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Blockchain and Knowledge Management: An Overview



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About the Speaker

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Basically, I am engineer in computer science then I converted to industrial engineering by my Master and Ph.D, my researches include

Intellectual capital measurement and Knowledge management
Decision making and performance measurement
Data mining and knowledge discovery
Business intelligence and decision support
Industry 4.0
Automatic summarization
Blockchain and its applications in industry and knowledge management

PLAN

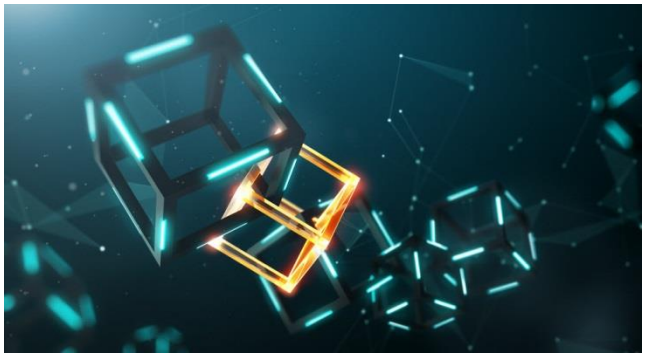
1- Introduction
2- What is blockchain?
3- What is knowledge management?
4- Problematic
5- Barriers of Knowledge management
6- Why blockchain?
7- Applications of blockchain
8- Part I. Blockchain and knowledge Management by technIc and method (gamification, crowdsourcing, machine learning and correlations, semantic and ontologies)
9- PART II: Blockchain and knowledge Management by technology (industry 4.0, edge computing, cloud computing)
10- PART III: Blockchain and knowledge Management human values
11- Conclusion and trends
12- References

Introduction

After Two years of pandemic situation
The Humanity is not Ready in Technologogy for Such situations

The blockchain is among the emerging solutions witch may help in knowledge capitalization and sharing by secured way

Knowledge



BLOCKCHAIN

Knowledge

The Blockchain

[51]

What Is the Blockchain?

A digital ledger that keeps a record of all transactions taking place on a peer-to-peer network

All information transferred via blockchain is encrypted and every occurrence recorded, meaning it cannot be altered

It is decentralised, so there's no need for any central, certifying authority

[33]

It can be used for much more than the transfer of currency; contracts, records and other kinds of data can be shared

Encrypted information can be shared across multiple providers without risk of a privacy breach

Difference Between a Blockchain and a Database

Criterion	Blockchain	Database
Authority	Decentralized	Centralized
Architecture	Peer-to-peer model	Client-server model
Performance	Relatively slower (crypto)	Quick
Cost	Expensive	Not Expensive
Data processing	Only read and write	Create, read, update, delete
Data integrity	Data integrity	Has no data integrity
Transparency	Transparent	Not transparent
Cryptography	✓	×

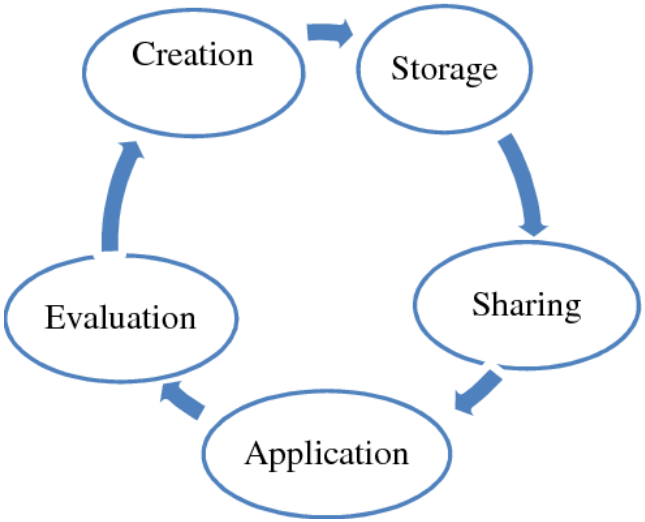
[48]

KNOWLEDGE MANAGEMENT

KNOWLEDGE MANAGEMENT

«**Knowledge** is embodied in an individual .. It is the foundation his skills. It represents **80%** of the capital of the company.

Knowledge management is an organizational process for creation, storage, sharing, application and evaluation of knowledge of individuals across the organization to provide assistance to work and increase organisational effectiveness.



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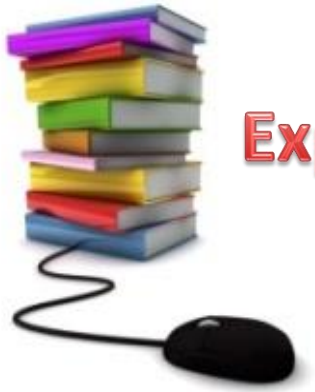
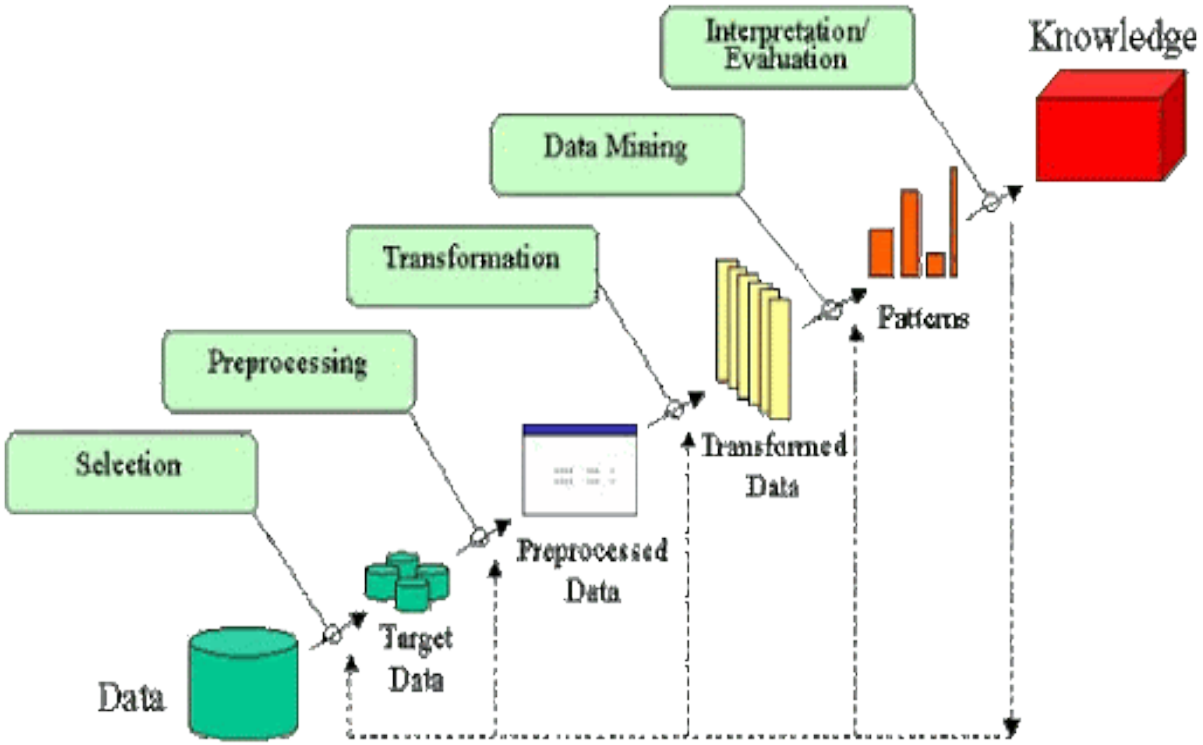
Tacit Knowledge and Explicit Knowledge



Explicit

Tacit

Hidden in big data



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PROBLEMATIC (1)

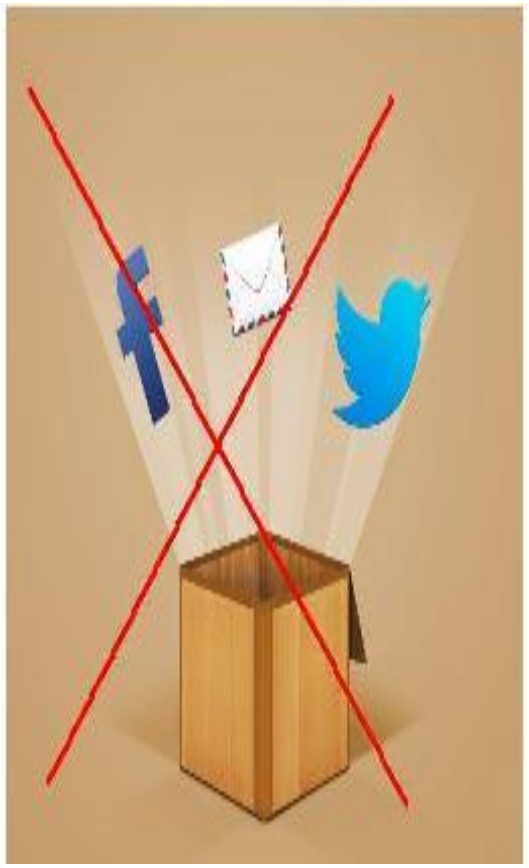
Departure to competitors

Loss of expertise

Retirement

Conversion

PROBLEMATIC (2)



No sharing of knowledge

World 38,33%

Algeria 13,33%

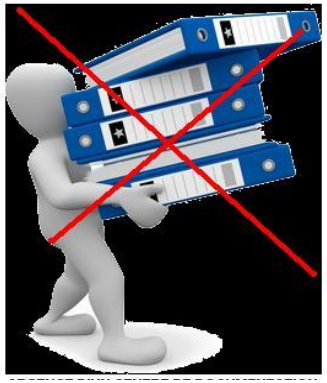
Explicit-tacit knowledge

PROBLEMATIC (3)

World 29 %

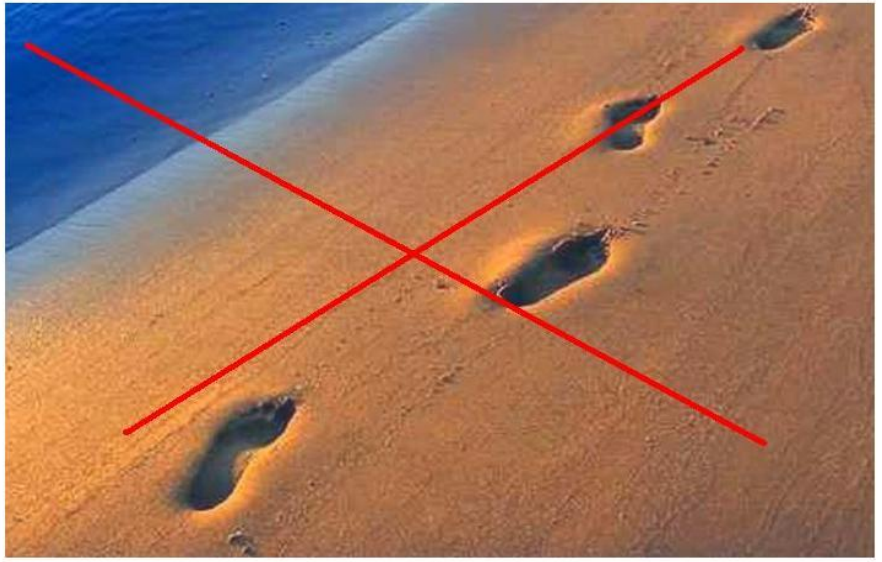
Algeria 0,034 %

No memory



documentation center

Electronic document management



No traceability

Barriers of Knowledge Management

Related to organization

1- Bureaucracy

2- Lack of incentives.

Related to knowledge

3- Loss of proprietary knowledge

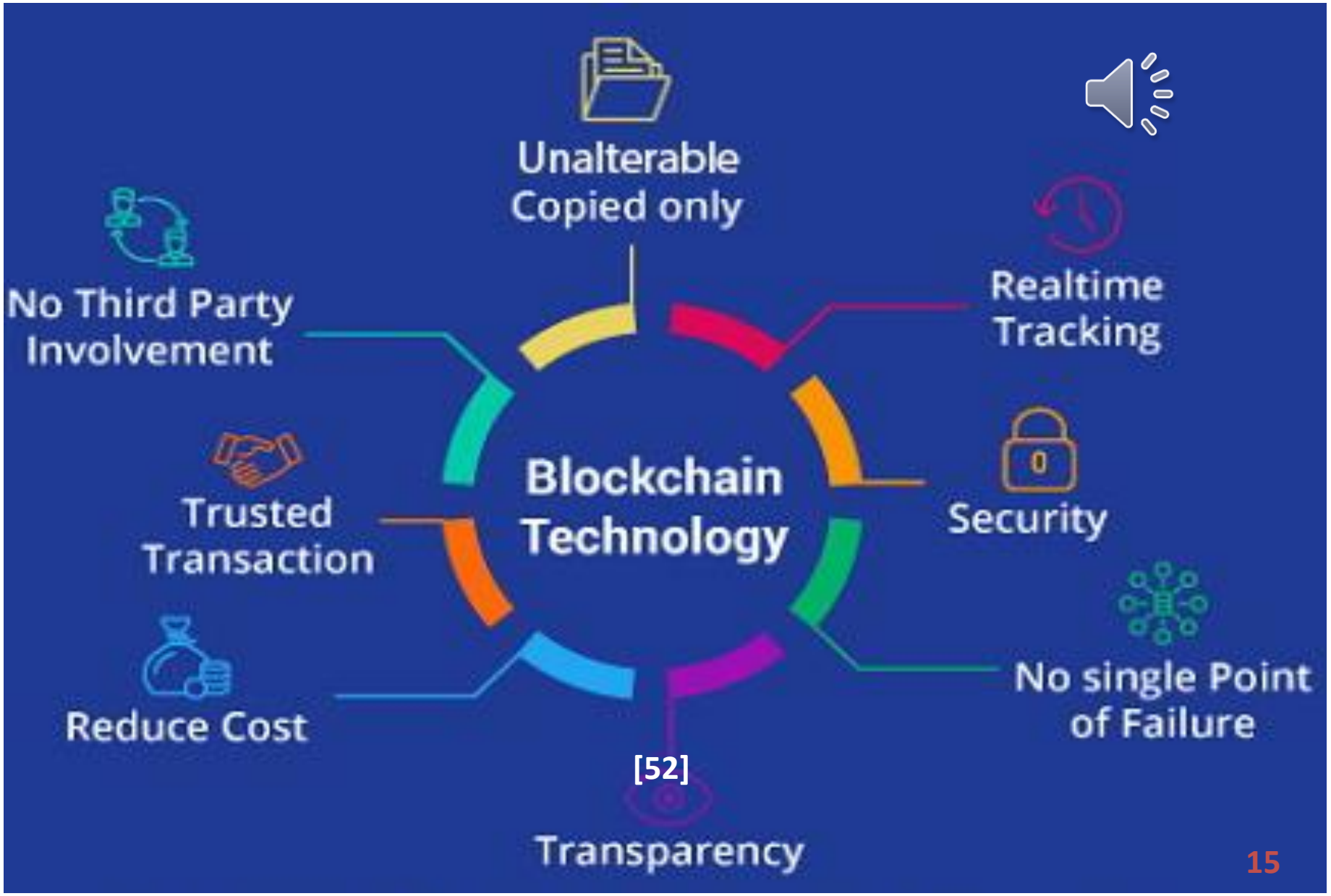
4- Retention

Related to people

5- Poor interpersonal skills

6- Fear of failure

Why Blockchain for Knowledge Management?



