What Is Smart Contract? Digital Asset Ownership Technology in Blockchain

Smart contracts are digital agreements recorded on the blockchain. A **smart contract in blockchain** is developed using blockchain-specific programming languages, such as **Solidity**.

A smart contract enables both parties to fulfill their commitments and receive agreed-upon outcomes **without the need to trust or involve a third party** to enforce the agreement.

Smart contracts enable the registration of ownership over digital assets

What Is Smart Contract?

A smart contract outlines a set of conditions between parties on the blockchain. Once these conditions are fulfilled, the **smart contract** is registered on the blockchain and its terms are executed **automatically**.

The **smart contract in blockchain** serves as the foundation for various concepts in the world of digital assets and **cryptocurrency**, including **NFTs**, **decentralized applications (dApps)**, the **Metaverse**, and more.

Advantages and Disadvantages of Smart Contracts

By storing all contract data on the blockchain, **smart contracts** provide **high transparency**. After the contract is signed and stored on the blockchain, it becomes nearly **immutable**, as a key benefit of this technology.

However, full dependency on code also introduces a **risk of coding errors**, which may lead to incorrect execution or exploitation of the contract.

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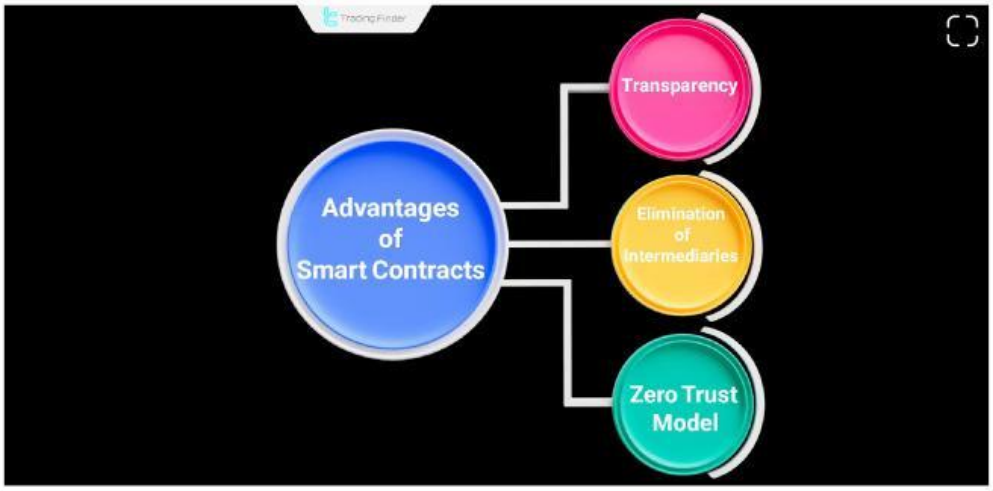
Advantages of Smart Contracts

Using smart contracts, agreements are executed **without requiring a third party**. This eliminates intermediaries, allowing for **direct and trustless transactions** between parties.



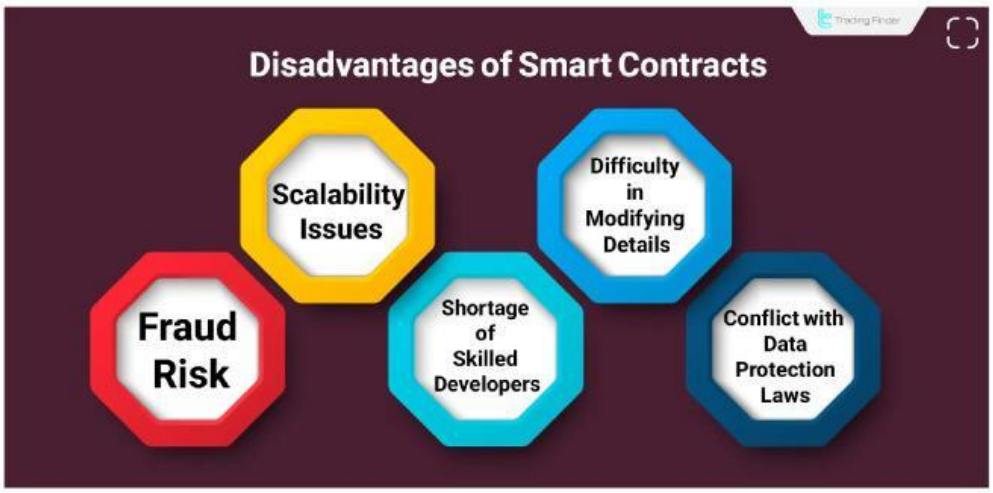
One of the benefits of smart contracts is the elimination of intermediaries in agreements

Some of the core advantages include:

- **Transparency**: All parties can access a single, **verifiable version** of the contract data, which **reduces manipulation and ensures** clarity;
- **No Need for Intermediaries**: There is no requirement for **external supervision or enforcement**, which speeds up execution and reduces transaction costs;
- **Zero Trust Model**: **Trust is unnecessary**. All terms are transparently recorded on the **blockchain** and are practically unchangeable.

