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Intellectual Property Valuation Report

Understanding the Market Value of Intellectual Property

BLOCKCHAIN-BASED AUTHENTICATION AND COMMUNICATION

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December 11, 2023

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1 Executive Summary

Blockchain technology is a distributed database or ledger that enables the secure sharing of information. Data is stored in a database, and transactions are recorded in a ledger. This technology, known as distributed ledger technology (DLT), allows for permanent, immutable, and transparent recording of data and transactions, enabling the exchange of value. Storing data in the blockchain will bring vast improvements to data security. Currently, the cloud data is stored in centralized storage units, which makes it sensitive to any security breach. Blockchain can enhance the safety and speed of cloud storage. The data stored in the blockchain will be stored across the network. There will be no need to rely on a central entity or location in this case. Any data attack will not be potentially fatal to blockchain storage. There will be no way to tamper with or steal the data stored in the blockchain. Storing data in the blockchain will secure it from force majeure circumstances that damage and destroy centralized databases at present (e.g., theft or hacking). A distributed blockchain data storage network will store redundant copies of data among different nodes so that there is no data downtime or loss, no matter what. Blockchain has the potential to store, process, and manage data without the need to rely on any third party.

SUBJECT MATTER: IMPLEMENTATION OF BLOCKCHAIN IN AUTHENTICATION AND COMMUNICATION

The subject portfolio under consideration comprises plurality of patent publications in US, EP, CA, JP, AU, and KR jurisdictions, relating to a single patent family. Thus, this report estimates the market value of the whole patent family. The portfolio describes various inventions that disclose methods for validating authenticity of a physical identification object and securing satellite data communications between first and second stations and granting access to property to a user of a key fob. A brief of the exemplary technologies as covered in the US granted/allowed patents within the family is provided below.

- **US10878429B2**

Barcodes, such as the Universal Product Code (UPC), are used in various industries to identify and track products. The first six to nine digits of a UPC are called company prefixes, assigned by GS1, the global standards organization for item and shipment identification. The next set of digits is called product numbers, which uniquely identify individual items. Product numbers are arbitrarily assigned by each company, while the twelfth character is called the check digit. Global identifiers, like UPC barcodes, simplify product information management and enable local stores to easily retrieve product information at the point of sale. However, companies must not create their own UPC numbers, as they can be duplicated, counterfeited, or stolen. Tracking each product can be logistically challenging, leading to unnoticeable revenue losses. Consequently, there is a need for a method for validating the authenticity of a physical identification object.

The invention thus outlines a method for storing user images, read-only images of physical identification objects, and corresponding digital identifiers in the blockchain. When a request to access a physical identification object's image is received, the user is prompted to input a code for validation. After validating the code, the system captures and verifies the user's image against stored data. It then scans

the physical identification object, matches its digital identifier, and transmits the read-only image to the user. The system automatically checks the validity of the physical identification object by comparing it with the read-only image. If invalid, it adds a blockchain block with details about the invalid physical identification object to a blockchain associated with the user.

- **US11257098B2**

Data communications are crucial in various industries, with many investing in security systems to control access to property. Security systems include physical locks and keys designed to protect property from unlawful access and communication data hacking. However, these keys are vulnerable to risks such as copying or theft. Hacking techniques have also been developed to counter advancements in security technology. The invention thus outlines a method for secure communication between two stations via a satellite, specifically for accessing physical property. The first station requests an access key to access physical property from a server, which validates and provides the access key. The first station shares this access key with the second station, and the second station transmits the access key to the server. The server further validates the access key, and upon successful validation, the server sends confirmation data to the first station via the satellite. Then the server permits secure data communications between the two stations. Further, the server generates and stores a validation history of the access key in a hyper ledger, preventing satellite data communications via an uplink if the server fails to validate the access key.

- **US20220277317 (Application Granted)**

As data communication is an integral part of business, various industries are investing in security systems to control access to property. Unlawful access to the property and communication data hacking can be achieved by using physical locks and keys or similar security systems. However, these keys are vulnerable to risks such as copying or theft. Further, hacking techniques have also been developed to counter advancements in security technology. Therefore, the invention outlines a method for granting access to property to a user of a key fob. Firstly, a key fob receives an encryption code from a mobile device and transmits it to a validation module, which is incorporated into the property. The validation module checks the code's validity and grants access to properties when the code is valid. If the code is determined to be invalid, it denies access to the property and, in response, transmits an access message to the key fob and a first access log message to the mobile device. The mobile sends a second log message to a server, updating the key fob's access log in a hyper-ledger.

MARKET TRENDS

With increasing connectivity, IoT devices are falling victim to security vulnerabilities, such as botnet attacks, distributed denial of service (DDoS) attacks, and insecure interfaces. Unsecured IoT devices give access to cybercriminals to exploit the system. IoT used in blockchain adds a higher level of security to prevent data breaches to make IoT safer and smarter.

The global Blockchain Technology market is expected to reach $176 billion by 2025 and $3.1 trillion by 2030[1]. Vendors in the market are focusing on increasing the customer base to gain a competitive edge in the industry. Therefore, key players are taking several strategic initiatives, such as mergers and acquisitions, and partnerships with other major companies.

- Some of the major players operating in the blockchain technology market include *IBM Corp., Microsoft Corp., The Linux Foundation, BTL Group Ltd., Chain, Inc, Circle Internet Financial Ltd., Deloitte Touche Tohmatsu Ltd., Digital Asset Holdings, LLC, Global Arena Holding, Inc., Mona, Ripple and etc.* The existing market players seem to be providing digital identity verification and property access management solutions, however, on the basis of the preliminary research, any product or technology having an exact overlap with the subject claimed terms, could not be identified. Considering the advancements in solutions for digital identity verification and property access management, it is believed that more and more market players will be willing to adopt the technologies disclosed in the subject patent publications in the coming future.

FAIR MARKET VALUE CALCULATION

A Hybrid Approach has been followed to evaluate the appropriate Fair Market Value for the Patent Portfolio under study.

- The first part of this hybrid approach involves market analysis of the technology disclosed in the IP under study and understanding how much revenue would be generated by the implementation of the subject technology. Several factors such as *Market Share, Adoption Rate, Annual Revenue, Overall Expenses, Net Profit Margin, IP contribution to Net Profit, Tax and Duties, etc*., influencing the market are considered to arrive at an expected Fair Market value.
- The second part of this hybrid approach involves rigorous analysis of the Intellectual Property pertaining to the technology under study. Different factors that would affect the applicability of a patent are taken together to understand the actual worth of the Intellectual Property under study. For example – what problem is being solved by the patent is the problem being solved prevalent in the market, availability of similar products in the market, etc.

Based on all the evaluated factors, the Fair Market Value for the subject patent family is estimated to be around **USD 2 – 2.5 billion**.

[1] https://www.gartner.com/en/doc/3855708-digital-disruption-profile-blockchains-radical-promise-spans-business-and-society

2 Introduction

2.1 IP Valuation – An Overview

The current market value assessment exercise aims to determine the Net Present Value (NPV) that the patent portfolio pertaining to the given technology may generate for the patentee/licensee of the invention based on the present status and forecasting of the future value of the technology. The methodology followed in the current valuation exercise utilizes a financial model to understand/evaluate/determine various parameters such as the size of the market, market share, projected growth over time, etc. to estimate future cash flows that would be realized based on commercial exploitation of the patents in the portfolio. The valuation exercise considers the potential product revenue adjusted for the contribution of the patent to the product and additionally discounted based on the risk assessment of the patent (is the patent issued or still in the application phase, term of the patent, how easy it is to invent around, technological lifecycle, risk of successful patent challenge, etc.).

2.2 Technology under Focus

The subject patent portfolio covers facets relating to validating authenticity of a physical identification object and securing satellite data communications between first and second stations and granting access to property to a user of a key fob. A brief description of all the patent publications under study is illustrated below.

- **US10878429B2**

This invention outlines a method for storing user identification through a blockchain-based approach. It involves storing user images, read-only images of physical identification objects, and trackable digital identifiers in separate blockchains on servers. When a request for a read-only image arises, the user is prompted to input a code. Validating the code triggers capturing and comparing the user's image with the stored image in the blockchain. Upon a match, a trackable digital identifier is obtained from a scanned physical identification object. The system searches for this identifier and transmits the corresponding read-only image to the user's device via a secure protocol. A comparison between the scanned physical identification object and its read-only image determines its validity. If found invalid, a block with information about the invalid object is added to the blockchain associated with the user.

Specifically, a blockchain passport application is initiated by a mobile device when a user clicks on an app icon. The device then displays a scan button, allowing the user's camera or other scanning device to scan a passport barcode or other identification document to obtain scanned code information. The scanned code information is then searched for by a government server for passport information corresponding to the code. The information may include an image of the person, a portion of a passport document, or an electronic passport. The mobile device then gains read-only access to the passport information securely stored in a blockchain on a government server. The passport information includes an image of the valid passport. In some cases, the mobile device displays the passport information to

determine its validity. In other cases, the device may scan a physical passport to obtain an image and compare it to the passport securely stored in the blockchain. After obtaining read-only access, the user can select a "Scan Item" button on the mobile device.

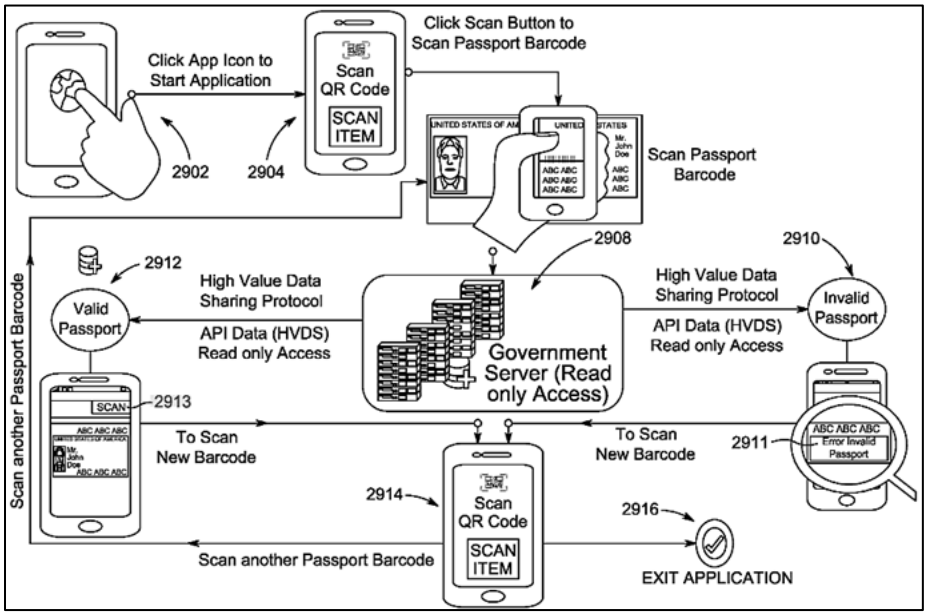


Figure 1 Exemplary figure from the patent depicting the invention

Additionally, after starting the application, the ID number and/or text is scanned, e.g., via OCR. Then, the application determines whether the ID is valid or not. If the ID is valid, ID proof details are displayed. If the ID is invalid, an error message is displayed (e.g., a message with the text: Invalid ID proof). Then, unless another ID proof needs to be scanned, the application is exited.