[52]

Applications of Blockchain

Monatery use of blockchain (80%)

Bitcoin

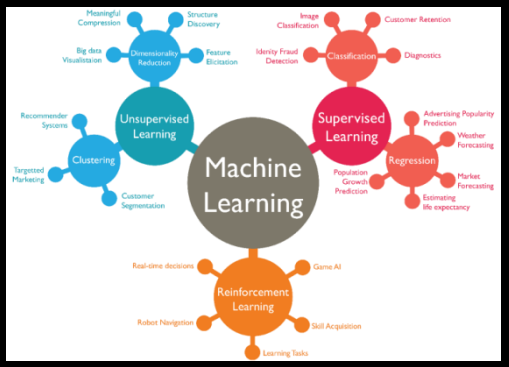
Etherium

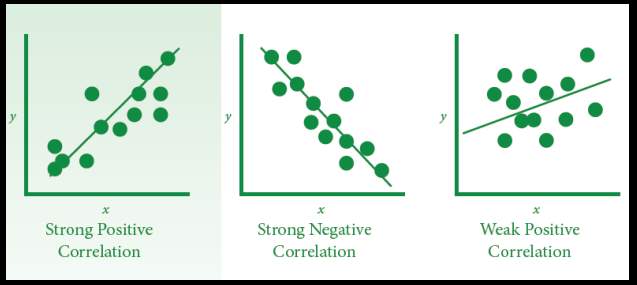
Non-Monatery use of blockchain (20%)

Applications of Blockchain

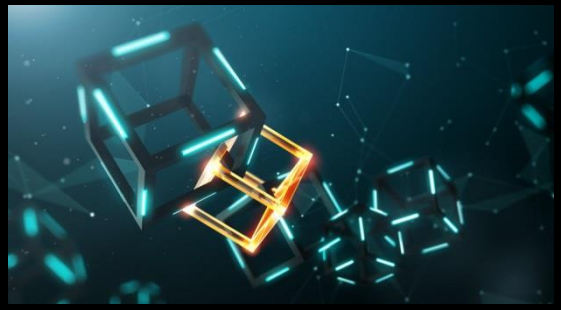
How about Blockchain in knowledge management?

PART I: BLOCKCHAIN AND KNOWLEDGE MANAGEMENT BY TECHNIC AND METHOD

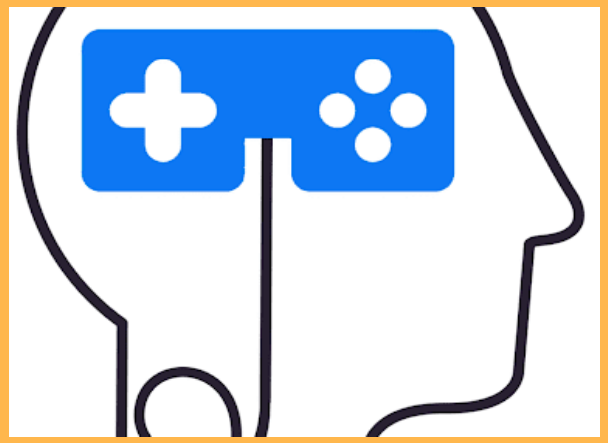




Correlations

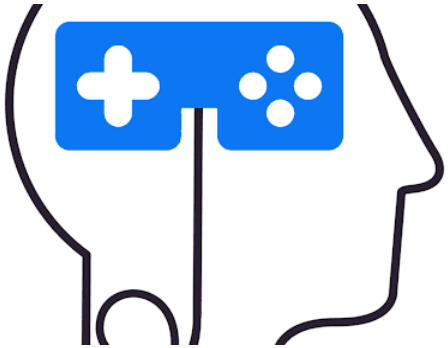


I.1 AQUIRING AND SHARING KNOWLEDGE BY GAMIFICATION (learning by games) AND CROWDSOURCING (knowledge from social medias) USING BLOCKCHAIN



The use of Blockchain-supported Reward Systems for Knowledge Transfer between Generations (1)

Current storage of knowledge? [1]	
Wiki	**38,81%**
Structured online file storage	**32,84%**
E-mails	**32,84%**
Tools from external service providers	28,36%
I do not know if we have any knowledge management in the company.	13,43%
Online-Spreadsheets	7,46%
Other (please specify)	1,49%



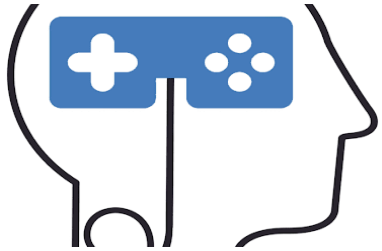
[1]

Reward System in Knowledge Management	
No, where I work there are no rewards for (successful) knowledge management.	**38,81%**
Yes, there are incentives in the form of monetary payments for those who pass on knowledge.	32,84%
We have rewards in the form of gamification, that means in a playful way. The rewards are purely symbolic in character.	32,84%
We have rewards in the form of gamification, that means in a playful way. The rewards are noncash prizes, such as vouchers.	28,36%
Yes, there are incentives in the form of monetary payments for those who pass on knowledge and for those who receive it.	13,43%
We have rewards in the form of gamification, that means in a playful way. But the rewards are ultimately cash prizes.	7,46%
Other (please specify)	1,49%

The use of Blockchain-supported Reward Systems for Knowledge Transfer between Generations (2)

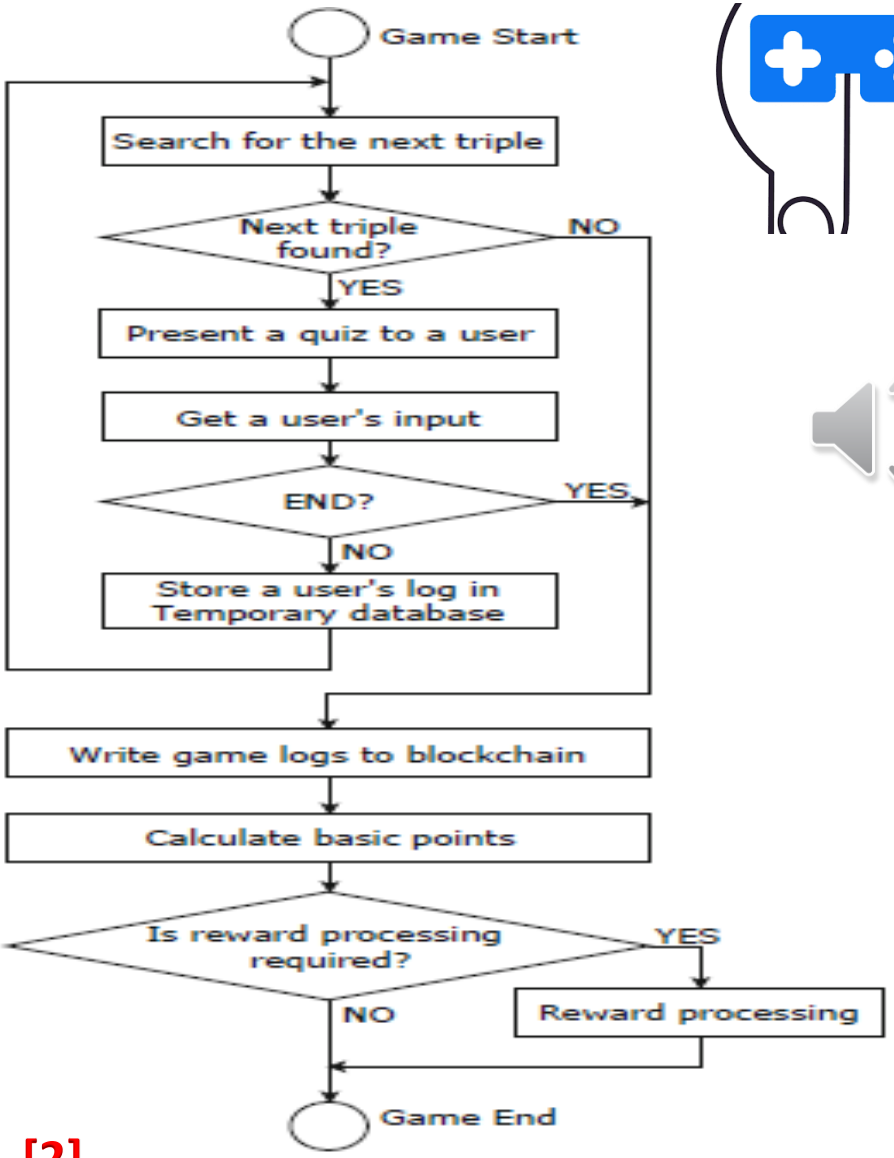
Knowledge Transfer Process	
In a company-wide database	36,36%
Only verbal (e.g. meetings), no protocols	22,73%
We have no transfer of knowledge, or it is not recorded whether and how it is carried out	22,73%
Handwritten and filed in folders	12,12%
We use external cloud services	10,61%
In a database that is stored locally	9,09%
We use Blockchain based solutions	1,52%

From a technical perspective, the authors have managed to demonstrate that Blockchain technologies can play a role in knowledge management. The initiation of knowledge transfer, particularly between generations, through gamification and nudging is possible and attractive. Securing documents so that they cannot be manipulated is feasible.



Toward Blockchain-Assisted Gamified Crowdsourcing for Knowledge Refinement

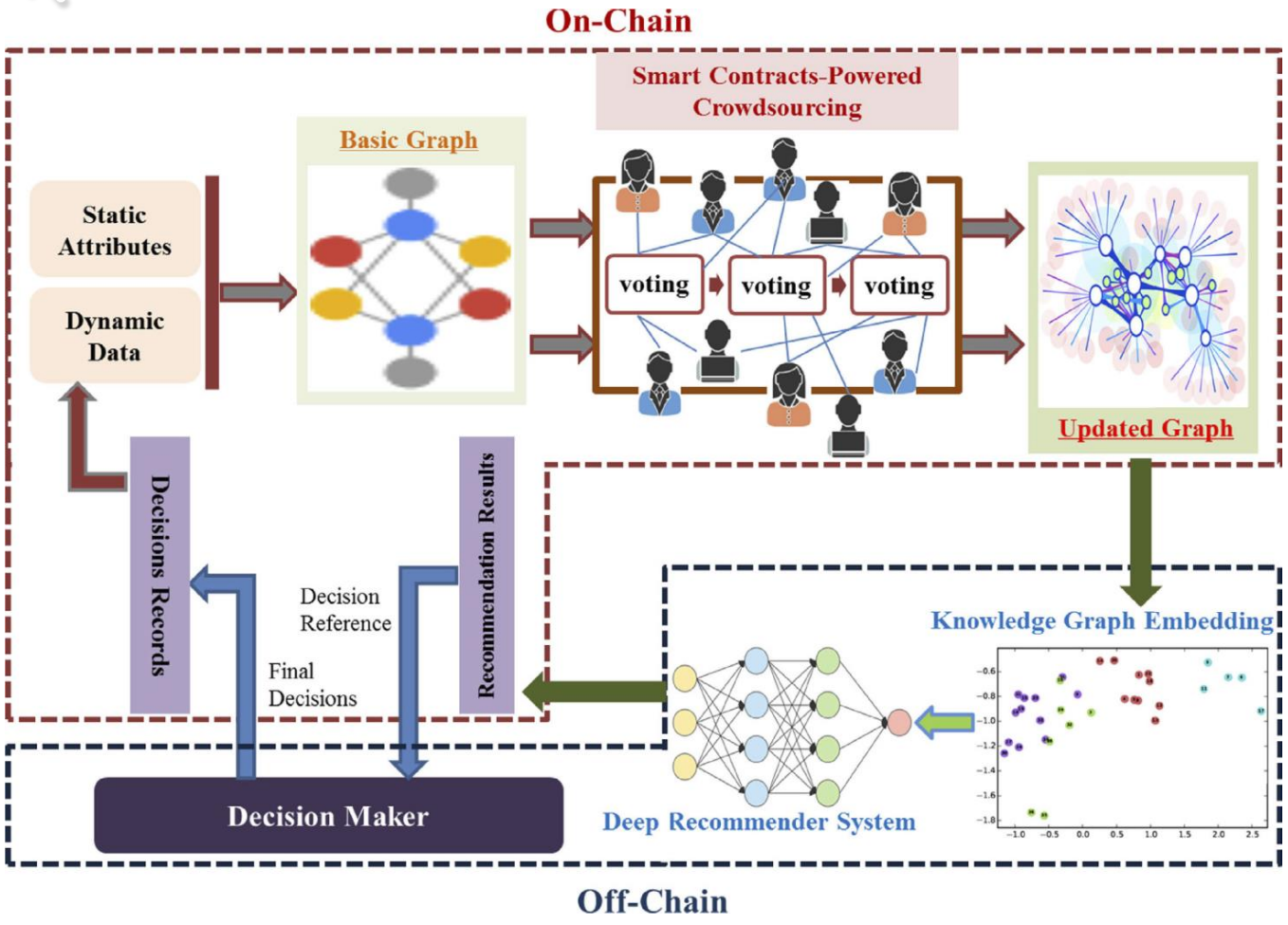
Gamification (enhance systems by involving users by games) could be introduced into **crowdsourcing (knowledge from social Medias or crowds)** so that users are given rewards according to their contribution.
blockchains is usefull to ensure transparency of the user reward calculation.
It is extandable to application of blockchains to the process of gathering the knowledge content



[2]

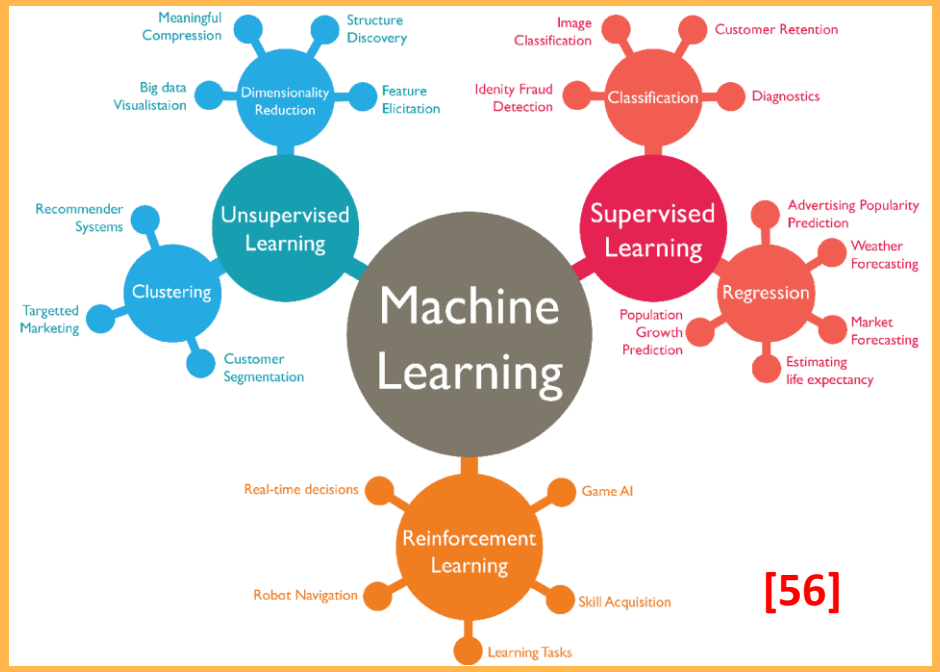
Decentralized Construction of Knowledge Graphs for Deep Recommender Systems Based on Blockchain-Powered Smart Contracts

propose a novel decentralized knowledge graph construction method by means of crowdsourcing, and the business logic of **crowdsourcing is implemented by blockchain-powered smart contracts** to guarantee the transparency, integrity, and auditability. On this basis, the decentralized knowledge graph is used for a deep recommender system, and case studies validate the effectiveness of the system.



