

Combining Blockchain and Artificial Intelligence for improved Marketplaces: A Potential Technology Convergence

Abstract— Marketplaces, as digital platforms that link buyers and sellers, have increased in popularity in recent years. However, obstacles such as data asymmetry, trust challenges, and the involvement of middlemen have limited their full potential. Blockchain technology creates decentralized, transparent, and secure transaction records, removing the need for intermediaries and decreasing costs. Artificial intelligence systems evaluate marketplace data, allowing for customised experiences, efficient supply chains, and fraud detection. The combination of blockchain and artificial intelligence increases trust, transparency, as well as effectiveness in marketplaces. Scalability, interoperability, and safety issues must be solved in order to fully realize the benefits of this integration and influence the future of marketplaces.

Keywords: Blockchain, Marketplaces, IA, Combination, Machine learning

I. INTRODUCTION

Marketplaces have evolved as important platforms for allowing transactions between sellers and buyers in a variety of industries in recent years. These digital ecosystems motivate economic growth and innovation by connecting people, companies, and communities in an easy and effective way. Traditional marketplaces frequently come across challenges such as asymmetry of data, problems with trust, and the existence of intermediaries, which might limit their full potential.

Since the merging of blockchain technology with artificial intelligence (AI) offers an exciting opportunity to overcome these challenges to completely change the economic ecosystem. With its decentralized and immutable nature, blockchain provides a means of building trust and transparency in the marketplace system through removing the need for intermediary and providing a secure and visible ledger of transactions. At the same time, artificial intelligence (AI) systems are able to analyse huge quantities of data and extract valuable information, allowing marketplaces to provide personalized ideas, dynamic pricing, and predictive analytic. Additionally, artificial intelligence (AI) algorithms are capable of identifying and avoiding fraudulent activity, maintaining the marketplace ecosystem's integrity and credibility. The incorporation of blockchain and AI technology

within marketplaces has enormous potential to boost transparency, safety, effectiveness, and customer satisfaction. Marketplaces can encourage trust among participants and improve transactions through the combination of the decentralized characteristics of blockchain and the analytical powers of AI. There are obstacles that must be surmounted in order to get all of the advantages of blockchain and AI marketplaces. This study tries to create a taxonomy for marketplaces,

categorizing them depending on whether they use artificial intelligence (AI), blockchain technology, or a combination of the two. Blockchain Technology: An Innovative Approach to Decentralized Trust and Transparency. The primary focus will be on defining the transformative potential of marketplaces through the combination of blockchain and AI breakthroughs. It will explore into the advancements in AI, focusing on its potential in data processing, prediction, and automation. Furthermore, the study will investigate the synergies that emerge from the combination of blockchain and AI, demonstrating how their combined strength might transform marketplaces by constructing decentralized, immutable data processing and decision-making systems. The ultimate goal is to deliver information that will help individuals make informed judgments about the best blockchain or AI solutions for their marketplaces. In first section, we will go into the fundamentals of blockchain, providing a thorough definition as well as studying its major qualities and many types. This foundation will serve as the foundation for a more in-depth understanding of how blockchain works. Moving on to Section 2, our attention will be drawn to the use of blockchain in marketplaces. We will talk about how blockchain is changing traditional market structures by bringing transparency, security, and decentralization. Concrete examples and application cases will be discussed to demonstrate blockchain's disruptive impact on marketplaces. Moving on to Section 3, we shall define artificial intelligence (AI), explaining its key principles and numerous applications. This part intends to acquaint readers with

AI principles and terminology as a prelude to the discussion of its integration with blockchain that follows

The focus of Section 4 will be on the synergies between AI and blockchain. We will investigate how the integration of these technologies can improve security, efficiency, and decision-making processes. Real-world examples will be used to highlight the possible benefits.

Finally, in Section 5, we will focus on the unique integration of AI and blockchain within marketplaces. This section will explain how this integrated approach can transform market dynamics by providing insights into successful implementations through case studies and examples. The session seeks to highlight the practical consequences and benefits of combining AI and blockchain in the field of marketplaces.

