

# Bitcoin Library: Make Bitcoin Stone

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**Abstract.** As humanity progresses in the way information is stored, the lifespan of stored information paradoxically decreases, and the mediums capable of long-term storage lack convenient accessibility. This paper discusses the significant advantages of using the Bitcoin blockchain for information storage. As the consensus on Bitcoin strengthens, the Bitcoin network has emerged as the most secure option for storing information. However, the majority of information currently stored on the Bitcoin blockchain does not fully utilize its potential value, and much of this information lacks practical significance. In light of this, this paper introduces the Bitcoin Library project, aimed at redefining the value of blockchain information storage. By permanently preserving cultural materials on the Bitcoin blockchain, the project facilitates global instant access and provides an innovative solution for the protection and inheritance of cultural heritage. At the core of the project is the use of blockchain technology's immutability and decentralization to ensure the security and permanence of information. Furthermore, by introducing the Book token economic model, the Bitcoin Library project establishes a self-sustaining economic system, ensuring the sustainability of its long-term operations.

## 1. The Evolution of Information Storage and the Revolutionary Role of the Bitcoin Network

As human society has developed, the means of storing information have evolved from primitive etchings on stones and walls to paper records, and now to modern electronic devices. While these advancements have significantly improved the efficiency and convenience of information storage, the durability of information from a long-term preservation perspective has shown a decreasing trend. For example, traditional paper materials can last for hundreds of years, whereas the lifespan of modern electronic storage devices typically spans only a few decades. Even information carved into more durable substances like stone cannot escape the fate of physical environmental damage and erosion over time.

In recent years, scientists have explored new methods using quartz glass as a data storage medium. This technology employs lasers to create minuscule physical changes within quartz glass, thereby achieving long-term data storage. Theoretically, the data preservation capabilities of quartz glass can reach hundreds of millions of years, significantly surpassing the lifecycle of traditional storage mediums. However, despite the significant advantages of quartz glass storage technology in terms of

data preservation duration, it presents limitations in the convenience of information retrieval. This technology requires the use of specific reading devices to decode and access the stored data, which not only increases the cost of accessing information but also limits its accessibility.

In contrast, information storage based on the Bitcoin network, although theoretically not as physically durable as quartz glass, offers nearly instantaneous global access. With the aid of the internet, anyone can access data on the blockchain at any time from any location without the need for special equipment, greatly enhancing the circulation and availability of information.

As the value of Bitcoin has significantly increased, so too has the strength of its consensus mechanism. This consensus is not only rooted in the robustness of the technology but is also reflected in a large community of stakeholders—including miners, developers, investors, and millions of ordinary users. These participants create a strong network effect, with each individual contributing in their own way to the stability and security of the Bitcoin network. The immutability of information on Bitcoin is primarily attributed to several core principles

Throughout history, the way we store information has dramatically evolved, moving from ancient carvings on stones and walls to paper records, and now to our modern-day digital devices. While these technological advancements have undoubtedly made storing and accessing information more efficient, they haven't necessarily extended the lifespan of the information we keep. For instance, while traditional paper can last centuries, the life expectancy of modern electronic storage is just a few decades at best. And while carving information into stone may seem like a permanent solution, these are still vulnerable to physical and environmental wear and tear over time.

Recently, scientists have started to look into quartz glass as a potential solution for long-term data preservation. This technique involves using lasers to make tiny physical changes in quartz glass to store data, potentially preserving information for hundreds of millions of years—far outlasting conventional storage methods. But there's a catch: accessing this data requires specialized reading equipment, which can be costly and isn't exactly user-friendly.

This brings us to the fascinating role of the Bitcoin network in modern information storage. Although the physical lifespan of data stored on the Bitcoin blockchain may not match that of quartz glass, the accessibility it offers is unparalleled. Thanks to the internet, anyone can access blockchain data anytime, anywhere, without needing any special tools, dramatically enhancing how information flows and is used globally.

As Bitcoin's value has soared, so has the robustness of its consensus mechanism. This strength comes not just from the technology itself but also from the vast community of stakeholders it has garnered—miners, developers, investors, and millions of everyday users. This collective effort creates a powerful network effect, ensuring the stability and security of the Bitcoin network. The key to Bitcoin's success in securing data lies in its core principles[1]:

**1. Cryptographic Hash Functions (SHA-256):** Each Bitcoin block contains a series of transactions, which are encapsulated within a data block and encrypted using the SHA-256 algorithm to generate a unique hash value. Due to the one-way nature of hash functions—meaning it is nearly impossible to deduce the original data from the hash value—and their high sensitivity to input changes, any slight modification to the block data results in a significant alteration of the hash value.