[3]

I.2 BLOCKCHAIN AND DISCOVERY OF KNOWLEDGE USING MACHINE LEARNING AND DISCOVERING CORRELATIONS



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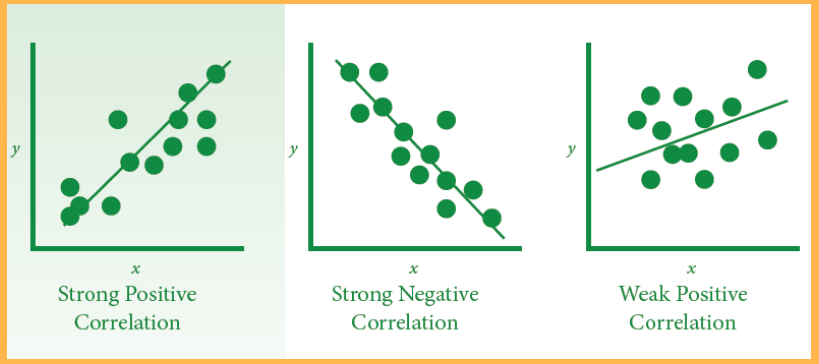
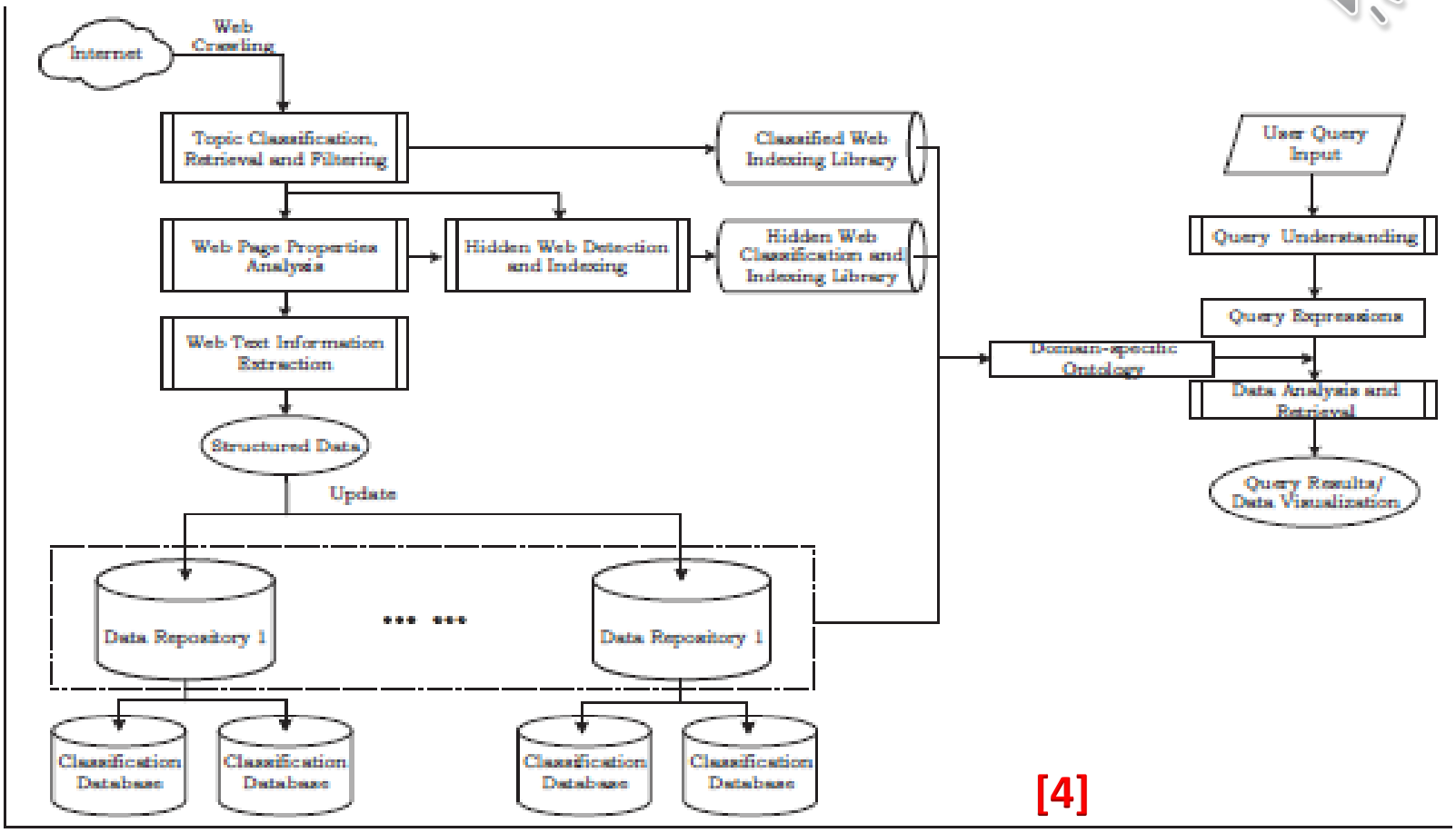


Correlations

A Novel Blockchain Oracle Implementation Scheme Based on Application Specific Knowledge Engines

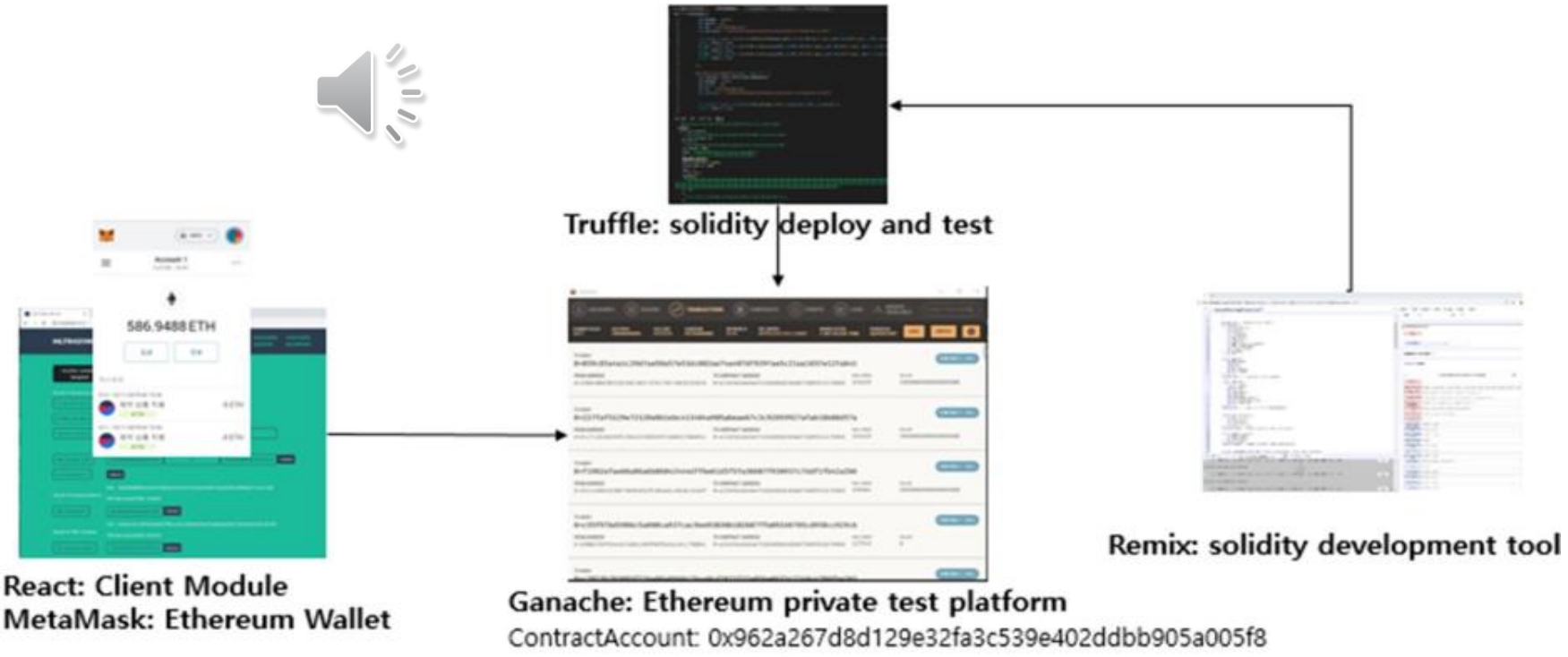
In blockchain ecosystems, an Oracle is a service tool which provides real-world data for smart contracts and other blockchain applications. Application Specific Knowledge Engine (ASKE) is an integrated topic/application-centered knowledge portal that supports effective information retrieval and analysis. Inspired by ASKE. The authors propose a novel Oracle implementation scheme. The proposed scheme can realize multi-source data extraction and analysis, then working prototypes are demonstrated to show the validity of the scheme.



[4]

Data Privacy-Preserving distributed Knowledge Discovery Based on the Blockchain

This work proposes a blockchain based distributed machine learning method which does not disclose the participating parties' data and gives the penalty to betraying parties. The proposed method makes the participating parties communicate with each other via the smart contract on the blockchain network. It uses a blockchain-based incentive system to establish trust among parties and to improve the quality of discovery knowledge.



ML Model Builder 1 : **0x2DcCa9B61E50D79A90a813fcD6a42c3A3Ac52e6f**
ML Model Builder 2 : **0x2DcCa9B61E50D79A90a813fcD6a42c3A3Ac52e6f**
ML Model Builder 3 : **0xDc27C2b26EDbfb7Eb223589D4997dDA997DA8D1e**

[5]

Early mover (dis)advantages and knowledge spillover effects on blockchain startups' funding and innovation performance

An empirical analysis is conducted on 255 startups in the blockchain industry found between 2007 and 2016. The results show that while early mover advantages exist in terms of funding attraction from venture capitals, the entry timing and innovation performance have an inverted U-shaped relationship, as expected. Knowledge spillover activities of blockchain startups positively moderate the relationship between the entry timing and the venture capital attraction.

Early mover advantages	Late comer advantages
• Preemption of key resources • Lock-in effect with high switching costs • Learning curve effect on innovation	• Lower market or technological uncertainty • Lower cost for entry preparation • Relatively easier R&D processes with imitation

Criteria for determining entry timing	
Firm size	**Industry type**
• SMEs or startups: Early mover strategy • Large firms: Late comer strategy	• High-tech industries: Early mover strategy • Low-tech industries: Late comer strategy

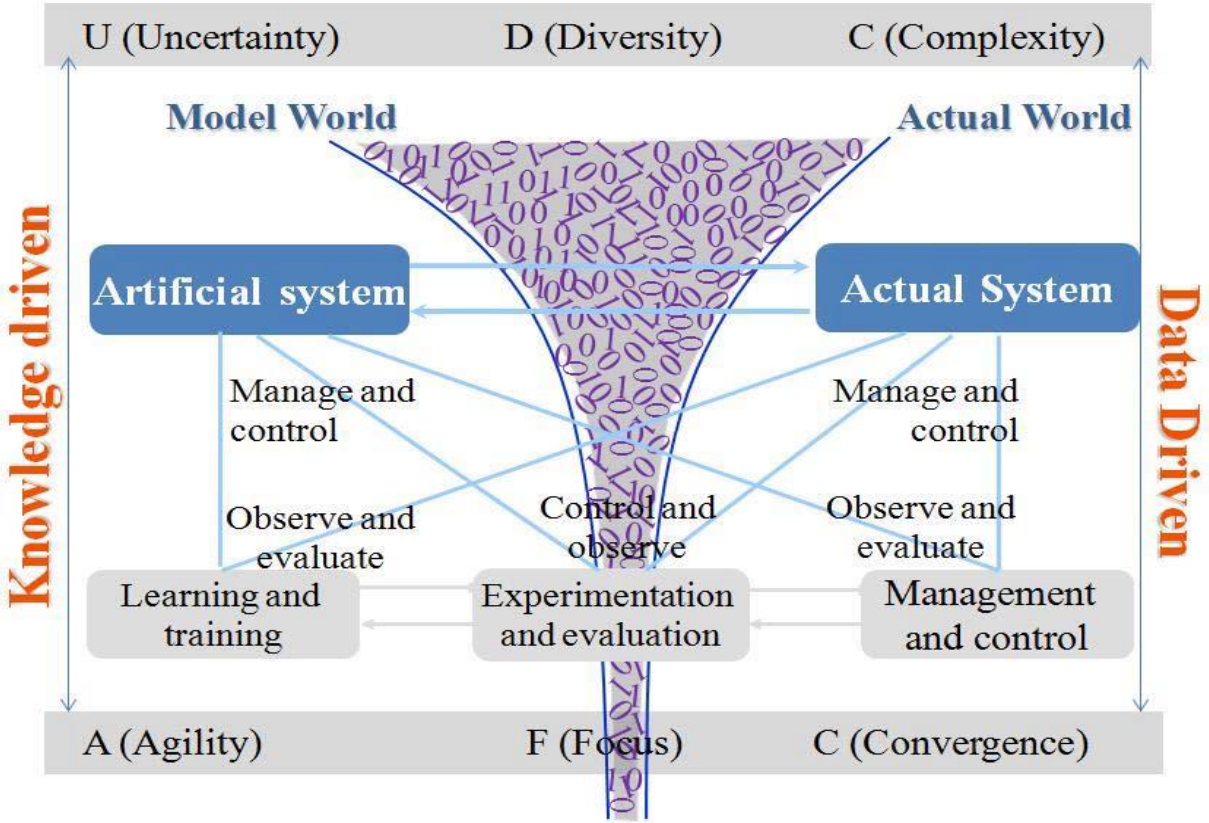
Application to the context of blockchain industry	
• Blockchain startups: small-sized firms	• Characteristics unlike typical high-tech industries ✓ Voluntary knowledge or technology disclosure ✓ Active knowledge sharing

Research questions of the study
• Are early mover (dis)advantages valid for startups in the blockchain industry? • How are early mover (dis)advantages altered depending on the startup's knowledge spillover activities?

[6]

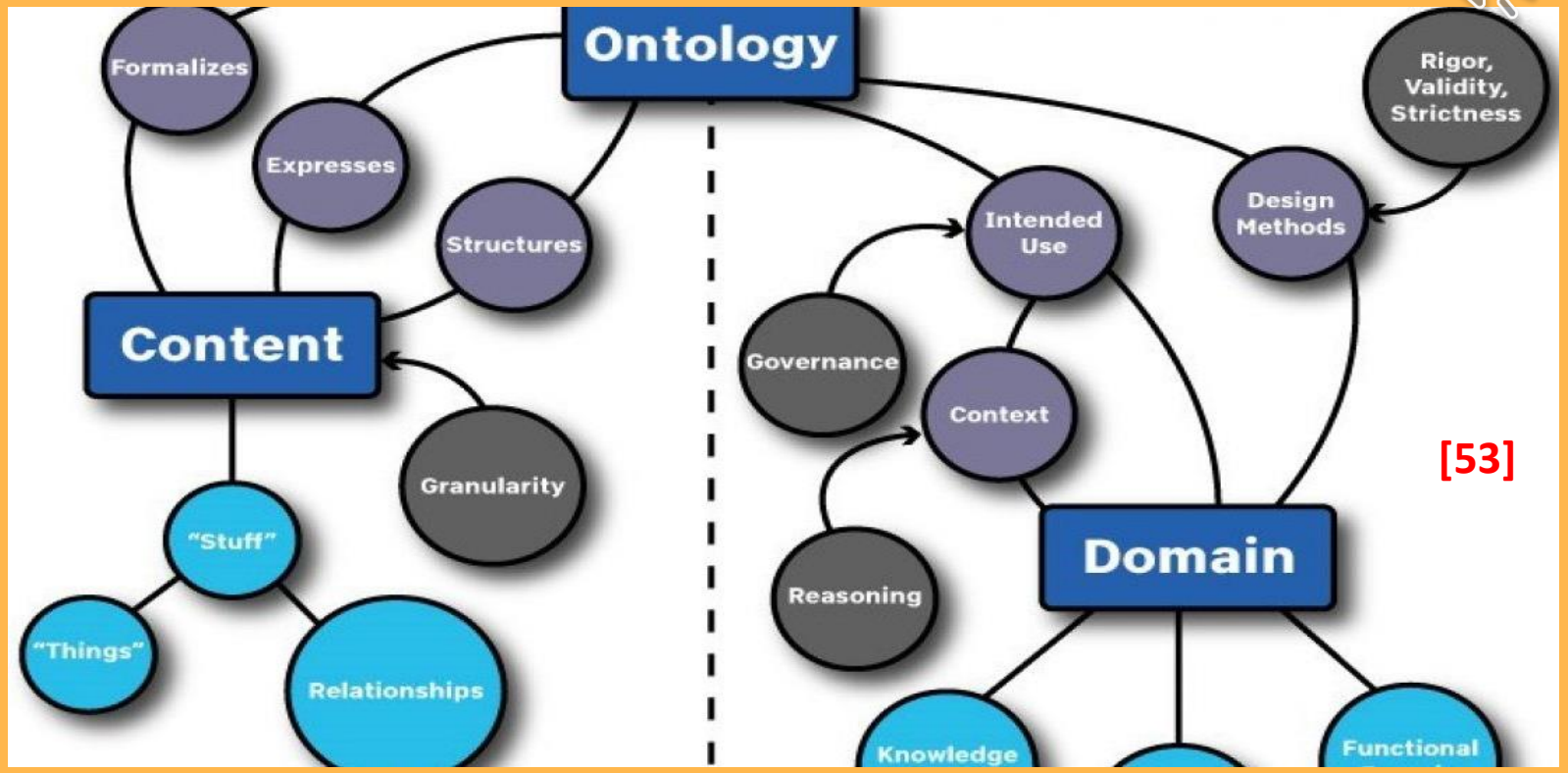
Blockchain-Based Knowledge Automation for CPSS-Oriented Parallel Management

With the rapidly deepened integration of the real world and the virtual society, cyber–physical–social system (CPSS)-oriented parallel management proves to be an effective and efficient way in solving these problems. In this article, authors utilize blockchain technology and smart contracts in knowledge automation and investigate blockchain-based knowledge automation, which can be used for cyber–physical–social system (CPSS)-oriented parallel management.