A. Definition of blockchain technology

Blockchain technology is a decentralised, distributed database of record or shared public/private digital ledgers that exists across a network and that is used to record transactions that have been executed and shared among participating agents [1]. It includes a chain of blocks, containing a list of transactions, a timestamp, and a unique cryptographic hash.

B. Characteristics of blockchain technology

Blockchain technology has multiple important characteristics that set it different from traditional centralized systems. The following are some significant characteristics associated with blockchain technology:

- **Decentralization:** Blockchain is a decentralized network, which means that no central authority or middleman governs the system. The transactions are not controlled by any individual or organization. There is one copy of the ledger for each connection in the blockchain network [2]

- **Immutability:** Once a transaction is added to a block and then to the blockchain, it is very difficult to change or modify. All network nodes must approve the data before it is added to the block [2]

- **Transparency:** Once a document is registered on the blockchain, it is sufficient to prove that it existed at the moment it was registered and that it has not been altered. The blockchain is said to be transparent since anyone can download it in full at any time and check its integrity. As a result, all blockchain users have access to both current and historical transactions. [3]

- **Security:** To identify fraudulent transactions, you would be required to hack into every single node and alter each "Ledger." It is almost impossible to erase all copies of the documents, which are maintained on a global network of servers. While it is possible to attack one or more machines, attacking the blocks of information copied in all machines connected to the network is far harder. This provides the blockchain with higher security. [4]

Blockchain, by using its distinctive characteristics, opens opportunities for trust, transparency, and efficiency in a variety of industries.

C. Types of blockchain technology

There are various types of blockchains, each having a distinctive set of characteristics. The following are different types of blockchains:

- **Public Blockchain:** Anyone may access a public blockchain to get involved in the network as a node. [4]

- **Private Blockchain:** Access to private blockchains, also known as permissioned blockchains, is limited to a restricted number of participants. [4]

- **Consortium Blockchain:** A consortium blockchain is a cross between a public and a private blockchain. They are managed by a consortium, or a group of organizations. Consortium blockchains achieve a compromise between openness and control, allowing trustworthy groups to securely communicate and exchange data. [4]

II. BLOCKCHAIN -BASED MARKETPLACES

In recent years, blockchain-based marketplaces have acquired major interest and popularity. These marketplaces utilize the benefits of blockchain's decentralized and transparent nature in order to establish platforms that allow transactions between peers.

A. Marketplace Definition

A marketplace is a platform where consumers and sellers are able to do commercial transactions. It functions like a sort of intermediary, permitting multiple stakeholders to exchange goods and services.

Marketplace or e-marketplace is a system information between organization where buyers and sellers in the market communicate information covers price, product and afford complete transaction through technology information and communication electronic namely the internet. [5]

Sellers post their goods or services in a marketplace, and buyers browse all of the merchandise, compare opportunities, and make purchasing decisions. The marketplace serves as a centralized platform on the web for these transactions. There are critical in coordinating supply and demand and promoting trade and economic activity.

B. Actors in the marketplace

There are various main actors or participants in a marketplace. These actors play multiple roles and contribute to the marketplace's function. Here are some of the most typical marketplace actors.

- **Buyers:** are individuals who are interested in buying goods or services from the marketplace. They search through the postings, evaluate options, make decisions, and have transactions with vendors.

- **Sellers:** Sellers are individuals or companies who offer products or services for trade on the marketplace. They produce listings, set prices, handle inventory, and link with buyers to set up transactions. [6]

- **Operators:** The entity that owns, controls, and administers the marketplace. They are in charge of creating and maintaining the marketplace infrastructure, as well as assuring its functionality and managing the overall user experience.

