SCIENTIFIC CULTURE
www.sci-cult.com

SCIENTIFIC CULTURE, Vol. 12, No, 2.1, (2026), pp. 4339-4354
Open Access. Online & Print

DOI: 10.5281/zenodo.19009107

EXPLORING THE COMPLEMENTARY ROLE OF GENERATIVE AI AND BLOCKCHAIN IN THE EVOLUTION OF ISLAMIC BANKING TRANSACTIONS: CHALLENGES AND STRATEGIC SOLUTIONS

Saba Mohammad Al-Bool[1*]

[1]Full-time Lecturer, Department of Fiqh and Usul, Faculty of Sharia and Islamic Studies, Yarmouk University, Irbid, Jordan.
saba.albool@yu.edu.jo, https://orcid.org/0009-0005-0543-5331

Received: 09/01/2026
Accepted: 09/03/2026

Corresponding Author: Saba Mohammad Mostafa Al-Bool (saba.albool@yu.edu.jo)

ABSTRACT

This study aims to define generative artificial intelligence and Blockchain technology, explain their mechanisms, and explore their applications in the Islamic banking sector along Murabaha, with the challenges they face. The study adopts descriptive, inductive, and analytical methodologies. The findings reveal that the integration between Blockchain technology and generative AI—which is capable of prediction and precise data analysis—enables the provision of customized financial products. For instance, these technologies can assist banks in creating credit cards tailored directly to consumers' priorities, transforming existing bank cards into smart ones. This allows bank management to identify customers' interests and subsequently design cards specifically suited to everyone's spending and shopping habits. The study recommends training banking sector employees on modern technologies and building public trust in emerging technologies through courses, workshops, and scientific seminars introducing these innovations, And its application in Islamic financing formulas, especially Murabaha.

KEYWORDS: Generative Artificial Intelligence, Blockchain, Banking Sector, Financial transactions, Murabaha

1. INTRODUCTION

The economy forms the backbone of nations, requiring the integration of the latest technological innovations to keep pace with modern developments, enhance efficiency, and raise economic performance to compete with advanced economies (Xia et al., 2024). Today, progress is measured by how effectively technology is implemented and developed in economic systems, especially in the banking sector. The banking sector plays a vital role in economic growth by providing financing for companies and individuals and offering diverse financial services. Thus, it must adopt modern technologies and stay abreast of global advancements.

The world is currently witnessing a new industrial revolution marked by the rise of technologies such as artificial intelligence and blockchain (Rashid & Kausik, 2024). Though not entirely new, their rapid advancement and wide-ranging applications have made them leading technologies in the financial world.

It appears that digital transformation in the banking sector will accelerate significantly over the next five years, driven by developments in generative AI and blockchain (Forrester, 2025). The combination of the latest AI generation and blockchain innovations will lead to a complete restructuring of the global financial infrastructure. Hence, the researcher finds it necessary to examine the integrative role of generative AI and blockchain in developing the Islamic banking sector and the challenges that accompany it.

Although artificial intelligence—particularly generative AI—is among the most advanced and widely discussed modern technologies, and many consider it a key driver of future global operations across sectors, including Islamic banking, integrating generative AI and blockchain could reshape the entire global financial infrastructure, not just the banking sector. Therefore, this study seeks to answer the main question: What is the integrative role of generative AI and blockchain technology in developing the Islamic banking sector, and what challenges does it face? From this central question arises the following sub-questions: What are the concepts of generative AI and blockchain technology? How do generative AI and blockchain operate? How can these technologies be integrated in the banking sector, and what challenges accompany such integration?

And The importance of this research lies in the following points:

1. Providing a useful reference for researchers and professionals in the banking sector to help them apply modern technologies in future studies and practical development.
2. Highlighting generative AI and blockchain as key financial technology innovations that require further exploration of their applications in banking.
3. Building customer trust in the modernization of the banking sector through the adoption of efficient, fast, and cost-effective digital systems.

The scope of the study is Murabaha sale to the purchaser.

2. PREVIOUS STUDIES

After thorough investigation, the researcher found no previous study focusing on the integrative role of generative artificial intelligence and blockchain technology in developing the banking sector. The novel contribution of this study lies in its comprehensive analysis of how these two technologies, when combined, can transform banking operations, enhance security and transparency, and address sector-specific challenges. This research moves beyond summarizing existing views by proposing a conceptual framework for the synergistic implementation of AI and blockchain in banking, detailing practical applications, and identifying unique challenges and opportunities arising from their integration. However, a few articles and studies addressed generative AI in other contexts, including:

Al-Mursi (2024) studied using generative artificial intelligence tools to improve the skills of producing children's stories in early childhood. The study aimed to identify standards for producing children's stories using generative AI tools suitable for kindergarten teachers to enhance their storytelling performance.

Thabet (2024) studied accredited evaluation and completeness of generative artificial intelligence chatbots' responses in commercial websites comparing between Google Bard and ChatGPT. The study examined the accuracy and completeness of AI Chatbots responses in the field of library and information science by assessing how well these tools respond within that domain.

Al-Ghatrifi (2023) discussed the professional use of generative AI in journalism, highlighting both the potential risks and the opportunities for responsible utilization of this technology in the media sector.

Rania and Khalid (2023) explored the effect of AI and blockchain networks in enhancing the value of digital banking transactions, particularly in relation

to cryptocurrencies such as Bitcoin and Ethereum, through a review of literature on AI, blockchain, and digital currencies.

The present study aligns with previous research in outlining the theoretical framework of certain aspects of generative AI and blockchain technology. However, its novel contribution is the explicit articulation of a framework for integrating AI and blockchain in banking, offering original insights into how their convergence can drive innovation, improve operational efficiency, and mitigate risks specific to the banking industry. This study uniquely provides actionable recommendations for financial institutions seeking to leverage the combined strengths of these technologies.

3. METHODOLOGY

This study adopted a multi-method approach to ensure a comprehensive understanding and robust findings.

First, the descriptive method was used to provide a theoretical overview of generative AI and blockchain technology, synthesizing definitions and fundamental concepts from existing literature. Next, the inductive method was applied by systematically reviewing and extracting key insights from contemporary scientific books and research articles relevant to these technologies. This process involved identifying patterns and trends in current applications and theoretical discussions.

Finally, the analytical method was employed in a step-by-step manner: (1) examining specific case studies and documented applications of generative AI integrated with blockchain in the banking sector; (2) analyzing the processes and outcomes of these integrations; and (3) evaluating the challenges and limitations reported in the literature. These analytical steps enabled the study to draw nuanced conclusions about the real-world implementation and associated challenges, thus directly aligning the methodology with the research outcomes.