[7]

I.3 SEMANTIC S AND ONTOLOGIES USING BLOCKCHAIN

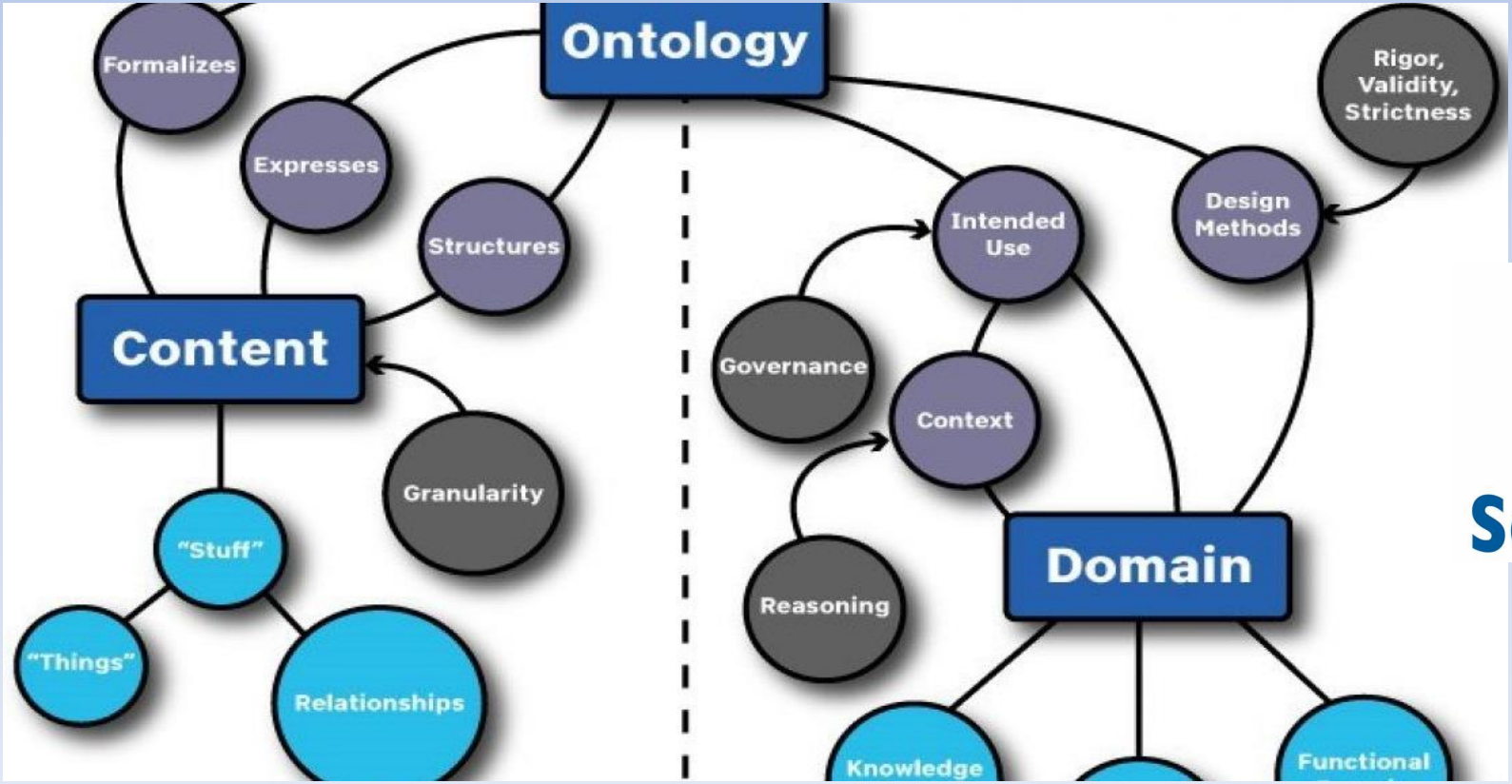


[53]

Semantic [54]

DEFINITION OF ONTOLOGY

Ontology is a formal knowledge representation is about building models of the world, of a particular domain or a problem, which allow for automatic reasoning and interpretation. Such formal models are called ontologies and can be used to provide formal semantics (i.e., machine-interpretable meaning) to any sort of information: databases, catalogs, documents, web pages, etc.

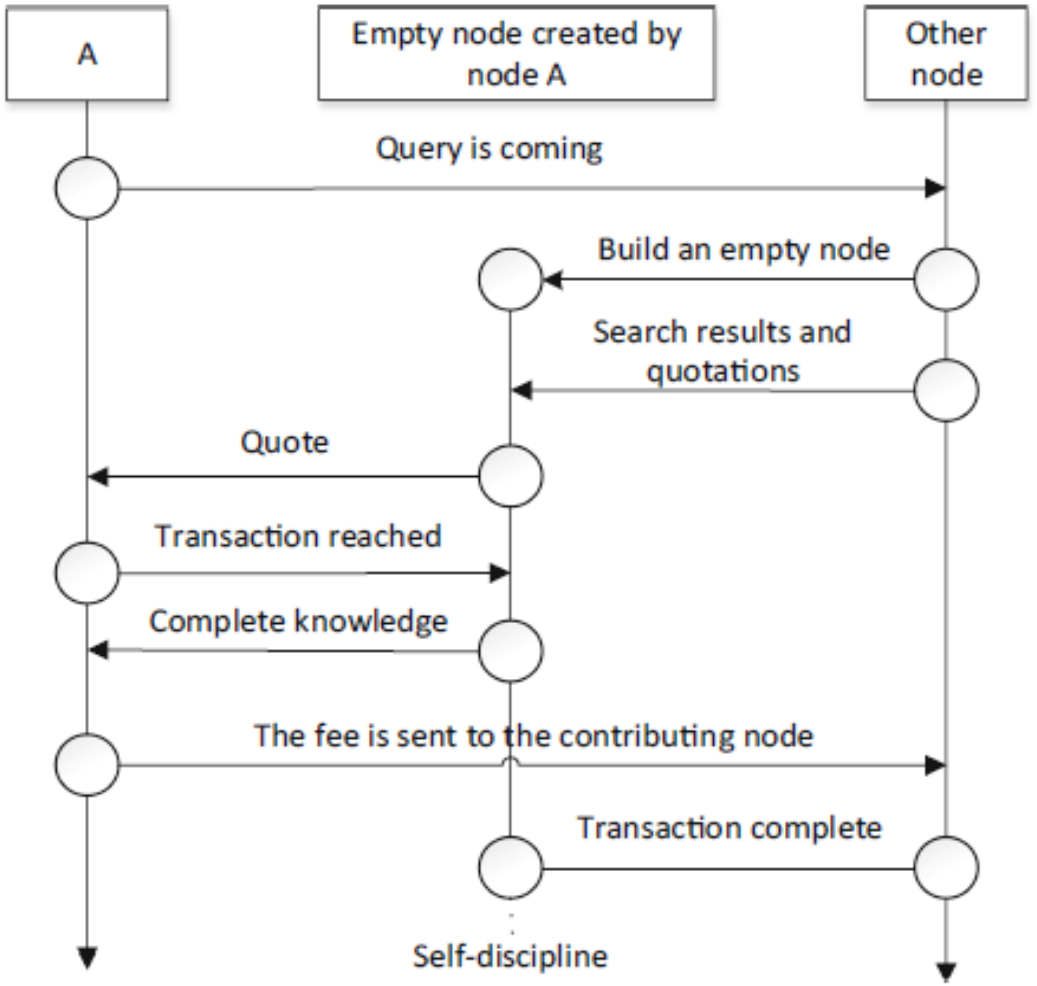


Semantic

Semantic Knowledge Sharing Mechanism Based on Blockchain

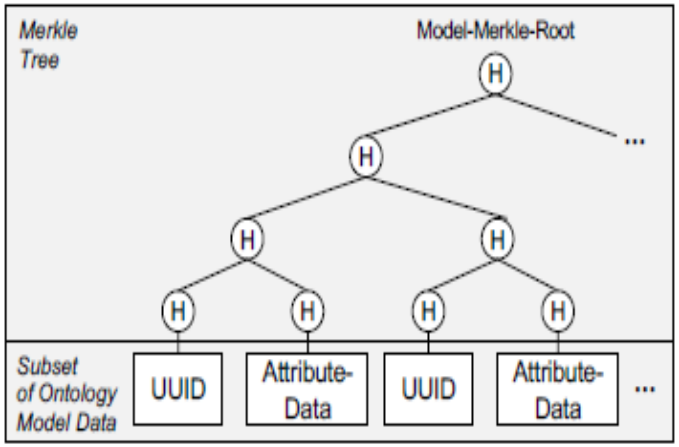
Combined with blockchain, a decentralized semantic knowledge sharing mechanism based on blockchain is proposed. The decentralized global knowledge graph is constructed by using the inter-node communication mechanism, and the query mode and transaction flow design based on the mechanism are realized. The experimental results show that the semantic knowledge sharing mechanism based on blockchain proposed is feasible, and compared with the traditional centralized knowledge graph, the construction time and query rate are greatly improved.

Schematic diagram of query transaction flow.

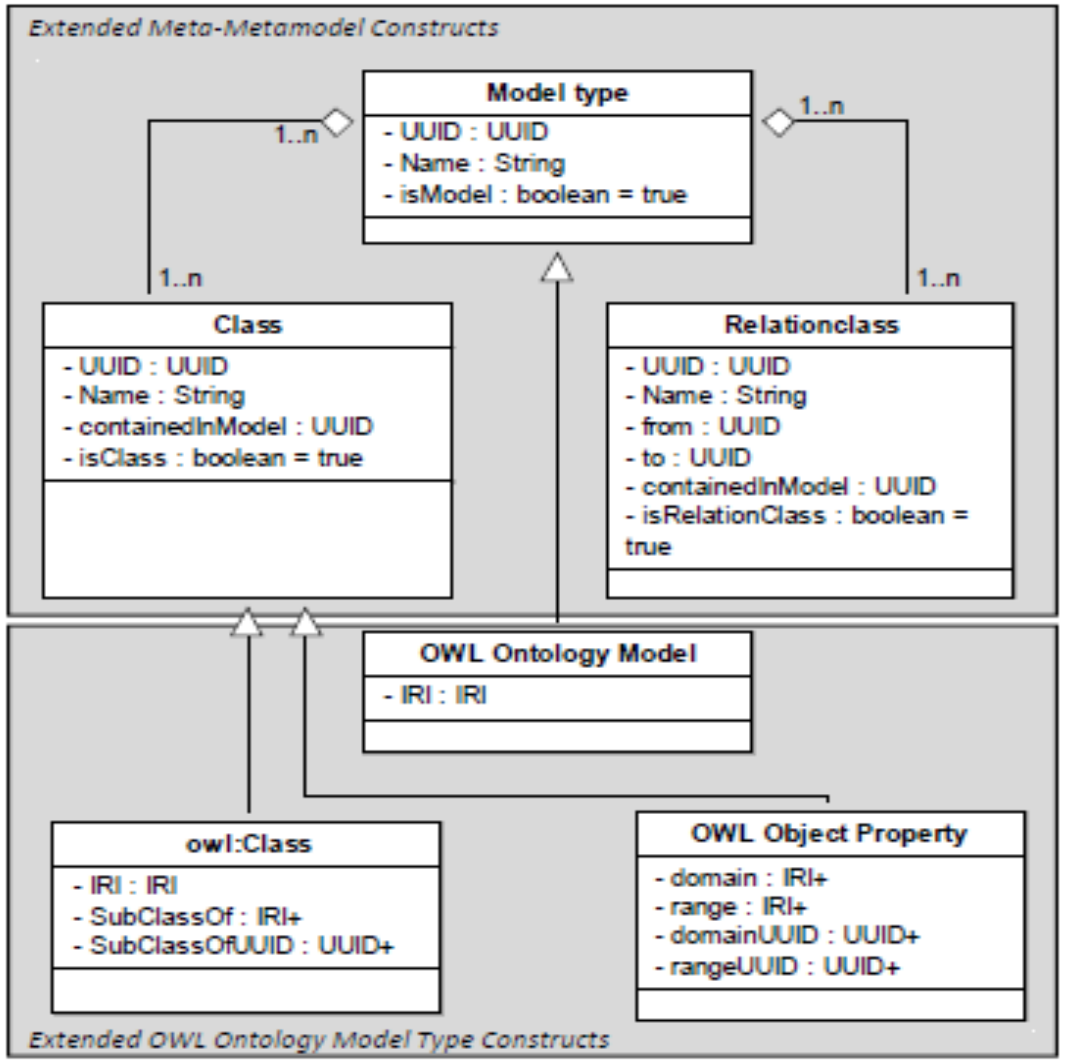


[8]

Applying the Concept of Knowledge Blockchains to Ontologies



Knowledge Blockchains revert to blockchain technologies for enabling a transparent monitoring of knowledge evolution, for tracking the provenance of knowledge, for establishing delegation schemes, and for ensuring the existence of patterns in formal conceptualizations using zero knowledge proofs. Based on their original application to enterprise models,

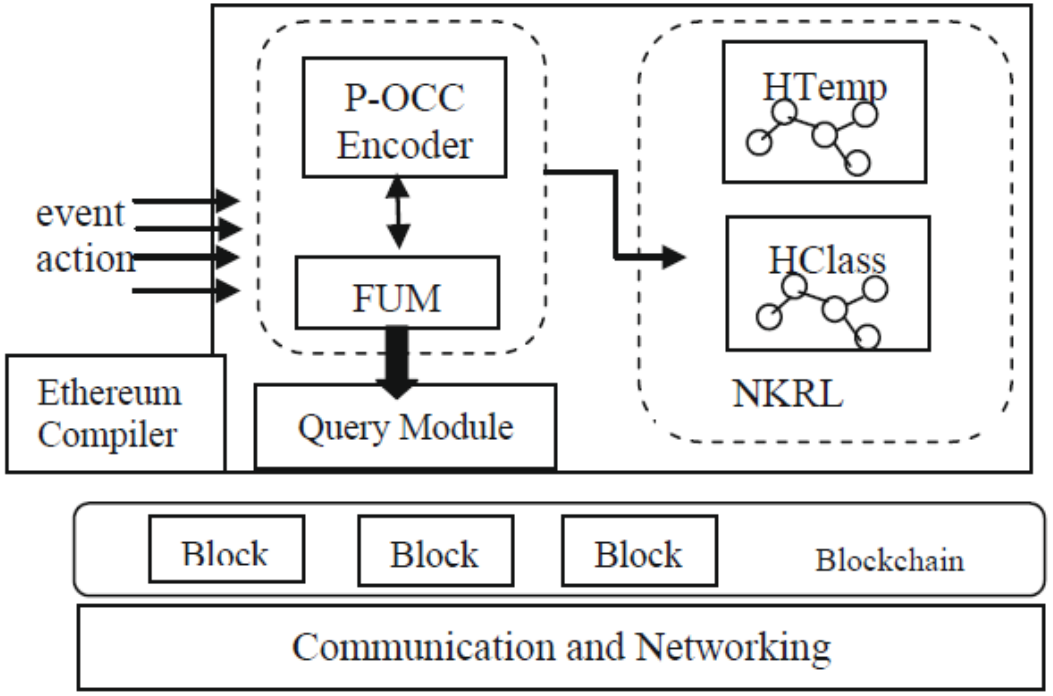


[9]

Narrative Knowledge Representation and Blockchain: A Symbiotic Relationship

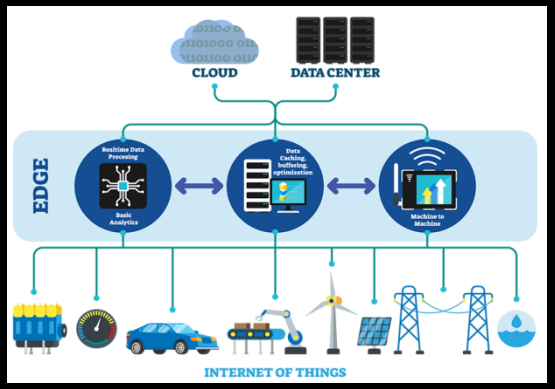
Ontologies jointed to blockchain facilitate the understanding and sharing of intrinsic components – smart contracts, transaction, knowledge- and relationship within a Blockchain. The main goal of this approach is to promote common data exchange, the design of decentralized, and the chronological semantic relationships on the Blockchain and Ethereum Smart Contracts making use of the narrative semantic representation foundations allowing therefore the web to survive and Blockchain technology to prosper.