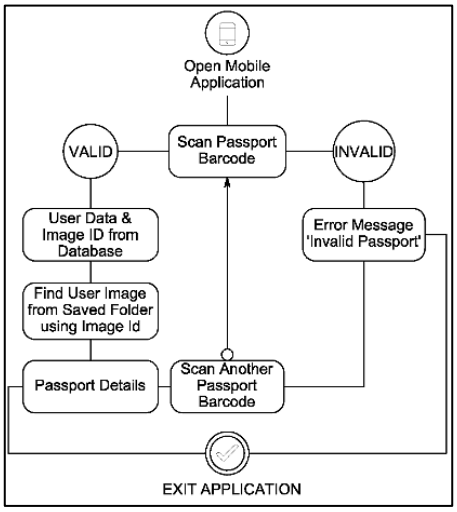


Figure 2 Exemplary figure from the patent depicting validity of the physical identification object

Furthermore, a software application to convert paper/plastic IDs to digital and store the files on Blockchain has also been developed.

- **US11257098B2**

The invention describes a method for securing satellite data communications in a sequential manner. A first station transmits a request for an access key to access a property to a server through satellite. Upon receiving the access key from the server, the first station transmits it to a second station. Subsequently, the second station forwards this access key back to the server for validation. If the server successfully validates the access key, it transmits validation data to the first station via the satellite, permitting further satellite data communication between the first and second stations. Moreover, the server maintains a validation history of the access key in a Hyperledger for record-keeping. If the server fails to validate the access key, the satellite has the capability to deny data communications, ensuring a robust security protocol for the interaction between the two stations.

Specifically, the servers determine if the received access key from the first station matches the one sent to the second station. If they do, they validate the key and notify the first station. The first station then allows communication with the second station via satellite. If the key does not match, the first station denies communication. The first station denies communication with the second station. If the second station is a valid station, it may attempt to receive another access code from the servers. The satellite communication method repeats, and in cases of validation and non-validation, servers create a block for these determinations and save it in the hyper-ledger.

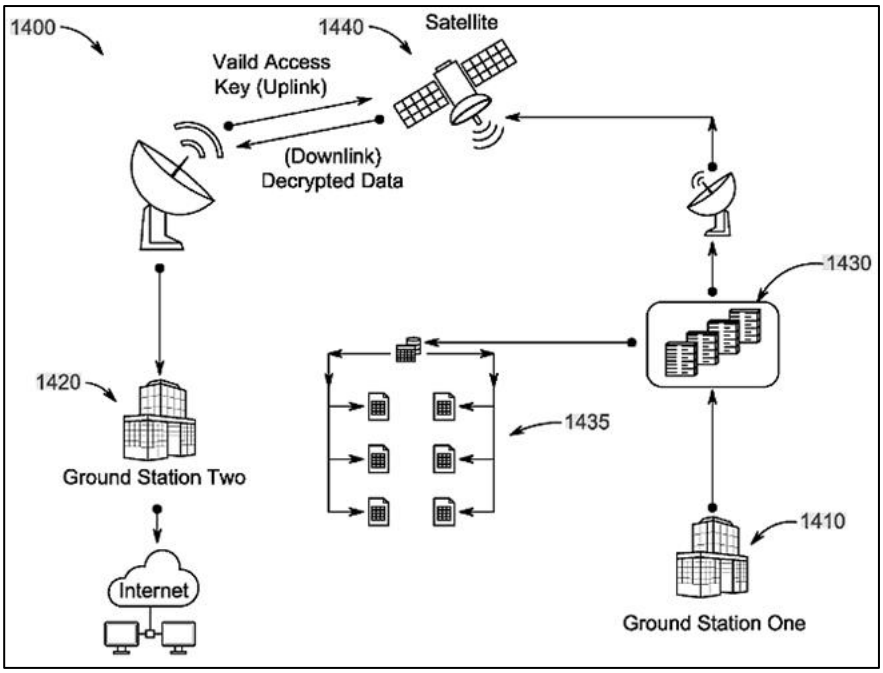


Figure 3 Exemplary figure from the patent depicting the invention

- **US20220277317 (Application Granted)**

The invention describes a method for granting access to property to a user of a key fob. First, the key fob receives an encrypted code from a mobile device. Subsequently, the key fob transmits this encrypted code wirelessly to a validation module residing on a computing device within the property. Following this, the validation module determines the validity of the encrypted code, either granting or denying access accordingly. Once this determination is made, the computing device sends two crucial messages: an access message to the key fob for immediate action and a first access log message to the mobile device for record-keeping. Notably, the first access log message triggers the mobile device to dispatch a second access log message to a server. Lastly, upon receiving the second access log message, the server updates the access log of the key fob in a Hyperledger.

Specifically, the key fob system consists of a property, a smart device, a key fob, and a server connected through a network. The key fob grants access to the property upon receiving an encrypted code from the smart device. The entry can be a door, engine, or lock, depending on the property. For example, a land vehicle property may have a door for entering or an engine to start. For aircraft or watercraft properties, the entry may be a door for controlling the aircraft or watercraft. For buildings or safes, the entry may be a door or lock. The smart device functions as a control device in the key fob system, capable of communicating with the key fob and the server via various methods, such as the internet wirelessly or wired, and with the key fob through Bluetooth. The key fob may have one or more buttons for accessing the property. For example, one button may be used to start an engine for land vehicles, watercraft, aircraft, or military vehicles. The key fob can be preprogrammed to pair with property via Bluetooth, eliminating the need for an internet connection. The same can be done with smart devices, also paired via Bluetooth. The server can store the access history of the key fob in property in a hyper ledger using blockchain technology. This allows the server to generate blocks for storing the access history and save them in the hyper-ledger stored on servers.

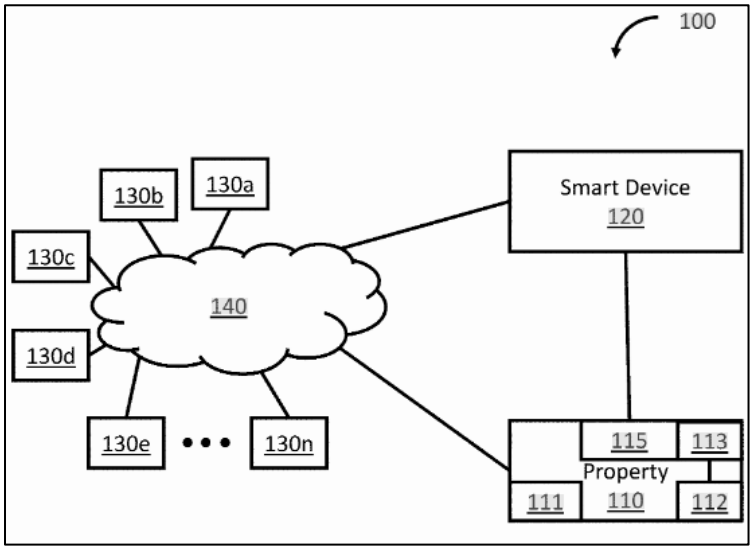
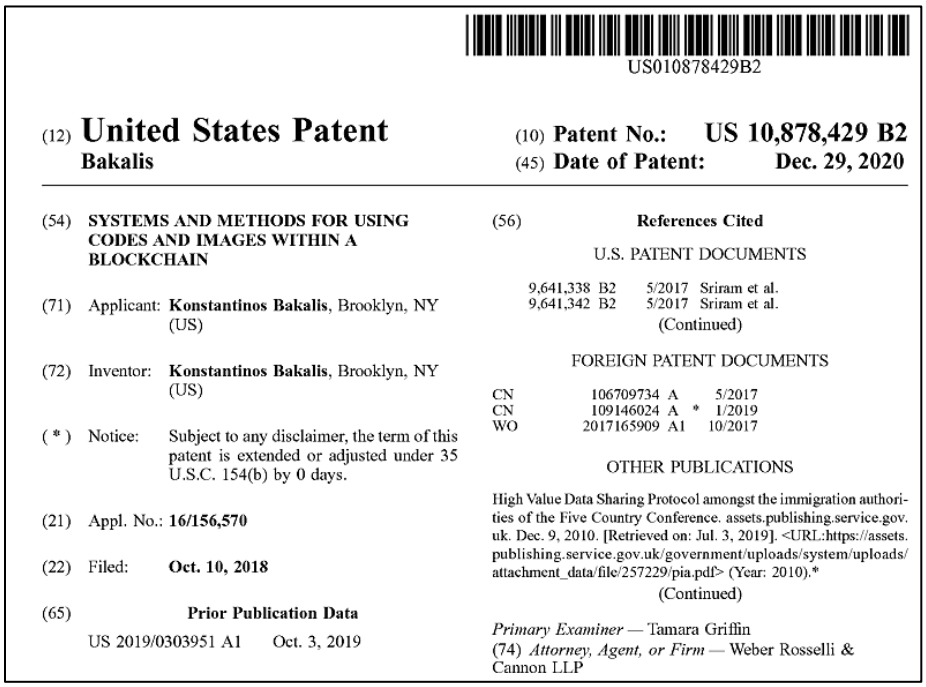


Figure 4 Exemplary figure from the patent depicting the invention

3 Impact of Subject Invention

3.1 Subject Patent Portfolio

The subject portfolio under consideration comprises plurality of patent publications in US, EP, CA, JP, AU, and KR jurisdictions, relating to a single patent family. Thus, the value computed in this report is for the overall patent family.