3.1. The Concept of Generative Artificial Intelligence and Blockchain Technology

The world today is witnessing a new technological industrial revolution, with rapid advancements in modern technologies such as artificial intelligence and blockchain. While traditional AI focuses on analyzing and utilizing existing data, generative AI goes beyond by producing entirely new content that appears to be human made. This concept will be clarified in the following sections:

3.2. The Concept of Generative Artificial Intelligence

Generative AI represents a key stage in the evolution of artificial intelligence—it is a new form that has been defined in multiple ways, including:

- A form of machine learning in which AI platforms generate new outputs in response to commands based on the data they were trained on (International Monetary Fund, 2023).
- A type of artificial intelligence capable of generating and creating text, images, and programming code; it learns how to construct new information from existing data and produces entirely new content rather than merely classifying or identifying it like traditional AI (Al-Ghatrifi, 2023).
- A field of AI focused on automatically creating new and innovative content instead of just analyzing existing data; it can produce various types of outputs—texts, images, sounds, code, and more—that appear as if created by humans (Al-Khalifa, 2023).
- A machine learning model capable of generating new examples like training data.
- A subfield of deep learning that uses deep neural network techniques to simulate human ability in creating new, original, and innovative data or content.
- A form of artificial intelligence technology capable of generating diverse content such as text, images, audio, and synthetic data.
- Thus, generative artificial intelligence is a more advanced form of AI that produces various types of innovative content (UAE Ministry of AI, 2023; SDAIA, 2023).

3.2. The Concept of Blockchain Technology

Blockchain technology has been defined in many ways, as it is a newly developed innovation driven by the demands of technological progress. Some definitions include:

1. Blockchain is defined as "a distributed database of records," or a public ledger of digital transactions or events that have been executed and shared among participating parties. Each transaction in the public ledger is verified through the consensus of most participants in the system, and once the information is entered, it can never be deleted" (Crosby et al., 2016, p. 8).
2. According to Wikipedia ("Blockchain," n.d.), "Blockchain, or the chain of blocks, is a distributed database distinguished by its

ability to manage an ever-growing list of records called blocks. Each block contains a timestamp and a link to the previous block. It is designed to maintain the stored data and prevent modification, meaning that once information is stored in the blockchain, it cannot later be altered."

3. Garrick and Michel emphasized distinguishing blockchain from other systems, defining it as "a new type of distributed ledger consisting of a chain of cryptographically linked blocks containing grouped transactions, with data published to all participants in the network" (Hileman & Rauchs, 2017, p. 11).
4. Marcella Atzori considered Blockchain's main innovation to be that transactions between parties no longer require trust—they are automatically recorded. The logic behind this protocol is decentralized or mathematical trust. She defined the technology as "a database containing all transactions executed within a peer-to-peer network" (Atzori, 2017, p. 45).

In summary, blockchain technology is a special type of decentralized database that serves as a public ledger for transactions executed among participating members (Al-Bool, 2022). It consists of a series of cryptographically linked blocks, and transactions are verified through the consensus of most participants.

Mechanism of Generative Artificial Intelligence and Blockchain Technology

Generative artificial intelligence represents one of the most advanced and widespread AI technologies. It is a type of machine learning capable of creating new data—such as images, texts, and audio clips—based on human training of these systems (UAE Ministry of AI, 2023). When these technologies are interconnected, their effectiveness increases. The mechanism of operation of generative AI and blockchain can be explained as follows:

Mechanism of Generative Artificial Intelligence

Generative AI includes numerous tools and technologies that operate together. Generally, its mechanism works as follows:

Generative AI models rely on deep learning techniques, using neural networks and various architectures to create new data based on existing training datasets (SDAIA, 2023). The process involves several fundamental steps: data preparation, model construction, model testing, deployment, and optimization (SDAIA, 2023; SAP, n.d.).

- Data Preparation: Identify the type of data to be generated and collect a large dataset of the same type for training. For example, if the goal is to generate poetic texts, a wide range of poems must be gathered to help the model learn different styles and poetic patterns. The data is then cleaned and formatted appropriately, such as dividing texts into smaller units (sentences or words) and converting them into numerical representations (SDAIA, 2023).
- Model Construction: The structure and architecture are chosen based on the data type and application area. Deep learning algorithms such as Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), or Transformers are used. The training data is applied to teach the model, and hyperparameters are fine-tuned to improve performance until the desired results are achieved.
- Model Testing: Testing data are used to evaluate the model's performance, determining its efficiency in generating content like the target material, as well as the accuracy and consistency of its results. Weaknesses such as bias or security vulnerabilities are identified. Evaluation strategies like Human Reinforcement Learning Feedback can also be applied, where reviewers' feedback on the model's performance is collected and analyzed to correct errors and improve output quality (SDAIA, 2023).
- Model Deployment: The model is prepared for use in the operational environment. This includes converting it into a format suitable for deployment in production, ensuring its integration with the organization's other systems, and continuously monitoring and adjusting its performance to maintain desired outcomes while ensuring compliance with security and protection standards (SDAIA, 2023).
- Model Optimization: After deployment, the model's performance is continuously evaluated and improved through user feedback, comparing results with expected outcomes, identifying weaknesses, and determining areas for enhancement. The model can be refined by retraining it, modifying its architecture, or applying new algorithms (SDAIA, 2023; SAP, n.d.).

4. MECHANISM OF BLOCKCHAIN OPERATION

Blockchain technology facilitates accurate and fast transactions financially and otherwise. It serves as a

public ledger of transactions executed among participating members, consisting of a series of cryptographically linked blocks verified through majority consensus (Issa, 2019). Blockchain follows a specific mechanism to add transactions while ensuring data security. The process unfolds as follows:

Step 1: A member of the blockchain network requests to add a new transaction or data to the network using their digital signature. The transaction is digitally signed with their private key, which is known only to them. Each member also has a public key, their identifiable address on the blockchain network—known to all participants. The public key is mathematically linked to the private key and is used to verify the authenticity of the sender's digital signature. Thus, the sender's identity is confirmed. For example, if someone wants to transfer Bitcoin to another person, they must first digitally sign the transaction using their private key (Crosby et al., 2016; World Bank, 2017; Houben & Snyers, 2018).

Step 2: Once digital signatures are verified, the transaction request is broadcast to network members via the peer-to-peer (P2P) network. Each member has a copy of the Blockchain's recorded data and can interact directly with any other member without central authority. This makes blockchain a decentralized network. Each participant's computer acts as a node, and the blockchain network consists of interconnected nodes communicating through the P2P system (Herweijer et al., 2018; Bryson et al., 2018).

Step 3: The nodes that make up the blockchain network verify the validity of the transaction or data being added through consensus mechanisms. These ensure that all nodes agree on every decision related to the Blockchain's state to prevent system failure, particularly concerning new transactions or data additions (Lewis et al., n.d.).

Step 4: Once the nodes verify the data or transactions to be added, these verified records are grouped together and stored in a block—the Blockchain's basic unit of data storage. The information stored may include medical, real estate, contractual, or cryptocurrency data intended for secure preservation within the blockchain, functioning as a public ledger for all recorded data (Heutger & Kückelhaus, 2018).

Step Five: The block is added to the existing blockchain and becomes immutable through encryption using the hashing mechanism. Each block includes the hash of the previous block, which is what links all blocks in the blockchain together. If the content of any block changes, its hash changes immediately. Each block also contains a timestamp indicating when it was added to the chain, making all blocks interconnected and chronologically ordered. The very first block in the chain is called the genesis block, and it does not contain a hash from a previous block. Once a block is added to the blockchain, the data or transactions it contains are officially recorded on the network (Boucher et al., 2018; Nwachukwu, 2019; Yaga et al., 2018).