**2. Proof of Work (PoW):** PoW requires miners to solve complex computational problems to validate their work, involving substantial computational resources and electricity consumption. Once the

problem is successfully solved, a new block is created and added to the blockchain. Each new block's hash value includes the hash of the previous block, creating a chain of blocks. Therefore, to alter any existing block's information, an attacker would need to recalculate the hash values for that block and all subsequent blocks and complete the corresponding PoW, which is practically infeasible due to the immense computational effort required.

**3. Decentralized Network:** The decentralized nature of the Bitcoin network means that no single point can control the entire blockchain. Any changes within the network must be agreed upon by the majority of nodes, that is, over 50% of the computational power. This design significantly increases the difficulty for potential attackers to tamper with the information on the chain.

**4. Economic and Social Deterrents:** For potential attackers, the cost of attempting a 51% attack far outweighs the potential gains, given the current technological and market dynamics. Specifically, controlling more than half of the network's computational power would require a tremendous amount of capital to purchase and operate the necessary mining equipment. Moreover, the computational power of the Bitcoin network is distributed globally, maintained by thousands of independent mining operations and individual miners, making it nearly impossible to amass enough computational power to launch an attack. Even if an attacker could successfully control the required computational power, the attack itself would likely have a significant negative impact on the market value of Bitcoin. News of a successful attack would greatly diminish trust in Bitcoin, thereby reducing its value. Thus, attackers would not be able to reap the expected economic benefits from their attack, and would instead face substantial financial losses.

Therefore, the Bitcoin network is not only secure, but also a powerful tool for maintaining the immutability and reliability of data. As a distributed ledger built on blockchain technology, it offers a highly secure and tamper-proof platform for data storage. Compared to traditional server-based storage solutions, which often depend on centralized management entities for security and integrity, the Bitcoin network provides a more reliable and secure solution for information storage. The core of blockchain technology lies in its global, distributed node consensus mechanism, ensuring the permanence and immutability of data. As long as the Bitcoin network continues to operate, the information stored on it potentially has eternal life. By encoding human knowledge and cultural achievements into the Bitcoin blockchain, we can essentially create a digital library that never fades, offering a robust and enduring repository for human civilization. This is not just a technological breakthrough but a profound revolution in how we preserve knowledge and culture.

## **1.1 Guarding Our Legacy: Preserving Cultural Heritage in the Digital Age**

As our society continues to progress and technology rapidly advances, we are staring down the barrel of a future filled with immense possibilities. In this future, our ways of living and entertaining ourselves could undergo radical changes. As we move forward, traditional reading habits and the appreciation of classic literature might gradually be edged out by emerging forms of entertainment. Over time, even those literary works that hold significant importance to human history and culture could fade from public consciousness, eventually being forgotten as they are mentioned less and less.

In this context, those of us living in the 21st century—witnesses and participants of a technological explosion—bear a unique responsibility and mission. We need to preserve the classic literary works

that have defined our culture and history for future generations. In this endeavor, the Bitcoin network and its blockchain technology offer a unique solution. By permanently storing digital copies of these literary works on the Bitcoin blockchain, we ensure their preservation free from physical constraints and guarantee that no matter how far human civilization progresses, these crystallizations of human intellect and emotion remain easily accessible and appreciable by future generations.

This is not just about storing data; it's about safeguarding our collective memory and ensuring that our cultural heritage continues to enrich lives, long into an uncertain and digitally-dominated future. By leveraging the blockchain, we're not just archiving what we cherish; we're keeping it alive and relevant, ready to inspire and educate the world anew.

## 1.2 The Current State and Potential Value of Data Storage on the Bitcoin Blockchain

While the Bitcoin network has introduced a revolutionary platform for data storage, the information currently stored on the blockchain often doesn't fully exploit this advantage. For instance, consider the analysis under the BRC20 protocol, where a token like sats has already generated 21,722,504 records of mint and transfer types. Each record takes up about 60 bytes on average, amounting to a total of approximately 1.3 billion bytes. To put this volume of data into perspective, let's compare it to the storage needs of literary works. Novels vary widely in length, so here we provide some average byte requirements for different categories of literature and how many such books could be stored within 1.3 billion bytes.