US010878429B2

(12) **United States Patent**
Bakalis

(10) **Patent No.: US 10,878,429 B2**
(45) **Date of Patent: Dec. 29, 2020**

(54) **SYSTEMS AND METHODS FOR USING CODES AND IMAGES WITHIN A BLOCKCHAIN**

(71) Applicant: **Konstantinos Bakalis**, Brooklyn, NY (US)

(72) Inventor: **Konstantinos Bakalis**, Brooklyn, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **16/156,570**

(22) Filed: **Oct. 10, 2018**

(65) **Prior Publication Data**

US 2019/0303951 A1 Oct. 3, 2019

(56) **References Cited**

U.S. PATENT DOCUMENTS

9,641,338 B2 5/2017 Sriram et al.
9,641,342 B2 5/2017 Sriram et al.
(Continued)

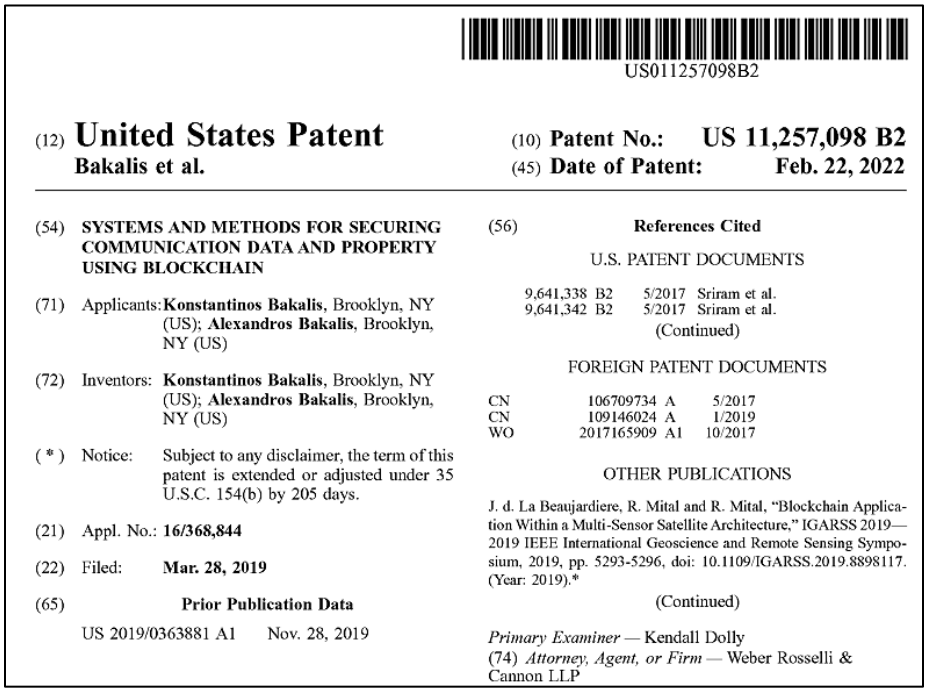
FOREIGN PATENT DOCUMENTS

CN 106709734 A 5/2017
CN 109146024 A * 1/2019
WO 2017165909 A1 10/2017

OTHER PUBLICATIONS

High Value Data Sharing Protocol amongst the immigration authorities of the Five Country Conference. assets.publishing.service.gov.uk. Dec. 9, 2010. [Retrieved on: Jul. 3, 2019]. <URL:https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/257229/pia.pdf> (Year: 2010).*
(Continued)

Primary Examiner — Tamara Griffin
(74) *Attorney, Agent, or Firm* — Weber Rosselli & Cannon LLP



US011257098B2

(12) **United States Patent**
Bakalis et al.

(10) **Patent No.: US 11,257,098 B2**
(45) **Date of Patent: Feb. 22, 2022**

(54) **SYSTEMS AND METHODS FOR SECURING COMMUNICATION DATA AND PROPERTY USING BLOCKCHAIN**

(71) Applicants: **Konstantinos Bakalis**, Brooklyn, NY (US); **Alexandros Bakalis**, Brooklyn, NY (US)

(72) Inventors: **Konstantinos Bakalis**, Brooklyn, NY (US); **Alexandros Bakalis**, Brooklyn, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 205 days.

(21) Appl. No.: **16/368,844**

(22) Filed: **Mar. 28, 2019**

(65) **Prior Publication Data**

US 2019/0363881 A1 Nov. 28, 2019

(56) **References Cited**

U.S. PATENT DOCUMENTS

9,641,338 B2 5/2017 Sriram et al.
9,641,342 B2 5/2017 Sriram et al.
(Continued)

FOREIGN PATENT DOCUMENTS

CN 106709734 A 5/2017
CN 109146024 A 1/2019
WO 2017165909 A1 10/2017

OTHER PUBLICATIONS

J. d. La Beaujardiere, R. Mital and R. Mital, "Blockchain Application Within a Multi-Sensor Satellite Architecture," IGARSS 2019—2019 IEEE International Geoscience and Remote Sensing Symposium, 2019, pp. 5293-5296, doi: 10.1109/IGARSS.2019.8898117. (Year: 2019).*
(Continued)

Primary Examiner — Kendall Dolly
(74) *Attorney, Agent, or Firm* — Weber Rosselli & Cannon LLP

US 20220277317A1

(19) **United States**

(12) **Patent Application Publication**

Bakalis et al.

(10) **Pub. No.: US 2022/0277317 A1**

(43) **Pub. Date: Sep. 1, 2022**

(54) **SYSTEMS AND METHODS FOR SECURING COMMUNICATION DATA AND PROPERTY USING BLOCKCHAIN**

(71) Applicants: **Konstantinos Bakalis**, Brooklyn, NY (US); **Alexandros Bakalis**, Brooklyn, NY (US)

(72) Inventors: **Konstantinos Bakalis**, Brooklyn, NY (US); **Alexandros Bakalis**, Brooklyn, NY (US)

(21) Appl. No.: **17/672,429**

G06K 7/10	(2006.01)
G06K 7/12	(2006.01)
H04L 9/06	(2006.01)
H04L 9/08	(2006.01)
H04L 9/30	(2006.01)

(52) **U.S. Cl.**

CPC ***G06Q 30/0185*** (2013.01); ***G06K 7/1413*** (2013.01); ***G06K 7/10722*** (2013.01); ***G06K 7/12*** (2013.01); ***G06K 7/1417*** (2013.01); ***H04L 9/0643*** (2013.01); ***H04L 9/0827*** (2013.01); ***H04L 9/0861*** (2013.01); ***H04L 9/30*** (2013.01); *H04L 9/50* (2022.05)

3.2 Market Applications/Advantages of Technology

A blockchain is a digital ledger of transactions maintained by a network of computers in a way that makes it difficult to hack or alter. Technology offers a secure way for individuals to deal directly with each other, without an intermediary like a government, bank or other third party. A list of records, called blocks, is linked together using cryptography. Each transaction is independently verified by peer-to-peer computer networks, time-stamped and added to the ledger. Once recorded, the data cannot easily be altered. Blockchain has various applications across different industries and settings. Below is listed some key market applications:

1. **Healthcare:** Traditional healthcare databases are typically centralized, making them vulnerable to single points of failure or cyber-attacks. Blockchain can provide secure and decentralized data storage and management. Blockchain can reduce patient identities, reducing the risk of identity theft and unauthorized access to sensitive healthcare information.
2. **Manufacturing:** Many manufacturing companies store information on parts, such as bar codes, QR codes, etc., in a database, which can be attacked by a cyber-attack, causing a loss of data. Blockchain can eliminate the risk of cyber-attacks by storing QR codes and bar codes in a block on the blockchain. The information becomes immutable. It cannot be altered or tampered with. This ensures the integrity of the QR codes over time.
3. **Government:** Utilizing blockchain in government processes can strengthen identification and authentication mechanisms, reduce the risk of fraudulent activity, and enhance the overall security and trustworthiness of government-issued identification systems. Government servers can store all the required data of a user in dedicated blockchains, which creates a transparent and immutable record of invalid identification attempts.
4. **IT Vendors:** Blockchain technology offers IT vendors a robust framework to improve transparency, security, and efficiency across various aspects of their operations. Data security and privacy are major concerns for IT vendors, as they store sensitive customer data and transactions on a blockchain, which ensures a high level of security.
5. **Travel and Leisure:** Many airline companies store data in traditional IT infrastructure, which can be vulnerable to cyber-attacks. By adopting blockchain, authorities can maintain tamper-resistant and auditable records, contributing to overall travel security. The decentralized nature of blockchain adds an additional layer of trust and transparency to the identification process in the travel and leisure industry.

Block chain offers numerous advantages across different industries and settings. Here are several key benefits:

1. **Enhanced security:** Blockchain can significantly alter the way sensitive data is viewed by creating a secure, end-to-end record that prevents fraud and unauthorized activity. It also addresses privacy issues by anonymizing personal data and using permissions to prevent access. The data is stored across a network of computers, making it difficult for hackers to view.

2. **Greater transparency**: Blockchain technology can significantly improve the way sensitive and crucial data is viewed. It creates an end-to-end encrypted record, preventing fraud and unauthorized activity. Privacy issues are addressed by anonymizing personal data and using permissions to prevent access. Blockchain stores information across a network of computers, making it difficult for hackers to view data. It also provides greater transparency by recording transactions and data identically in multiple locations, allowing all network participants with permissioned access to see the same information. Transactions are immutable and time- and date-stamped, enabling members to view the entire transaction history, virtually eliminating fraud opportunities.
3. **Instant traceability:** Blockchain technology provides an audit trail for asset provenance, aiding industries with concerns about environmental or human rights issues or counterfeiting. It allows direct sharing of provenance data with customers, exposing weaknesses in supply chains. Traceability data can also reveal weaknesses in supply chains, such as goods waiting for transit at loading docks.
4. **Increased efficiency and speed**: Blockchain streamlines traditional paper-heavy processes, reducing time, human error, and third-party mediation. Transactions can be completed faster and more efficiently, with documentation and transaction details stored on the blockchain, eliminating the need for paper exchange and reconciling multiple ledgers, resulting in quicker access to the stored details.
5. **Immutability:** Blockchain uses hashing techniques to store each transaction on a block that is connected to each other, so it has tighter security. Data cannot be tampered with in blockchain technology due to its decentralized structure so any change will be reflected in all the nodes so one cannot do fraud here, hence it can be claimed that transactions are tamper-proof.
6. **Cost Reduction:** As blockchain needs no third man, thus, it reduces the cost for the businesses and gives trust to the other partner.

Furthermore, a couple of patents in the family comprise the use of satellite communication for data communications. Secure Satellite data communication is the transmission of information between two or more points via communication satellites orbiting the Earth. Satellites act as relay stations in space, receiving signals from ground-based stations and retransmitting them to other ground-based locations. It plays a crucial role in enabling long-distance and global communication, particularly in areas where traditional terrestrial communication infrastructure is impractical or unavailable. Below are illustrated a few applications of satellite communication systems.

- **Military and Defense Systems:** Military applications often involve secure communication for accessing sensitive physical assets. Secure satellite data communication can ensure that only authorized stations can communicate and access equipment or systems.
- **Maritime Communication and Navigation:** Secure satellite communication is vital for maritime applications including safe navigation, tracking vessels, and transmission.