C. Types of marketplaces

The accessibility and exposure of the marketplace to participants are referred to as private and public marketplaces. The following is an overview of each type:

- **Public Marketplace:** Anyone who wishes to engage may do so in a public marketplace. This means that anyone can purchase or sell goods and services on the marketplace. Public marketplaces are often big and offer a wide range of goods and services. eBay, Amazon, and Alibaba are some examples of public marketplaces. [7]

- **Private Marketplace:** Private marketplaces are only accessible to a small number of customers and merchants. This group is often comprised of firms that have been pre-screened by the marketplace operator. Private markets are often smaller in size than public marketplaces and offer a more limited range of goods and services. Alibaba Cloud Marketplace and Amazon Web Services Marketplace are two instances of private markets. [8]

D. Different Architectures of marketplaces

Vertical and horizontal marketplaces are two approaches to marketplace structuring based on the size and concentrate on the products or services offered. Each type is explained below:

-Horizontal marketplace: Horizontal marketplaces are marketplaces that do not specialize in a certain product or service category. This means that marketplace merchants can provide a wide range of items or services. Horizontal marketplaces are often larger than vertical marketplaces, but they provide a less specialized range of goods and services. eBay, Amazon, and Alibaba are instances of horizontal markets. [10]

Vertical Marketplace:are marketplaces that specialize in a certain product or service category. This means that all of the sellers on the marketplace provide products or services in the same category. Vertical marketplaces are often smaller than horizontal marketplaces, but they provide a more specialized range of goods and services. Etsy, which offers handmade and vintage goods, and Airbnb, which rents out homes and flats, are two instances of vertical marketplaces.[9]

How Blockchain Can Solve Security, Safety and Transparency Issues ?

Traditional marketplaces, despite their popularity and ease of use, encounter a variety of difficulties and challenges. These are a few of the most frequent problems with traditional internet marketplaces:

- **Trust and safety:** Building trust between customers and vendors in traditional on-line markets can be hard. Worries about fraudulent sellers, fake product descriptions, or untrustworthy evaluations and ratings may destroy trust and discourage potential consumers.

- **Privacy and Data Security:** On-line marketplaces collect and store customer data, including financial and personal data. Weak privacy measures or deficiencies in security of information may result in information theft and decrease user trust.

- **Seller Verification:** In traditional on-line marketplaces, identifying the reliability and trustworthiness of sellers can be difficult. In the lack of comprehensive seller identification measures, buyers can come across untrustworthy or inattentive sellers, resulting in a bad customer experience.

- **Limited Payment alternatives:** Some on-line marketplaces might provide limited ways to pay, which can be inconvenient for buyers who desire other forms of payment or have difficulties with the authorized payment options.

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- **The need for more safety, transparency, and efficiency in marketplaces** led to the migration from traditional marketplaces to blockchain-based marketplaces. Traditional marketplaces frequently rely on intermediaries, centralized systems, and manual processes, which can lead to risks, high costs, and a lack of transparency. We now have the opportunity to build decentralized and trust-less marketplaces. Blockchain-based marketplaces combine distributed ledgers, smart contracts, and cryptographic security to enable direct peer-to-peer transactions, avoiding the need for intermediaries. This change brings multiple benefits, including reduced fraud, enhanced transactional transparency, lower costs, more identity verification and efficient resolution of conflicts.

E. Examples of marketplaces based on blockchain:

The emergence of blockchain technology generated a wave of creativity, leading to the development of various blockchain-based marketplaces across a wide range of industries. These marketplaces utilize blockchain's special features, such as decentralization, immutability, and smart contracts, to transform the way goods and services are exchanged. These systems provide a variety of solutions designed for particular market needs, ranging from decentralized peer-to-peer marketplaces like OpenBazaar and Origin Protocol to specialized NFT marketplaces like OpenSea and SuperRare.

OpenBazaar: OpenBazaar is a protocol and network for fully decentralised commerce, developed and published by the organisation OB13 (OpenBazaar, n.d.). It enables to sell and buy goods and services on-line (e.g. music, clothes, art, jewellery, food and beverages, and cryptocurrencies) by connecting people directly without middlemen. This results in no fees for sellers and buyers, no data collection, and no restrictions. OpenBazaar is based on a decentralised network of user-operated nodes. Therefore, the usage requires to run the OpenBazaar server (i.e. network node/ back-end application) and client (visual interface/front-end application). The decentralised OpenBazaar Network is built on top of the Inter Planetary File System (IPFS) to store listings of offered goods and services. [12]

-**OpenSea:** Opensea marketplace is the best market for selling and transacting NFTs of all time [13]. They provide a good representation of the NFT market due to their dominance in sales volumes and the number of traders who frequent their marketplace.[14].