Based on the definitions of short, medium, and long novels, their average word counts are approximately 7,500 words, 40,000 words, and 80,000 words, respectively. If we calculate an average of 6 bytes per word, the byte requirements for each type of literary work are about 45,000 bytes, 240,000 bytes, and 480,000 bytes. The following table illustrates how many books could be inscribed using the space occupied by the sats token under the BRC20 protocol:

This example shows us not just the vast capacity of blockchain data storage but also underscores how this technology can be leveraged beyond traditional applications. Just imagine, the same technology used to track and verify transactions can also serve as a digital fortress safeguarding our literary heritage. The potential is vast and varied, stretching from the realm of cryptocurrencies into the very core of human culture and knowledge.

	Short story	novella	Full-length novel
Average bytes	45000 bytes	240000 bytes	480000 bytes
How man books can be stored by 1.3 billion bytes?	28888 books	5416 books	2708 books

The Masterpiece "One Hundred Years of Solitude" comprises approximately 150,000 words, which, including the foreword, occupies around 820,000 bytes. Remarkably, just one satoshi token can encapsulate 1,585 copies of this vast tome on the Bitcoin blockchain. While Bitcoin can host countless fungible tokens, named whatever we choose, how many such renowned works do we actually have? Even if we combined every major work in human history, it wouldn't fill the space occupied by a single fungible token.

This comparison highlights the immense storage capacity of the Bitcoin blockchain, which is currently widely used for recording financial transactions. If we were to repurpose this capability towards cultural and educational ends, its potential value would be enormous. Through the Bitcoin Library project, we could tap into this underutilized resource to create a digital global library, offering readers worldwide instant access to world literature. This would also provide a secure and enduring repository for humanity's cultural heritage.

By establishing a digital library, we would be building an unprecedented monument to civilization, paving new paths for the transmission of human knowledge and cultural accumulation. This initiative isn't just about preserving the past; it's about embracing the future, leveraging cutting-edge technology to secure the treasures of human expression for generations to come. This is more than a technical feat—it's a cultural revolution, offering every story a chance to be told and every voice a chance to be heard, forever.

## **2. Ensuring the Sustainability of the Bitcoin Library**

### **2.1 Economic Model**

Establishing a digital library on the Bitcoin blockchain involves addressing the costs associated with data inscribing, especially the transaction fees required for inscribing books. While donations provide necessary financial support in the early stages, they are not a viable long-term solution. The instability and unpredictability of donations mean they cannot guarantee the project's continuity and stable development. Moreover, reliance on donations can make the project overly dependent on external factors for funding allocation and decision-making, affecting its autonomy and flexibility.