- **Global Connectivity for IoT Devices:** Internet of things (IoT) devices in various industries, such as utilities, transportation, and logistics, rely on secure satellite data communications to ensure global connectivity and the safe transfer of data between devices.
- **Land Surveying and Mapping:** Land surveyors rely on satellite communication to transfer mapping data, boundary measurements, and topographic information. This facilitates real-time collaboration among surveying teams and helps in updating maps with accurate geospatial data.
- **Aerospace and Aviation:** Secure satellite data communications facilitate safe air traffic management, real-time aircraft tracking, and communication between ground control and aircraft.

Secure satellite data transfers provides significant benefits in a variety of sectors and contexts. Here are a few important advantages:

1. **Wide scope:** Satellite communication can cover a wide range of the Earth's surface, including inaccessible and hard-to-reach ranges. This makes it a perfect solution for communication in regions where terrestrial communication framework isn't accessible or not cost-effective to introduce.
2. **High-speed communication:** Satellite communication can transmit information at high speeds, permitting quick and efficient communication. Usually particularly valuable for applications that require real-time information transmissions, such as video conferencing or remote sensing.
3. **Reliability:** Satellite communication is profoundly reliable because it isn't influenced by climate conditions or characteristic catastrophes that can disturb earthly communication foundations. This makes it a prevalent choice for basic applications such as military communication or emergency response.
4. **Secure Data Transfer:** Secure satellite communication employs encryption and authentication protocols, ensuring the confidentiality and integrity of the transmitted data. This is vital for sensitive applications like military operations and healthcare.
5. **Global Positioning:** Satellites contribute to global positioning systems (GPS), supporting navigation and location-based services which are integral in sectors like transportation, logistics, and emergency response.
6. **Support for IoT and M2M Communication:** Satellites play a crucial role in supporting the Internet of Things (IoT) and machine-to-machine (M2M) communication, providing connectivity for a myriad of devices and sensors.

These applications and advantages collectively make secure satellite data communications a valuable and versatile solution for addressing communication challenges in diverse settings and industries.

4 Industry/Market Research

The industry research aims to answer some obvious questions such as how big the industry is in terms of revenue, who are the top manufacturers, what is the growth rate, etc. To begin with, the first step is to identify the critical information required and analyze various sources for gathering said critical information. For this purpose, different product directories, industry catalogs, reference books, or other available literature are analyzed. Further, different publicly available literature through the web is surveyed with respect to the market to ascertain a product's novelty and the competitive advantages or disadvantages.

Apart from the online literature, it is also helpful to take note of the companies providing similar products in the said domain since they could be potential licensees should one choose to go further in the commercialization process. It is also a motive to understand the lifecycle of the subject technology. The below data has been surveyed from different sources to understand the market landscape.

4.1 Market Size – Global Blockchain Technology Market

The patents/inventions under consideration relate to the Blockchain Technology for validating authenticity of a physical identification object, securing satellite data communications between first and second stations and granting access to property to a user of a key fob. Thus, to estimate a fair market value of the portfolio, we explored several market reports dealing with Blockchain Technology. All these reports have comparable market statistics and owing to the presence of sufficient information required for calculating the market value, we have consulted a market report from *Gartner (Report)* for gathering data points related to the market. Besides, considering the average remaining life of portfolio, we have forecasted the market from the year 2023 to 2039.

GLOBAL BLOCKCHAIN TECHNOLOGY MARKET SIZE

Gartner forecasts that the business value generated by blockchain will grow rapidly, reaching $176 billion by 2025 and $3.1 trillion by 2030 [2].

The growing demand for e-identity has driven the expansion of Blockchain technology. The platforms based on blockchain technology have diverse applications in countries with weak identification processes and in unregulated countries. At the national level, the adoption of market demand-based identity platforms of blockchain technology has been carried out by many governments in order to promote secure transactions in the public and private sectors. Various governments have been using blockchain technology with their e-citizenship programs over the past few years. As a result, these countries have been able to develop identity-related procedures on their own and manage to reduce bureaucracy. Moreover, this technology has helped them to digitize all kinds of public transactions through a secure digital identity.

[2] https://www.gartner.com/en/doc/3855708-digital-disruption-profile-blockchains-radical-promise-spans-business-and-society

The major driving factor that is contributing to the ever-prospering growth rate of the Blockchain market include the increase in venture capital and investment in blockchain technology, widespread use of blockchain solutions in banking and cybersecurity, strong adoption of blockchain solutions for smart contracts, payments, and digital identities, and increased government initiatives. The blockchain networks have been promoted by government authorities in many countries. This is mainly due to the benefits that this technology brings to different businesses, such as increased transparency and efficiency. In addition, government initiatives and partnerships with commercial organizations to incorporate blockchain networks to protect existing systems are driving demand for blockchain systems. The market is expected to continue to offer the most lucrative opportunities for revenue generation throughout the forecast period.

Adoption of blockchain technology solutions has achieved massive popularity during the last 2–3 years for various business applications such as payments, exchanges, smart contracts, documentation, and digital identity. Investments by venture capitalists in blockchain technology increased during the first half of 2022. In 2021, the total capital inflows in the blockchain space were USD 30.5 billion. In 2022, this amount was surpassed by July. The total inflows by July 2022 were USD 31.3 billion in blockchain investments. With 616 deals, Web3 was the most popular sector of the blockchain industry for investment, while DeFi was the second most popular with 299 deals in 2022. Another example is the blockchain startup Diamond Standard, which raised USD 30 million in a funding round led by Left Lane and Horizon Kinetics. Investments declined during the second half of 2022[3].

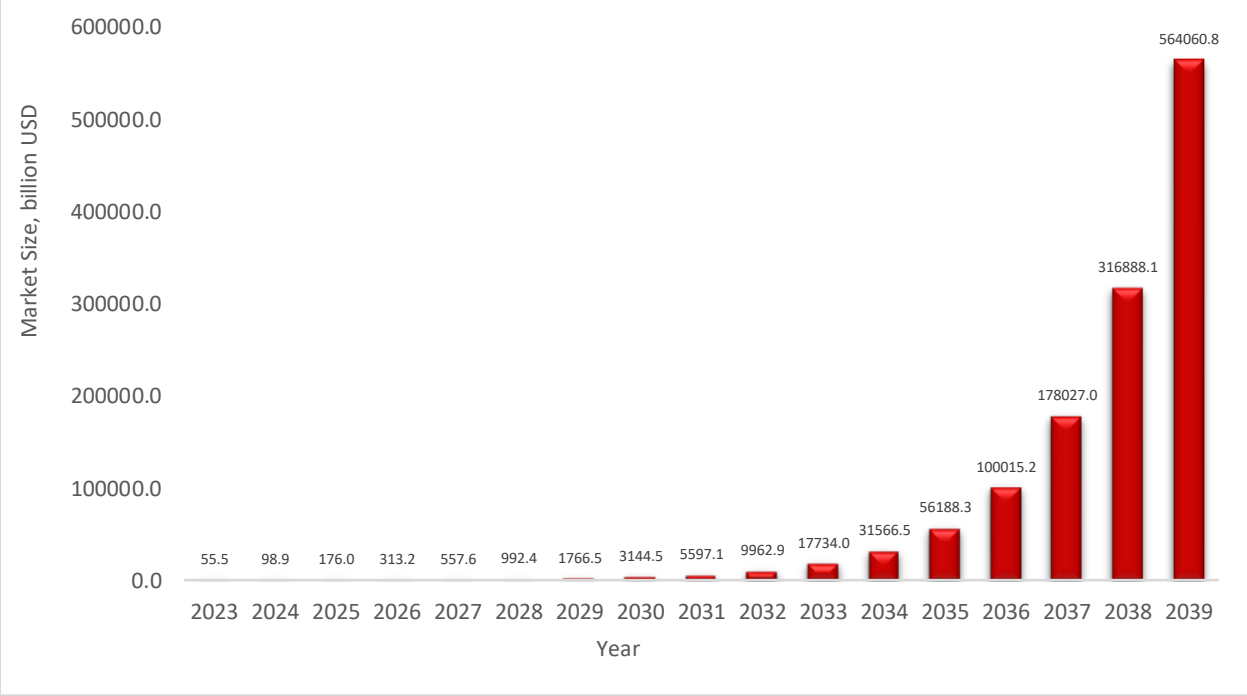


Figure 5 Exemplary figure from the patent depicting the invention

[3] https://www.marketsandmarkets.com/Market-Reports/blockchain-technology-market-90100890.html

OTHER GEOGRAPHICAL INSIGHTS

On a regional basis, the North American region has gained the largest market share due to the large number of startups in the region due to the growing demand for blockchain networks by large enterprises operating in the region. The presence of cutting-edge technological solutions in this region has greatly benefited the Blockchain technology market. Below is presented the region-wise share.

Regions	Revenue Share in 2022 (%)
North America	38%
Asia Pacific	22.60%
Europe	26.50%
Latin America	8.30%
MEA	4.60%

