INDIAN MARITIME UNIVERSITY
Mumbai Port Campus
(Marine Engineering & Research Institute, Former D.M.E.T.)

Students’ Edition of BRINICLE
in Collaboration with
IIRE JOURNAL
of
MARITIME RESEARCH & DEVELOPMENT
(IJMRD)

ISF Institute of Research and Education (IIRE)

MARCH 2019
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Maritime sector has always been influencing the global economy. Shipping facilitates the bulk transportation of raw material, oil and gas products, food and manufactured goods across international borders. Shipping is truly global in nature and it can easily be said that without shipping, the intercontinental trade of commodities would come to a standstill.

Recognizing the importance of research in various aspects of maritime and logistic sector, IIRE through its Journal of Maritime Research and Development (IJMRD) encourages research work and provides a platform for publication of articles, manuscripts, technical notes, papers, etc. on a wide range of relevant topics listed below:

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Indian Maritime University – Mumbai Port Campus comprises of two premier institutes, Lal Bahadur Shastri College of Advanced Maritime Studies and Research (LBS CAMSAR) & Marine Engineering and Research Institute (Former D.M.E.T.). LBS CAMSAR is the post sea training institute whereas MERI Mumbai is the pre – sea training institute.

LBS CAMSAR was founded in October, 1948 under the recommendations of the Merchant Navy Training Committee as Central Government premier post sea training institute for Merchant Navy Officers of Navigation & Engineering. And since then, it is offering the comprehensive range of courses for Merchant Navy Officers.

Marine Engineering and Research Institute (M.E.R.I.), formerly known as Directorate of Marine Engineering Training (D.M.E.T.), was established in the year 1949 by the Govt. of India, when the need was felt to train Marine Engineers separately. And since then, it is imparting the education and training to the cadets with a goal of producing the best marine engineers and nautical officers for the world with adopting the latest technology to meet the latest and demanding requirements of the shipping fraternity.
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MESSAGE FROM THE CONVENER

It is very heartening to note that Indian Maritime University – Mumbai Port Campus (Marine Engineering & Research Institute) is organizing a two days Technical Fest Brinicle in association with Maritime Training Trust, D.G Shipping on 28th & 29th March, 2019. This fest is an initiative taken by Maritime Training Trust with an objective of enhancing the maritime knowledge of the participants and to provide all the stakeholders of Maritime Industry an opportunity to gain a great deal of insight into the “emerging technologies”.

I am thankful to IIRE Journal of Maritime Research and Development for collaborating with us. It is pleasing to note that the twelve accepted papers dwell on maritime subjects ranging from Artificial Intelligence, IoT, Inland waterways in India, Sustainable Development, which will dominate the industry in the coming years.

As the success of the event depends ultimately on the people who have worked in planning and organizing it, so I would like to thank the members in all the committees for their great efforts on this success.

Hare Ram Hare
Convener, Brinicle
Editorial

IIRE efforts to ingrain culture of research continues unabated.

A specific seminar is planned in March 2019 at Mumbai bringing researchers, industry and academia together to discuss and highlight the importance of research in the maritime sector.

Yet another opportunity arose when the Indian Maritime University – Mumbai Port Campus invited IIRE to collaborate in the presentation and publication of research based papers of their young cadets pursuing graduate maritime courses. Twelve papers were selected after a process of review which are now being published in a Special edition of the IIRE Journal of Maritime Research and Development. It was heartening to see papers dwelling on some contemporary themes like, Technology inroads into shipping, Sustainable Shipping, Coastal & Inland Waterways that is finding lot of thrust in India. Block-chain technology, Artificial intelligence, Energy efficiency are the areas covered in some of these selected papers. Papers chosen for publication in the Journal was the reward propagated and this brought in much encouragement and healthy competition. The moot idea was once again to engrain the discipline of research in the impressionable minds of the young cadets finding their sea-legs in a dynamic and highly operationalized and challenging shipping environment.

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POTENTIAL OF BLOCK CHAIN TECHNOLOGY IN THE SHIPPING INDUSTRY

Pranav Sudhir Chakkarwar

Abstract
This paper presents the potential of blockchain technology in the shipping industry. Initially the general idea is to get a better understanding of this technology and its working, finally we try to recognise its potential if implemented in the shipping industry; including its results/impacts on this widespread industry. As the etymology of the name suggests that a blockchain just means many blocks of something (in our case information) connected to one other through connections/chains. Blockchain is one of the best technologies which is used to seamlessly and securely accomplish cryptocurrency transactions. Blockchain technology was first used while designing bitcoin which is a secure and widely accepted cryptocurrency. Our major concern here is about the implementation of blockchain technology in the shipping industry. This technology can be used to carry out financial transactions and track shipments in real time. However, this technology does not limit itself to financial and documentation purposes but it can also be used by an autonomous group of vessels which will privately and securely exchange information for a seamless sailing experience. A blockchain network is also secure against a cyber-attack.

Keywords: Blockchain, Network, Secure, Cryptocurrency, Internet, Exchange Of Data, Autonomous Vessels, Cyber-Attack.

1. INTRODUCTION TO BLOCKCHAIN TECHNOLOGY:

Blockchain has a simple structure yet this technology is considered as a very complex technology because of the techniques/algorithms that keep it going. Structure of a blockchain can be imagined as a number of blocks (of information) connected one other with chains (secure links). Blockchain technology is secure because each block stores an
entity called hash which differentiates it from every other block. Anyone on the network can view the blocks and access all of its information at any time but cannot alter it[1]. Every computer which connects to a blockchain network receives a copy of all the blocks which is continuously updated this makes it very secure. This network is called a hub less network there is no ultimate server or a controller which can manipulate the original data. Therefore, a hacker would have to manipulate every copy of the on this network which is impossible because there can be thousands or even millions of copies of the chain [2].