Thus, the process of adding transactions to the blockchain is completed. The blockchain functions like a ledger where all transactions are recorded and executed through computers. However, humans still play a crucial role, as they control these computers and initiate blockchain transactions. Despite the automation, blockchain operations still begin with a human action the individual initiating a transaction.

4.1. Integrating Generative Artificial Intelligence and Blockchain into the Banking Sector and the Challenges They Face

Modern technological innovations are expected to bring a qualitative leap to banking operations and services by enhancing efficiency and execution processes. This will be explained through the following points:

4.2. Integrating Generative AI and Blockchain Applications in the Banking Sector

Generative AI tools are transforming the banking services industry. For instance, the online payment platform Stripe recently announced the integration of generative AI technology into its products (Aisera, n.d.).

Both generative AI and blockchain technology are used in various areas of the banking sector, including:

Risk Management: AI can be employed to identify and monitor risks, as well as to develop and implement risk management strategies (Shaip, 2023). Blockchain, on the other hand, is one of the most powerful innovations in information and financial technology, capable of minimizing — if not eliminating — risks. This is due to its decentralized information distribution, which ensures complete credibility, security, and transparency — qualities often lacking in centralized networks. In blockchain, millions of users participate in every transaction (known as an open ledger), making data manipulation impossible because all participants act as witnesses and sources of trust among contracting parties (Khomeini, 2021).

When the capabilities of generative AI and blockchain are combined for risk management in the

banking sector, they are expected to bring about a massive revolution within the next three to five years (Agarwal et al., 2024). These technologies will enable banks to move away from routine operations toward direct collaboration with business units to implement proactive and effective risk prevention measures early in the customer interaction process — a practice known as the "Shift Left" approach (Agarwal et al., 2024).

This transformation allows risk specialists to focus more on providing strategic business advice, whether in product development or major decision-making. It also helps identify and analyze emerging risk trends, strengthen banks' adaptability, and promote proactive improvement of operations and risk controls (Agarwal et al., 2024).

Moreover, advances in AI — particularly in generative AI — could lead to the creation of specialized "risk intelligence centers" that heavily rely on these technologies. Such centers would support all levels of institutional protection, including commercial, operational, compliance, and auditing functions. They would offer significant benefits such as automated reporting, greater risk transparency, enhanced decision-making efficiency, and partial automation of policy and procedure updates in line with evolving regulatory requirements (Agarwal et al., 2024).

For example, McKinsey has developed a virtual expert powered by generative artificial intelligence capable of providing customized answers based on the company's exclusive information and resources (Agarwal et al., 2024). This opens the door for banks to develop similar tools that analyze financial transactions with other banks, detect warning signals, monitor market news, evaluate asset price changes, and more—helping make more accurate risk-related decisions. Generative AI and blockchain technologies provide advanced solutions in the areas of risk and compliance through three main models: First, the virtual expert, where users can ask questions and receive concise answers drawn from long documents and unstructured data. Second, automation of manual processes, which saves time by performing complex and time-consuming tasks. Third, programming acceleration, in which old code is updated and translated, or entirely new code is written. These models effectively support and enhance risk and compliance functions, making them essential to strengthening risk management and compliance strategies within institutions (Agarwal et al., 2024).

Generative AI offers highly efficient, advanced solutions—it can generate detailed reports on suspicious activities through precise analysis of customer and transaction data. Moreover, it automates and updates customer risk assessments by monitoring changes in "Know Your Customer" (KYC) information. This approach improves the accuracy and effectiveness of transaction monitoring by generating and refining the necessary code to detect suspicious activities and analyze transactions efficiently. Consequently, it enhances financial security and reduces financial crimes. Blockchain complements this system through its immutability— if any transaction is altered, the change is immediately detected, leaving no room for manipulation or fraud (Agarwal et al., 2024).

Secondly, the capabilities of generative AI and blockchain are bringing about a fundamental transformation across all aspects of the financial sector (Rodriguez, 2024). Through advanced algorithms and machine learning methods, AI enables financial institutions to analyze complex data, detect fraud patterns, and improve strategic decision-making. Its role in algorithmic trading, risk management, and customer service is particularly crucial. These technologies contribute to greater operational efficiency, cost reduction, and improved customer experience through personalized financial services (Rodriguez, 2024).

Among the most influential applications of AI in the financial sector is fraud detection and prevention. AI systems can analyze vast amounts of transactional data in real time, accurately identifying anomalies and potential fraud far better than traditional methods. This helps protect customers and reinforces trust and institutional security (Rodriguez, 2024).

Third, these advanced technologies enable the generation of accurate financial reports, sophisticated predictive models, and specialized investment strategies, thereby enhancing strategic decision-making and achieving better financial outcomes (Rodriguez, 2024).

In customer service, generative AI provides innovative solutions through chatbots and advanced virtual assistants, which handle numerous customer inquiries and transactions efficiently improving customer experience and satisfaction (Rodriguez, 2024).

Fourth, enhancing banking services and operations: generative AI plays a central role in shaping financial services by enabling predictive analytics for risk management, strengthening credit scoring systems, and offering personalized financial advice (Aisera, n.d.). Integrating generative AI with existing banking systems simplifies processes, reduces costs, and improves decision-making. As

banks continue to adopt and refine these technologies, they will be better equipped to meet evolving customer needs and maintain a competitive advantage in the financial industry.

Fifth, combining human expertise with the power of generative AI and modern technologies provides consumers with more comprehensive and personalized financial plans. By training generative AI on clients' financial goals, risk profiles, income levels, and spending habits, institutions can deliver tailored recommendations on budgeting and saving (Aisera, n.d.).

The same applies to investment: generative AI can provide suggestions based on clients' financial goals, income, and time horizons. For financial planners, this can lead to smarter investment decisions, wealth management, and trading through blockchain-based platforms (Aisera, n.d.).

Sixth, banks are known for handling massive volumes of paper documents, but manual sorting, analysis, signing of documents, and various financial applications can be time-consuming and costly. To reduce operational costs, banks can use AI models to scan large volumes of documents to identify or summarize important data for review or create records on blockchain networks containing all information and documents—reducing costs, saving time, effort, and money in accessing this information (Aisera, n.d.).

Seventh, blockchain technology will lead to a digital economy whose economic transactions and banking operations feature:

- Greater transparency in digital economic transactions and banking operations: Every member of a blockchain network can access all information related to transactions conducted via the blockchain, making it highly trusted by customers. This level of transparency is absent in private companies or the traditional financial system, where no central authority provides universal access to information, making transactions difficult to alter or delete once entered the blockchain (Ibrahim, 2018; Troupia, n.d.).
- Enhanced security in economic transactions and banking operations: Once data is recorded on the blockchain, it becomes immutable. When data is added to a block and then appended to the chain, it cannot be altered because it is encrypted using a hash function. Any attempt to modify a block's data will change its hash, which will appear in all subsequent blocks. Altering the data would require changing all subsequent blocks, which is impossible in a distributed blockchain database. Blockchain thus provides a high degree of security and confidentiality, enabling safe exchange of financial assets such as money, stocks, and other holdings (Politou et al., 2019; Berryhill et al., 2018; Troupia, n.d.).
- Reduced cost, time, and effort in banking operations and economic transactions: Compared to traditional, time-consuming processes, banks are increasingly leveraging AI, blockchain, and smart applications to facilitate and accelerate various banking operations. Customers prefer digital services, aiming to enhance service quality and increase adoption. Studies show that 80% of customers prefer conducting transactions via the internet and mobile apps, which boosts operational efficiency for Islamic banks (Al-Qaisi & Al-Bawab, 2021; Shihadeh & Al-Atoum, 2021).
- Chronologically sequenced banking operations and economic transactions: Blockchain consists of a series of chronologically ordered blocks. Each block contains a timestamp indicating when it was added to the chain. These timestamps are encrypted, ensuring that blockchain blocks are time-linked, with each block representing a completed transaction before being appended to subsequent blocks (Sorrell & Donegan, n.d.).
- Automated, intelligent banking operations and economic transactions: Smart contracts, a key blockchain application, execute automatically based on predefined conditions agreed upon by users. Once these conditions are met, the contract is carried out automatically. Ethereum is one of the most well-known platforms for smart contracts, with other blockchain-based platforms such as NEM, NEO, and Cardano also enabling automatic execution of smart contracts (Makridakis & Christodoulou, 2019).

Blockchain technology helps reduce banks' operational costs by minimizing waiting lines in banking halls, reducing paperwork and documentation, and maintaining fewer branches. According to estimates by the global consulting firm McKinsey, the costs borne by financial service providers could decrease by 80% to 90% through offering digital services to customers compared to traditional branch-based banking (Shihadeh & Al-Atoum, 2021). Blockchain also significantly reduces the circulation of counterfeit or fraudulent money.

Bokthir noted that using modern banking tools and technologies is among the most important

methods banks employ to differentiate themselves from competitors, with blockchain technology being one of the best tools used in banking to evaluate and compare services (Boukathir, 2019).

From the above, it can be concluded that integrating modern technologies such as AI and blockchain will transform the banking industry in how transactions are conducted, leading to automated banking operations and services that save time, effort, and money while ensuring speed and accuracy.

Banking consultant Bahij Al-Khatib told Sky News Arabia — Economy: "The future of global finance belongs to blockchain and generative AI. The integration of these two technologies will change the way the banking industry operates as we know it. Banks and financial institutions will need to implement certain necessary changes to their business models and expand their investments in these technologies to enhance competitiveness and keep pace with market trends" (Sky News Arabia, 2023).

At the heart of the modern technological revolution stands generative AI, which, although in its early stages according to many experts, has quickly established itself as a leading force in reshaping the financial services sector. Forty-three percent of global financial sector experts reported that their institutions have already started leveraging this technology. Even more significant, 67% of financial executives worldwide expect to increase their investments in generative AI technology, allocating future budgets for it. This investment is expected to generate a massive economic impact, with estimates suggesting that generative AI could add between $200 billion and $340 billion in value to the global banking sector, representing a golden opportunity for ambitious business leaders to redefine the financial landscape (Al-Dandashi, 2024).

Generative AI, with its enormous capabilities, opens doors to a promising revolution in financial services. Specifically, soon, we will see innovations offering highly personalized insurance policies tailored to individual user needs, along with financial news reports customized to users' preferences. This will be facilitated by intelligent virtual assistants, which do not merely provide information but also help users make decisions that reduce risks and maximize value. This marks the dawn of a new data-driven era in finance, designed to meet the needs of everyone, with generative AI as a key catalyst for achieving a future of efficiency, inclusivity, and security (Al-Dandashi, 2024).

The integration of blockchain and generative AI, capable of precise data prediction and analysis, allows for personalized financial products. For example, this technology could help banks create credit cards targeted to individual consumer priorities, turning existing cards into smart cards. This enables banks to understand customers' interests and later offer cards customized to everyone's spending and shopping habits (Sky News Arabia, 2023).

Farid Khalil noted that blockchain and AI can work together at multiple points—for instance, AI can analyze the large datasets stored in blockchain to provide fast, powerful, and reliable analytics, while blockchain preserves AI data integrity. Integrating blockchain and AI can lead to new financial solutions, such as the creation of crypto banks and decentralized financial services that rely on blockchain networks while benefiting from AI's power (Sky News Arabia, 2023).

Challenges faced:

Despite the development of modern technological tools such as generative AI and blockchain in the banking sector across various transactions, this advancement faces several challenges, including:

- AI Bias: This refers to the tendency of machine learning algorithms to replicate and amplify pre-existing biases in training datasets, which can lead to unfair or unethical outcomes, significantly affecting marginalized communities—for example, biased hiring practices, loan approvals, and unequal criminal sentencing (Argaam, 2024). Generative AI tends to reproduce biases present in its training data rather than mitigating them, often magnifying or perpetuating them, raising questions about the accuracy of its applications and potentially causing broader ethical issues (Argaam, 2023).

Mitigation: This challenge can be addressed by reducing AI bias through careful data selection, preprocessing techniques, and algorithm design to minimize bias and promote fairness. Continuous monitoring and evaluation of AI systems also help identify and correct bias.

- Ethical Issues: AI ethics involves discussions around privacy violations, perpetuation of bias, and social impact (Argaam, 2024).

Mitigation: These issues can be managed by adopting a focused approach when implementing AI in sensitive areas like healthcare and criminal justice, ensuring ethical principles are applied to achieve fair outcomes. Balancing technological advancement with ethical considerations is crucial for socially beneficial AI use while minimizing risks and encouraging ethical innovation.

- AI Integration: This involves incorporating

AI systems into production and services to enhance automation and efficiency. It requires identifying relevant use-case scenarios, tuning AI models for specific contexts, and ensuring compatibility with existing banking systems. Integration challenges include data interoperability, staff training, change management, and the need for advanced banking infrastructure (Argaam, 2024).

Mitigation: Strategic planning, stakeholder engagement, and iterative implementation can optimize AI performance and reduce disruptions, making AI integration critical for transformational change and competitive advantage in banking and other sectors (Argaam, 2024).

- Data Privacy and Integrity: Data security and privacy are major concerns because generative AI systems require large amounts of data for operation and training (Argaam, 2024).

Mitigation: Building user trust through transparent data practices and ethical data-handling protocols is essential for user confidence in AI systems and responsible data management (Argaam, 2024).

- Legal Issues Related to Generative AI and Blockchain: Currently, there are no independent laws governing these technologies or the legal issues arising from them (Argaam, 2024).

Mitigation: Legal experts, policymakers, and technology specialists must collaborate to develop clear rules and policies that balance innovation, accountability, and stakeholder rights (Argaam, 2024).

- Limited Knowledge of Generative AI: The general public's limited understanding of AI is a critical issue affecting informed decision-making, adoption, and regulation (Argaam, 2024).

Mitigation: Implementing effective educational and awareness programs ensures public understanding of AI concepts, use cases, and potential impacts, while training banking sector employees to use advanced technologies like generative AI and blockchain.

- Building Trust: Trust in AI and blockchain systems is essential for their widespread adoption and acceptance (Argaam, 2024).
- High Training and Maintenance Costs: Training generative AI models, such as large language models (LLMs) for ChatGPT, is extremely expensive, often costing millions of dollars due to computational power and infrastructure requirements. For example, OpenAI's former CEO Sam Altman stated that training ChatGPT-4 cost $100 million (Argaam, 2023).
- High energy consumption and data immutability: updating generative AI models requires large computational resources and time, which represents a major technical challenge.

