslim heirs divide up their property. The Syariah Court has the power to impose freezing orders on the basis of Islamic law, particularly for Muslims, in order to ensure compliance with Islamic law.

The Syariah Court is responsible for handling Muslim inheritance disputes and has the authority to distribute assets in accordance with the Islamic inheritance law, known as Faraid. The allocation of a deceased person's assets among their legitimate heirs is decided by Faraid. The court supervises the distribution of the deceased's inheritance in compliance with Islamic law, assessing family relationships and allocating shares according to Faraid standards (Abdul Malek et al., 2017). Amanah Raya Berhad has been given guardianship and maintenance of frozen estates by the Jordanian government. As a trust corporation, it protects and holds onto the value of assets that have been frozen until they are released or disposed of in compliance with legal requirements or court rulings (Amanah Raya Berhad Act of 1995, Act 533). Furthermore, as an executor or trustee appointed in wills or trusts, Amanah Raya Berhad provides professional estate administration services, including asset evaluation, financial management, and asset distribution. Multiple laws, regulations, and court rulings make up Jordan's regulatory framework for frozen estates, which has resulted in a high level of legal complexity. The interpretation and implementation of these restrictions cause uncertainty and delays in asset management and distribution. The involvement of several authorities, each with different rules and procedures, such as the Land Office, Amanah Raya Berhad, High Court, and Syariah Court, increases the complexity and raises the possibility of misunderstandings and conflicts (Nasrul et al., 2021). Moreover, one reason for the difficulties is the lack of legislation pertaining to frozen estates. Though pertinent, the regulations that are now in place focus more on general estate administration than the specifics of handling frozen estates. The insufficiency of the current legal system leads to protracted legal fights and delays in resolving issues related to frozen estates. To effectively regulate frozen estates, law enforcement authorities, regulatory entities, and judicial institutions must work together. Nonetheless, there are obstacles in the way of accomplishing smooth cooperation and data exchange among various organisations. Due to information silos and a lack of coordinated efforts, inadequate coordination results in inefficiencies, delays in conflict resolution, and poor decision-making (Ahmad & Laluddin, 2010; Abdullah et al., 2020; Salleh et al., 2023). The administration of frozen estates must deal with a variety of difficulties, such as intricate legal matters, coordination concerns, and the requirement for responsibility and openness. With its unique features immutability, decentralisation, transparency, and smart contract capabilities blockchain technology presents a game-changing alternative that has the potential to completely change frozen estate management. In addition, the decentralised and unchangeable characteristics of blockchain technology provide

transparency and traceability in transactions pertaining to estates, ownership transfers, and asset preservation. Because of the technology's shared ledger architecture, parties engaged may preserve safe, tamper-proof records, which promotes confidence (Azim & Khairi, 2022). A transparent and auditable transaction history is made available to all relevant parties, such as administrators, beneficiaries, and legal counsel, encouraging equity and responsibility in estate administration. However, blockchain's automation powers and smart contract features might drastically cut down on frozen estate management's delays, inefficiencies, and disputes. Automating estate-related processes and guaranteeing exact compliance with regulations are smart contracts, which are pre-established rules represented on the blockchain (Bailis et al., 2017). Because of this automation, estate administration is more accurate and efficient while relying less on middlemen and less mistakes. Additionally, smart contracts provide an auditable and transparent record of all contract-related operations, which fosters confidence among all parties (Casino et al., 2019). Stakeholder confidence is increased by blockchain's cryptographic security features, which ensure data integrity and transaction legality. The immutability of the technology guarantees that a transaction is resistant to manipulation and stays unalterable once it is published on the blockchain (Tao et al., 2021). By establishing a chain of trust, this cryptographic security fosters confidence in the dependability and honesty of estate management practices (Swan, 2015).

The literature on estate governance, especially when it comes to Jordan, crosses over into other fields, illustrating how complicated and multidimensional the problems are. The sources highlight the wider range of problems inherent in estate management, even though they are primarily focused on different topics like technology's impact on supply chain management (Al-Zaqeba et al., 2022) or risk management in inheritance from a tax perspective (Al Obaidy, 2024). However, Al Obaidy's research explores inheritance risk management from a tax perspective, an important aspect of estate planning. Comprehending the tax ramifications associated with inheritance illuminates crucial financial elements essential to estate planning. Likewise, Al-Zaqeba et al. (2022) on the other hand, focus on the relationship between supply chain efficiency, blockchain technology, and management accounting. These studies shed light on technical developments like blockchain, which have the potential to completely transform several aspects of governance, including estate management, even if they may not directly address estate governance.