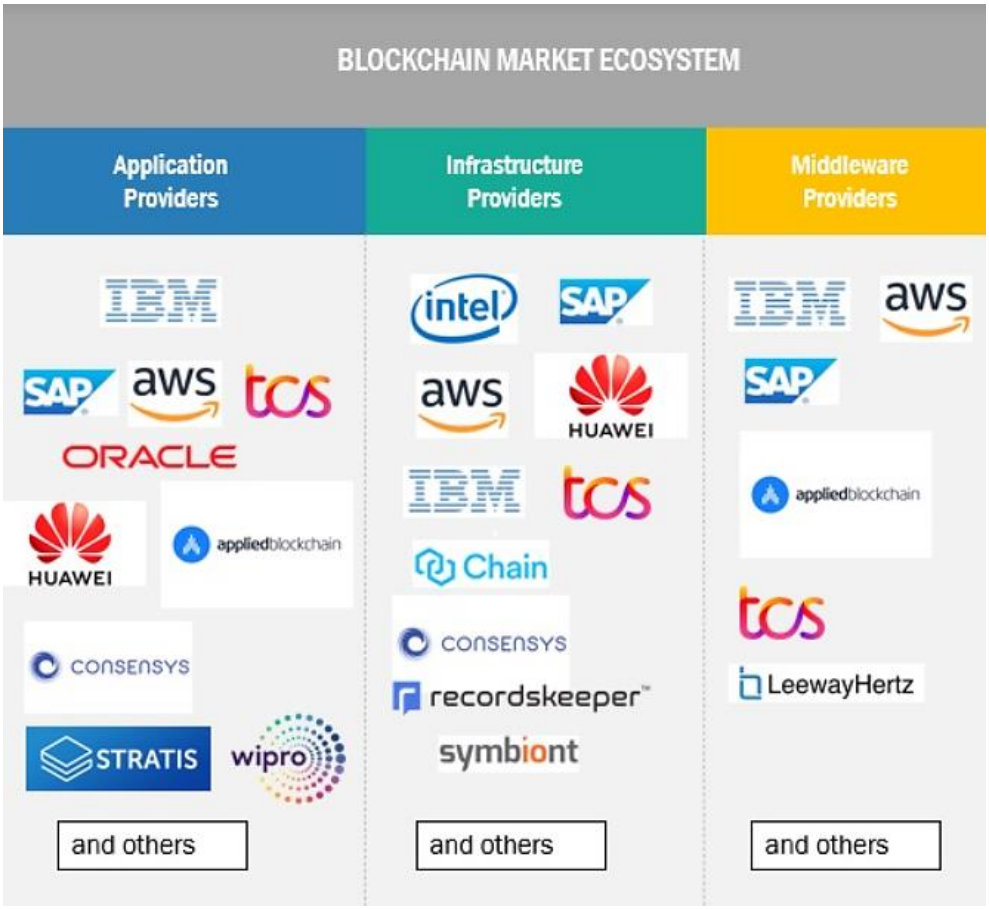
The large number of blockchain suppliers in North America has made it the dominant region in the global blockchain market. As the region has strong economic countries such as the US and Canada, it offers the most significant and advanced technological infrastructure. The presence of significant players in this region including IBM, AWS, LeewayHertz, and others is one of the primary drivers boosting the growth of the blockchain market in North America. Companies in this region are developing blockchain technology solutions to enhance the customer experience. Governments have also taken initiatives to spread awareness about blockchain technology such as arranging Blockchain Expos around the world as the demand for the blockchain technology rises and business operations become simpler. Government organizations such as the National Institute of Standards and Technology (NIST) are another example. NIST has been exploring blockchain technology on various levels including protocols, security guarantees, and cryptographic methods, as well as use cases, applications, and existing services.

COMPETITIVE LANDSCAPE / KEY PLAYERS

From its initiation, the blockchain technology has gained the interest of enterprises worldwide and has witnessed various experiments majorly conducted by large enterprises in collaboration with technology providers. Most of the major Fortune 500 companies ranging from BFSI to retail and eCommerce and from manufacturing to transportation are exploring the blockchain technology for its various benefits in business operations and data security. Some of the major enterprises experimenting with the blockchain technology are Walmart, Maersk, DHL, CGS, Dole, Nestlé, World Wildlife Fund, and the UN. Another factor contributing to the high market share of large enterprises in the blockchain market is the high R&D investments in developing the best-fit technology to enhance an organization's business efficiency. Large enterprises have the advantage of sufficient capital and other resources to incorporate newer technologies, enabling them to take the lead in the blockchain market. The global blockchain market is characterized by the presence of a significant number of large and several small players. IBM Corporation, Microsoft, and Google are some of the key players in the market. Although established players dominate the market, there are tremendous growth opportunities for new entrants that make

low-cost products to target the developing end markets. The rapidly changing market scenario with the increasing emphasis on enhancing aesthetics by minimizing maintenance costs is expected to provide growth opportunities to vendors.

Blockchain Market Ecosystem[4]



[4] https://www.marketsandmarkets.com/Market-Reports/blockchain-technology-market-90100890.html

4.2 Market Share & Adoption Rate

- **MARKET SHARE**

R&D initiatives play a vital role in enabling vendors to remain competitive in the marketplace. There are a large number of blockchain technology vendors in the market and therefore, continuous investment in R&D projects is highly important to gain a competitive edge over other players. Consequently, blockchain technology manufacturers are channeling a certain percentage of their revenue for R&D projects to launch new products with technologically advanced features and remain ahead of the existing players in the market. The players are focusing on developing innovative products and investing in R&D initiatives to expand their product portfolios. Since the development of the most prominent peer-to-peer decentralized crypto currency, the growth of the blockchain technology market has accelerated. Nowadays, many investors from different fields understand the benefits of this technology. From finance to medicine, various industries are choosing to integrate blockchain technology into their infrastructure.

The blockchain market might comprise other technologies and/or features (i.e., market alternatives) that would not overlap with concepts of blockchain solutions related to the subject inventions. Hence, *the market share of the disclosed blockchain technologies similar to the subject invention is assumed to be covering approx. 2% (0.02) of the overall blockchain technology market.*

- **ADOPTION RATE**

Achieving a high product adoption rate is key to the success of any product. The adoption process is different for different individuals as some people are more willing to adapt to change faster and some might adopt it later. The product adoption process consists of five groups of people[5]:

- **Innovators** *(comprising 2.5% of people):* These are individuals willing to take risks and that are enthusiastic about new technology.
- **Early Adopters** *(comprising 13.5% of people)*: The early adopters wait to see some initial results before jumping on board. They are willing to utilize new technology and are easily persuaded by innovators.
- **Early Majority** *(comprising 34% of people)*: The early majority shows some interest in technology but wait to see what happens with the early adopters before jumping on board.
- **Late Majority** *(comprising 34% of people)*: This cohort of individuals is cautious of new technology and waits for a majority of the population to adopt a new process to see its impact.
- **Laggards** *(comprising 16% of people)*: The final cohort of people are those who are resistant to change and skeptical of new technology.

[5] https://whatfix.com/blog/product-adoption/

Moreover, the adoption rate is one of the important factors in determining the market value of a product. Importantly, the rate at which a product is taken up has a great effect on the revenue that goes to the developer of the product. As often happens, initial uptake is low, and adoption grows slowly as people become aware of the product, try it out, and use it[6]. Early adopters show the product's potential value, and gradually other consumers begin to use it. As more users see the benefits, the product spreads throughout the market.

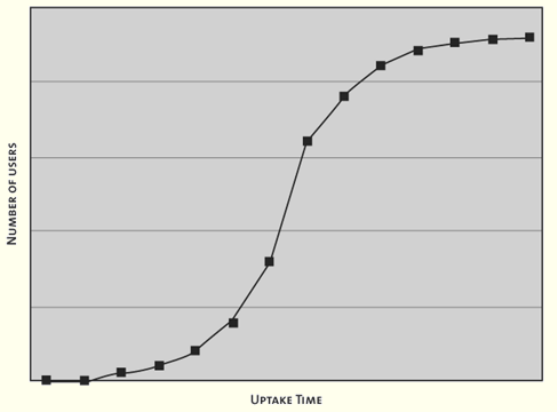


Figure 6 Generalized Adoption Curve for A New Product

From the market research, it is observed that many companies are working in the blockchain domain (please refer to Section 4.3) and many products in the market offer digital identity verification and property access management solutions, however a product with an exact implementation similar to the subject technology, was not identified during the preliminary research (although a detailed infringement research might yield potential products). Therefore, *the adoption of blockchain technologies, as disclosed in the subject patent portfolio, is valued to be covering less than 1% (considered 0.0025 for the current study) of the market presently. Further, considering the anticipated growth of the subject technology, the rate of adoption is estimated to increase at approximately 3% YoY for the next 3 years, increase at 6% YoY for the subsequent 3 years, increase by 9% YoY for the further 3 years, increase by 12% YoY for the further 3 years, and then increase at 15% YoY for the remaining forecasted years.*

[6] http://www.iphandbook.org/handbook/ch09/p02/

PRELIMINARY CALCULATIONS

Blockchain Technology Market (billion USD)									
Factors	**2023 (A)**	**2024 (B)**	**2025 (C)**	**2026 (D)**	**2027 (E)**	**2028 (F)**	**2029 (G)**	**2030 (H)**	**2031 (I)**
Global Blockchain Technology Market Size	55.5	98.9	176.0	313.2	557.6	992.4	1766.5	3144.5	5597.1
Market Share	1.11	1.98	3.52	6.26	11.15	19.85	35.33	62.89	111.94
Adoption Rate	0.0025	0.0026	0.0027	0.0027	0.0029	0.0031	0.0033	0.0035	0.0039

Blockchain Technology Market (billion USD)								
Factors	**2032 (J)**	**2033 (K)**	**2034 (L)**	**2035 (M)**	**2036 (N)**	**2037 (O)**	**2038 (P)**	**2039 (Q)**
Global Blockchain Technology Market Size	9962.9	17734.0	31566.5	56188.3	100015.2	178027.0	316888.1	564060.8
Market Share	199.26	354.68	631.33	1123.77	2000.30	3560.54	6337.76	11281.22
Adoption Rate	0.0042	0.0047	0.0053	0.0059	0.0068	0.0078	0.0090	0.0104

4.3 Present Market Applicability

EXISTING PRODUCTS & TECHNOLOGIES

According to a recent survey, enterprises are particularly optimistic about blockchain adoption. The study revealed that nearly 90% of businesses surveyed have already implemented blockchain technology to some extent, and 87% are planning to invest in it within the next year[7]. Notably, China now has more than 33,000 registered companies claiming to use blockchain technology in their businesses, according to the country's Center for Information and Industry Development[8]. The adoption of blockchain technology in the enterprise landscape is happening faster than anticipated. Some of the exemplary companies with their products somewhat in-line with the subject patents, have been listed below. Based on the conducted quick product search, it is observed that there are existing solutions for authenticity verification and access control to a property that are used for authentication and access for a user. However, explicit information related to claim elements such as storing, capturing, matching user data for the authenticity of an object, access log being stored in a hyper ledger etc. and could not be identified in conducted primary search.

(Please note that this conclusion is the result of a preliminary product search analysis, and a detailed infringement search might to conduct to ascertain a potential overlap of the subject patent(s) with the relevant target(s)).

Nonetheless, increased venture capital funding and investment in blockchain technology, widespread implementation of blockchain solutions in banking and cyber security, widespread adoption of blockchain solutions for payment, access verification, digital identities, and rising government initiatives are all contributing to the high growth rate of the blockchain market. Considering the advancements in blockchain services, it is believed that more and more market players would be willing to adopt the technology disclosed by the subject invention in the coming future. It is also believed that blockchain will be the most promising technologies in the coming years, and the current insistent research work being done in this domain certainly indicates that the subject patents hold good futuristic potential.

Few related market products/technologies with respect to US10878429B2:

1. EVERNYM

Evernym is a digital identity company that uses distributed ledger technology to create secure and verifiable digital identities. Evernym's platform allows users to create and manage their own digital identities, which can be used to validate their identity and access services without having to share their personal information. Evernym also offers a solution for verifying the authenticity of government-issued IDs. Evernym's solution works by storing a hash of the government-issued ID on the distributed ledger technology. For example, whenever a user wants to verify their identity, they can simply share their digital identity with the verifier. The verifier can then compare the hash of the government-issued ID on

[7] https://linkedin.com/pulse/why-90-enterprises-adopting-blockchain-paul-lucki/
[8] https://news.bitcoin.com/33000-companies-in-china-claim-to-use-blockchain-technology/

the distributed ledger technology to the hash of the digital identity that the user is sharing. If the two hashes match, then the verifier can verify that the user's digital identity is authentic.