This challenge can be addressed by designing some models to allow for incremental updates, which provides a potential solution to this complex problem.

Blockchain technology also faces a set of challenges as a newly emerged technology. The most prominent of these challenges are:

Storage capacity and lack of scalability: Blockchain collects data related to the transactions it processes, and as the number of transactions grows day by day, the blockchain requires more storage space. Currently, the Bitcoin blockchain has exceeded 100 gigabytes. For transactions to be processed correctly they must be stored on the blockchain. Due to original limits on block size and the time required to create a new block, Bitcoin's blockchain can handle only about seven transactions per second, which cannot meet the requirement of processing millions of transactions simultaneously. Because block capacities are very small, miners prioritize large-fee transactions over small ones; however, increasing block size would slow propagation across the blockchain. Specialists have tried to solve this problem by improving storage on the blockchain through pruning transaction records. Another approach is Sharding—dividing the blockchain into primary and secondary blocks where the blockchain stores only the primary blocks, thereby reducing storage burden (Bani Amer, n.d.; Al-Shater, 2019).

Privacy leakage: Members of the blockchain network carry out transactions and store data using an address or name that masks their real identity. All network participants can view transaction information, and each participant has a public key that others can see, which poses a privacy breach for transactions. Studies have shown that it is possible to link a user's Bitcoin transactions to reveal personal information. Attempts are underway by specialists to address this privacy vulnerability (Zheng et al., 2018).

Network takeover via a 51% majority attack: Bitcoin and other cryptocurrencies rely on blockchain technology. In Bitcoin, a new block is created, mined, and appended to the distributed chain roughly every ten minutes. Once added and mined, a block cannot be changed because an invalid block would be detected and rejected by other miners. However, if an attacker or group of attacker's controls most of the network's computational power (hash rate), they can interfere with the recording of new blocks. They could prevent other miners from completing

transactions, monopolize mining of new blocks, and collect all rewards. They could block other users' transactions or issue a transaction and then reverse it — a double-spend. A 51% attack refers to an assault on a blockchain network, typically Bitcoin's, where miners controlling more than 50% of the hash power attempt to undermine the network. Attackers could prevent new transactions from receiving confirmations, stopping payments between some or all users, and could reverse transactions completed while they controlled the network, enabling double-spending. Such attacks are rare on large public Blockchains, because as the number of transactions and nodes increases, it becomes harder to compromise the network and rewrite past transactions. Although some cryptocurrencies are more vulnerable to 51% attacks than others, and even if an attack occurs it seldom results in destruction and can be mitigated (Bitcoin Arabia, 2021).

Data alteration (fork issues): Blockchain networks rely on decentralization, requiring all participating members to follow the same protocol to function properly. Blockchain requires updates to fix issues or improve performance. When a blockchain software version is updated, some nodes become outdated while others are updated, causing compatibility issues between the two versions (Al-Shater, 2019; Lin & Liao, 2017).

High costs and electricity consumption: Blockchain technology requires significant financial investment and time, especially regarding blockchain systems. It needs appropriate infrastructure and skilled personnel to operate it. Technology relies on consensus mechanisms, including Proof of Work, which requires complex mathematical calculations to verify transactions. These calculations consume large amounts of electricity to power the computers running blockchain technology (Meva, 2018).

Lack of central authority control over blockchain: Blockchain technology is decentralized and is not managed by a central bank or any supervisory authority. There is no safety network if digital currencies are lost, and if a user loses their password, they lose all their funds. This increases the risk level because blockchain relies on cryptography. Issues such as inheritance and asset confiscation in cases of financial incapacity highlight the problems caused by the absence of a central authority regulating blockchain technology (Meva, 2018; Al-Atoum, 2020; Al-Shater, 2019).

Lack of clarity about all aspects of blockchain technology: Blockchain is a new and continuously evolving technology. Many people do not fully understand it, and it requires time to integrate into society. Most blockchain technologies remain theoretical and have not been widely implemented. Several concepts related to blockchain and digital currencies exist, but their applications are limited to certain countries. States must integrate blockchain technology across various sectors to enable public understanding and recognition. Legal frameworks should be established to regulate, develop, and implement blockchain across different areas of life (Meva, 2018; Al-Atoum, 2020).

Need for legal and regulatory institutions for financial tech innovations: Blockchain requires institutions to monitor its development and determine what is suitable for application according to legal and regulatory standards, including Islamic law principles. Innovation and creativity are necessary, but they must align with religious guidelines (Al-Shater, 2019).

Volatility of digital currency prices: Digital currencies, one of the most prominent blockchain applications, do not have a fixed value. Their market value can rise and fall significantly due to speculation, making them unstable and unreliable for trust and dependence (Al-Atoum, 2020).

These are the main challenges facing blockchain and generated AI technologies, but they are not limited to these. The novelty of these technologies and the ongoing evolution of their applications in various life sectors make their challenges more complex, especially in countries that have not yet experimented with them, due to the lack of infrastructure, skilled experts, institutional frameworks, or regulatory and religious systems.

The banking sector lacks the necessary infrastructure and qualified human resources to implement these modern technologies to meet the demands of the technologically driven contemporary era.

4.3 Murabaha to the Purchase Orderer as a Smart Contract in Islamic Financing

Murabaha to the purchase orderer is one of the most widely used financing formulas in contemporary Islamic banks (Hammoud, 1982). With rapid technological development, it has become possible to execute this contract through smart contract technology on blockchain networks (Shehadeh, 2021), raising important questions about the Sharia controls for electronically concluding these contracts.

First: Definition of Murabaha and Its Sharia Ruling:

Linguistically, Murabaha is derived from profit (ribh). It means providing funds on a profit-sharing basis (Ibn Manzoor, 1994; Al-Jawhari, 1987). In

Islamic jurisprudence, it is defined as: The sale of a commodity at the price for which the seller purchased it, with an agreed-upon profit margin mutually accepted by both parties (Al-Marghinani, n.d.; Al-Hattab, 1992; Al-Shirazi, n.d.).

Regarding the ruling on ordinary Murabaha, the majority of jurists (Hanafis, Malikis, Shafi'is, and Hanbalis) permit Murabaha sales (Al-Samarqandi, 1994; Al-Kharshi, n.d.; Ibn al-Mahali, 1996; Ibn Qudamah, 1994), based on the general implications of the Qur'anic verse: **"But Allah has permitted trade"** [Al-Baqarah: 275], and His saying: **"Except that it be a trade conducted by mutual consent among you"** [Al-Nisaa: 29]. These texts are general in permitting all types of sales unless evidence indicates prohibition, and Murabaha is a sale based on mutual consent and transparency (Al-Sarkhsi, 1993; Al-Shafi'i, 1990; Al-Nawawi, n.d.).

Second: Murabaha to the Purchase Orderer and Its Sharia Ruling:

Murabaha to the purchase orderer is defined as: "The bank purchases the commodity requested by the client for cash, then sells it to the client at a deferred price that includes an agreed-upon profit" (Al-Masri, n.d.). Another definition states: "The bank fulfills the request of the purchaser by buying the desired item with its own funds in exchange for the applicant's commitment to buy the item at an agreed profit margin" (Hammoud, 1982).