Disadvantages of Smart Contracts

The current infrastructure is not yet fully developed to utilize the full potential of **smart contracts**, which causes limitations such as **scalability issues**.



The use of smart contracts carries a risk of fraud

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Key disadvantages include:

- **Difficulty in Amending Details**: Due to **blockchain's** immutable nature, making even **minor edits** to a smart contract after deployment is very **challenging** and expensive;
- **Conflict with Data Protection Laws**: Under **regulations** like the **GDPR** in the European Union, individuals have the right to delete personal data. This conflicts with **blockchain's** unalterable record-keeping;
- **Shortage of Skilled Developers**: Because this field is still emerging, **finding developers** with sufficient expertise and experience in **smart contract development** is difficult;
- **Scalability Problems**: Currently, even the most prominent **blockchains** lack the processing power of **traditional systems** like Visa;
- **Fraud Risk**: Without thorough code review, **smart contracts** can be exploited, especially by **attackers hiding** malicious code.

Smart Contracts vs. Traditional Contracts

Smart contracts are automatically executed in a **blockchain** environment, while traditional **contracts** are created and executed with human intervention in real-world systems.

Feature	Traditional Contract	Smart Contract
Execution	Requires human or third-party intervention	Executes automatically when conditions are met
Need for Intermediary	Needs legal intermediaries for monitoring and enforcement	No intermediaries required
Transparency and Traceability	Documents stored in centralized, limited-access institutions	Stored publicly and transparently on the blockchain
Contract Security	Dependent on institutions and legal enforcers	Ensured via cryptography and decentralized networks
Execution Environment	Centralized legal or judicial systems	Transparent, decentralized blockchain environment
Trust Basis	Relies on trust in individuals or institutions	Trust is placed in the code and blockchain infrastructure
Modifiability	Amendable by courts or legal entities	Almost impossible to modify once deployed
Cost and Time of Execution	High due to legal, notary, and administrative costs	Lower due to removal of intermediaries and automation
Drafting Complexity	Requires legal expertise	Requires coding and economic knowledge

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How Smart Contracts Work?

Smart contracts use blockchain-compatible programming languages to define conditional logic, such as **If**, **When**, and **Then**. **These logical structures** enable the automatic execution of **agreements** without requiring human intervention.

A smart contract functions through five primary stages

The working mechanism of a smart contract involves five main stages:

Agreement

First, the **involved parties** must agree on the contract's terms and conditions. Then, the functionality and **specific logic** of the smart contract are **reviewed** and finalized.

Contract Creation

At this stage, the **smart contract** is written—either by the parties themselves or by a **smart contract** service provider. This step **requires high attention** to coding accuracy and security.
Any error in this phase can cause a **mismatch** between what was agreed upon and how the **contract behaves**.

Signing and Registration on the Blockchain

Once created, the smart contract must be signed by all parties and deployed onto the **blockchain**. This process is similar to a typical **cryptocurrency transaction**. After being recorded on the blockchain, the contract is **activated and becomes immutable**.

Execution

When the contract conditions are met, the **smart contract automatically** executes its predefined logic and provisions. **No human action** is needed to initiate or complete this step.

Storage

After execution, the outcome of the contract is stored **permanently and transparently** on the **blockchain**. These records cannot be modified, **ensuring data** integrity and accountability.