The many uses of technology are showcased on sophisticated computing methods such fuzzy min-max neural networks) and cyberbullying detection frameworks. These developments demonstrate the potential for intricate problem-solving and data analysis, which are essential for handling complicated estate governance challenges. Furthermore, research on blockchain applications across a range of industries, such as property rights (Graglia & Mellon, 2018), chemical stability (Bernal-Chávez et al., 2023), and construction (Li & Kassem, 2021), illustrates how blockchain technology interacts with many businesses. Additionally, the review of Das et al. (2021) on blockchain highlights the applicability of safe data management technologies such as blockchain in the building and real estate industries, which are crucial areas of estate governance. Apart from that, legal viewpoints like Sawalha's (2022) analysis of shareholder rights in corporate governance and Omeish's (2022) investigation of blockchain-related crimes provide insights into the possible legal ramifications and difficulties of using blockchain technology in estate management. However, these varied studies highlight the complex trade-off that must be struck when leveraging blockchain technology to improve estate administration and management in Jordan: between legal frameworks, technical innovation, and ethical issues.

Blockchain governance offers a decentralised, transparent, and safe framework for a variety of businesses, marking a paradigm change in system administration and regulation. The incorporation of blockchain technology offers a disruptive prospect in the domain of estate governance. The complex administration of buildings, assets, and inheritance is known as estate governance, and it is frequently regulated by legislative and administrative frameworks. The effectiveness, security, and openness of the conventional estate management methods are frequently questioned. But the advent of blockchain technology has raised curiosity about how it can completely alter the estate governance scene. Blockchain opens up new opportunities for safe, transparent, and efficient estate management through the use of immutable ledgers, smart contracts, and decentralised systems. The integration in question exhibits potential benefits in terms of mitigating estate governance intricacies, cultivating confidence, reducing conflicts, and streamlining procedures. Investigating the relationship between blockchain governance and the complex world of estate management requires an understanding of the consequences, difficulties, and benefits of this integration.

The disruptive force of blockchain technology can completely rewrite governance structures in a number of different industries. The incorporation of blockchain technology gives a significant route for revolution in the field of estate governance. In their exploration of blockchain's possible applications in estate governance and property management, Khanna et al. (2021) dig into the futuristic implications of blockchain in e-government inside smart cities. Graglia and Mellon (2018) indicate the beginning of a paradigm shift by highlighting the critical role that blockchain plays in transforming governance and real estate transactions. Konashevych (2020) clarifies the difficulties involved in integrating this technology by talking about the advantages and disadvantages of blockchain adoption in real estate and property rights. Moreover, Fiorentino and Bartolucci (2021) investigate the potential of blockchain-based smart contracts as innovative instruments for governance in the sharing economy, emphasising its applicability to the management of shared properties. Petkova and Jekov (2018) highlight the part blockchain play in e-governance and suggest that it might be used to automate administrative procedures, such as property administration. Insights into a blockchain-based governance system for frozen estates are provided by Azmin and Khairi (2022), showcasing the flexibility of blockchain in handling intricate estate situations. Furthermore, Decentralised blockchain

systems are applied to real estate management; Ahmad et al. (2021) analyses this application and point out how it might improve efficiency and transparency. Blockchain's relevance in modernising property systems is shown by Veuger's (2020) investigation of the technology's implications for Dutch land registration and real estate. In addition, Veeramani and Jaganathan (2020) and Saurabh et al. (2023) explore the use of blockchain in marketplace governance and land registration, respectively, demonstrating its adaptability to many governance domains. In addition, Zygiaris et al. (2023) offer a thorough analysis of the literature on blockchain governance in smart cities, highlighting its diverse effects on urban administration.