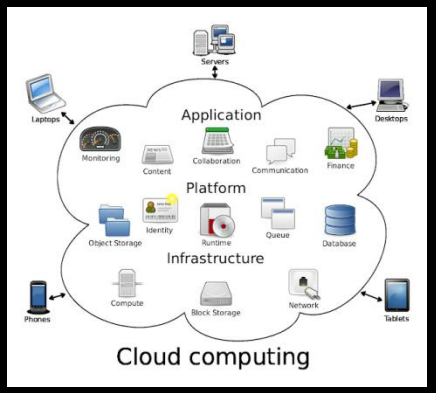
Simplified semantic architecture.

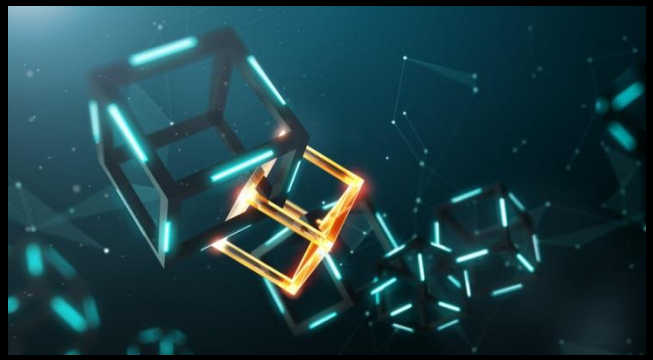


[10]

PART II: BLOCKCHAIN AND KNOWLEDGE MANAGEMENT BY TECHNOLOGY



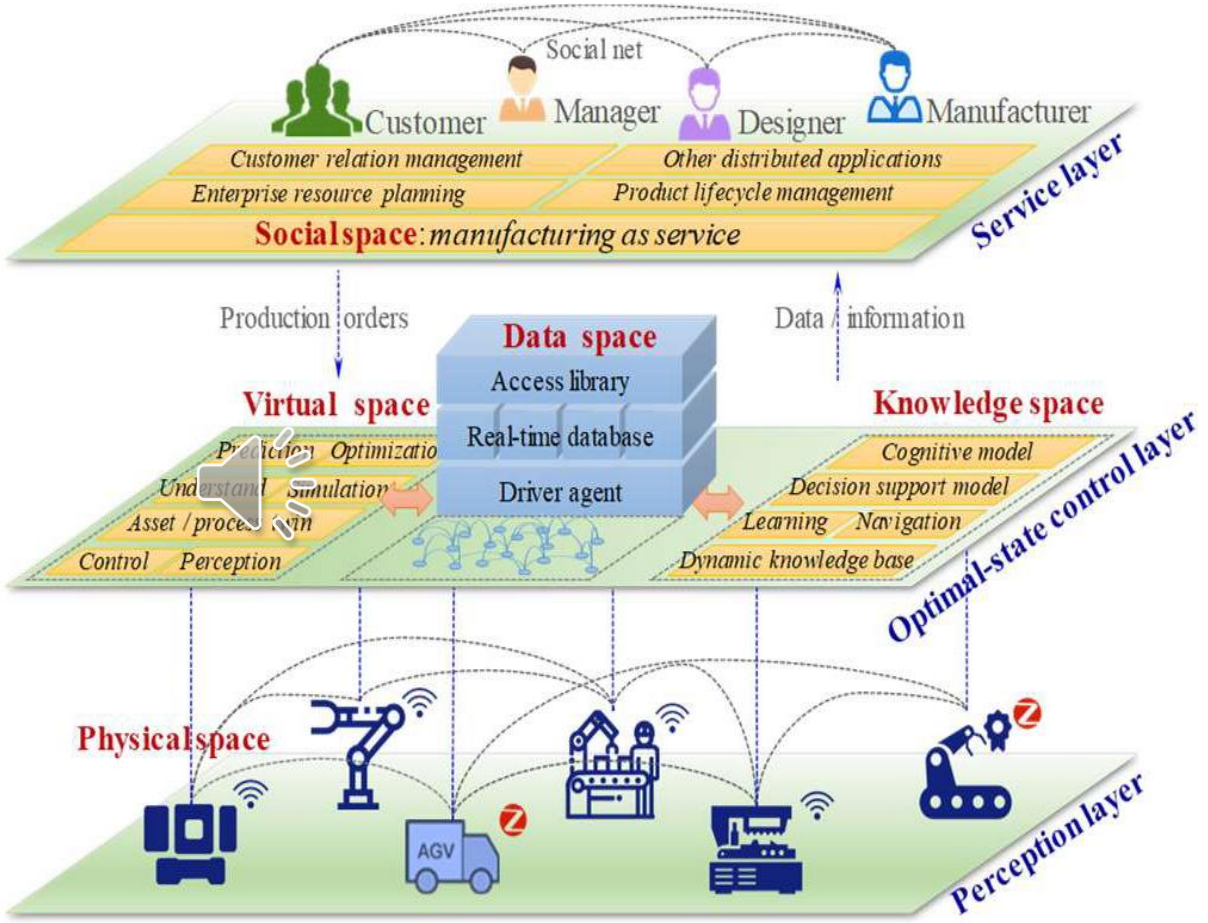




II.1 AQUIRING AND SHARING KNOWLEDGE BY INDUSTRY 4.0 TECHNOLOGIES USING BLOCKCHAIN

Manufacturing Blockchain of Things for the Configuration of a Data- and Knowledge-Driven Digital Twin Manufacturing Cell

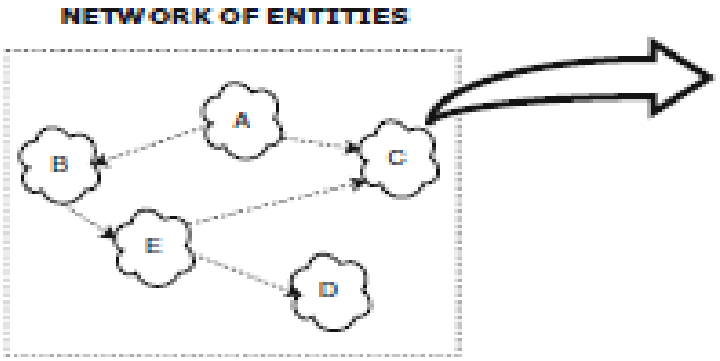
This work combines IIoT with the permissioned blockchain and proposes a novel manufacturing blockchain of things (MBCoT) architecture for the configuration of a secure, traceable and decentralized intelligent manufacturing systems (IMS). It uses a strong encryption algorithm based on a crash fault tolerant protocol. MBCoT equips IMS with a secure, traceable, stable and decentralized operating environment, while achieving competitive throughput and latency performance.

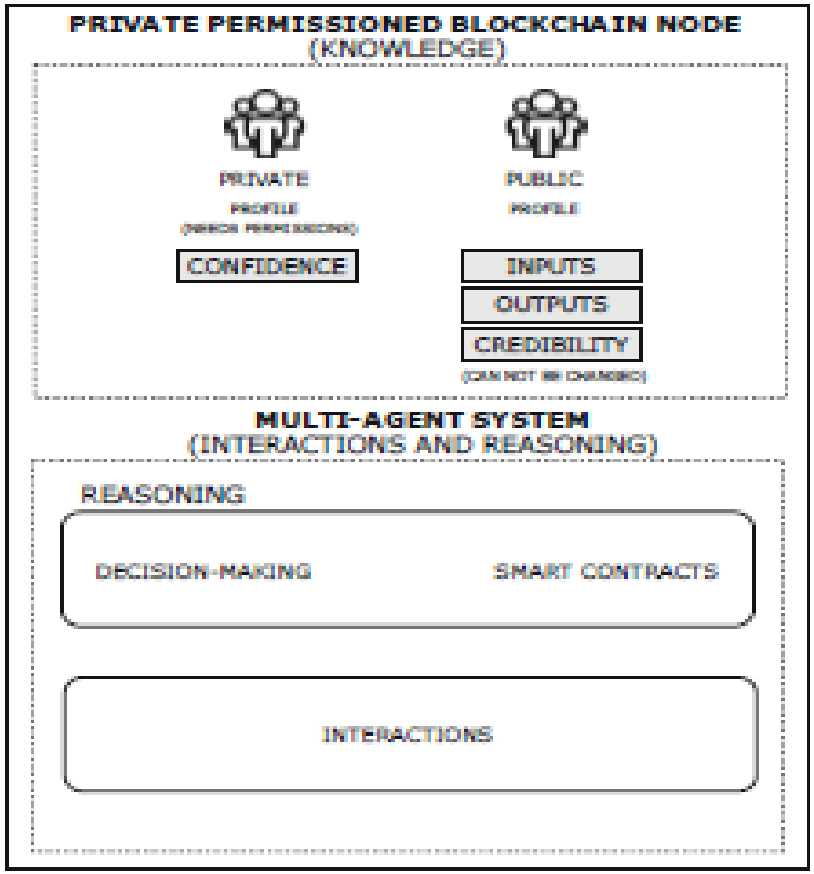


[11]

Improving Collaboration in Industry 4.0: The Usage of Blockchain For Knowledge Representation

A model that uses blockchain and multi-agent systems to help represent an organization in a network of entities, as well to create a system that is capable of handling entity transactions and provide a way of improving decision-making by enabling decisions to be done faster in a rapidly changing environment.





[12]

Forecasting technological positioning through technology knowledge redundancy: Patent citation analysis of IoT, cybersecurity, and Blockchain

This research approaches the relative locations of a company in the technological network based on patent citations of the IoT cybersecurity and blockchain. Authors applied the Technology Knowledge Redundancy method for the patent citation network, used the main two indicators TKS (Technology Knowledge Status) and TKR (Technology Knowledge Reliability) for the analysis, and then used the Derwent Innovations Index patent data.

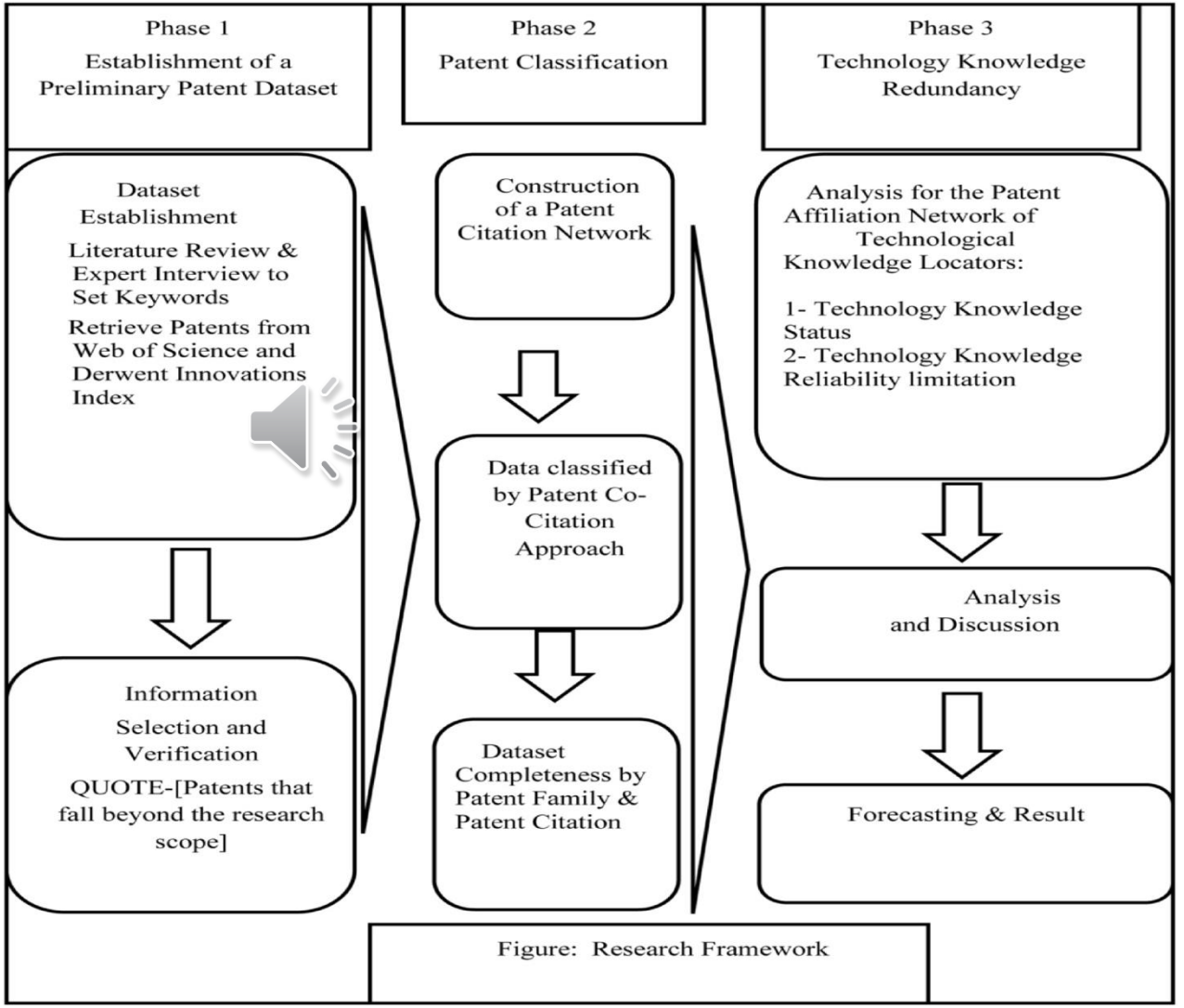
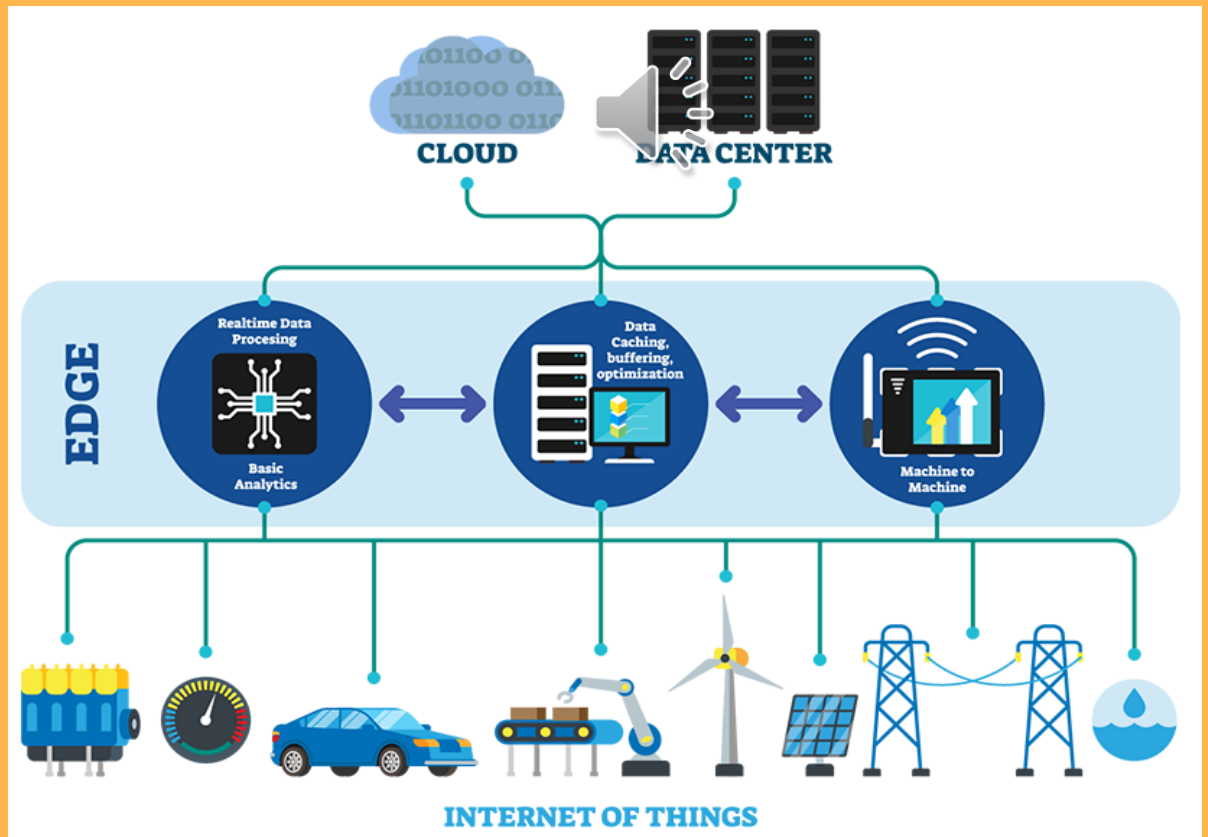