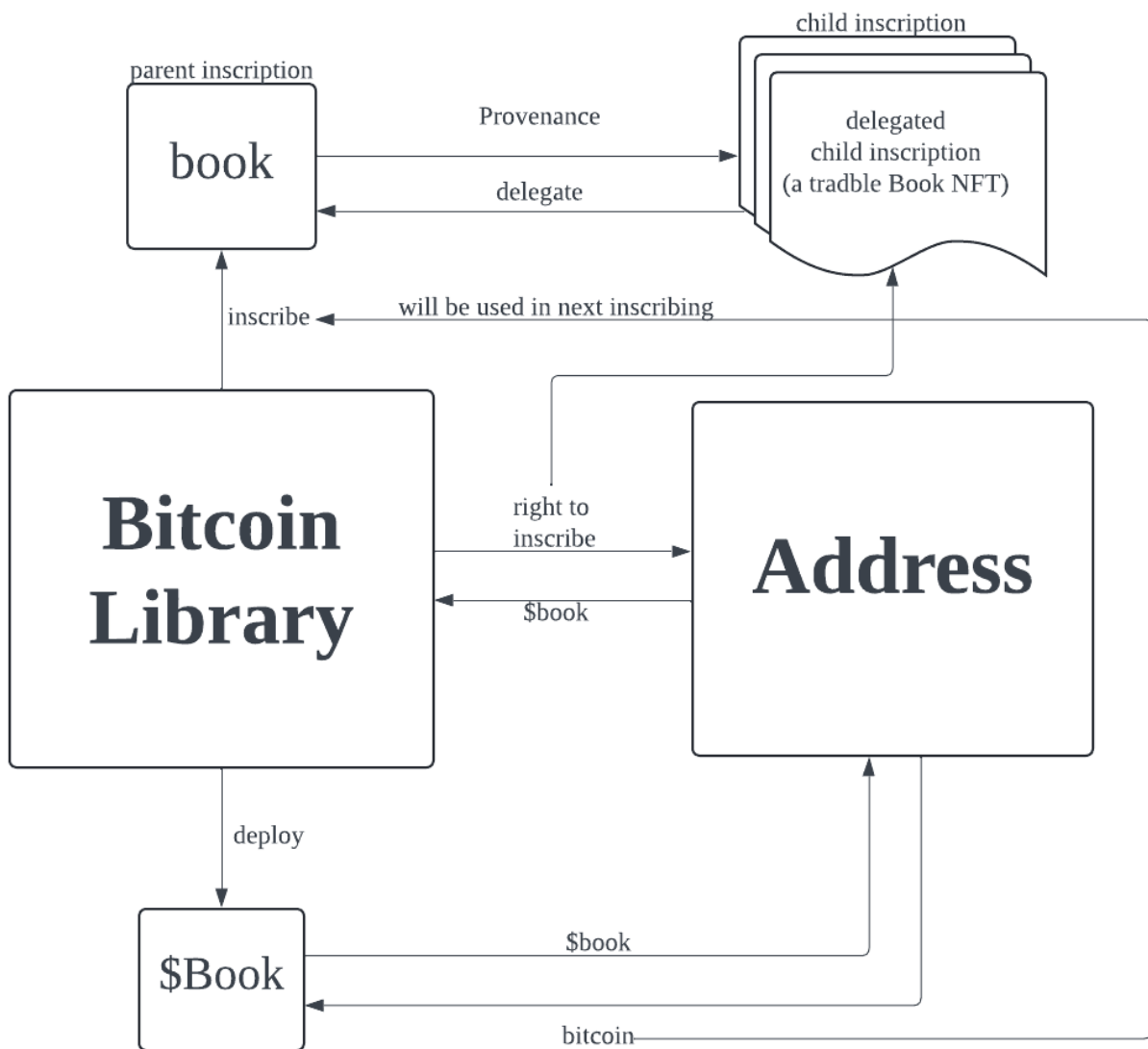
To ensure the project's sustainable operation, we've designed an economic and technical process with inherent recycling potential:

**1. Issuance of Book Tokens:** We issue a token named Book, which is central to participating in the project and minting child delegated inscriptions of books. Participants can purchase Book tokens using Bitcoin. This process not only provides initial funding for the project but also turns participants into direct supporters.

**2. Blockchain Listing of Books and child delegated inscription:** Once a book is successfully inscribed on the blockchain, participants holding Book tokens must transfer these tokens to the official address to be able to mint child inscriptions of the book. After receiving Book tokens, the

project can resell these tokens to obtain more Bitcoin. This Bitcoin will be used to inscribe more books, continuously expanding the project's book inventory and using up the market's Book tokens in the process of inscribing new sub-inscriptions.

**3. Ownership and Trading of Books:** Participants who inscribed sub-inscriptions receive a unique copy of the book in their blockchain address, which they can choose to keep or sell. Those who choose to keep it can enjoy benefits like using fewer \$Book tokens for the next book inscribing and voting rights on the selection of the next book to be inscribed by the library. Collections of book sub-inscriptions can be traded on NFT marketplaces like Magic Eden. The project earns additional income by collecting a small fee from each transaction, which helps maintain ongoing operations. This model is illustrated in the following diagram (Figure 1).