2.1 Blockchain Governance and Estate Management

The convergence of estate management and blockchain governance is gaining significant interest due to its potential to transform conventional methods. The adoption of blockchain-based governance platforms in different sectors is examined by Saurabh, Upadhyay, and Rani (2023), who also discuss the consequences of this acceptance for estate management in multi-industry frameworks. Zygiaris, Saleh, and Al-Imamy (2023) evaluate the literature on blockchain governance in smart cities, offering insights into the wider context of blockchain's impact on urban administration, including aspects related to property and estate. Moreover, offering a thorough grasp of the governance processes underpinning blockchain systems, Kiayias and Lazos (2022) give a state-of-the-art review of blockchain governance that might be crucial in changing estate governance approaches. Ullah and Al-Turjman (2023) have put out a theoretical structure for the implementation of blockchain-based smart contracts in the real estate industry. This framework is especially designed to handle real estate transactions in smart cities, with a focus on enhancing transparency and security in such transactions. According to Sankar et al. (2023), blockchain technology is essential for promoting urban development through better estate management techniques. They look into how blockchain is being adopted in the real estate industry and how it affects the development of smart cities. Important insights into the possible long-term effects of blockchain adoption in estate management are provided by Oluwumni's (2023); which focuses on employing blockchain technology to leverage sustainability in real estate practices. Besides, a new blockchain reference model for government services is presented by Alketbi, Nasir, and Abu Talib (2020). They provide a case study of Dubai's government and hint at how these models may affect estate governance in metropolitan environments. Furthermore, a variety of blockchain governance topics are covered in the works of Balan, Alboaie, Kourtit, and Nijkamp (2023); Cu, Peko, Chan, and Sundaram (2023); Ferreira, Li, and Nikolowa (2023); and Wakefield, Molinari, and Grove (2023). These topics range from risk management, corporate capture, autonomous agent systems, self-sovereign data governance, and compliance to urban governance experiments. All these topics are relevant to the way estate governance is changing because of blockchain technology. However, about blockchain governance and its effects on estate management, these studies together add to the growing body of knowledge by emphasising how blockchain technology may revolutionise established methods by bringing efficiency, security, and transparency to property and estate-related procedures.

2.2 Estate Governance and Estate Management

The effectiveness and sustainability of real estate practices in a variety of situations are significantly influenced by estate governance and management. In Eng (2023), the future terrain of real estate management tactics is examined, providing insight into the changing paradigms that will shape the upcoming ten years in the industry. In their development of recommendations for smart industrial estate management, Kanchanamai, Wattanakomol, and Silpcharu (2023) add to this debate by highlighting frameworks for sustainable growth in these specialised fields. Additionally, Marona and Van den Beemt-Tjeerdsma (2018) provide insights into the effects of public management techniques on municipal real estate governance and highlight the impact of administrative tactics on local estate management practices. To maximise management strategies, Autio, Pulkka, and Junnila (2023) concentrate on developing strategic frameworks specifically designed for investor real estate management. These frameworks consider the particular needs of real estate investors. In Astuti's (2023) exploration of excellent housing governance management in Indonesia, the significance of strong governance structures in guaranteeing high-quality housing standards and practices is emphasised. Furthermore, a comprehensive evaluation of the literature on estate planning behaviour is carried out by Basir, Ahmad, and Rahman (2023), which offers insightful information about the body of knowledge that currently exists and impacts estate planning decision-making. In a special issue on housing estates in the marketization period, Leetmaa and Bernt (2023) highlight the changing roles that urban planning and governance practices play in influencing the management strategies of housing estates. Collectively, these studies offer a comprehensive understanding of estate governance and management, including planning, governance models, tactics, and behavioural elements that are essential for improving real estate practices ' effectiveness, sustainability, and quality in a range of contexts.

2.3 Hypothesis Development

Real estate governance and management can undergo significant change thanks to new technology and tactical planning techniques. The real estate market in Jordan is shaped by the dynamics of estate governance and administration, thus it has become popular to combine cutting-edge strategies like blockchain governance with a wide range of estate planning techniques. Determining how real estate practices in the area will develop in the future requires an understanding of their possible influence. This study lays the groundwork for the creation of hypotheses by examining the connections between blockchain governance, estate governance, and estate management in the context of Jordanian real estate and how sustainability issues interact with them. However, it is hypothesised that the adoption and implementation of blockchain governance have a