SuperRare: SuperRare is a decentralized marketplace for collecting and exchanging unique digital pieces of art, or NFTs. The marketplace serves as a social network for crypto collectibles, having every item being authentic made by an artist.[15]

Decentraland: Decentraland is a platform, where users can explore a 3D virtual world and communicate with each other. The platform is built on the Ethereum blockchain. Thanks to its decentralised implementation, it is possible to play the game even without an actual account because all the information are managed through a decentralised network and therefore available to anyone on the Internet. Decentraland has many layered components built using Ethereum smart contracts. Its infrastructure is Peer-to-Peer (P2P), and the Decentraland protocol refers to three layers : Consensus layer, Land content layer and Real-time layer.[16]

KnownOrigin: is a blockchain-based marketplace specialized in non-fungible tokens (NFTs) for digital art and collectibles. It offers a platform for artists to display and sell their creations, as well as for collectors to find and acquire limited-edition digital artworks. To ensure secure and transparent transactions, KnownOrigin uses blockchain technology. Each piece of art is tokenized as an NFT on the Ethereum blockchain. The immutability and transparency of the blockchain ensure the authenticity and origin of each artwork.[17].

- The Sandbox Marketplace: It serves as a dynamic marketplace for creators, gamers, and investors to buy, sell, and exchange virtual assets. The Sandbox has been designed for collaboration with other blockchain platforms and marketplaces. Users may transfer assets and creations between The Sandbox and other compatible platforms, developing a connected ecosystem of virtual worlds. [18]

We will conduct a comprehensive comparison of the above marketplaces by outlining the major features and characteristics in a table format. This method will offer a concise picture, making it easy to identify resemblance distinctions and distinctive characteristics of each marketplace. The comparison table TABLE 1 can provide valuable insight to effectively understand and evaluate distinct blockchain-based marketplace.

We can take numerous conclusions from the preceding comparison:

- Diverse Goals: The markets' goals vary, from peer-to-peer trading (OpenBazaar) to digital art curation (SuperRare) and user-generated virtual worlds (Decentraland The Sandbox Marketplace). This highlights blockchain technology's adaptability to numerous sectors and use cases.

-Ethereum is the blockchain chosen for the majority of marketplaces, owing to its dominance in supporting decentralized applications and NFT ecosystems. OpenBazaar, on the other hand, uses the Bitcoin blockchain, demonstrating the flexibility of diverse blockchains for unique marketplace requirements.

Ethereum has become famous for its smart contract feature. Smart contracts are code-based agreements that execute operations automatically when specific conditions are fulfilled. This function permits the development of decentralized applications and offers trustless and automated interactions between participants. The infrastructure of Ethereum facilitates interoperability with other blockchain networks and platforms. Ethereum gives developers a developer-friendly environment with a variety of tools, documentation and programming languages. This accessibility inspires developers to create decentralized applications and contribute to the ecosystem's growth. The Ethereum developer community is dynamic and supportive, encouraging knowledge sharing and collaborative development.

-For Ethereum-based marketplaces such as OpenSea, SuperRare, Decentraland, KnownOrigin, and The Sandbox Marketplace, Proof-of-Stake (PoS) is the selected consensus protocol. OpenBazaar, on the other hand, employs Proof-of-Work (PoW) technology.

-Each marketplace has its own architecture, which includes decentralized peer-to-peer networks (OpenBazaar) and Ethereum-based solutions (OpenSea, SuperRare, Decentraland, KnownOrigin, and The Sandbox Marketplace). These structures are in line with the marketplaces' distinct functionalities and goals.