2. IDSCAN.NET

IDScan.net has introduced Digital Identity Validation (DIVE) API which is a tool used for verifying user identities digitally. It uses a combination of ID scanning and selfies to securely and accurately verify a user's identity. For example, when a user opens or clicks on a link sent via SMS, the user is redirected to IDScan.net web page. The user is then prompted to take three images: the front of their ID, the back of their ID, and an optional selfie. Once the user has captured the required images, they submit them to the IDScan.net DIVE API. The IDScan.net DIVE API uses a combination of computer vision techniques (OCR) and machine learning algorithms to verify the identity of the user. The DIVE API first analyzes the captured images to ensure they meet the requirements and are free from anomalies. The DIVE API then phrases the ID document using both PDF417 barcodes and Machine-Readable Zones (MRZ) to extract relevant information such as name, date of birth, and expiration date. The DIVE API also uses advanced machine learning algorithms to verify authenticity of the ID document. It checks for visual security features, document integrity, and inconsistencies in the extracted data. The DIVE API utilizes liveness detection techniques to ensure that the user is a real person and not attempting to use a fake ID or photograph and after the verification is complete, the IDScan.net DIVE API returns the results to the website.

3. IBM

IBM has introduced blockchain for digital identity and credentials which allow individuals, organizations, and institutions to manage, share, and verify digital identities and credentials. Individuals create their digital identities on the blockchain by providing their personal information and verifying their identity with a trusted issuer. Organizations and institutions issue credentials to blockchain which include diplomas, certifications, licenses, and other forms of proof of achievement and affiliation. Individuals can share their credentials with others by providing a link to their blockchain profile. Verifiers can then check the validity of the credentials on the blockchain.

4. DOCK.IO

Dock.io is a blockchain based solution for managing digital identities by providing secure, tamper-proof, and verifiable credential issuance, storage, and verification. The solution utilizes a combination of cryptography a blockchain technology to ensure the integrity and authenticity of digital identities. Each individual or entity is assigned a unique DID (Decentralized Identifiers), which serves as a digital address that represents their identity on the Dock blockchain. DIDs are similar to usernames but are cryptographically linked to an individual's private keys, ensuring ownership and control over their identity data.

5. NEC

NEC is enabling digital identity management through blockchain which provides a significant improvement in security, speed of transaction and user experience. The solution offers various applications in the real world, such as empowering individuals to control their personal data, addressing the challenges faced by refugees without proper documentation, eliminating bureaucratic passport creation processes, enhancing security and privacy of medical records and intellectual property, and simplifying KYC processes. By storing digital identity on a shared ledger, banks can access relevant data with customer consent, facilitating compliance with regulations and ensuring the protection of patient data. This solution also simplifies KYC processes, allowing banks to access relevant data with customer consent and perform due diligence.

6. ACCENTURE

Accenture has developed a digital identity prototype to modernize identity management for organizations and individuals. Utilizing blockchain and biometrics, the system simplifies establishing, tracking, and maintaining digital identities, making them more efficient, user-friendly, secure, and less susceptible to fraud. The system is interoperable with other databases, ensuring data remains in its original location, and works with mobile, connected, or standalone devices.

7. WIPRO

Wipro has introduced Decentralized Identity platform which is powered by blockchain and enables individuals, entities, and devices to hold their identity in a secured wallet that can be used to prove their identity, leveraging the trustable verifiable credentials that are issued to them by various entities. The solution allows authorized issuers to grant identity information to identity subjects as Verifiable Credentials, which are based on the subject's user records. Verifiers create a verification template with a QR code list of issuers, and the subject scans the code to retrieve the relevant credential. The subject selects attributes from the credential, ensuring the validity and ownership of the claims without the verifier reaching out to the issuer.

Few related market products/technologies with respect to US11257098B2 and US20220277317:

Presently available products or features have not yet adapted Hyperledger for storing the history of the access key and access log.

1. TESLA

A Tesla key fob is a device that allows a user to lock and unlock when the key fob is within a short distance. This feature uses a low-power radio signal to detect the presence of the key fob and communicate with the vehicle's sensors. The Tesla key fob also contains an RFID chip that is used to authenticate the key fob when it is placed against the B-pillar of the vehicle or tapped on the center console.

Tesla also allows its users to unlock their cars by using the Tesla mobile app. The Tesla mobile app enables drivers to manage various aspects of their cars, and it can also be used to lock, unlock, and start a vehicle. Tesla's app can remotely unlock and start all its vehicles, such as models X, Y, S, and 3. To unlock a Tesla car, the user must ensure that both the app and car are connected to a cellular network. Additionally, mobile access should be activated on the touchscreen. For example, users should open the Tesla app and tap Controls, followed by Unlock. Whenever a user taps yes on the confirmation pop-up window, it will instantly unlock the car doors.

2. HID GLOBAL

The HID Mobile Access solution allows users to use a mobile device as a credential to access doors, networks, services, and more. For example, employees can unlock their office using their iPhone or Apple Watch by adding an employee badge to their Apple Wallet. Further, employees can access office doors, elevators, turnstiles, multifunction printers, and much more using just their iPhone or Apple Watch. Employee badges in Apple Wallet integrate into the HID access control systems. Employees just need to hold their iPhone or Apple Watch near the reader to unlock it. In the HID Mobile Access solution, credentials (access key) are stored on the mobile device (Apple wallet), the request for access key is not sent to the server.

3. BMW

BMW Digital Key utilizes near-field communication such as NFC chips in smartphones or smart watches to communicate with BMW NFC antennas. Whenever a user places their phone or smart watch near the NFC antenna on the driver's door handle, the vehicle will recognize it and unlock the door. The user can then start the engine by placing the smart phone and smart watch on the NFC antenna in the center console.

4. NISSAN

Nissan offers remote door lock and unlock feature which operates through a combination of radio frequency (RF) technology and transponder embedded within the vehicle's key fob or a smart phone app (Nissan connect). For example, the driver opens the Nissan connect service app on their smartphone and selects 'Remote door Lock/Unlock' option. The app establishes a secure connection with the vehicle's telematics module, which is typically connected to the vehicle's cellular network. The driver then enters the PIN for the remote lock/unlock feature, ensuring security and preventing unauthorized access. The app sends a secure communication to the vehicle's telematics module, instructing it to send a lock/unlock signal to the dashboard. The dashboard processes the signal and unlocks the door.

5. VOLKSWAGEN

Volkswagen makes use of a transponder system in the remote key fob that communicates wirelessly with the car's computer. The transponder sends a unique signal that the car can identify signal that the car can identify, and when the key fob is pressed, the car unlocks or locks the doors. This feature allows drivers to lock or unlock their car doors, start, or stop their engines using a smartphone. This feature provides a variety of safety features, such as Automatic Crash Notification, and stolen vehicle locator. For example, a user can use Remote Access to unlock the vehicle doors and turn on notifications for stolen vehicle locator and crash notification.

6. AUDI

Audi Advanced Key is a keyless entry technology designed for car drivers, allowing them to start or open their cars without having to reach for their keys. The Audi Advanced Key connects to proximity sensors in car doors and trunk lids, activated by a radio pulse generator within five feet of the vehicle. When using a door handle or trunk, the Audi automatically unlocks. Audi also allows its users to access their vehicles through the Audi app. The Audi app uses Bluetooth to connect with the vehicle. Once the vehicle is connected, the user can use the app to lock and unlock doors, start the vehicle's engine, and more. For example, to unlock the doors, the user needs to open the app and tap the 'Unlock' button. The app then sends a signal to the vehicle, which unlocks the door.

Below are presented a few Satellite Communication Services where the subject inventions might be applicable.

7. INMARSAT

Inmarsat offers secure satellite communication services for the aviation, maritime, defence, enterprise, and government sectors. The Inmarsat solution provides aircraft positioning data for air traffic management, enabling planes to fly closer together and facilitating communication between pilots and controllers. Inmarsat Classic Aero offers surveillance through the Automatic Dependent Surveillance Contract (ADS-C) and communications through Controller Pilot Data Link Communications (CPDLC), meeting ICAO requirements. SB-S from Inmarsat is a secure broadband with speed IP connection for operations and safety communications, providing the same services as Classic Aero and enabling operational efficiencies such as engine monitoring, real-time weather, telemedicine, and preventive maintenance.

8. INTELSAT

Intelsat provides satellite communication services worldwide, serving sectors like media, broadband, government and mobility. Intelsat's secure global network offers broadband mobile connectivity at speeds that surpass traditional narrow band solutions, enabling en-route communications, intelligence, surveillance, reconnaissance, disaster recovery, and remote operations. Intelsat's aeronautical solutions utilize high-throughput satellite technology and its network to provide reliable, high-performance connectivity for governments and emergency response teams.

9. VIASAT

ViaSat is a satellite broadband service that also provides secure communications for government and commercial applications. ViaSat offers defense satellite communications, tactical networking, and cyber security solutions to provide a comprehensive approach with performance advantages, including multi-band, flexible SATCOM terminals and EW-resistant networks, ensuring resilient, end-to-end communications across domains and missions. Viasat's real-time HD video and broadband maritime communications services offer Search and Rescue (SAR) missions, whether searching for missing persons or locating lost aircraft, vessels, or wreckage. These services offer operational advantages, speeding up progress and increasing the likelihood of success in global SAR efforts.

10. SES S.A.

SES is a global satellite operator offering a range of satellite operator offering a range of satellite communication services which includes secure data transmission for government, aviation and maritime applications. SES's commercial maritime offering utilizes a fleet of high-throughput satellites and the Skala Global Platform ground system, enabling ships of all sizes to benefit from exceptional maritime connectivity. SES offer network services for digital transformation, cloud connectivity, and crew safety.

5 Evaluation Method

5.1 A Hybrid Approach to Calculate Fair Market Value

A Hybrid Approach has been followed to evaluate the appropriate Fair Market Value for the patents under study.

- The first part of this hybrid approach involves market analysis of the technology as covered by the IP understudy, understanding how much revenue would be generated by the implementation of the subject technology, whether the technology is fresh or obsolete in the market, and risk factors, etc. Along with these, many other factors influencing the market are considered to arrive at an expected Fair Market value.
- The second part of this hybrid approach involves rigorous analysis of the Intellectual Property under study. The first part of the hybrid approach would indeed give us an expected revenue from the commercial exploitation of the technology. However, different factors affect the applicability of a patent. These factors need to be taken together to understand what is the actual worth of the Intellectual Property which is under study. For example – what problem is being solved by the patent is the problem being solved prevalent in the market, availability of similar products in the market, etc.