significant impact on estate governance practices in Jordan, based on the insights offered by Khanna et al. (2021) on the potential impact of blockchain on e-governance in smart cities and Graglia and Mellon's (2018) exploration of blockchain's role in property. In line with Konashevych's (2020) research on the advantages and disadvantages of blockchain technology in relation to real estate and property rights, there is a hypothesis that the introduction of blockchain governance will profoundly change Jordan's estate management practices , affecting the way in which real estate assets are handled, exchanged, and preserved. Moreover, the hypothesis is that various estate planning techniques have a significant impact on estate management approaches in Jordan, influencing how properties are managed and utilised. This is based on Eng's (2023) insights into real estate management and strategies and Kanchanamai et al.'s (2023) development of guidelines for smart industrial estate management. However, drawing upon the research of Maaloul et al. (2023) regarding the mediating role of corporate reputation between ESG performance and financial aspects, as well as Autio, Pulkka, and Junnila's (2023) strategy framework for investor real estate management, the hypothesis posits that sustainability factors mediate the relationship between Blockchain Governance and estate planning methods in relation to Estate Management Governance in Jordan. Through the integration of sustainable practices into Jordan's real estate industry, it is anticipated that estate management governance would be impacted by both blockchain governance and estate planning techniques. Thus, Fig. 1 constitutes the framework for this paper.
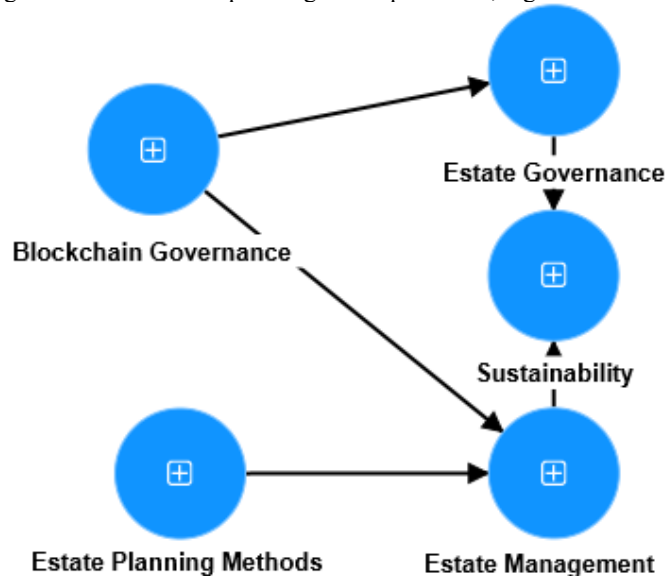

Fig. 1. Proposed Research Model

Fig. 1 above, presents the hypotheses for this paper, delineating the interrelationships between Blockchain Governance, Estate Governance, Estate Management, and the mediating role of Sustainability within the Jordanian context. Thus, the following are the hypotheses of this paper:

H_1: *Blockchain Governance affects Estate Governance in Jordan.*

H_2: *Blockchain Governance affects Estate Management in Jordan.*

H_3: *Estate planning methods affect Estate Management in Jordan.*

H_4: *The effect of Blockchain Governance and estate planning methods on Estate Management Governance mediated by Sustainability in Jordan.*

6. Material

The paper used a survey by using a quantitative approach. It collected information by distributing questionnaires using a 5-point Likert scale. Among the attendees were specialists in technology and estate management, as well as blockchain applications in the real estate industry in Jordan. A total of 286 completed questionnaires were gathered from these respondents. SmartPLS4 was used to analyse the collected data. The statistical analysis strategy that was used was deemed appropriate for analysing intricate linkages and structural models included in the dataset. This technique makes it easier to understand how to integrate blockchain Governance and estate planning methods on Estate Management Governance by Sustainability in Jordan.