In terms of data storage and management, marketplaces vary. Some keep ownership and transaction data on-chain (OpenBazaar, OpenSea, SuperRare, KnownOrigin), while others store metadata or artwork files off-chain. This gives for

improved performance and scalability while retaining critical data on the blockchain.

-Each marketplace has a diverse set of stakeholders, including consumers, sellers, developers, collectors, artists, curators, and investors. This highlights the collaborative nature of these platforms, which promotes participation and involvement among different community members.

All of the above marketplaces are permissionless, allowing for unrestricted participation without the need for specific authorization. This is consistent with the fundamental concepts of decentralization.

While blockchain technology has many advantages, such as decentralization, transparency, and immutability, it also has some drawbacks such as:

-Scalability: Because of its distributed nature and the requirement for consensus among nodes, blockchain networks suffer scalability issues.

-Energy Consumption: Blockchain networks, particularly those that use proof-of-work consensus processes, can require a lot of energy.

-Data Validation and Integrity: While blockchain maintains the integrity of stored data, validating the accuracy and validity of off-chain or external data may present issues.

-Privacy and Confidentiality: While blockchain enables transparency and immutability, it raises privacy and confidentiality problems for data stored on the blockchain.

- Smart Contract Intelligence: Smart contracts, while powerful, lack the ability to adapt to changing conditions or interpret complex data.

These weaknesses can be efficiently solved by combining AI and blockchain technology, hence improving the scalability, blockchain networks energy efficiency, data integrity, privacy, and intelligence of applications. AI and blockchain combined have the ability to overcome the limitations of each technology independently, resulting in more robust and powerful solutions.

Marketplace	Blockchain Framework	Objective of the marketplace	Objective of the Blockchain	Consensus Protocol	Architecture	Storage	Stakeholders	Smart contracts
OpenBazaar	Bitcoin	Peer-to-peer decentralized marketplace TO Sell physical and digital goods, Handmade and artisanal products and services	- Eliminates the need for intermediaries to reduce costs -Censorship resistance -Cryptocurrency payments	Proof-of-Work	Distributed peer-to-peer network	Transaction and order data on-chain, user data off-chain	Buyers, sellers, developers, moderators	Custom smart contracts
OpenSea	Ethereum	NFT marketplace and digital collectibles	Establish the authenticity and provenance of NFTs	Proof-of-Stake	Layer 2 solution (e.g., Immutable X) on Ethereum	NFT ownership data on-chain, meta data off-chain	NFT creators, buyers, sellers, developers	Ethereum smart contracts for NFT operations
SuperRare	Ethereum	Curated digital art marketplace	- Create and enforce scarcity -Blockchain's smart contract functionality to automate royalty payments to artists	Proof-of-Stake	Ethereum-based with focus on digital art and curation	Artwork ownership data on-chain, artwork files off-chain	Digital artists, collectors, curators, developers	Ethereum smart contracts for artwork operations
Decentraland	Ethereum	Virtual world and metaverse platform	-	Proof-of-Stake	Ethereum-based virtual world with LAND ownership system	Land ownership data on-chain, game assets off-chain	LAND owners, content creators, developers, users	Ethereum smart contracts for virtual world operations

TABLE I. BLOCKCHAIN-BASED MARKETPLACES COMPARISON

KnownOrigin	Ethereum	Digital art marketplace and curation	Ownership and control	Proof-of-Stake	Ethereum-based with focus on limited edition art	Artwork ownership data on-chain, artwork files off-chain	Digital artists, collectors, curators, developers	Ethereum smart contracts for artwork operations
The Sandbox Marketplace	Ethereum	User-generated virtual world and gaming	-Create a user-driven economy by utilizing digital tokens	Proof-of-Stake	Ethereum-based metaverse with LAND ownership	LAND ownership data on-chain, game assets off-chain	LAND owners, content creators, developers, gamers, investors	Ethereum smart contracts for virtual world operations

III. ARTIFICIAL INTELLIGENCE AI

AI, as defined by Marvin Minsky and John McCarthy—the fathers of the field—is any task performed by a program or a machine that seems to require intelligence. AI systems often exhibit the following behaviours associated with human intelligence: planning, learning, reasoning, and problem solving, as well as social intelligence and creativity.[19]