Figure: Research Framework

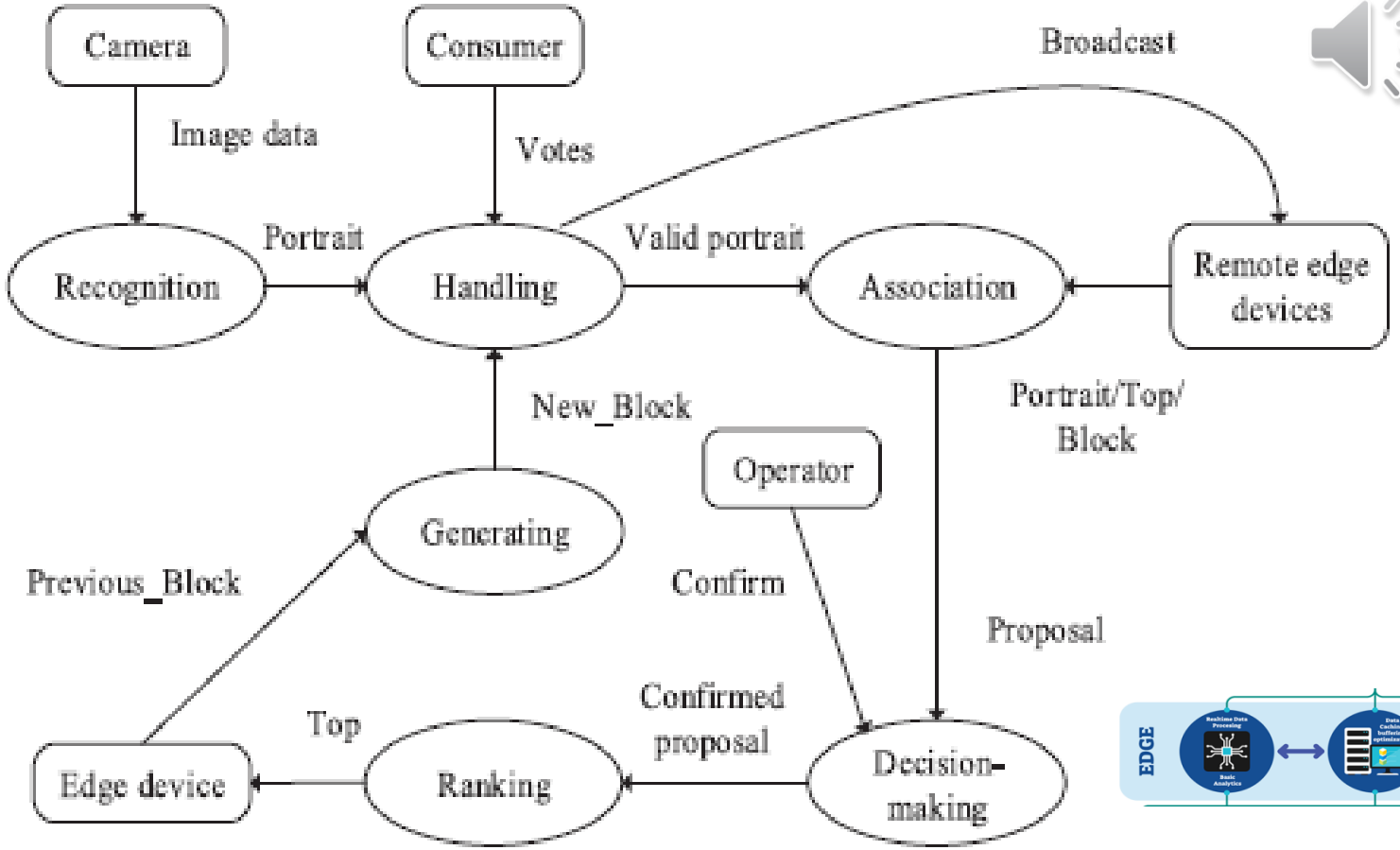
[13]

II.2 BLOCKCHAIN AND KM USING EDGE COMPUTING TECHNOLOGY



Preserving Edge Knowledge Sharing Among IoT Services: A Blockchain-Based Approach

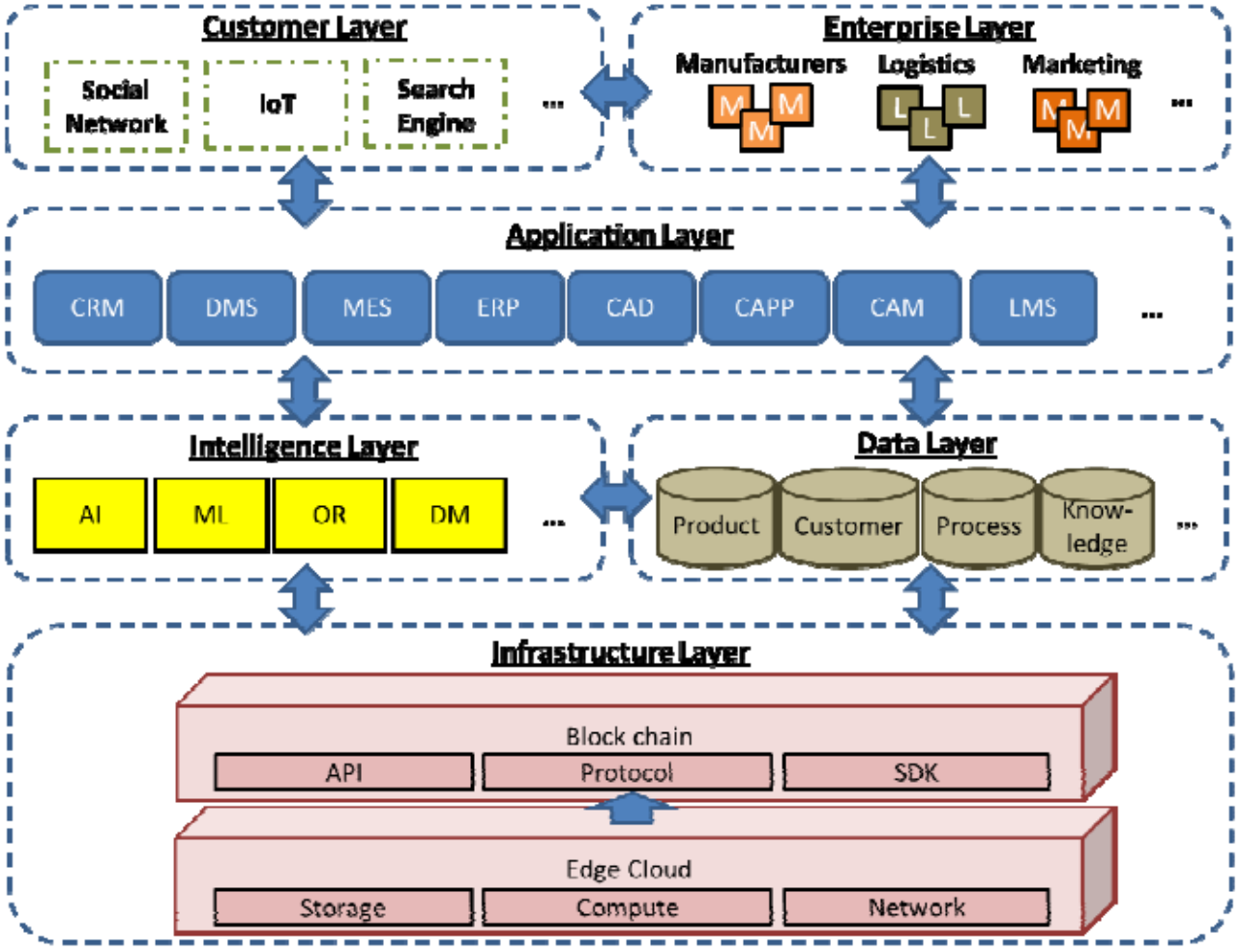
In this work, an user-centric blockchain (UCB) framework is proposed for preserving edge knowledge sharing in IoT. Significant superiorities of UCB benefit from the proof of popularity (PoP) consensus mechanism, which is more energy-efficient and fast. Security analysis and experiments based on Raspberry Pi 3 Model B demonstrate its feasibility with low block generating delay and complexity.



[14]

Towards Open Manufacturing: A Cross-Enterprises Knowledge and Services Exchange Framework based on Blockchain and Edge Computing

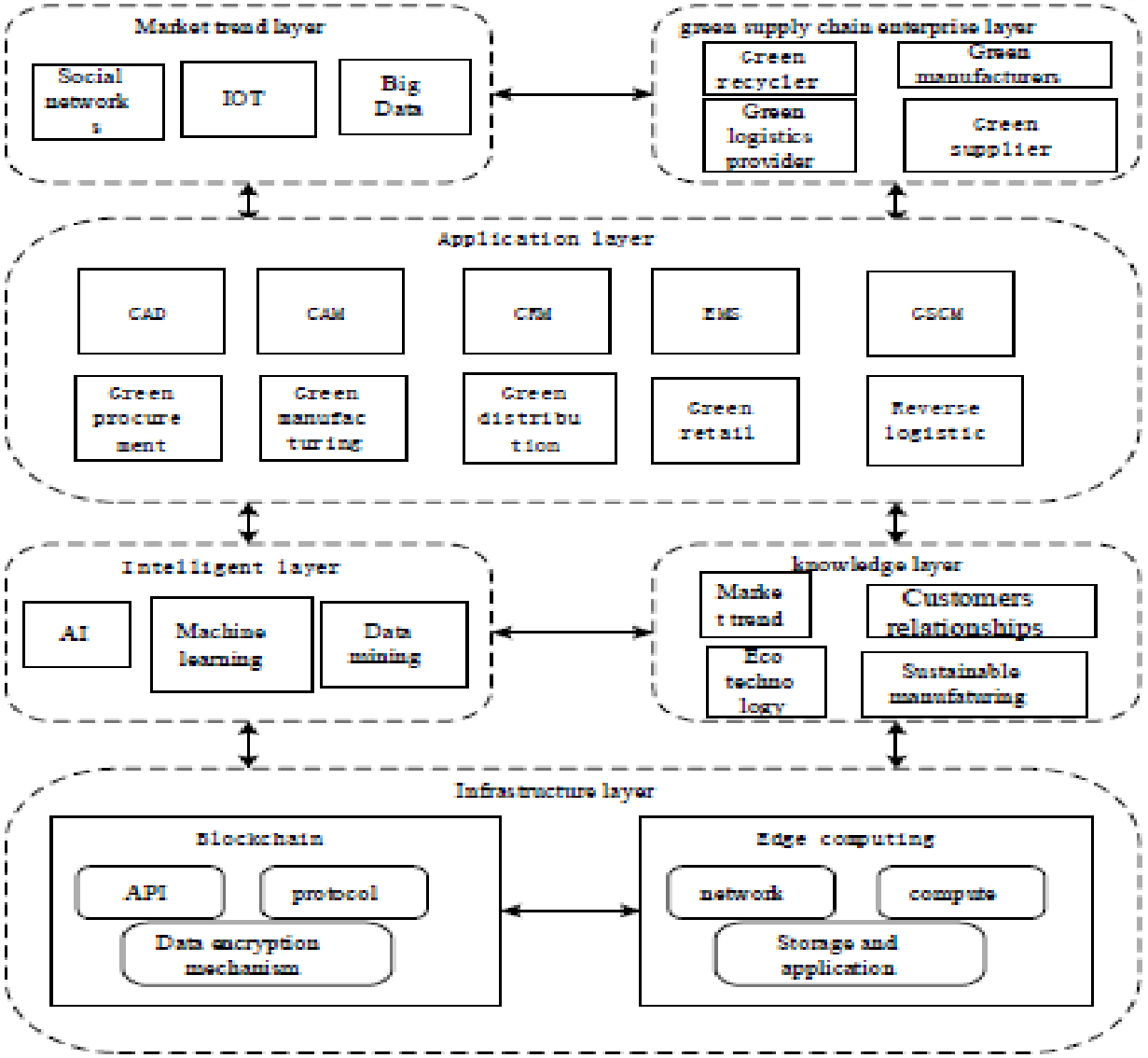
The proposed framework incorporates the recent development in edge computing technologies to achieve a flexible and distributed network. With the blockchain technology, it provides standards and protocols for implementing the framework and ensures the security issues. Not only information can be shared, the framework also supports the exchange of knowledge and services so that the parties can contribute their parts.