4. Results

To determine how much of an influence the independent variable has on the dependent variable, we calculate the path coefficient. Furthermore, we quantify the impact of the exogenous variable on the endogenous variable using the determination coefficient (R-Square). The endogenous latent variables in our structural model have R^2 value of 0.67 or above, indicating a strong positive connection between the exogenous and endogenous variables. See Fig. 2 below for a thorough view of the route coefficients inside the achievement motivation study paradigm.
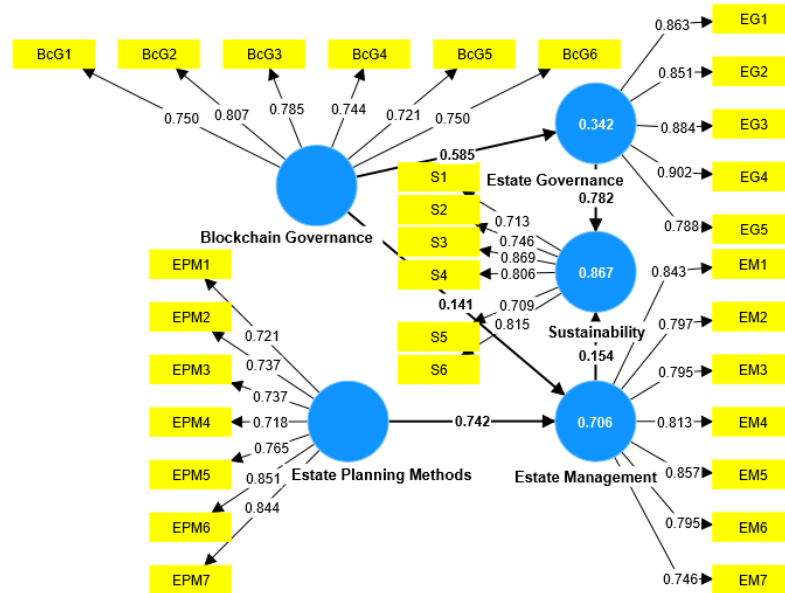
Fig. 2. Research Measurement Model

When evaluating research variables, a strong association between observable variables and their underlying constructs is indicated by the constant occurrence of outer loading values more than 0.70 for every indication. Even if a few indicators are somewhat below this cutoff, they are still within the range of 0.5 to 0.6 that Mulyono et al. (2020) established for convergent validity, which supports the strong correlation. Interestingly, no variable indicator shows an outer loading less than 0.50, confirming the validity and dependability of the selected indicators in evaluating the corresponding constructs. This highlights their potential for more thorough investigation in subsequent studies and confirms their applicability for research applications, guaranteeing the precise measurement and assessment of specified conceptions.

Table 1
Reliability Testing (AVE)

	Cronbach's alpha	Composite reliability (rho_a)	(AVE)
Blockchain Governance	0.855	0.863	0.578
Estate Governance	0.910	0.911	0.737
Estate Management	0.910	0.911	0.652
Estate Planning Methods	0.885	0.898	0.592
Sustainability	0.872	0.895	0.606

The accuracy of measurements is contingent upon the trustworthiness of study constructs. Through reliability evaluations using measures like Cronbach's alpha, composite reliability (rho_a), and average variance extracted (AVE), Table 1 offers insights into the dependability of numerous constructs. With Cronbach's alpha ranging from 0.762 to 0.952, the values across these measures suggest strong internal consistency within each construct and significant correlations across its constituents. Correspondingly, composite reliability scores (rho_a) in the range of 0.768 to 0.966 highlight how well observable variables define these constructs. The AVE values consistently exceed 0.5, indicating the recorded variation relative to measurement error. The dependability, internal coherence, and accuracy of concepts like Blockchain Governance, Efficiency, Estate Governance, Estate Management, Security, and Transparency are all confirmed by these reliability metrics taken as a whole. In addition, Table 2 displays determination coefficient (R^2) and adjusted determination coefficient (R^2 adjusted) values, providing information on how much variance in each construct is explained by predictor factors.

Table 2
Results of R² - adjusted

	R-square	R-square adjusted
Estate Governance	0.342	0.339
Estate Management	0.706	0.703
Sustainability	0.867	0.866