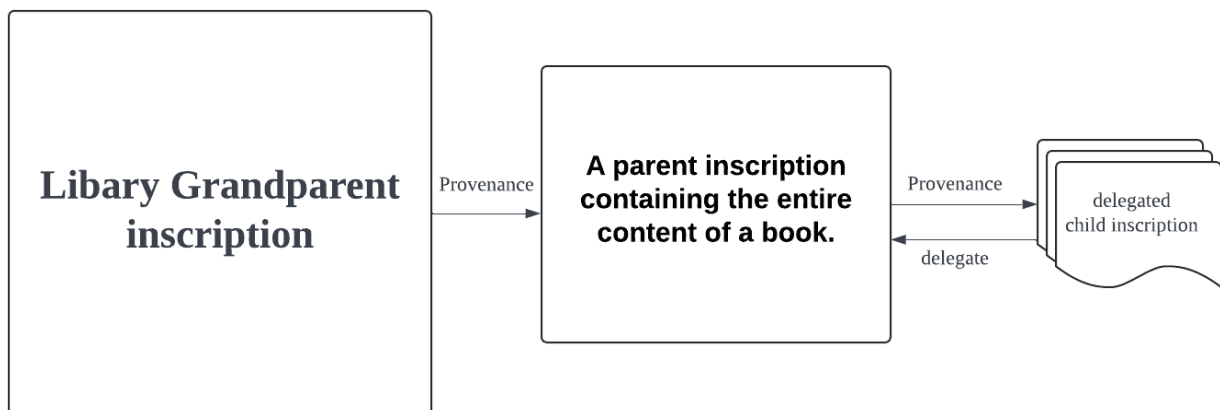
## 2.2 Book child delegated Inscription Techniques and how to make it

We employ a combination of parent-child inscription and delegate inscription technologies to ensure efficient and flexible book management and access:

**Parent-Child Inscription Technology:** This method is used to establish hierarchical relationships between inscriptions, particularly in creating collections of books. By creating a parent inscription that represents an entire collection, child inscriptions are derived from it, with each child inscription representing an individual book within the collection. This approach not only helps clearly define the scope of a collection but also facilitates the management of book series. Each book belongs to a different collection, yet all are part of the overarching Bitcoin Library collection.

**Delegate Inscription Technology:** For the actual content of the books, delegate inscription technology significantly reduces data redundancy. Each child inscription does not store the book's content directly; instead, it points to an inscription containing the full content of the book. This means all child inscriptions are consistent in content with the parent inscription, ensuring the consistency and completeness of information while greatly conserving storage space.

These methods, illustrated in Figure 2, demonstrate how the Bitcoin Library can efficiently manage and provide access to a vast amount of literary content, streamlining the process while maintaining integrity and reducing the digital footprint. This innovative approach not only maximizes resource use but also aligns with the decentralized and secure ethos of the blockchain environment, providing a robust framework for cultural preservation in the digital era.[2]



### 2.3 The Economics Model of Book Token

According to our economic model, we understand that the Book token is crucial for the long-term operation of the project. We will use this as a basis to establish a sustainable model to ensure we can secure enough funds to mint new books. So, how do we determine how many Book tokens are needed for a book?

Consider the following mathematical model:

Let the Gas fee for minting a book be  $G(b)$ , let the price of one \$book that library sales to public at time  $t$  be  $v(t)$ , let the number required \$book tokens to inscribe a child delegated inscription be  $R(b)$ , and let the number of minting child delegated inscription of a book be  $n(b)$ . Here, the variable  $b$  represents the book, and  $t$  represents time.

To achieve sustainability, we first need to satisfy the following inequality:

$$C(b) > \frac{G(b)}{v(t) \cdot n(b)}$$

This inequality ensures that the library can at least recover the minting costs from the Book tokens collected during the minting of a new book, securing the gas for the next book.

After the library recovers these \$book tokens, they need to be sold to raise the funds necessary for minting new books. The selling process introduces market pressure as it involves releasing tokens into the market. Although there's a deflationary effect when the tokens are recovered, to protect the interests of \$book holders and mitigate any significant market impact due to the library's recovery and selling actions, we have developed the following model:

When the library recycles \$book tokens, they are not directly released into the market. Instead, we offer a special discount to users who owned the previous child inscription. Simply put, users who owned the last book child inscription can acquire enough tokens at a lower price for the next minting. This gives users two options:

1. Quickly sell the tokens to the market. They will miss the next book's inscribing and lose the eligibility to mint \$book at a lower price.
2. Hold onto the tokens until the next book is inscribed. This allows them to acquire a new book's NFT at a lower price while keeping the tokens circulating between the library and themselves, thus reducing the library's market impact.