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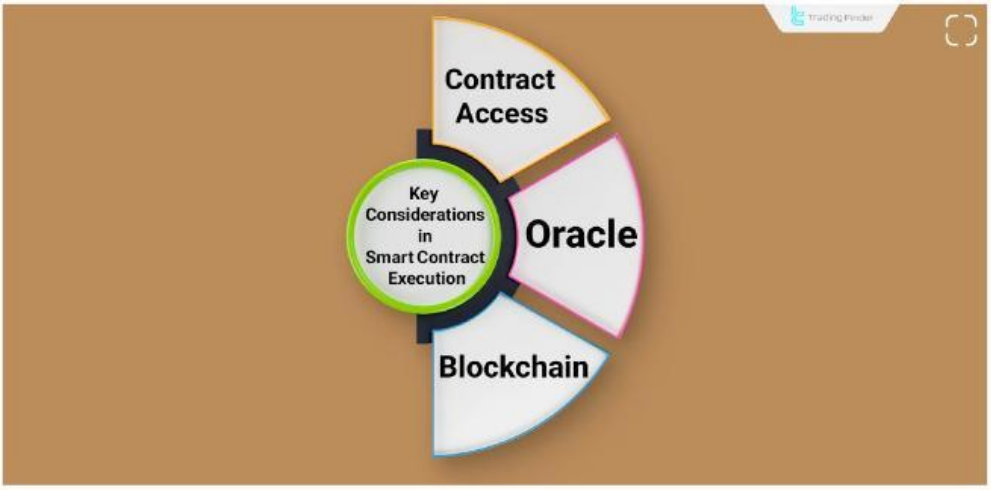
Key Considerations in Smart Contract Execution

For a **smart contract in blockchain** to work correctly, multiple technical aspects must be in place. These include selecting a suitable blockchain, **assigning appropriate permissions**, and integrating with **oracles** to access external data.



Without proper access, a smart contract may fail to execute its terms

Access Control

A **smart contract** must be granted complete access to perform all **agreed actions**. If these permissions are not defined correctly, the **smart contract** may not function properly after initiation.

Example

In an **NFT sale**, if the contract lacks permission to transfer the NFT, the ownership won't be **changed** even after the buyer makes **the payment**.

Oracle

Some **smart contracts** require data that exists outside of the blockchain, such as **price feeds**, **weather reports**, or **economic news**. These off-chain inputs are delivered via **oracles -** trusted third-party services.

Example

A contract based on i**nterest rate decisions or economic announcements**, must fetch data from reliable sources. **Chainlink** is one of the most popular **Oracle providers**, connecting real-world data to blockchain networks.

Blockchain Selection

Choosing the right blockchain is crucial for the smart contract's performance. Factors such as transaction speed, gas fees, and scalability affect its usability.

Ethereum was the first blockchain to implement smart contracts; however, several others, such as **Solana**, **Avalanche**, and **Polkadot**, also offer smart contract functionality.

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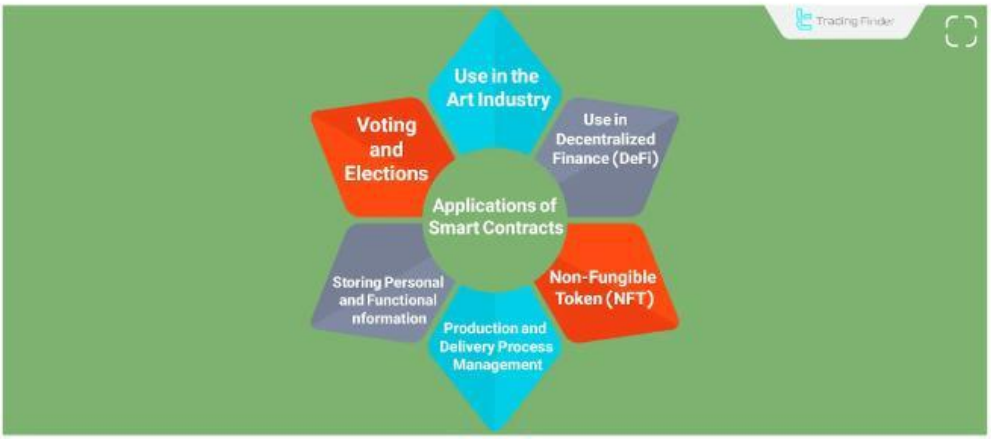
Applications of Smart Contracts

Smart contracts have applications in various sectors, including **art**, **finance**, **identity verification**, **entertainment**, and **data management**.



Smart contracts are applied across industries such as art, production, and identity services

Smart Contracts in the Art Industry

Artists can use **smart contracts** to register the ownership of their artworks on the blockchain, significantly reducing the risk of copyright theft.

Another application in the art sector is in managing **agreements between artists and production companies**. By defining revenue shares directly in the smart contract, each party automatically receives its portion of the earnings - quickly and with no calculation errors.

This, eliminates the need for **complex legal agreements** and time-consuming accounting processes.