Contemporary scholars have differed their rulings into two main opinions:

First Opinion: Permissibility, held by Dr. Sami Hammoud (1982), Dr. Yusuf Al-Qaradawi (1990), Dr. Al-Siddiq Al-Darir (n.d.), Dr. Abdul Sattar Abu Ghuddah (n.d.), and others. Their evidence includes:

1. The original principle in transactions is permissibility, and there is no evidence prohibiting this form (Al-Qaradawi, 1990).
2. The general nature of Sharia evidence permitting sales, such as "But Allah has permitted trade" (Al-Qaradawi, 1990).
3. The existence of similar transactions in classical Islamic jurisprudence, as mentioned in "Kitab Al-Makharij wal-Hiyal" by Al-Shaybani (1999, as cited in Omar, n.d.).

Second Opinion: Prohibition, held by Dr. Rafiq Al-Masri (n.d.), Dr. Bakr Abu Zayd (n.d.), Dr. Hassan Abdullah Al-Amin (1983), and others. Their evidence includes:

1. Murabaha to the purchase orderer is considered a sale of what one does not possess, as the bank sells to the customer before owning the commodity (Afaneh, 1996, citing Al-Ashqar, 1995).
2. It is viewed as an indirect means of obtaining cash (tawarruq) rather than a genuine sale and purchase transaction (Melhem, 2005).

The Preponderant View:

After reviewing the evidence and discussions, the opinion of permissibility appears stronger for several reasons:

1. The bank does acquire ownership of the commodity before reselling it to the customer (Afaneh, 1996).
2. The claim that this transaction resembles prohibited sales is not definitive, while the Qur'anic texts permitting sales are clear and general (Melhem, 2005).
3. In cases of doubt, the definitive textual evidence takes precedence over speculative reasoning.
4. Contemporary juristic councils and regulatory bodies (such as AAOIFI, 2014) have approved this transaction subject to specific controls.

Third: Smart Murabaha Contract (E-Murabaha):

The concept of electronic Murabaha emerged as the first online Murabaha model fully compliant with Islamic Sharia (Shehadeh, 2021). It brings together the customer and the seller in an electronic environment through the financial institution, streamlining the Murabaha process and eliminating the need for physical presence of the parties (Al-Marzouqi, 2016).

How to Execute a Murabaha Contract Through Smart Contracts:

1. **Establishing the Blockchain Network:** A dedicated blockchain network connects Islamic banks, customers, and commercial entities, containing all necessary information for financing operations (Shehadeh, 2021).
2. **Customer Subscription:** The customer subscribes using their digital identity and selects Murabaha financing from available options on the blockchain network (Al-Marzouqi, 2016).
3. **Submitting Purchase Request:** The customer submits a request specifying all details of the desired commodity through the blockchain network (Al-Sartawi, 2015).
4. **Promise Contract (Optional):** Some banks conclude a promise contract via blockchain, while others omit this step as the commodity can be resold through the network if the customer withdraws (Omar, 1987; Helmous, Al-Amin, & Kariz, 2017).
5. **Bank Acquisition of the Commodity:** The bank acquires ownership through a contract

executed on the blockchain with the seller, eliminating lengthy procedures and paperwork (Helmous, Al-Amin, & Kariz, 2017).

6. **Execution of the Murabaha Contract:** The contract is digitally programmed with all Sharia controls converted into machine-readable code. Once verified as Sharia-compliant, it executes automatically (Shehadeh, 2021). The commodity is delivered to the customer, and the contract is digitally signed without requiring physical presence.
7. **Adding to Blockchain:** The completed smart contract forms a new block added to the blockchain, with the adder rewarded in Islamic digital currency.
8. **Default Mechanism:** If the customer defaults, the smart contract is programmed to offer the commodity to other suppliers or buyers through the blockchain network.

Fourth: Sharia Controls for Smart Murabaha Contracts:

For the smart Murabaha contract to be valid, the following Sharia controls must be observed (AAOIFI, 2014):

1. **Ownership Transfer:** The bank must genuinely own the commodity and bear its risks before selling it to the customer. The smart contract must verify actual ownership transfer (Omar, 1987).
2. **Contract Independence:** The promise to purchase must be distinct from the actual sale contract. The smart contract must maintain this separation (Afaneh, 1996).
3. **Price Certainty:** The cost price and profit margin must be known to both parties. The smart contract must clearly display both elements (Al-Sartawi, 2015).
4. **Subject Matter Existence:** The commodity must exist at the time of sale. Smart contracts must verify the actual existence of the goods (Helmous, Al-Amin, & Kariz, 2017).
5. **Absence of Prohibited Elements:** The contract must be free from riba (usury), gharar (excessive uncertainty), and other prohibited elements (Al-Qaradawi, 1990).
6. **Meeting and Acceptance:** While physical meeting is not required in e-contracts, the electronic offer and acceptance must be clearly recorded on the blockchain (Shehadeh, 2021).
7. **Documentation:** All stages of the transaction (purchase order, promise, bank's purchase, final sale) must be properly documented on the blockchain (Omar, 1987).

5. CONCLUSIONS

The study revealed that Generative AI is a type of artificial intelligence that is more advanced and capable of producing various forms of innovative content. Blockchain is a specialized type of database representing a public ledger of transactions. Generative AI models rely on deep learning techniques, using neural networks and various architectures to create new data based on the training dataset. Building these models involves essential steps such as data preparation, model construction, testing, deployment, and improvement. Blockchain records transactions and executes them through computers, but humans still control these machines and conduct blockchain transactions. Blockchain has not eliminated the human factor; even though transactions are executed automatically, they originate from a person who initiates the transaction.

The integrative role of generative AI and blockchain is evident. By combining generative AI and blockchain capabilities in banking risk management, a revolutionary transformation is expected within the next three to five years. These technologies will enable the sector to shift from routine operations to direct collaboration with commercial departments, implementing proactive and effective risk prevention measures, And its application in Islamic financing formulas, especially Murabaha.

The integration of blockchain technology and generative AI, which can accurately predict and analyze data, allows for the provision of customized financial products. For example, this technology can help banks create credit cards that directly target consumers based on their priorities, transforming the existing bank cards into customers' hands into smart cards. This enables bank management to understand customer interests and, at a later stage, offer cards specifically designed to match everyone’s shopping and spending habits.

Generative AI can be used to analyze the large datasets stored in blockchain, providing powerful, fast, and reliable analytics, while blockchain can preserve AI data and maintain its integrity. The integration of blockchain and AI will contribute to developing new financial solutions. For instance, this integration could lead to the creation of crypto-banks and decentralized financial services that rely on blockchain networks and leverage the power of AI.

Despite the tremendous advancements these

technologies will bring, they also face challenges---technical, administrative, legal, regulatory, and social. These challenges must be addressed, infrastructure in banks must be established to implement these technologies, and qualified human resources in advanced technology must be prepared.

The study recommends:

- Introducing university programs that combine banking and technology, such as FinTech banking specialization.
- Establishing infrastructure in banks to provide an appropriate environment for applying AI and blockchain technologies.
- Training banking sector employees in modern technologies.
- Building public trust in new technologies through courses, workshops, and scientific seminars introducing these innovations.
- Establishing legal and regulatory frameworks for modern technologies in the banking sector.
- Conducting further studies on AI and blockchain technologies, which are continuously evolving.

