

1- What is Blockchain technology and how does it work? Blockchain technology is originally the name given to the design underpinning the operation of the digital currency Bitcoin. Bitcoin's creator never used the term "blockchain" in his whitepaper, and reading the paper one gets the distinct impression that the author was not introducing a new technology in the traditional sense of the term, but a software design drawing on several existing technologies to allow him to create a "purely peer-to-peer version of electronic cash". The essence of Bitcoin's blockchain's operation is that whenever two network members transact, they announce their transaction to all network members (nodes), who record the transaction into a block with a limited capacity. Once the block is full, nodes simultaneously perform Proof-of-Work—mathematical operations that are hard to solve but whose correct solution is easy to verify. These mathematical operations are unrelated to the bitcoin transactions, but are indispensable to the operation of the system, as they force the verifying nodes to expend processing power which would be wasted if they included any fraudulent or invalid transactions. The first node that succeeds in solving a Proof-of-Work problem broadcasts the solution, along with the block of transactions, to all other nodes. Nodes can quickly and cheaply verify the accuracy of the transactions and solutions, and when 51% of the processing power of the network votes to approve a block, nodes begin recording new transactions to a new block, amended to all previous blocks [1]. The first node that solves the Proof-of-Work problem is rewarded with a specific quantity of the currency of the network. This reward makes verifying transactions potentially profitable, and leads to it being commonly referred to as 'mining', though 'verifying' is arguably a more functionally accurate description.

How it Works Each block in the blockchain contains a unique code, known as a hash, that links it to the previous block. This creates a chain of blocks, hence the name blockchain. When a new block is added to the chain, it is verified by the network of computers, ensuring that the information contained within it is accurate and tamper-proof. The underlying principles of blockchain technology include decentralization, immutability, and transparency. Decentralization means that there is no central authority controlling the network, making it more secure and resistant to hacking. Immutability refers to the fact that once a block is added to the chain, it cannot be altered or deleted. Transparency means that all transactions on the blockchain are visible to anyone with access to the network.

2- What are the types of Blockchain? There are three main types of blockchain technology: public, private, and hybrid.

Potential Impact on Industries Blockchain technology has the potential to revolutionize industries such as finance, healthcare, and supply chain management.

- Public Blockchain Public blockchain is an open and transparent ledger that anyone can access and participate in. It is decentralized and operates on a peer-to-peer network, making it resistant to censorship and tampering. Potential impact on industries: Public blockchain has the potential to disrupt industries such as finance, supply chain management, and healthcare by providing a secure and transparent way to store and transfer data.
- Private Blockchain Private blockchain is a closed network that is controlled by a single entity or group of entities. It is not open to the public and is not decentralized, making it more vulnerable to tampering and censorship. Potential impact on industries: Private blockchain has the potential to improve supply chain management, voting systems, and identity verification by providing a secure and efficient way to store and transfer data.
- Hybrid Blockchain Hybrid blockchain combines elements of both public and private blockchain, allowing for greater flexibility and

control over data storage and transfer. Potential impact on industries: Hybrid blockchain has the potential to improve supply chain management, voting systems, and identity verification by providing a secure and efficient way to store and transfer data while also allowing for greater control and privacy. ●

**Consortium blockchain** How it works. The fourth type of blockchain, consortium blockchain, also known as a federated blockchain, is similar to a hybrid blockchain in that it has private and public blockchain features. But it's different in that multiple organizational members collaborate on a decentralized network. Essentially, a consortium blockchain is a private blockchain with limited access to a particular group, eliminating the risks that come with just one entity controlling the network on a private blockchain. In a consortium blockchain, the consensus procedures are controlled by preset nodes. It has a validator node that initiates, receives and validates transactions. Member nodes can receive or initiate transactions [2]