![Figure 2 Computer network where blocks are exchanged](image)

1.1. Public Blockchain:
Blockchain networks can be generally categorized as public and private blockchains. The public blockchains can be anonymously accessed by anyone and security is maintained using the mechanism of ‘proof of work’. Most public blockchain networks are used financial transactions. The ‘Proof of work’ means computational work and this work is done by miners. Miners are the most important part of a public blockchain network as all of the computational work is done by them [3].

![Figure 3 A public blockchain network](image)
1.2. **Private Blockchain:**

A private blockchain on the other hand can only be accessed with a permission. Private blockchain is the one we are concerned about because in the shipping industry the data should be shared between the vessels and not with everyone. Private blockchain uses a pair of a public and a private key combination, which are used to digitally sign each block which is quite secure \[^4\].

![Diagram](image.png)

Figure 4 A private blockchain network

2. **IMPLEMENTATION OF BLOCKCHAIN TECHNOLOGY IN THE SHIPPING INDUSTRY:**

The blockchain has already entered the shipping industry but with an angle of financial efficiency and transparency. IBM and Danish transport with logistics giant Maersk launched a platform based on the blockchain technology which effectively tracks data about shipments in real time. This technology has also helped so as to determine the location of a container in real time without intermediate people \[^5\]. As of today, a lot of documentation is required for transactions in shipping, such as sales contract, charter party agreements, bills of lading, port documents, etc. all these are passed through many parties until they reach the desired person. Blockchain can handle these transactions with ease as they will be easily available and they cannot be changed because of their timestamps and the hashes. To change a transaction, the whole chain has to be altered and the majority of participants should accept the change which is almost impossible \[^6\].
Table 1

<table>
<thead>
<tr>
<th>Job</th>
<th>Blockchain technology</th>
<th>Current technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tracking of shipments in real time</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>No intermediate person required</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Loads of documentation</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Reliability</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

2.1. Smart Contracts:

Smart contracts are digital contracts which are automatically executed thus saving human efforts. For example, if an owner of a restaurant orders raw materials from food vendor he will specify his order in a purchase order. The vendor when receives the order he prepares it accordingly and a bill of lading is made specifying all the details of the order and the food is shipped by the vendor. Once the order is arrived, it is checked by the owner’s representative and the bill of lading is sent to the owner so that he completes the payment. This traditional method requires a lot of physical work [7].

Whereas if we use blockchain technology the advantages are-

1. Secure - No central storage which could be attacked by hackers. Global Trade's most important document is encrypted and securely written on the blockchain network, accessible only with traders' private keys.

2. Fast - Smart Bill of Lading is issued instantly and is immediately available to the Exporter. When agreed conditions are met, Smart Bill of Lading is transferred to the legal owner of goods instantly, without couriers in the middle. Just like sending an e-mail.
3. **Paperless** - A blockchain-based Smart Bill of Lading will be equivalent to a paper one. Having it on the blockchain just takes the pain away. No need to print, send, store and archive it.

![Figure 5 Old way to transfer a bill of lading](image)

![Figure 6 New way to trade](image)

4. **Cost savings** - Each paper Bill of Lading is sent at least three times with couriers making it extremely expensive and slow. The average cost for sending a Bill of Lading three times is around $100 and it takes up to 10 days to reach the final destination. Millions of Bill of Ladings are created every year [8].
2.2. Autonomous Vessels:

Figure 7 Artists impression of an autonomous vessel

Autonomous vessels are being constantly tested for being reliable. Blockchain technology can be used to improve the status of autonomous vessels which are currently being currently tested \[9\]. A blockchain network can be used to establish a secure connection between all the ships and they can share navigational, survey data or can warn other ships against danger. The network should be open and accessible on the internet, keeping the network open doesn’t expose the network to a cyber-attack. Because, to change some information on the network the attacker would have to edit every copy of that block that is present on the network and then find the correct hashes so that it matches with the previous blocks which is impossible. If an unwanted situation arises, we can take control of each of the vessels instantly since we can always access the network and we are a part of it \[10\].

3. CONCLUSION:

Concluding the paper, its quite obvious that the use of blockchain technology will bring tremendous changes in the techniques and method of trading of the shipping industry. Transactions will be seamless and trading will be faster than ever, it will be easier for the owner to trust he buyer and the buyer will get real time information of the position
of his container (if containerized) and its location in real time, which is not possible with traditional techniques. Finally, it can be used to securely drive autonomous vessels which are interconnected and will result in a lot of profit and safety of the vessel.

REFERENCES:


https://cargox.io/welcome/
https://www.coindesk.com/information/what-is-the-difference-between-open-and-permissioned-blockchains
https://www.globalpsa.com/autonomous-ships/


Nolan Bauerle (Mar 10, 2018) Retrieved from, Coindesk, What is the Difference Between Public and Permissioned Blockchains?:

Unidentified authors (Apr 25, 2018) Retrieved from, OPENSEA.PRO, How can the shipping industry take advantage of the blockchain technology: https://opensea.pro/blog/blockchain-for-shipping-industry

Unidentified authors (Feb 21, 2019) Retrieved from Investopedia, Blockchain, Explained: https://www.investopedia.com/terms/b/blockchain.asp


Unidentified authors (Nov 30, 2017) Retrieved from, PSA, Autonomous Ships:

Unidentified authors Retrieved from, CargoX, Reshaping the Shipping Industry:
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