[15]

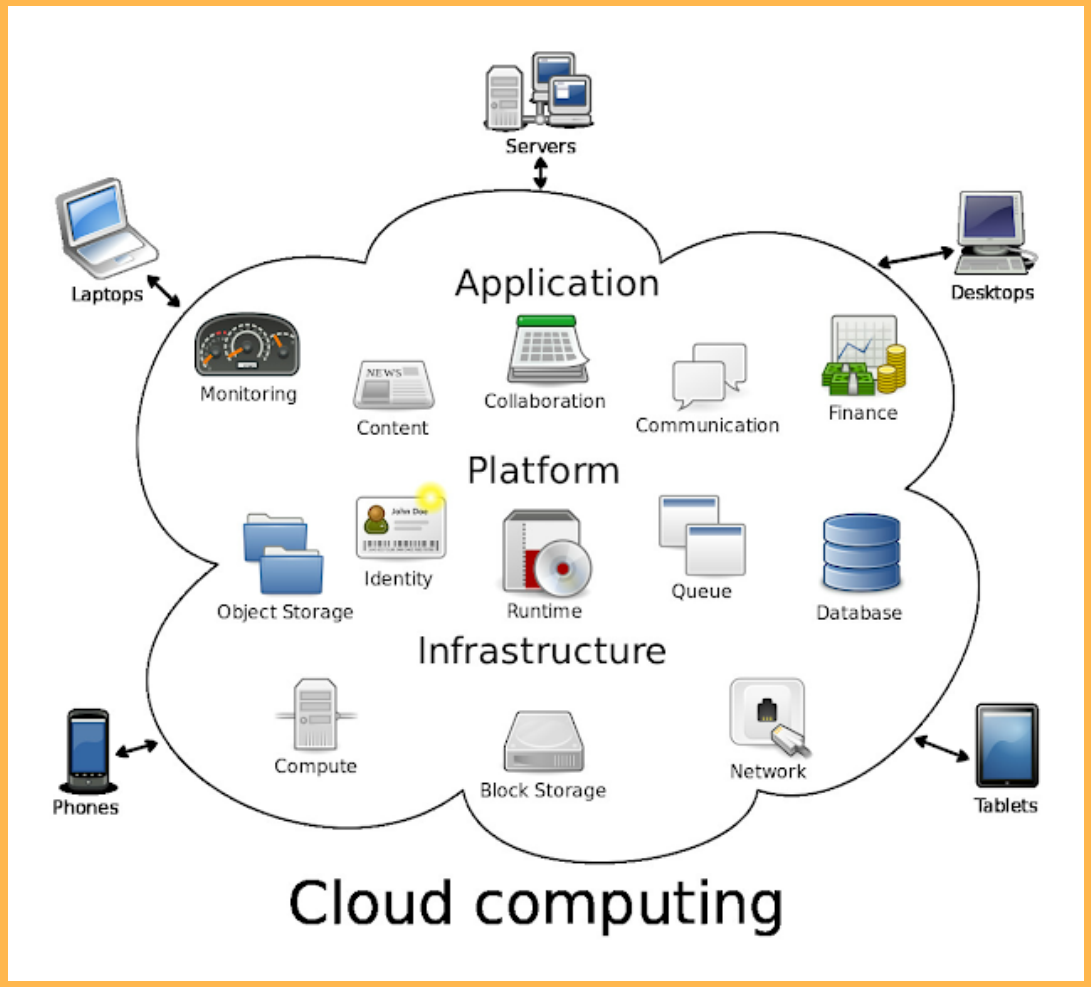
A Knowledge Sharing Framework for Green Supply Chain Management Based on Blockchain and Edge computing

Authors propose a decentralized knowledge sharing framework based on blockchain and edge computing technologies. The security and reliability of the knowledge sharing framework are guaranteed by the security encryption, non-tamperability of the blockchain. Edge computing that provides edge intelligence services is integrated into the framework to meet the needs of the blockchain for distributed networks.



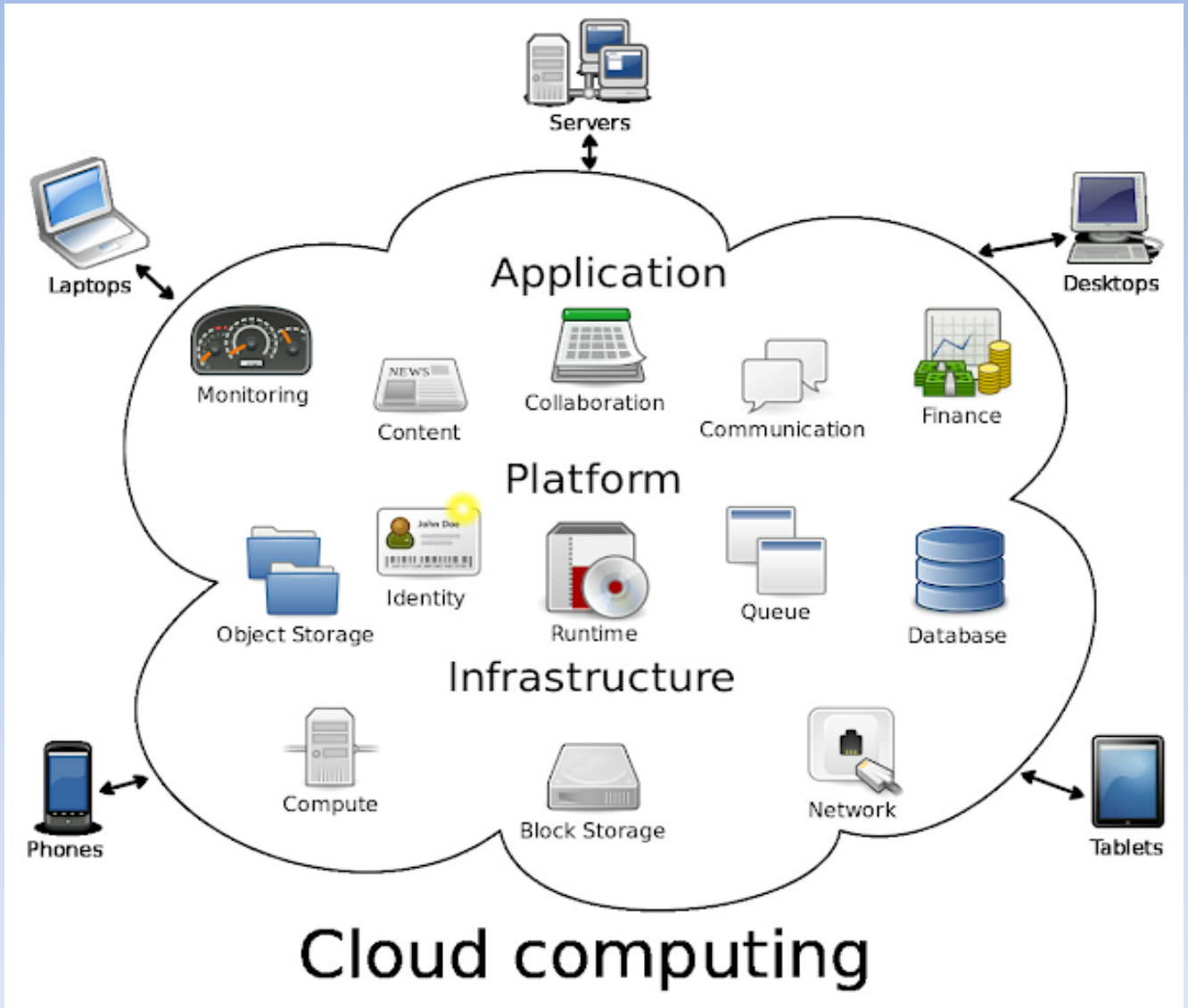
[16]

II.3 BLOCKCHAIN AND KM USING CLOUD COMPUTING TECHNOLOGY



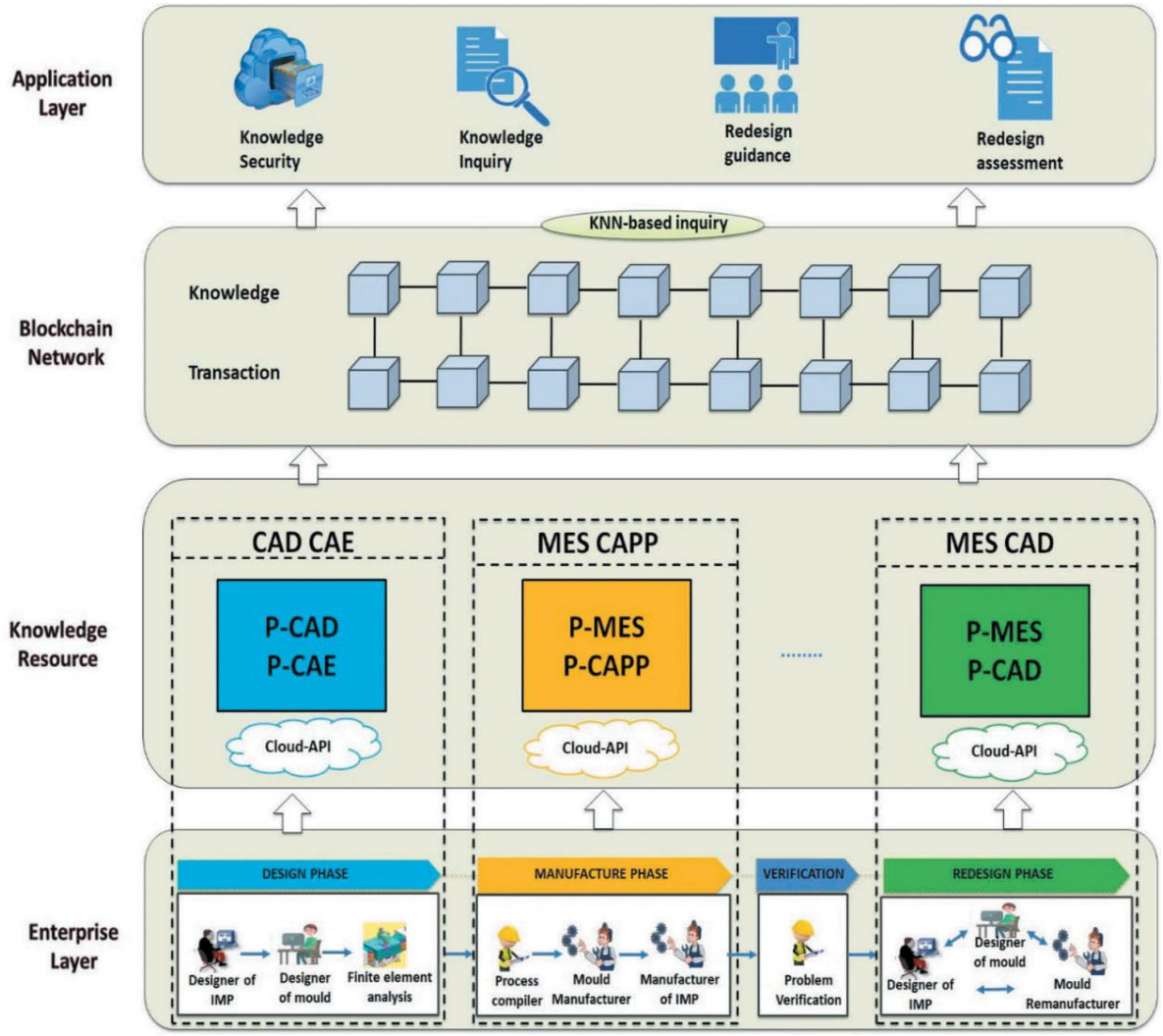
Definition of the Cloud Computing

It provides the infrastructure to collect data and deliver information to the Internet. Rather than a personal computer or a local server, it uses a multitude of remote servers to manage and process such large volumes of data. It provides the platform to share applications to run programs. The term Cloud in which the Internet refers to a platform for storing data and running applications.



CKshare: secured cloud-based knowledge-sharing blockchain for injection mold redesign

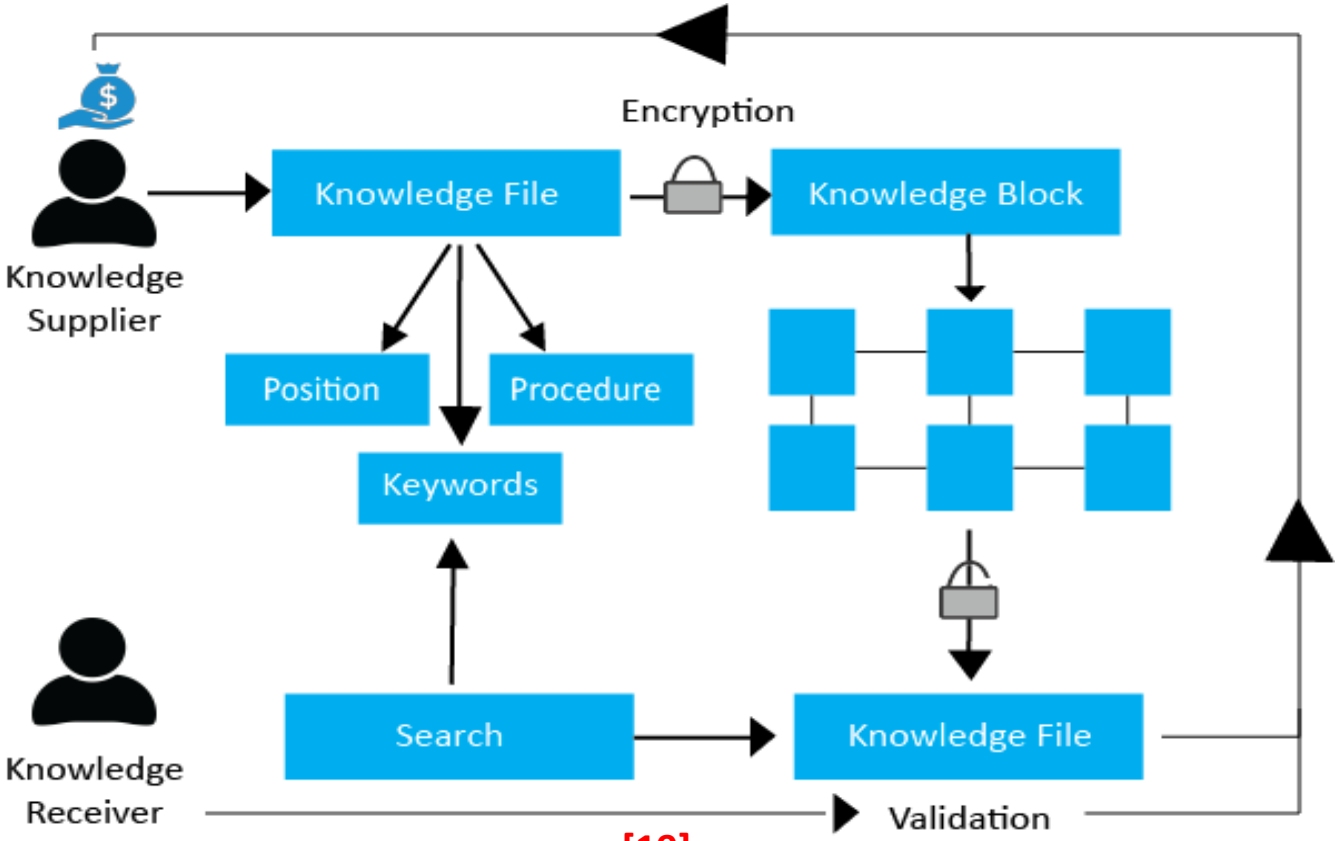
A trustable mold redesign knowledge-sharing platform, known as **CKshare, based on private cloud and blockchain** technology. The private cloud to store the mold redesign knowledge of each party to meet its own privacy and data format requirements. The blockchain network is used for recording the knowledge and its transactions to ensure security and trustfulness.



[17]

Knowledge Decentralization in the age of Blockchain. Developing a Knowledge-Transfer System using Digital Assets.

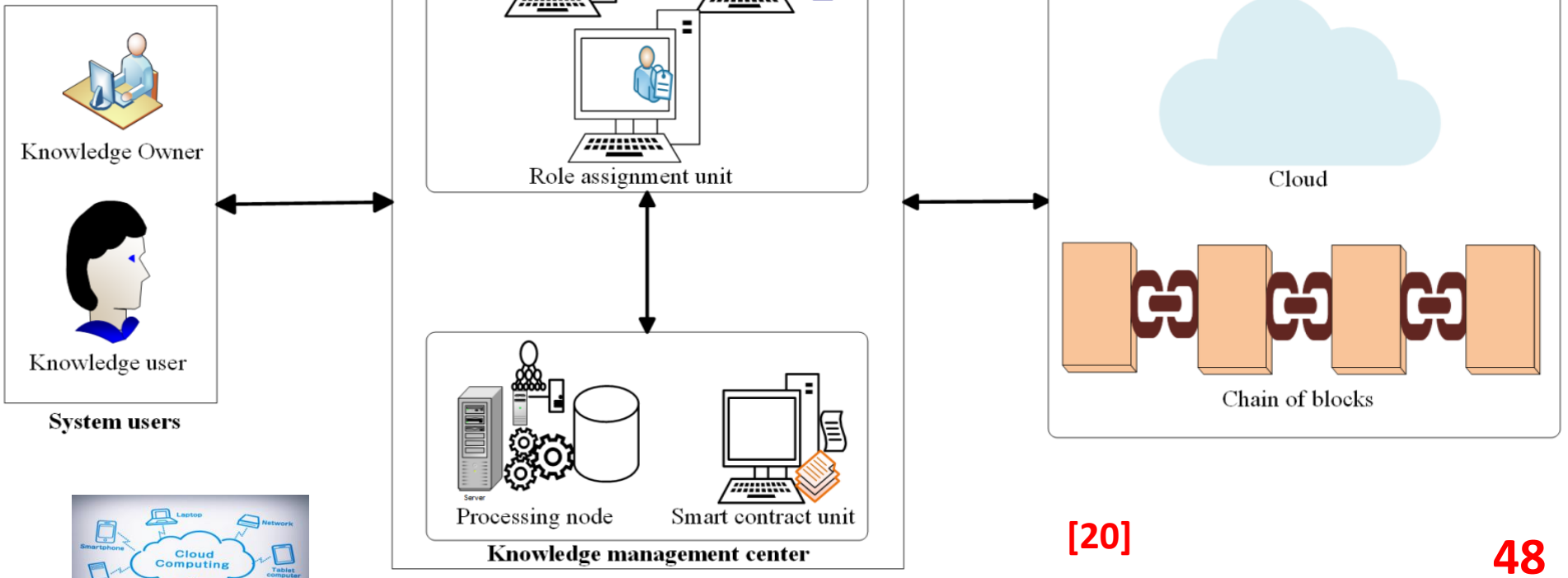
The aim of this work is to challenge the traditional ways to perceive organizational knowledge by creating a model that allows the application of private blockchains to knowledge evolution, ownership and transfer. Moreover, intellectual property rights need to be well established and properly upheld in all organizations in order to create an environment that is open to knowledge sharing. However, with the development of the blockchain technology, both the trust and intellectual property issue can be easily overcome especially **integrating the cloud services**.