Even if most users choose the first option, the eligibility to acquire tokens at a lower price will gradually shift to those more willing to contribute to building the library's collection. This design not only protects token holders' interests but also encourages more book enthusiasts to actively participate in our project. Through this mechanism, we can stabilize the market and ensure that the \$book token's price is not adversely affected by the library's recycling and selling activities. Moreover, it provides a benefit to those truly passionate about minting new books, allowing them to purchase tokens at a lower price and actively participate in the minting process, contributing to the project's long-term development. Holders of \$book tokens will gain the right to vote, and the community's voting results will determine the next book selection for the Bitcoin Library. Additionally, as we develop this public project, we use \$book as a means for community governance. When the project faces pivotal decisions, all \$BOOK holders will receive voting power proportionate to their token holdings, thus tightly integrating the community with the library.

In summary, we have developed an economic model that ensures the project's stable operation in its early stages. However, this model may not be suitable when the \$book token's market value is very high. Future challenges will be discussed later. We define \$book not merely as an accessory to books but envision it as the book of humanity, book of genes, book of planets, book of animals, book of art, and book of everything worth remembering. Imagine transferring human genomes onto the blockchain, or exquisite artworks and historically significant buildings as they fade over time... \$book is the cornerstone of all these, forming the foundation of everything worth storing on bitcoin.



### **3. Governance Structure and Financial Management**

To ensure the fairness, transparency, and long-term sustainability of the Bitcoin Library project, we place great importance on establishing a robust governance structure and financial management system. In the project's early stages, we plan to implement the following measures:

1. **Multi-Signature Wallet Setup:** Following the successful minting of the project's first book, we will seek to collaborate with reputable third parties to jointly manage the funds of the Bitcoin Library. By setting up a multi-signature wallet, any use of funds will require the joint approval of multiple parties, thus ensuring the safety and transparency of the project's finances. We will also open up a supervision mechanism to the community, where all token holders possess voting rights that influence the future decisions of \$Book. The community will act as witnesses to ensure the proper operation of the project.

2. **Regulatory Compliance:** To further enhance public trust in the project, the Bitcoin Library will voluntarily submit to external oversight to ensure its operations are transparent and fair. The blockchain network's openness ensures that the library will manage its funds through a public address, with every transaction recorded and disclosed to all community members.

3. **Early Builder Incentives:** Recognizing the critical importance of early participants to the project's success, we will reserve a portion of Book tokens as rewards for early builders. These tokens will serve as recognition of their contributions and trust, while also motivating more people to join and support this public interest project.

Through these measures, the Bitcoin Library project is committed to creating a healthy, transparent ecosystem, ensuring that all participants—whether contributors, readers, or administrators—can collaborate in an environment that promotes the preservation and heritage of human culture. We believe that with the power of the community and the participation of well-meaning third parties, the Bitcoin Library can achieve its grand vision and make a lasting contribution to humanity's repository of knowledge and culture.

### **4. Summary**

The proposal of the Bitcoin Library project marks the dawn of a new era—an era where Bitcoin blockchain technology is used to permanently preserve and globally share humanity's cultural heritage. This project not only addresses the limitations of traditional and modern information storage methods in terms of permanence and accessibility but also ensures the project's long-term sustainability and self-sufficiency through an innovative Book token economic model. With the implementation of this project, we will be able to provide global users with instant access to cultural materials and literary works from around the world, regardless of their original formats or storage conditions.

As the Bitcoin Library project develops, we look forward to expanding it into a comprehensive platform for the preservation of digital heritage, not limited to books but also including ancient buildings, artworks, and even biodiversity information. These efforts will collectively build a repository of knowledge and culture that future societies can rely on.

To achieve this ambitious goal, the Bitcoin Library project will dedicate itself to establishing sound governance structures and financial management systems to ensure the project's transparency, fairness, and security. Simultaneously, we will actively seek the participation and support of the community and well-meaning third parties to promote the successful implementation of the project.

Ultimately, the Bitcoin Library project is not just a technological innovation; it represents a cultural revolution, a profound respect and protection for the achievements of human intellect. We believe that through the collective efforts of the community, the Bitcoin Library will serve as a bridge connecting the past, present, and future, leaving behind a rich, diverse, and vibrant cultural heritage for future generations.

## **References**

- [1] Satoshi Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System," <https://bitcoin.org/bitcoin.pdf>.
- [2] Casey, "Ordinals," <http://www.https://docs.ordinals.com>.