Integration of Generative Ai and Blockchain in Islamic Banking.

Use-Case	Role of Generative AI	Role of Blockchain	Expected Benefit
Risk Management	Analyzing customer/transaction data and generating risk reports	Immutable transaction records and transparent audit trails	Enhanced risk detection and compliance
Fraud Detection	Real-time anomaly detection and predictive analytics	Tamper-proof transaction history	Reduced fraud and improved trust
Sharia Compliance Monitoring	Automated document analysis and contract review	Smart contracts ensuring rule-based execution	Streamlined, automated compliance
Customer Service & Onboarding	Intelligent chatbots, KYC automation, personalized product offers	Secure storage of customer identities and onboarding records	Faster, more secure onboarding
Investment Advisory	Personalized investment recommendations	Transparent, secure investment transaction record keeping	Improved investment outcomes, customer confidence
Document Management	Automated document classification and extraction	Secure, immutable digital records	Reduced paperwork, easier audit, cost savings

REFERENCES

AAOIFI. (2014). *Shari'a standards*. Accounting and Auditing Organization for Islamic Financial Institutions.

Afaneh, M. (1996). *Murabaha to the purchase orderer between Sharia and law*. Unpublished manuscript.

Agarwal, R., Kramer, A., Christensen, I., & Logit, A. (2024). Using generative AI to enhance risk management and compliance in the banking sector. McKinsey & Company. https://www.mckinsey.com/featured-insights/highlights-in-arabic/how-generative-ai-can-help-banks-manage-risk-and-compliance-arabic/ar

Aisera. (n.d.). The rise of generative AI in banking and financial services. Retrieved November 9, 2025, from https://aisera.com/blog/generative-ai-in-banking/

Al-Amin, H. A. (1983). *Contemporary financial transactions in Islamic jurisprudence* [In Arabic]. Dar Al-Fikr.

Al-Atoum, B. (2020, November 13). Blockchain technology flaws. E3arabi. https://e3arabi.com/

Al-Baul, S. M. (2022). Smart contracts using blockchain technology: A jurisprudential and applied study [Unpublished doctoral thesis]. University of Jordan.

Al-BOOL, S. M. (n.d.). The integrative role of generative artificial intelligence and blockchain technology in developing the Islamic banking sector and the challenges it faces [Working paper].

Al-Dandashi, A. (2024, March 28). Reshaping the financial sector: Generative AI opens new horizons. Al Bayan. https://www.albayan.ae/world/global/2024-03-28-1.4847108

Al-Ghatrifi, A. (2023). Professional use of generative AI in journalism: Risks and opportunities. Misr University Journal for Human Studies, 3(Special Issue 92), 47–92.

Al-Hattab, M. (1992). *Mawahib al-Jalil*. Dar Al-Fikr.

Al-Jawhari, I. (1987). *Al-Sihah*. Dar Al-Ilm Lilmalayin.

Al-Khalifa, H. B. S. (2023). Introduction to generative AI. Ewan Research Group. https://www.researchgate.net/figure/ktab-mqdmt-fy-aldhka-alastnay-altwlydy_fig1_371790205

Al-Marghinani, A. (n.d.). *Al-Hidaya* [In Arabic]. Al-Maktaba Al-Islamiyya.

Al-Marzouqi, A. (2016). *Electronic contracts in Islamic jurisprudence* [In Arabic]. University of Sharjah.

Al-Mursi, G. N. (2024). Using generative AI tools to improve early childhood storytelling skills: Proposed

standards. King Faisal University Scientific Journal: Humanities and Administrative Sciences, 25(1), 73–81.
Al-Nawawi, Y. (n.d.). *Al-Majmu'. Dar* Al-Fikr.
Al-Qaisi, R. T. I., & Al-Bawab, A. A. (2021). The impact of blockchain technology on financial statements in Jordanian commercial banks [Unpublished master's thesis]. Middle East University.
Al-Qaradawi, Y. (1990). Murabaha to the purchase orderer: A juristic study [In Arabic]. *Journal of the Islamic Fiqh Academy*, 7(3), 1-152.
Al-Samarqandi, A. (1994). *Tuhfat al-Fuqaha* [In Arabic]. Dar Al-Kutub Al-Ilmiyya.
Al-Sarkhsi, M. (1993). *Al-Mabsut* . Dar Al-Ma'rifa.
Al-Sartawi, M. (2015). *Operations of Islamic banks* [In Arabic]. Dar Wael.
Al-Shafi'i, M. (1990). *Al-Umm*. Dar Al-Ma'rifa.
Al-Shater, M. (2019). Blockchain technology and its effects on the Islamic finance sector: A descriptive study. Journal of Research and Applications in Islamic Finance, 3(2), 22-30.
Al-Shaybani, M. (1999). *Kitab Al-Makharij wal-Hiyal* . Maktab Al-Thaqafa.
Al-Shirazi, I. (n.d.). *Al-Muhadhdhab*. Dar Al-Fikr.
Argaam. (2023, December 8). 9 concerns raised by generative AI. https://www.argaam.com/ar/article/articledetail/id/1689300
Argaam. (2024, March 1). Top 10 challenges facing AI in the near future. https://www.argaam.com/ar/article/articledetail/id/1708245
Atzori, M. (2017). Blockchain technology and decentralized governance: Is the state still necessary? Journal of Governance and Regulation, 6(1), 45–56. https://doi.org/10.22495/jgr_v6_i1_p1
Bani Amer, T. (n.d.). Exploring blockchain technology and its applications in Islamic finance (pp. 12–15).
Berryhill, J., Bourgery, T., & Hanson, A. (2018). Blockchains unchained: Blockchain technology and its use in the public sector (OECD Working Papers on Public Governance, No. 28). OECD Publishing. https://doi.org/10.1787/2dcf3f77-en
Bitcoin Arabia. (2021, February 17). 51% attacks on blockchain networks. https://bitcoinorabia.com/attack-51/
Blockchain. (n.d.). In Wikipedia. Retrieved November 9, 2025, from https://ar.wikipedia.org/wiki/%D8%B3%D9%84%D8%B3%D8%A9_%D8%A7%D9%84%D9%83%D8%AA%D9%84
Boubidi, R., & Litem, K. (2023). The impact of AI on enhancing blockchain performance for digital banking transactions. Al-Hadith Journal of Financial and Economic Studies, 6 (10), 40–58.
Boucher, P., Nascimento, S., & Kritikos, M. (2018). How blockchain technology could change our lives. Publications Office of the European Union.
Boukathir, N. (2019). The impact of using innovative financial products on building competitive advantage in public commercial banks: A case study of the National Bank of Algeria and the Agricultural and Rural Development Bank, Setif.
Bryson, D., Penny, D., Goldenberg, D. C., & Serrao, G. (2018). Blockchain technology for government. The MITRE Corporation.
Crosby, M., Pattanayak, P., Verma, S., & Kalyanaraman, V. (2016). Blockchain technology: Beyond Bitcoin. Applied Innovation Review, (2). https://scet.berkeley.edu/wp-content/uploads/AIR-2016-Blockchain.pdf
Forrester. (2025, July 9). Digital banking is poised for a revolutionary transformation over the next decade. Forbes. https://www.forbes.com/sites/forrester/2025/07/09/digital-banking-is-poised-for-a-revolutionary-transformation-over-the-next-decade/
Hammoud, S. (1982). Development of banking operations compatible with Islamic Sharia [In Arabic]. *Journal of Islamic Fiqh Academy*, 1(2), 800-820.
Helmous, S., Al-Amin, M., & Kariz, M. (2017). *Management of Islamic banks* [In Arabic]. Dar Al-Jamia.
Herweijer, C., Waughray, D., & Warren, S. (2018). Building block(chain)s for a better planet. World Economic Forum.
Heutger, M., & Kückelhaus, M. (2018). Blockchain in logistics: Perspectives on the upcoming impact of blockchain technology and use cases for the logistics industry.
Hileman, G., & Rauchs, M. (2017). Global blockchain benchmarking study. University of Cambridge, Judge Business School, Centre for Alternative Finance. https://www.jbs.cam.ac.uk/faculty-research/centres/alternative-finance/publications/global-blockchain-benchmarking-study/