Artificial intelligence is concerned with the development of computers able to engage in human-like thought processes such as learning, reasoning, and self-correction [20]

In the field of artificial intelligence (AI), numerous major methods and techniques are used. Here are some of the most well-known AI techniques:

- **Machine Learning (ML):** Machine learning is a subset of AI that focuses on algorithms and models that allow computers to learn and make predictions or decisions without being explicitly programmed. ML techniques include supervised learning, unsupervised learning, semi-supervised learning, and reinforcement learning. [21]

- **Deep Learning (DL):** Deep learning is a sub-field of machine learning that uses artificial neural networks, particularly deep neural networks, to learn and extract high-level representations from data. DL models are capable of automatically learning hierarchical features and have been highly successful in domains such as computer vision, natural language processing, and speech recognition. [21]

- **Natural Language Processing (NLP):** NLP deals with the interaction between computers and human language. It involves tasks such as language understanding, sentiment analysis, machine translation, text generation, and question-answering systems. NLP techniques employ approaches like tokenization, part-of-speech tagging, named entity recognition, and sentiment analysis.[21]

There has been an increase in the creation of research dealing with the coupling and convergence of AI and blockchain, categorizing the combination's potentials into two distinct groups. On the one hand, blockchain can be used to support AI, which is known as Blockchain for AI. This area covers data management and blockchain-based data marketplaces for example. AI, on the other hand, can be employed in blockchain systems, which is known as AI for Blockchain. This includes, for example, ensuring the security of smart contracts.[22]

A. AI for blockchain:

The use of artificial intelligence (AI) techniques and algorithms to improve various aspects of blockchain technology is referred to as AI for blockchain. By combining AI and blockchain, new possibilities for optimizing and upgrading blockchain systems, processes, and applications emerge. Here are a few examples of how AI can be used in the context of blockchain:

Consensus Mechanisms: Artificial intelligence algorithms can be used to improve consensus mechanisms in blockchain networks. AI may help enhance consensus protocols, improve scalability, minimize energy consumption, and improve overall network performance by analysing network data and patterns.

-Smart Contract Analysis: AI can be used to analyse and evaluate smart contract logic and potential weaknesses, assuring their accuracy, security, and compliance with required requirements.

Security and Fraud Detection: AI can improve blockchain network security by identifying and reducing possible dangers and violence. Machine learning algorithms can analyze network behavior, discover anomalies, and alert users to potential hacking or malicious actions.

IV. COMBINING BLOCKCHAIN AND AI

-Privacy-Preserving Techniques: AI can help to improve privacy on blockchain networks. Homomorphic encryption and federated learning, for example, can enable data analysis and model training on encrypted blockchain data without revealing sensitive information.[24]

B. Blockchain for IA:

The integration of blockchain technology with artificial intelligence (AI) systems to enhance and optimize various elements of AI applications is referred to as blockchain for AI. AI for blockchain intends to overcome issues related to data integrity, privacy, security, and trust in AI systems by exploiting the decentralized and transparent characteristics of blockchain. Here are some significant areas where blockchain can be used in conjunction with AI:

-Data Sharing and Collaboration: Blockchain allows for the secure and decentralized sharing of data among numerous parties while protecting data privacy and ownership. AI models can access varied datasets without compromising sensitive information by leveraging blockchain-based data marketplaces or federated learning methodologies, enabling collaboration and enhancing AI model performance and accuracy.

-Data Provenance and Auditing: The immutable and transparent ledger of blockchain ensures the integrity and auditability of AI training data by providing a trustworthy record of data transactions and modifications. This increases confidence and accountability in AI systems by allowing for the verification of data sources, data quality, and regulatory compliance.

- AI Model Marketplace and Governance:Blockchain-based platforms can let developers build AI model markets where they can safely share, purchase, and sell AI models. Smart contracts on the blockchain can automate licensing, usage tracking, and royalty distribution, providing fair compensation and proper credit for AI models while retaining transparency and responsibility.