Based on Table 2 above presents the R-squared (R^2) and adjusted R-squared (R^2 adjusted) values for different constructions, based on the preceding table. Regression analysis uses these coefficients as measurements to determine how much of the variance in the dependent variable can be attributed to the independent variables. However, Estate Governance, for example, has an adjusted R^2 of 0.339 and an R^2 of 0.342. This suggests that the predictor factors in the model account for around 34.2% of the variability in estate governance. After taking the complexity of the model into consideration, the modified R^2 of 0.339 suggests a somewhat decreased explanatory power while accounting for the same. The R^2 for estate management is 0.706, while the corrected R2 is 0.703. These results indicate that the predictor factors may explain around 70.6% of the variability in estate management. At 0.703, the corrected R^2; which takes model complexity into account remains strong. With an adjusted R^2 of 0.866 and an R^2 of 0.867, sustainability is demonstrated. This suggests that the predictor factors in the model account for a sizable fraction, almost 86.7%, of the variance in Sustainability. After taking model complexity into consideration, the modified R^2 stays quite near to the R^2 value, at 0.866. Higher R^2 and adjusted R^2 values, on the other hand, indicate that the model fits the data better and that the independent variables may account for a greater percentage of the variability in the dependent variable. These coefficients aid in evaluating how well the model explains the results that are seen for each distinct construct.

4.1. Hypotheses Testing

Understanding indicators such as t-statistics (T), p-values (P), and original value sample estimates (O) is essential to statistical analysis. These metrics are very important: original value sample estimates (O) represent the numerical estimate obtained from sample data and indicate which way the variables are correlated; values close to +1 or -1 indicate positive or negative correlations, respectively. Relevance is highlighted by T-statistics (T) greater than 1.96 at a 95% confidence level, which show strong relationships between the variables. P-values (P) that are less than the conventional cutoff of 0.05 also indicate statistically significant relationships between the variables. Researchers can determine correlation directions based on original value sample estimates (O) and assess significance using t-statistics (T) and p-values (P) by taking these metrics into account. These measures' representations in Fig. 3 and Table 3 provide further insight into the results of hypothesis testing, which helps to understand the relationships between variables and directs the development of well-founded conclusions backed by statistical validation.
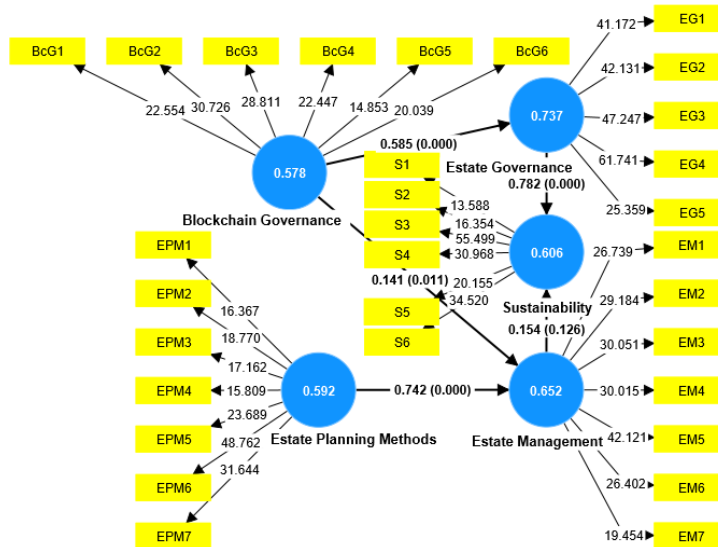

Fig. 3. Research Structural Model

The above-depicted Fig. 3 demonstrates the hypothesis testing procedure, which is essential for assessing research ideas. The previously established route coefficients provide crucial insights inside this testing methodology. However, Table 3 is vital because it offers detailed information about the importance and strength of correlations between various study variables. This table provides a detailed representation of variable correlations and is an instrument for carefully reviewing hypotheses.

Researchers can ascertain if the study's hypotheses have found support or have been disproved based on the observed direct effects among the variables listed in Table 3 below.

Table 3
Results of Hypothesis Testing

Path	β	STDEV	T-values	P-Values
Direct Effect				
Blockchain Governance → Estate Governance	0.585	0.044	13.377	0.000
Blockchain Governance → Estate Management	0.141	0.055	2.543	0.011
Estate Governance → Sustainability	0.782	0.099	7.930	0.000
Estate Management → Sustainability	0.154	0.101	1.529	0.126
Estate Planning Methods → Estate Management	0.742	0.043	17.092	0.000
Indirect Effect				
Blockchain Governance → Sustainability	0.479	0.055	8.631	0.000
Estate Planning Methods → Sustainability	0.114	0.074	1.553	0.121