Houben, R., & Snyers, A. (2018). Cryptocurrencies and blockchain.

Ibrahim, A. (2018). Does blockchain mean higher transparency in the financial sector? Revista de Contabilidad y Dirección, 27, 79-92.

International Monetary Fund. (2023). AI lexicon. Finance & Development. https://www.imf.org/ar/Publications/fandd/issues/2023/12/AI-Lexicon

Ibn Manzoor, M. (1994). *Lisan al-Arab* [In Arabic]. Dar Sadir.

Ibn al-Mahali, J. (1996). *Kanz al-Raghibin* [In Arabic]. Dar Ihya Al-Turath.

Ibn Qudamah, A. (1994). *Al-Mughni* [In Arabic]. Dar Al-Fikr.

Ibrahim, A. (2018). Does blockchain mean higher transparency in the financial sector? *Revista de Contabilidad y Dirección*, 27, 79-92.

International Monetary Fund. (2023). AI lexicon. *Finance & Development*. https://www.imf.org/ar/Publications/fandd/issues/2023/12/AI-Lexicon

Issa, H. A.-S. (2019). The emergence of smart contracts in the blockchain era (1st ed.). Dar Al-Nahda Al-Arabiya.

Khomeini, B. T. M. (2021). The role of blockchain in reducing the risks of Islamic finance. Revue d'économie et de statistique appliquée, 18(2), 140–161.

Lewis, A., et al. (n.d.). Understanding blockchain technology and what it means for your business (DBS Asian Insights Sector Briefing, 19).

Lin, I.-C., & Liao, T.-C. (2017). A survey of blockchain security issues and challenges. International Journal of Network Security, 19(5), 653–659.

Makridakis, S., & Christodoulou, K. (2019). Blockchain: Current challenges and future prospects/applications. Future Internet, 11(3), 258. https://doi.org/10.3390/fi11030062

Meva, D. (2018). Issues and challenges with blockchain: A survey. International Journal of Computer Sciences and Engineering, 6(12), 201–208. https://doi.org/10.26438/ijcse/v6i12.201208

Nwachukwu, U. J. (2019). Overview of blockchain technology cryptographic security [Master's thesis]. University of Turku.

Omar, M. A. (1987). Practical applications of Murabaha to the purchase orderer [In Arabic]. *Journal of Islamic Fiqh Academy*, 3(4), 1-46.

Politou, E., Casino, F., Alepis, E., & Patsakis, C. (2019). Blockchain mutability: Challenges and proposed solutions. IEEE Access. https://doi.org/10.1109/ACCESS.2019.2904740

Rashid, A. B., & Kausik, M. A. K. (2024). AI revolutionizing industries worldwide: A comprehensive overview of its diverse applications. Hybrid Advances, 7, 100277. https://doi.org/10.1016/j.hybadv.2024.100277

Rodriguez, J. (2024). The role of AI in reshaping the future of the financial sector. Erem Business. https://www.erembusiness.com/opinions/w4hgxmd

SAP. (n.d.). What is generative AI? Retrieved August 6, 2024, from https://www.sap.com/mena-ar/products/artificial-intelligence/what-is-generative-ai.html

Saudi Data and AI Authority (SDAIA). (2022). Data and AI lexicon (1st ed.). https://sdaia.gov.sa/en/MediaCenter/KnowledgeCenter/ResearchLibrary/SDAIAPublications15.pdf

Saudi Data and AI Authority (SDAIA). (2023). Generative AI (1st ed.). https://sdaia.gov.sa/ar/MediaCenter/KnowledgeCenter/ResearchLibrary/Generative-AI.pdf

Shaip. (2023, February 23). How AI is shaping the future of banking | Top 6 use cases. Retrieved November 9, 2025, from https://ar.shaip.com/in-the-media/top-6-use-cases-of-ai-in-the-banking-sector/

Shihadeh, M. K. Y., & Al-Atoum, Y. M. (2021). Digital transformation in Islamic banks operating in Jordan: An analytical study from an Islamic perspective [Unpublished doctoral dissertation]. Yarmouk University.

Sky News Arabia. (2023). How blockchain and AI will change banking. https://www.snabusiness.com/article/1641306-%25D8%25B3%25D9%258A%25D8%25BA%25D9%258A%25D-%25D8%25A7%25D9%2584%25D9%2585%25D8%25B5%25D8%25B1%25D9%2581%25D9%258A%25D8%259F

Sorrell, J. W. H., & Donegan, S. L. (n.d.). Blockchain technology: Opportunities and risks.

Thabit, M. A. (2024). Evaluating the reliability and completeness of generative AI bots in commercial sites: A comparative study between Google Bard and ChatGPT. Egyptian Journal of Information Science, 11(2), 132–163.

Troupia, N. (n.d.). Blockchain technology and its impact on the digital future of economic transactions:

Opportunities and challenges. Contemporary Economic Research Journal, 3(1), 98-109.

United Arab Emirates, Ministry of State for Artificial Intelligence. (2023). 100 practical applications and uses of generative AI. https://ai.gov.ae/wp-content/uploads/2023/04/406.-Generative-AI-Guide_ver1-AR.pdf

World Bank Group. (2017). Distributed ledger technology (DLT) and blockchain (FinTech Note No. 1). H. Natarajan, S. Krause, & H. Gradstein (Authors). http://documents.worldbank.org/curated/en/-WP-PUBLIC-DistributedLedger-Technology-and-Blockchain-Fintech-Notes.pdf

Xia, L., Baghaie, S., & Sajadi, S. M. (2024). The digital economy: Challenges and opportunities in the new era of technology and electronic communications. Journal of Economic Technology, 15(2), 45-67. https://doi.org/10.1016/j.asej.2023.102411

Yaga, D., et al. (2018). Blockchain technology overview. National Institute of Standards and Technology.

Zheng, Z., Xie, S., Dai, H., Chen, X., & Wang, H. (2018). Blockchain challenges and opportunities: A survey. International Journal of Web and Grid Services, 14(4), 352–375. https://doi.org/10.1504/IJWGS.2018.10016848