**3- How does blockchain technology maintain its immutability? Immutability** Blockchain technology maintains its immutability through a decentralized ledger system that records all transactions on multiple nodes. This ensures that once a transaction is recorded, it cannot be altered or deleted, making it tamper-proof and transparent. Immutability is defined as the ability of a blockchain ledger to remain unchanged, unaltered, and memorable. Each of the blocks of information, like facts or transaction details, is carried out with the help of a cryptographic principle or a hash value. Now, this hash value has an alphanumeric string generated by each block individually. Each block contains a hash value or digital signature for itself and the previous one. This, in turn, ensures that the blocks are retroactively coupled and unrelenting. Blockchain technology functionality ensures no one can interfere with the system or change the already saved data in the league. It knows that blockchain is distributed, and decentralization is also quite essential. Here a consensus is made among the different storing a copy of the data. It is this consensus that makes sure the originality of data is rightly maintained. Immutability is undoubtedly one of the most outstanding features of blockchain technology and also brings out the best use cases of smart contracts that can be deployed. The concept can redefine the entire process of auditing data to make it much more efficient and cost-effective, bringing about more trust and integrity in the data.

**Blockchain Immutability = Cryptography + Hashing Process.** Each information block, such as facts or transaction details, is created using cryptographic principles or hashes. Cryptographic hashing is key to blockchain immutability, and the most common hash function is SHA-256. The algorithm is a subset of the parameters that connect all of the network's blocks, resulting in immutability. These blocks cannot be altered and are sequentially secure. [3]

**4- Why is Blockchain a trusted approach? Trusted Approach** Blockchain technology is a trusted approach because it uses a decentralized system of nodes to verify transactions and maintain a secure and transparent ledger. This eliminates the need for intermediaries and reduces the risk of fraud or errors. Blockchain is a trusted approach because of its decentralized nature and immutability. **Decentralized Nature** Blockchain is a decentralized system, meaning that it is not controlled by any single entity. This makes it more secure and resistant to tampering or hacking attempts. **Blockchain vs Traditional Database Systems Security** Blockchain is a decentralized system that uses cryptography to secure transactions and data. This means that there is no central authority controlling the network, making it more resistant to hacking and cyber attacks. In contrast, traditional database systems are vulnerable to attacks and can be compromised if the system is not properly

secured. Transparency Blockchain is a transparent system that allows for the tracking of transactions and data. This means that all parties involved in a transaction can see the entire history of the transaction, including who made the transaction and when it was made. In contrast, traditional database systems can be opaque, making it difficult to track the history of a transaction or data.

5- What are the most important key features of Blockchain technology? Key Features of Blockchain Technology

Decentralization Blockchain technology is decentralized, meaning that it is not controlled by any single entity. Transactions are recorded on a distributed ledger that is maintained by a network of computers, rather than a central authority.

Immutability Transactions on the blockchain are immutable, meaning that once they are recorded, they cannot be altered or deleted. This ensures the integrity and security of the data stored on the blockchain.

Transparency The blockchain is transparent, meaning that all transactions are visible to anyone who has access to the network. This promotes accountability and reduces the risk of fraud or corruption.

Future Applications Blockchain technology has the potential to revolutionize various industries, including finance, healthcare, and supply chain management. Some of the most promising applications of blockchain technology include:

- Secure and transparent voting systems
- Smart contracts for automated transactions and agreements
- Decentralized identity verification for increased security and privacy

The impact of blockchain technology on the global economy could be significant, as it has the potential to increase efficiency, reduce costs, and improve transparency and security in various industries.

6- Give some examples of the most popular application of Blockchain technology Benefits of Blockchain Technology

Increased Efficiency Blockchain technology allows for faster and more secure transactions, reducing the need for intermediaries and streamlining processes.

- \* JPMorgan has formed a team within its Onyx unit that will develop and commercialize new blockchain-based solutions.
- \* Bitcoin is one of the top cryptocurrency providers, which use blockchain technology to operate.
- \* Luxury retail brands like Tiffany & Co., Dolce & Gabbana, and Gucci have experimented with NFT projects. Nike even acquired NFT company RTFKT in 2021.
- \* Healthcare giants Humana, MultiPlan, and UnitedHealth Group formed Synaptic Health Alliance, a venture that explores blockchain tech applications in healthcare and has worked on a blockchain-enabled provider directory solution.
- \* IBM and Mediaocean launched a blockchain consortium in 2020 for the digital media supply chain, bringing together advertisers, agencies, and publishers.
- \* Google has also reportedly created a new unit in 2022 dedicated to “blockchain and other next-gen distributed computing and data storage technologies.” [4]