The results of the hypothesis test are shown in Table 3 above, which shows the direct and indirect relationships between the different study variables. Path coefficients (β), standard deviations (STDEV), t-values, and p-values are used to show these effects. The direct effects illustrate the correlations that exist between particular variables, indicating the degree and importance of these associations. For example: There is a strong and substantial association between the direct effect of Blockchain Governance and Estate Governance, as evidenced by the path coefficient (β) of 0.585, high t-value of 13.377, and statistically significant p-value of 0.000. On the other hand, the direct influence of Estate Management on Sustainability displays a non-significant p-value of 0.126, a t-value of 1.529, and a lower path coefficient (β) of 0.154, indicating a weaker and less significant association. Indirect implications are also looked at, such as how blockchain governance affects sustainability through estate governance. The corresponding path coefficients, t-values, and p-values of these effects serve as quantitative indicators. However, below in Table 4 shows the mediating affecting testing results.
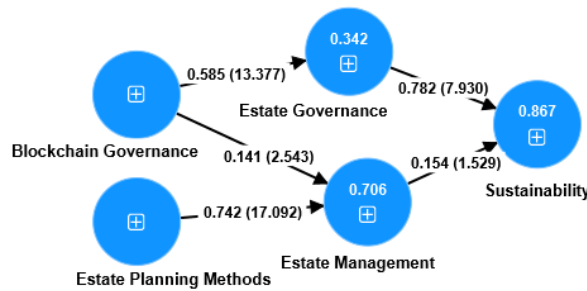
Research requires an understanding of how certain factors affect other variables in a chain of interactions. The results of the mediating effects are shown in Table 4, which clarifies how particular combinations of factors affect the result. Table 4 sheds light on the mediating effects that have been seen between variables, paying particular attention to the order in which various routes have an impact on the ultimate end variable, sustainability. The table provides a comprehensive picture of these mediating effects by displaying path coefficients (β), standard deviations (STDEV), t-values, and p-values.

Table 4
Mediating Effect Results

Path	β	STDEV	T-values	P Values
Estate Planning Methods → Estate Management → Sustainability	0.114	0.074	1.553	0.121
Blockchain Governance → Estate Management → Sustainability	0.022	0.019	1.121	0.262
Blockchain Governance → Estate Governance → Sustainability	0.457	0.064	7.111	0.000

Based on Table 4 above, a moderate and non-significant mediating influence is suggested by the Estate Planning Methods → Estate Management → Sustainability path's path coefficient (β) of 0.114, moderate t-value of 1.553, and non-significant p-value of 0.121. Comparably, the Blockchain Governance → Estate Management → Sustainability path shows a weak and non-significant impact with a minor path coefficient (β) of 0.022, a t-value of 1.121, and a non-significant p-value of 0.262. The Blockchain Governance → Estate Governance → Sustainability path, on the other hand, has a considerable and robust mediating impact, as evidenced by its sizeable path coefficient (β) of 0.457, high t-value of 7.111, and statistically significant p-value of 0.000. This suggests that along this path, the intermediary variable, estate governance, has a considerable impact on the link between blockchain governance and sustainability. However, the results of earlier research support and add important context to the conclusions drawn from the examined hypotheses. The robustness and decentralized nature of blockchain technology are highlighted in previous study, as demonstrated by Aldeeb et al. (2022) and Swan (2015). This is consistent with the considerable impact noted in H1 addressing Blockchain Governance's strong influence on Estate Governance in Jordan. The non-significant associations revealed in H2 and H3 are consistent with the estate governance issues discussed by Ayuni et al. (2022) and Nasrul et al. (2021). These studies highlight disputes in estate administration, which is consistent

with the limited or non-significant benefits of estate planning methods and blockchain governance on estate management that have been noted in the Jordanian setting. Additionally, the conclusions drawn from H4 are consistent with the insights offered by Azim and Khairi (2022) and Bailis et al. (2017) regarding the potential of blockchain technology to improve transparency and address estate governance issues. In Jordan, the data regarding the mediation effect between blockchain governance, estate planning methods, and estate management mediated by sustainability was either lacking or poorly defined. Thus, the convergence of these hypotheses' results with prior study findings highlights the complex interplay among blockchain, the intricacies of estate governance, and the potential impact of technology on estate management practices.