-AI Model Verification: Blockchain can be used to decentralize the storage of AI models, training data, and validation outcomes. This enables independent verification and auditing of AI models to ensure their fairness, accuracy, and adherence to ethical principles. Furthermore, blockchain can improve AI model comprehension by giving a transparent record of the models' judgements.

-Tokenization:Tokens based on blockchain technology can be used to encourage and reward AI model developers, data suppliers, and validators. Token economies can establish a collaborative environment in which users are encouraged to contribute high-quality data, train robust AI models, and uphold the overall system's integrity.[25]

By integrating blockchain with AI, the aim is to create more transparent, secure, and trustworthy AI systems, resolving issues related to data privacy, trustworthiness, and accountability.

Combining Blockchain and AI in marketplaces

The marriage of blockchain with artificial intelligence (AI) has the potential to transform several industries,

including marketplaces. Marketplaces can benefit from increased transparency, security, and efficiency by using the power of blockchain's decentralized infrastructure and AI's analytical skills.

There are numerous marketplaces based on the combination of blockchain and AI, covering a wide range of industries and sectors.

SingularityNET is a marketplace for AI services and algorithms that runs on Ethereum . It employs a decentralized architecture to promote the sharing and exploitation of various artificial intelligence (AI) abilities. SingularityNET serves as a platform for AI developers to provide their services and algorithms.AI is used in the marketplace for tasks such as analysis, suggestion, and decision assistance.

Ocean Protocol is a blockchain-based marketplace centered on safe and decentralized data sharing. It offers a platform for individuals and businesses to exchange, monetize, and access data while maintaining privacy and control over their data. Ocean Protocol uses blockchain technology to provide transparent and auditable transactions, data provenance, and equitable pay for data sources. It analyzes and extracts insights from data using AI algorithms, allowing users to make more educated decisions.

WeiCrowd is a decentralized marketplace that matches investors with blockchain initiatives in need of funding. It uses smart contracts to conduct secure and transparent investment transactions on Ethereum. WeiCrowd uses AI algorithms to provide investors with decision support and insights, allowing them to make informed investment decisions.

Golem is a decentralized marketplace where individuals may share and consume computing power for a variety of tasks. It is based on Ethereum . In exchange for bitcoin payments, Golem users can rent out their unused computing resources or access computing power from other users. By utilizing a distributed computing approach, this marketplace improves resource optimization and cost-effectiveness. Golem intends to provide an effective and decentralized solution for computationally intensive activities such as rendering, machine learning, and scientific simulations.We are going to create a comparison table to evaluate and compare different marketplaces based on various criteria

What we can conclude from the table TABLE 2 below :

The objective of AI varies across the marketplaces. Some marketplaces focus on optimization and recommendation, while others emphasize data analysis and insights.Different types of AI, such as machine learning or distributed computing, are employed across the marketplaces. This reflects the specific AI capabilities and technologies leveraged to meet the marketplace's objectives.Data management, both off-chain and on-chain, differs each marketplace. Off-chain data may include meta-data or communications, whereas on-chain data is directly kept on the blockchain. This has an impact on data privacy, scalability, and accessibility.Each marketplace's use cases vary, starting with decentralized e-commerce to a safe data marketplace to linking investors with blockchain initiatives. This demonstrates the various applications and sectors targeted by each platform. By evaluating and interpreting these