Smart Contracts in Decentralized Finance (DeFi)

Initially limited to **peer-to-peer (P2P)** transactions, the scope of **DeFi** has expanded significantly through the use of smart contracts. Today, smart contracts enable all of the things below without any central authority:

- **Lending and borrowing protocols**
- **Yield farming and staking**
- **Derivatives trading**

Smart Contracts in NFTs

The **core structure** of **non-fungible tokens** (**NFTs**) is built upon smart contracts. A smart contract defines ownership, metadata, and custom rules such as:

- **Resale royalties**
- **Access control to digital platforms**
- **Usage rights and licensing**

Without **smart contracts**, the enforcement and verification of these rules in the NFT ecosystem would not be possible.

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Smart Contracts in Production and Delivery Management

Companies can encode their internal rules and timelines into smart contracts for **automated oversight**. For example, if a deliverable is not submitted on time, the smart contract can automatically send notifications or apply penalties - **without human supervision**.

This ensures that **operational consistency** and **workflow compliance** are maintained throughout the supply chain.

Smart Contracts for Storing Personal Information

Individuals can use **smart contracts** to store personal data - such as **resumes**, **identification**, and **professional experience -** on blockchain-based digital identity cards.

When these smart contracts are integrated into external platforms, users can **selectively share** specific information with third parties. This gives users complete control over who sees what, ensuring **privacy and security**.
These blockchain-based credentials can also support **automated verification** during onboarding or credit evaluation processes.

Smart Contracts in Voting and Elections

Using **smart contracts** in electoral systems eliminates the need for physical presence while improving **transparency** and **tamper resistance**.

Votes stored on the blockchain cannot be **altered** or **deleted**, making the process ideal for:

- **Governmental elections**
- **Organizational governance**
- **Blockchain-based DAOs (Decentralized Autonomous Organizations)**

Risks of Smart Contracts

Despite their many benefits, **smart contracts** carry **inherent risks**, especially related to programming errors and fraud. Once a smart contract is deployed and signed, its terms become **unalterable**.

This means that attackers may exploit contracts by hiding **harmful logic** within the code.

Example

A **smart contract** presented during a **wallet connection** may appear harmless. But **once confirmed**, it might execute a **hidden transaction -** transferring funds to an attacker's wallet without the user's knowledge.

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How to Prevent Smart Contract Fraud?

Reviewing smart contract code helps reduce risks associated with their use

To avoid falling victim to smart contract scams, users and developers can adopt the following measures:

- **Review Smart Contract Code**: Use auditing tools such as **SolidityScan** to analyze the smart contract code and identify potential vulnerabilities or malicious logic before signing it;
- **Check the Platform's Credibility**: Before connecting your crypto wallet to any platform, ensure that the platform is **reputable** and has a proven track record;
- **Verify the Website Address (URL)**: Many scam projects use domain names that closely mimic trusted platforms. Always check the **full and correct web address** to avoid **phishing attacks** and unauthorized contract interactions.

Best Blockchains for Smart Contracts

Multiple blockchain networks support **smart contracts in blockchain** development and deployment. The following are among the most popular:

- **Ethereum**
- **Tron**
- **Solana**
- **Avalanche**
- **Polkadot**
- **Binance Smart Chain**
- **Tezos**
- **TON (Telegram Open Network)**
- **Algorand**

Each of these blockchains has its own benefits and trade-offs in terms of:

- **Transaction speed**
- **Gas fees**
- **Community support**
- **Developer tools**
- **Scalability**

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Programming Languages for Smart Contracts

The cost, efficiency, and security of a smart contract often depend on the **programming language** used to write it.

Popular languages for smart contract development include:

- **Solidity**: Most widely used for Ethereum-based contracts
- **Vyper**: Similar to Python, with a focus on security and simplicity
- **Yul**: Intermediate language for Ethereum Virtual Machine (EVM)
- **Rust**: Often used in **Solana** and other non-EVM chains
- **Move**: Used in platforms like **Aptos** and **Sui**, emphasizing safety

The language selected directly affects the **gas consumption**, **execution speed**, and **security model** of the contract.

Conclusion

Smart contracts automate the execution of agreements through **code-defined terms** that are **stored** and **enforced** on a blockchain. Their primary benefits include:

- **Transparency**
- **Security**
- **Speed**

These contracts operate based on logical triggers, such as **If–Then–When**, managing every phase of an agreement - from **initiation** and **storage** to execution - **without manual involvement**.

Despite their power and versatility in areas such as **DeFi**, **NFTs**, and **real estate**, smart contracts come with risks. Without sufficient **knowledge and code auditing**, users may fall victim to **coding errors** or **fraudulent logic**.

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