Thus, this overall Hybrid Approach proceeds in three steps:

1. **Market Evaluation of Portfolio**
   Output: A figure representing expected revenue

2. **Intellectual Property Evaluation of Portfolio**
   Output: A weighted factor (0.00 to 1.00)

3. ***Net Fair Market Value = Step 1 Output X Step 2 Output***

6 Calculation of Fair Market Value

6.1 Step 1: Market Evaluation of Technology

The approach followed in this evaluation involves market analysis of the technology covered by the IP under study in the forecast years (2023-2039), to understand how much revenue would be generated by the implementation of the subject technology, along with consideration of many other factors influencing the market to arrive at an expected value. All the below values are in billions of USD.

Factors	2023 (A)	2024 (B)	2025 (C)	2026 (D)	2027 (E)	2028 (F)	2029 (G)	2030 (H)	2031 (I)
Market Size	55.5	98.9	176.0	313.2	557.6	992.4	1766.5	3144.5	5597.1
Market Share	1.11	1.98	3.52	6.26	11.15	19.85	35.33	62.89	111.94
Adoption Rate	0.0025	0.0026	0.0027	0.0027	0.0029	0.0031	0.0033	0.0035	0.0039
Annual Revenue	0.00278	0.00509	0.00933	0.01711	0.03229	0.06093	0.11495	0.22303	0.43273
R&D Cost	0.00008	0.00015	0.00028	0.00051	0.00097	0.00183	0.00345	0.00669	0.01298
Actual Revenue	0.00269	0.00494	0.00905	0.01660	0.03132	0.05910	0.11151	0.21634	0.41975
Net Profit Margin	0.00027	0.00049	0.00091	0.00166	0.00313	0.00591	0.01115	0.02163	0.04197
IP Contribution to Net Profit	0.00009	0.00016	0.00029	0.00053	0.00100	0.00189	0.00357	0.00692	0.01343
Tax and Duties	0.00002	0.00003	0.00006	0.00011	0.00021	0.00040	0.00075	0.00145	0.00282
Profit after tax	0.00007	0.00012	0.00023	0.00042	0.00079	0.00149	0.00282	0.00547	0.01061
Risk Factor	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
Annualized NPV	0.00006	0.00012	0.00021	0.00037	0.00067	0.00123	0.00226	0.00424	0.00796
Product Factor	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Adjusted NPV	0.0001	0.0001	0.0002	0.0003	0.0005	0.0010	0.0018	0.0034	0.0064

Factors	2032 (J)	2033 (K)	2034 (L)	2035 (M)	2036 (N)	2037 (O)	2038 (P)	2039 (Q)
Market Size	9962.9	17734.0	31566.5	56188.3	100015.2	178027.0	316888.1	564060.8
Market Share	199.26	354.68	631.33	1123.77	2000.30	3560.54	6337.76	11281.22
Adoption Rate	0.0042	0.0047	0.0053	0.0059	0.0068	0.0078	0.0090	0.0104
Annual Revenue	0.83958	1.67380	3.33688	6.65241	13.61747	27.87497	57.06007	116.80195
R&D Cost	0.02519	0.05021	0.10011	0.19957	0.40852	0.83625	1.71180	3.50406
Actual Revenue	0.81440	1.62358	3.23677	6.45283	13.20895	27.03872	55.34826	113.29790
Net Profit Margin	0.08144	0.16236	0.32368	0.64528	1.32090	2.70387	5.53483	11.32979
IP Contribution to Net Profit	0.02606	0.05195	0.10358	0.20649	0.42269	0.86524	1.77114	3.62553
Tax and Duties	0.00547	0.01091	0.02175	0.04336	0.08876	0.18170	0.37194	0.76136
Profit after tax	0.02059	0.04104	0.08183	0.16313	0.33392	0.68354	1.39920	2.86417
Risk Factor	27.50	30.00	32.50	35.00	37.50	40.00	42.50	45.00
Annualized NPV	0.01493	0.02873	0.05523	0.10603	0.20870	0.41012	0.80454	1.57529
Product Factor	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Adjusted NPV	0.0119	0.0230	0.0442	0.0848	0.1670	0.3281	0.6436	1.2602

Market Size, **Market Share**, **and Adoption Rate** are already discussed in Section 4.1 and Section 4.2 Other legends used in the above calculation of the fair market value are as follows:

- **Annual Revenue:** The Annual Revenue from the technology is the product of the market share, and the adoption rate of the subject patented technology. This figure will give an idea of how deeply the subject technology would penetrate the market. Annual Revenue is the product of Market Share and Adoption Rate.
- **R&D Cost:** These are the costs utilized in innovative activities undertaken by corporations in developing new services or products or improving existing ones. Research and development expenses can be defined as an expense arising from studies and product development processes. For instance, Google parent, Alphabet, invested in funding rounds that totaled $1.5 billion in the year 2021-22 across four blockchain companies — Fireblocks, Dapper Labs, Voltage, and Digital Currency Group. Other top companies participating in the funding of blockchain companies over the same time frame (i.e., 2021-2022) are BlackRock, Morgan Stanley, top Wall Street banks like Goldman Sachs, BNY Mellon, Citi and Wells Fargo. Overall, 40 companies invested about $6 billion in blockchain-related investments in the said time period[9].

  Based on the market research, it is seen that prominent market players in the blockchain technology market put a considerable amount of their net revenue into the research and development of new technologies. For example, Google puts around 14.06% of their revenue in R&D activities[10]. However, Google might utilize the said 14.06% for various other activities as well besides blockchain technology. Similarly, IBM and Microsoft put around 10.35% and 13.11% of their revenue in R&D activities. Furthermore, there might be other small and medium-sized enterprises which would invest a lesser amount in R&D. Thus, to cover a broad spectrum of the market, we have considered R&D cost in the blockchain technology systems domain to be an average value of approx. 3% (0.03).

Google

ITEM	2018	2019	2020	2021	2022	5-YEAR TREND
Sales/Revenue	136.96B	161.4B	182.35B	257.49B	280.88B	
Sales Growth	-	17.85%	12.98%	41.21%	9.08%	
SGA Growth	-	17.78%	4.70%	20.17%	20.31%	
Research & Development	21.42B	26.02B	27.57B	31.56B	39.5B	
Other SG&A	24.46B	28.02B	29B	36.42B	42.29B	

[9] https://blockworks.co/news/alphabet-poured-1-5b-into-blockchain-companies-over-10-months-study-finds

[10] https://www.marketwatch.com/investing/stock/goog/financials?mod=mw_quote_tab

IBM

ITEM	2018	2019	2020	2021	2022
Sales/Revenue	79.59B	77.15B	55.18B	57.35B	60.53B
Sales Growth	-	-3.07%	-28.48%	3.94%	5.54%
Cost of Goods Sold (COGS) incl. D&A	43.55B	41.76B	25.01B	26.54B	29.23B
SGA Growth	-	6.56%	-5.05%	1.15%	-1.05%
Research & Development	5.03B	5.6B	5.97B	6.22B	6.27B
Other SG&A	18.22B	19.17B	17.55B	17.57B	17.27B

[11] [12]

Microsoft

ITEM	2019	2020	2021	2022	2023
Sales/Revenue	125.5B	143.02B	168.09B	198.27B	211.92B
Sales Growth	-	13.95%	17.53%	17.96%	6.88%
Cost of Goods Sold (COGS) incl. D&A	42.91B	46.08B	52.23B	62.65B	65.86B
SGA Growth	-	10.02%	4.46%	13.71%	10.13%
Research & Development	16.88B	19.27B	20.72B	24.51B	27.2B
Other SG&A	23.1B	24.71B	25.22B	27.73B	30.33B

[13]

- **Actual Revenue:** This is the revenue calculated after deducting the other expenses.
- **Net Profit Margin:** The net profit margin (NPM), or simply net margin, measures how much net income or profit is generated as a percentage of revenue. The profit margin is the profit earned by the concerned entities after reducing all company expenses from the Annual Revenue. For the current study, it is seen that the NPM of prominent blockchain players is high, but there might be other companies generating less NPM. We have thus conservatively considered the profit margin owing to blockchain to be approx. 10% (0.10) of the Actual Revenue.

Google

Current and historical gross margin, operating margin and net profit margin for Alphabet (GOOG) over the last 10 years. Profit margin can be defined as the percentage of revenue that a company retains as income after the deduction of expenses. Alphabet net profit margin as of September 30, 2023 is **22.46%**.

[14]

[11] https://www.marketwatch.com/investing/stock/ibm/financials?mod=mw_quote_tab
[12] https://www.marketwatch.com/investing/stock/ibm/financials?mod=mw_quote_tab
[13] https://www.marketwatch.com/investing/stock/msft/financials?mod=mw_quote_tab
[14] https://macrotrends.net/stocks/charts/GOOG/alphabet/profit-margins

BlackRock.

Current and historical gross margin, operating margin and net profit margin for BlackRock (BLK) over the last 10 years. Profit margin can be defined as the percentage of revenue that a company retains as income after the deduction of expenses. BlackRock net profit margin as of September 30, 2023 is **30.66%**. 15

Morgan Stanley

Current and historical gross margin, operating margin and net profit margin for Morgan Stanley (MS) over the last 10 years. Profit margin can be defined as the percentage of revenue that a company retains as income after the deduction of expenses. Morgan Stanley net profit margin as of September 30, 2023 is **10.86%**. 16

- **IP Contribution to Net Profit:** At the lower end, the IP is considered to contribute 25% to the net profit margin[17], taking into account other expenditures for selling a product in the actual market. This contribution can be higher considering the breadth of coverage of the IP portfolio. Considering the breadth of the subject portfolio, we have considered the value of this parameter as 32% (0.32).
- **Tax and Duties:** These refer to the taxes, duties, excise, and other fixed costs that are incurred by the entities. We have considered the tax structures of various geographies here. For example, The United States imposes a tax on the profits of US corporations at a rate of 21 percent[18]. Thus, 21% of the absolute profit would be spent in the form of taxes. These figures for Europe, and Asia-Pacific, are between 15 and 25%.
- **Profit after tax:** It is the true profit earned via IP after adjusting it for various tax-related fixed costs.
- **Risk Factor/Discount Rate:** The risk factor considers the risks that have an impact on the generation of the future revenue or income stream. The risk factor is majorly dependent upon the maturity stage of the technology: Early Stage, Mid Stage, or Matured Stage. The risk factor or the discount rate considers the overall market risk, the specific industry risk, and the risks associated with specific IP assets and operations being considered.