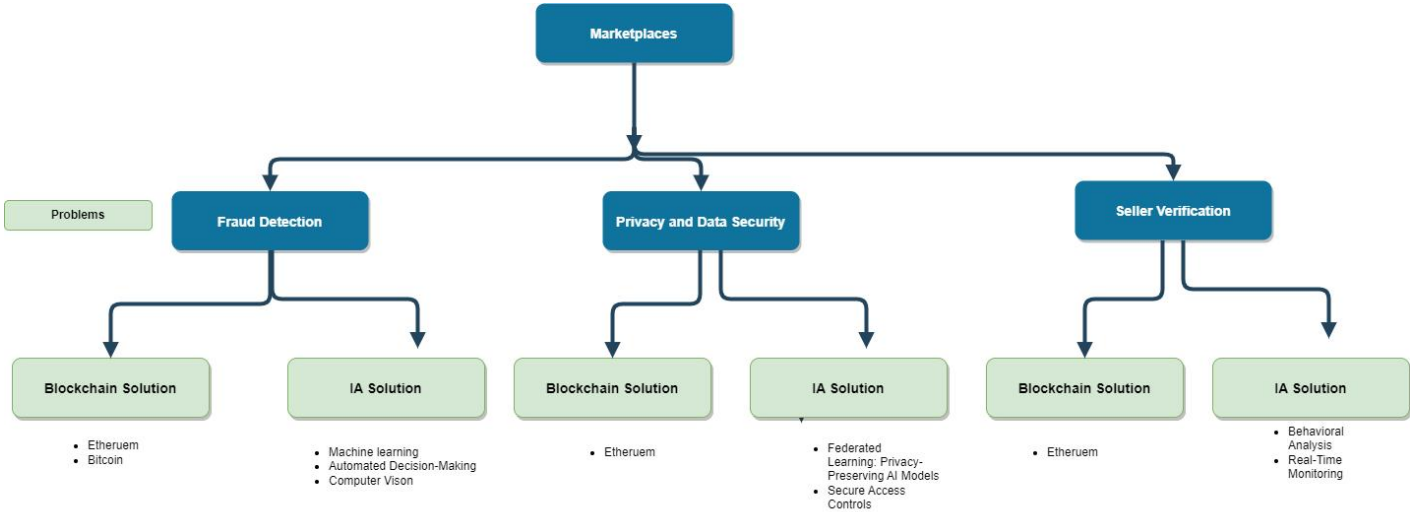
comparison table elements, one can acquire insights into the distinct features, strengths, and considerations related with each marketplace.[23]

TABLE 2 BLOCKCHAIN AND AI BASED MARKETPLACES COMPARISON

Marketplace	Use Case	Blockchain Framework	AI Type and contribution	Advantages
SingularityNET	Exchange utilization of AI services	Ethereum	Machine Learning: AI services and algorithms marketplace	Access to diverse AI capabilities
Ocean Protocol	Secure decentralized data marketplace	-	Machine Learning: Data analysis and insights	Secure data sharing, data monetization
WeiCrowd	Connecting investors with blockchain projects	Ethereum	Machine Learning: Decision support and insights	Access to investment opportunities
Golem	Decentralized marketplace for computing power	Ethereum	Distributed Computing: Resource optimization and sharing	Efficient resource sharing, cost-effective

Problems in marketplaces can be classified into three types: fraud detection, seller verification, privacy, and data security. A combination of blockchain and AI can

be used to overcome these difficulties. Ethereum is the most popular blockchain platform. In terms of artificial intelligence, solutions may include automated decision-making, federated learning, and machine learning.



V. CONCLUSION:

The combination of blockchain and artificial intelligence (AI) in marketplaces has the potential to impact a wide range of industries and sectors. The combination of these technologies provides a number of advantages, including increased transparency, security, efficiency, and transaction confidence .The decentralized and fixed nature of blockchain assures the integrity of data and transactions, while AI's sophisticated analytics and automation capabilities give users with valuable insights and personalized experiences. The marketplaces mentioned in this paper, such SingularityNET, Ocean Protocol, WeiCrowd, and Golem, demonstrate the wide range of applications and use cases

that may be achieved with this strong combination However, it is critical to examine the obstacles and constraints that may develop when deploying blockchain and AI in marketplaces, such as scalability, governance, and integration complexity. Future research and innovation in this discipline will continue to refine and expand these technologies' capabilities, releasing new opportunities and changing the marketplace environment across multiple sectors. As blockchain and artificial intelligence (AI) continue to grow, their integration in marketplaces holds enormous promise for establishing more safe, efficient, and intelligent trading ecosystems.

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