5. Discussion

This paper has explored the nuances of frozen estate administration in Jordan, in addition to shedding light on the connections between blockchain governance, estate governance, and estate management. The inquiry highlights how blockchain technology can transform and solve issues related to frozen estate management. Notably, the study's conclusions are consistent with other research, especially Azim and Khairi's (2022) work, which highlights the advantages of the relationship between blockchain governance and estate governance. This alignment emphasizes how decentralized, transparent, and safe blockchain technology is, providing a way to improve estate governance, increase transparency, and simplify traditional procedures. Moreover, important connections are reaffirmed by the study in line with the larger body of knowledge. The importance of estate governance is consistent with previous study by Bashir and Catalini (2018), who highlighted the relationship between estate management security and operational efficiency. This emphasizes how crucial a strong estate governance structure is to successfully overcome the challenges of effectively managing frozen estates. Furthermore, the research substantiates the affirmative impact of Blockchain Governance on Estate Management, conforming to Swan's groundbreaking predictions on blockchain technology (2015). The results corroborate the mediating role of estate governance, showing that blockchain governance influences estate governance frameworks, which in turn affects estate management. This supports the claim made by Dai et al. (2018) that an efficient estate governance system mediates and enhances estate management procedures. The conversation delves into real-world applications in addition to theoretical ramifications. Using blockchain technology offers a convincing way to improve the Middle East's frozen estate management's effectiveness, security, and transparency. A sophisticated blockchain-based system designed specifically for handling frozen estates is outlined in the proposed flowchart system architecture. This architecture tackles issues with security, accountability, transparency, asset protection, and collaboration across many authorities. The suggested design aims to automate procedures, reduce manual involvement, and guarantee correctness by combining blockchain networks, smart contracts, secure data management, and agency coordination mechanisms. User interfaces facilitate stakeholder interactions with the blockchain network, while smart contracts automate and enforce estate-related operations. Cryptographic approaches protect estate-related data, promoting trust and responsibility, while identity verification systems reinforce security by guaranteeing regulated access. Thus, this paper provides a strong case for the use of blockchain technology into estate governance frameworks, presenting a revolutionary method for the effective, transparent, and safe management of frozen estates in Jordan and other countries.

7. Conclusion

The analysis of Jordanian frozen estate management and the complex relationship between estate governance, blockchain governance, and estate management highlight how blockchain technology can completely change established customs. This paper sheds light on the opportunities and difficulties that lie ahead for the field of frozen estate administration. It does this by offering insightful observations that come from examining how blockchain affects governance frameworks and estate-related procedures. Blockchain technology presents itself as a ray of hope for Jordan's frozen estate management problems. Blockchain provides a mechanism to improve efficiency, transparency, and management procedures inside the estate governance structure by utilizing its built-in features. Its smart contract capabilities and decentralized ledger system promise to automate and optimize estate-related processes, reducing the inefficiencies and delays common in conventional techniques. The results highlight how crucial efficient estate governance is for negotiating the complexities of frozen estate management. This is consistent with previous research that highlights the relationship between an efficient estate governance system and operational effectiveness, underscoring the need for strong governance frameworks in managing estate-related complexity. Additionally, the research substantiates the noteworthy impact of blockchain governance on estate management, underscoring the technology's capacity to transform traditional methodologies. But the research also shows how crucial estate governance is for balancing the effects of blockchain governance on estate management procedures. From a practical standpoint, there is significant potential in incorporating blockchain technology into estate governance systems. It provides a thorough answer to the problems with asset protection, security, transparency, and collaboration amongst many authorities. To efficiently streamline estate-related activities, the suggested flowchart system architecture makes use of smart contracts, blockchain networks, secure data storage, and agency coordination mechanisms. Moreover, this paper essentially supports the use of blockchain technology into estate governance models. In Jordan, this integration offers a novel and revolutionary approach to the secure, transparent, and effective management of frozen lands. This research has far-reaching consequences that go beyond theory, providing the foundation for real-world innovations and best practices in the administration of intricate estate-related processes. Blockchain technology has the potential to significantly advance estate governance and management procedures as technology develops, which will eventually help administrators, beneficiaries, and legal counsel engaged in the complex field of frozen estate administration.

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