  Depending upon the specific risks associated with the technology being valued, the valuations frequently require the use of discount rates ranging from 20 to 40 percent and even higher in certain circumstances[19,20]. As the adoption of the technology would rise over the years, the quality of competition would also rise leading to an increase in the risk associated with the

[15] https://macrotrends.net/stocks/charts/BLK/blackrock/profit-margins

[16] https://macrotrends.net/stocks/charts/MS/morgan-stanley/profit-margins

[15] https://www.royaltyrange.com/home/blog/what-is-the-25-rule-in-intellectual-property-valuation

[16]https://taxfoundation.org/combined-federal-state-corporate-tax-rates-202

[19]https://www.stout.com/en/insights/article/common-errors-committed-when-valuing-patents-part-

[20] https://www.iam-media.com/article/42A755451DE6B562AF278C6FBB21285C9D3F51F1/download

adoption of this technology as compared to other alternatives over time. Since the adoption of this technology is at an early to mid-stage now, this factor has been taken to be varying over the coming years. Hence, we have assumed the risk factor as starting from 5% in 2023 and rising to 42.5% by 2038.

- **Annualized NPV:** It is the Net Present Value after considering the amount for the Risk factor.
- **Product Factor:** The Product factor implies how important the subject technology is to the overall product. A value of 1 would mean that the subject technology is completely relevant to all the parts of the product.

  The subject patent portfolio covers various facets of a complete product ecosystem, though some third-party integrations might be necessary such as servers/database or cloud for storage, encryption, authentication etc. Therefore, the contribution of the technologies as claimed in the subject patent portfolio would be around 80% (0.8) of the overall product ecosystem.
- **Adjusted NPV:** The Adjusted NPV takes into consideration the product factor.

NET NPV = Adding Adjusted NPV values (A-Q) for all the forecast years i.e., 2023 to 2039

= **USD 2.5766 billion**

6.2 Step 2: Intellectual Property Evaluation of Technology

The Intellectual Property has been evaluated based on the following pointers to calculate an IP factor that determines the overall value. The IP factor as calculated for the subject patent(s) is analogous to a percentile score given to the subject patent(s) with respect to an ideal IP in the related technology space. To keep parity between different parameters, we have assigned different weightages to different parameters. For example, parameters such as infringement and licensing potential have been assigned a weightage of 2 whereas parameters such as legal aspects and geographical coverage have been assigned a weightage of 0.5. Moreover, each parameter has been assigned a score from 1 to 5.

1. PRACTICAL APPLICABILITY **(Weightage: 1.5; Score: 5)**

This factor represents whether the invention covers a practically/commercially viable solution that is ready to be introduced in the market. This factor would be rated from 1 to 5, where 1 represents that the invention in its existing form may not have substantial commercial applicability, and 5 represents that the disclosed invention presents a commercially viable solution with very minimal, or no changes required as such.

2. TECHNOLOGY INFLUENCE **(Weightage: 2; Score: 4)**

This factor represents the impact of the invention on the existing solutions/technology existing in the market. This factor would be rated from 1 to 5 based on the disruptive nature of the subject invention – whether the subject invention is solving a common problem and would only act as an alternative to the existing solutions or whether it can completely replace the existing solutions. For example, 1 could mean that the disclosed invention would have an insignificant impact as there are already existing solutions that are being widely used/accepted, and 5 would mean that either there are no existing solutions or that the technology would be significantly advantageous/better than the current solutions.

3. DEVELOPMENTAL STAGE **(Weightage: 1; Score: 5)**

This factor represents the developmental stage of the subject invention, i.e., whether the idea is at a very nascent stage with no testing being performed to test the applicability of the invention, or if the subject invention is already being implemented in the market. This factor would be rated from 1 to 5, where 1 represents that just a rough idea exists presently with no testing done yet, and 5 represents that the subject invention already has a market presence.

4. BREADTH OF TECHNICAL COVERAGE (**Weightage: 1; Score: 5)**

This factor represents whether the subject invention disclosure has a multitude of aspects that can be covered via multiple patents or whether the invention has very few aspects that have already been covered by the patents. This factor would be rated from 1 to 5, where 1 represents that there are very few aspects that the subject invention discloses and the same has already been covered in

the existing patent(s), and 5 would represent that the subject invention potentially has a variety of aspects that are either already covered via multiple patents or can be covered via additional continuation applications.

5. DEMAND TREND **(Weightage: 1.5; Score: 5)**

This factor represents the market demand for the subject invention/idea. This factor would be rated from 1 to 5, where 1 represents that the subject technology is outdated and there is no current market demand for the same, and 5 represents that the current market demand for the subject technology is very high or is on a rise.

6. GEOGRAPHICAL RELEVANCE **(Weightage: 1.5; Score: 5)**

This factor represents the potential applicability of the subject invention with respect to the nature of markets and/or jurisdictions, i.e., whether the invention is applicable to a very low, local, or specialized market, or whether the invention seems to have a very high, international, or very broad market. This factor would be rated from 1 to 5, where 1 represents that the subject invention will have applicability to only a local or a specialized market, and 5 represents that the subject invention seems to have applicability to a very broad market across multiple jurisdictions.

7. CROWDEDNESS **(Weightage: 1.5; Score: 4)**

This factor represents the quanta of competition of the subject invention in the existing market scenario, i.e., whether there are many or only a few similar existing products and technologies in the market. This factor would be rated from 1 to 5, where 1 represents that the subject invention will have an extremely difficult penetration in the market owing to the heavy competition, and 5 represents that the market penetration will be extremely easy due to the non-existence of products and technologies analogous to the subject invention.

8. GEOGRAPHICAL COVERAGE **(Weightage: 2; Score: 5)**

This factor represents the overlap of the protection that the subject technology has in terms of geographical relevance (jurisdictions with a majority share of the given market). This factor would be rated from 1 to 5, where 1 represents that the subject technology has coverage only in limited jurisdictions, and 5 represents that the subject technology has been covered in all the important jurisdictions for the given market.

9. INVENTION R&D **(Weightage: 1; Score: 4)**

This factor represents the extent of R&D required to achieve a market-ready product, in terms of difficulty and expense. This factor would be rated from 1 to 5, where 1 represents that the extent of R&D required would be very high, and 5 represents that the extent of R&D required would be very low.

10. MANUFACTURING/DEVELOPING **(Weightage: 1; Score: 5)**

This factor represents the extent of efforts required for manufacturing/practicing the invention or product. This factor would be rated from 1 to 5, where 1 represents that a dedicated manufacturing facility/plant will need to be set up (for example) for manufacturing/practicing the invention or product, and 5 represents that no specially equipped manufacturing facility/plant is required, and the existing manufacturing/developing resources would be sufficient to practice the invention.

11. PROFITABILITY **(Weightage: 1; Score: 5)**

This factor represents the profitability/revenues that the subject invention is likely to gather. This factor would be rated from 1 to 5, where 1 represents that the expected revenue/profitability is likely to be very low, and 5 represents that the expected revenue/profitability is likely to be very high.

12. INFRINGEMENT **(Weightage: 2; Score: 2)**

This factor represents whether there are existing market products that seem to be implementing the claimed invention. This factor would be rated from 1 to 5, where 1 represents that the subject invention does not seem to have any infringement yet, and 5 represents that the technology has widespread infringement or is a Standard Essential patent.

13. LICENSING POTENTIAL **(Weightage: 2; Score: 5)**

This factor represents whether the companies would be willing to obtain a license for the subject invention to implement the claimed invention in their products (for example). This factor would be rated from 1 to 5, where 1 represents that the subject invention will have a low chance that another company will seek the license the invention, and 5 represents that the invention holds a very good licensing potential.

14. LEGAL **(Weightage: 0.5; Score: 5)**

This factor represents whether the technical subject matter/invention/idea when productized will comply with applicable laws within the applicable jurisdictions or whether changes will need to be made to make the product compliant with the applicable laws. This factor would be rated from 1 to 5, where 1 represents that the product based on the subject matter would clearly be non-compliant with the applicable laws even after any amendments, and 5 would mean that the product would be compliant with the laws without any changes.

15. POSSIBLE HAZARDS **(Weightage: 0.5; Score: 5)**

This factor represents the possible hazards or side effects the invention/idea/product is likely to have on the environment/society. This factor would be rated from 1 to 5, where 1 represents that the invention/idea/product could be very dangerous for the environment/society, and 5 represents that the invention/idea/product would be very safe.

Sr. No.	PARAMETER	WEIGHTAGE	SCORE	WEIGHTED SCORE	MAXIMUM WEIGHTED SCORE
1	Practical Applicability	1.5	5	7.5	7.5
2	Technology Influence	2	4	8	10
3	Developmental Stage	1	5	5	5
4	Breadth of Technical Coverage	1	5	5	5
5	Demand Trend	1.5	5	7.5	7.5
6	Geographical relevance	1.5	5	7.5	7.5
7	Crowdedness	1.5	4	6	7.5
8	Geographical coverage	2	5	10	10
9	Invention R&D	1	4	4	5
10	Manufacturing/Developing	1	5	5	5
11	Profitability	1	5	5	5
12	Infringement	2	2	4	10
13	Licensing potential	2	5	10	10
14	Legal	0.5	5	2.5	2.5
15	Possible hazards	0.5	5	2.5	2.5
		CUMULATIVE SCORE		**89.5**	**100**
		IP FACTOR		**0.895**	

Scoring Description:

0 – 25: The monetization potential is very less for this patent.
26 – 50: The monetization potential is moderately high, and the invention somewhat solves the existing problems.
51 – 81: The monetization potential is high, and it is feasible to solve the existing problems using the invention.
81+: The monetization potential is very high. An overlapping market solution is already present in the market, but the present solution could replace existing solutions.

6.3 Step 3: Fair Market Value

Step 3 Output = Step 1 Output X Step 2 Output

= $ 2.5766 billion x 0.895
= $ 2.3060 billion

Based on all the calculations,

The Fair Market Value for the subject patent family under study shall be around USD 2 – 2.5 billion

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The technology evaluation exercise Aims to provide a highly accurate figure to determine licensing feasibility of the subject invention. While a robust and tested procedure has been followed in the analysis to provide you with the best possible available information, some of the criteria are necessarily Subjective and the results may vary from person to person. We hope that this report provides the desired insights to the reader. While Sagacious has used the best resources for the work of technology valuation, Sagacious claims all warranties as to the accuracy, completeness, or adequacy of such information. Sagacious is not liable for any financial losses resulting from future unsuccessful efforts or apparent losses that might incur while going in for the commercialization.

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