[19]

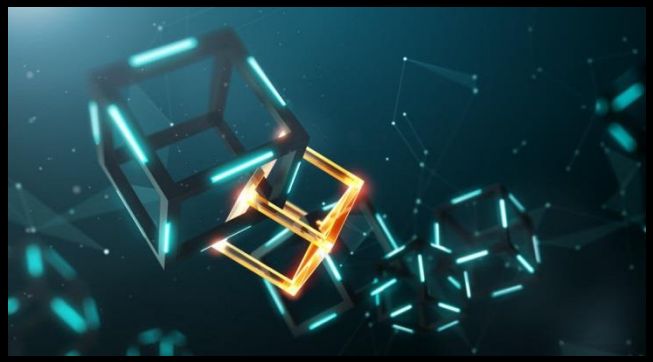
An ECDSA Approach to Access Control in Knowledge Management Systems Using Blockchain

In this work, a role-based access control RBAC model based on blockchain technology is presented, to enhance user authentication before knowledge is accessed and utilized in a knowledge management system (KMS). The blockchain-based system model and the smart contract ensure that transparency and knowledge resource immutability are achieved. As an essential part of RBAC model applied to KMS environment, trust is ensured in the network.



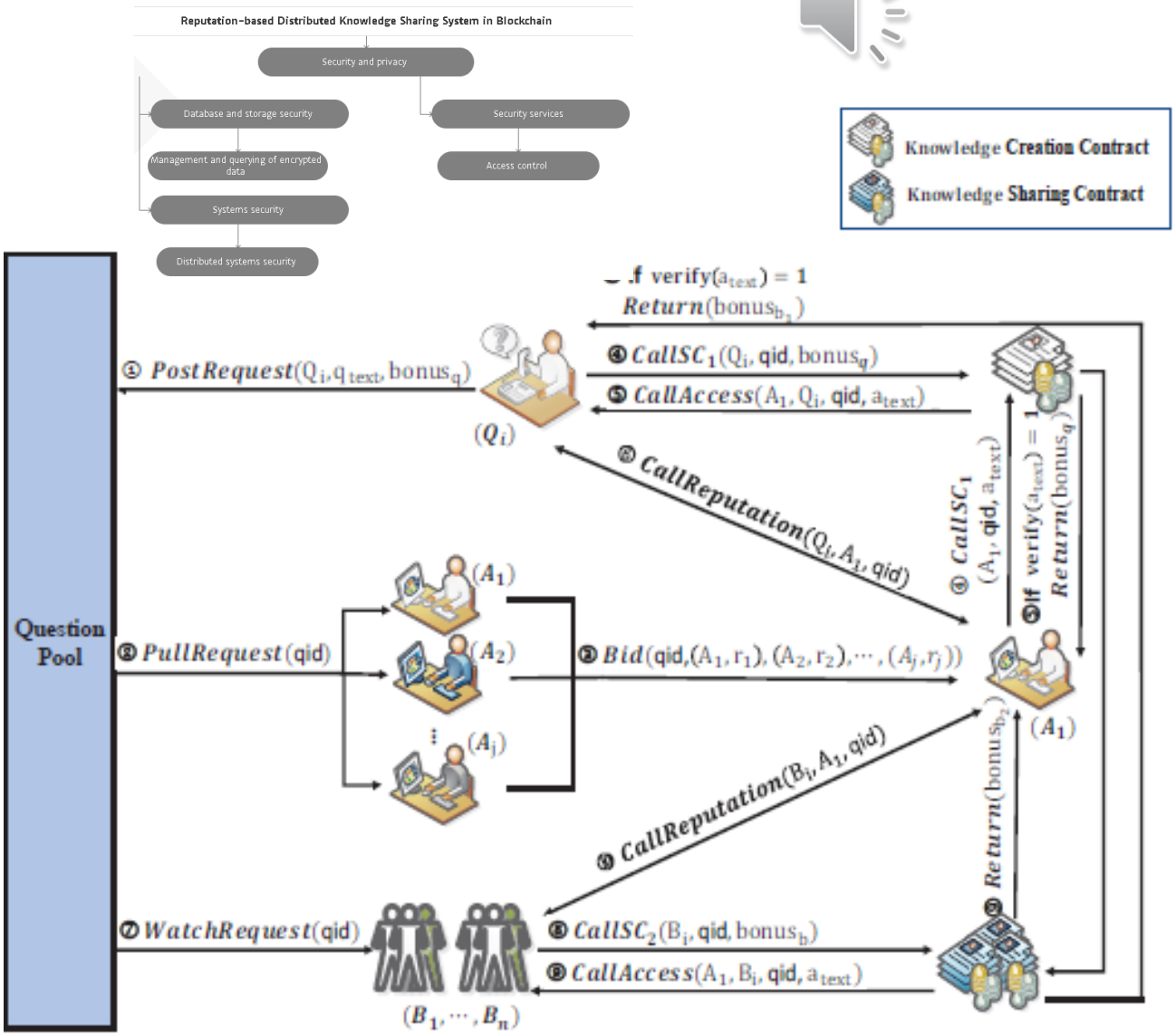
[20]

PART III: BLOCKCHAIN AND KNOWLEDGE MANAGEMENT FOR HUMAN VALUES



III. 1 Reputation-based Distributed Knowledge Sharing System in Blockchain

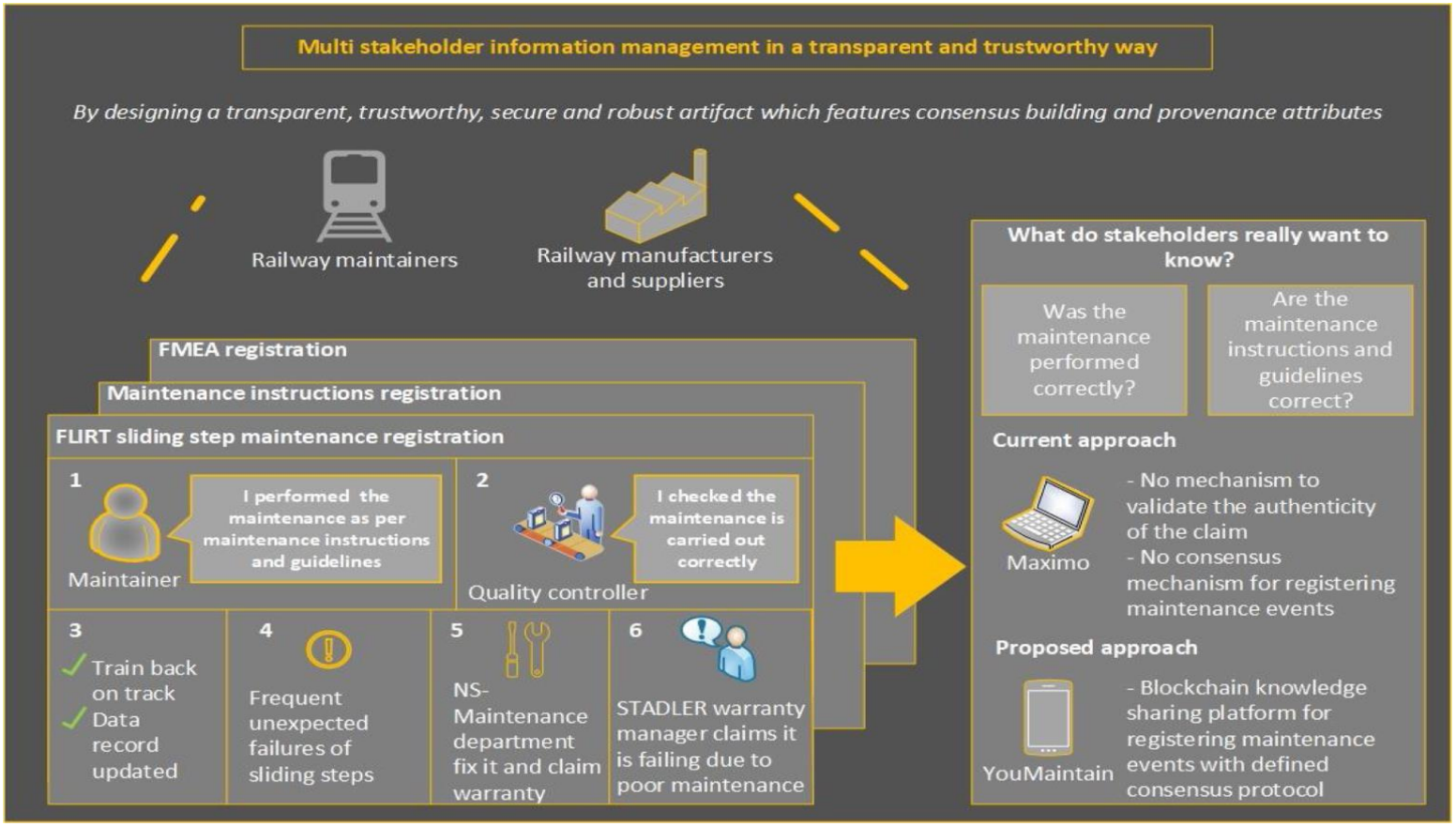
users' reputation represents users' credibility and the eligibility of providing valid answers.
Authors proposed Reputation Based Knowledge Sharing system in blockchain, called RBKS, to exploit the copyright protection of the knowledge owner to achieve the paid-for content service which allows bystanders who are interested in the shared knowledge to pay a small fee for the access.



[21]

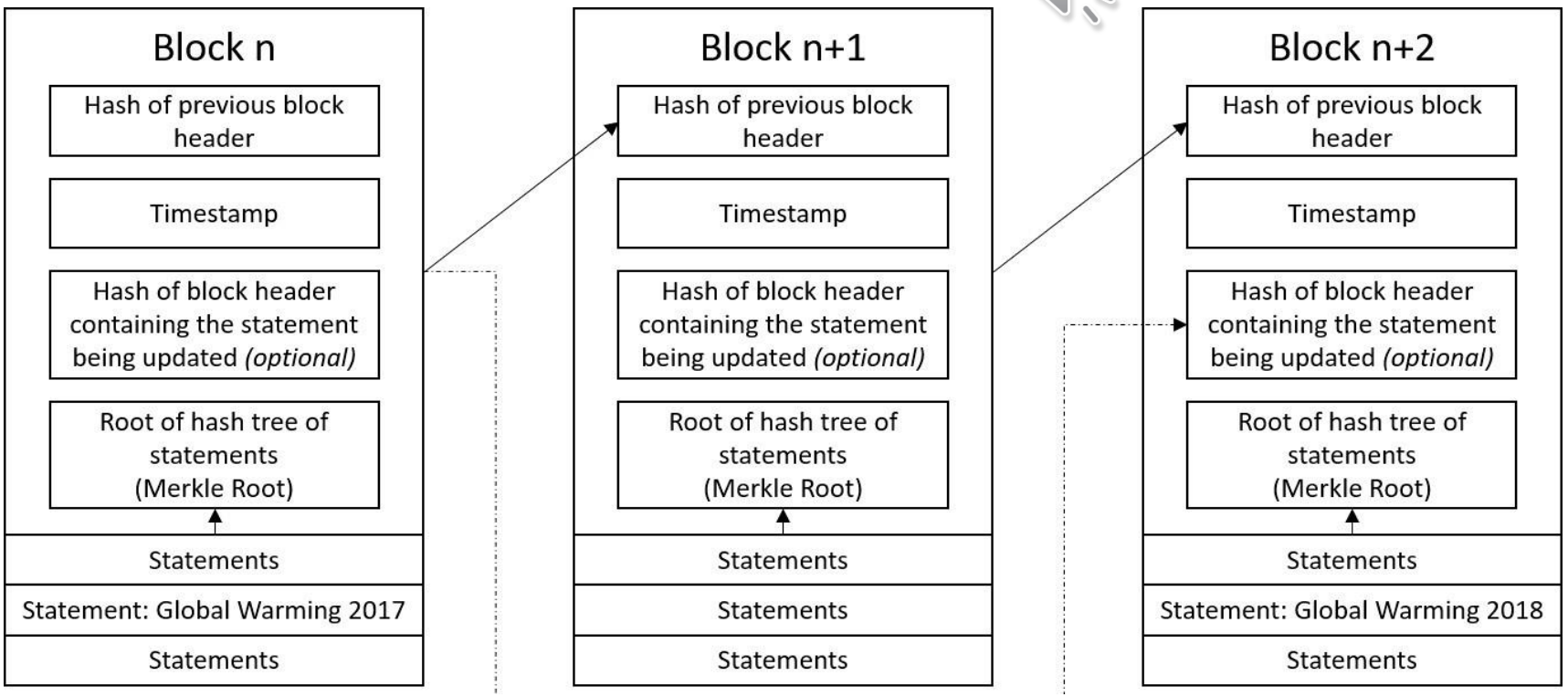
III. 2 Do you have confidence in how your rolling stock has been maintained? A blockchain-led knowledge-sharing platform for building trust between stakeholders

A business network archive is developed for the maintenance management of the sliding step of the train door system. The archive encompasses the business logic and transactional data required to enhance trust among stakeholders in the quality of performed maintenance. The developed archive is deployed on Hyperledger Fabric and effective. The results show that the developed business network, deployed on a customized Hyperledger Fabric consensus protocol, **enhanced trust among the stakeholders involved**.



[22]

The proposed model for managing knowledge provenance leverages the benefits of a blockchain to provide a solution which is decentralized, immutable and easy to update. By presenting knowledge statements in this form, it provides a data structure which overcomes many of the problems presented by the "post-fact" world without fundamentally changing the nature of academic discourse itself. This model is extendable to be used in accountability.



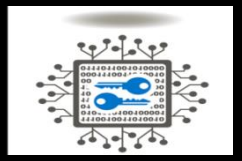
[23]

CONCLUSION AND TRENDS

Even its advantages (only for the high cost), the blockchain is still not used by goverments, not enough known and it needs laws to support it.

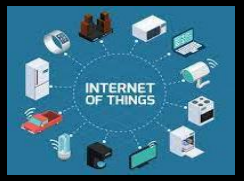
The trends of blockchain are

1- Further R&D direction for cryptography will more focus on the capability in fast big data processing.



2- Hardware blockchain technology will lead the spread of big data market by reinforcing fast speed and data security.

3- The future technologies related to the applications will be developed closely with encryption technologies which are essential part for artificial intelligence and IoT.



4- The exchange related technologies will focus on solving the problems in cryptocurrency transactions.

5- The further directions of the digital transaction technologies will focus on the big data processing.

[24]

DISCUSSION

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