BLOCKCHAIN ENABLED DEFENCE DIPLOMACY

ANUPAM TIWARI

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Diplomacy and the blockchain can be fused to achieve objectives in defence. The blockchain's tamper-proof and decentralised nature is being explored to secure communication, supply chain management, and border control while reducing fraud, manipulation, and cyber-attacks. Blockchain-enabled voting promotes transparent decision-making during peace-keeping missions. It can provide a secure platform to track goods and personnel, maintaining operational readiness and mitigating risks. This paper highlights how a blockchain speeds up derivatives in defence diplomacy, which traditional methods could not determine. Combining diplomacy with the blockchain yields a potent approach to meet defence objectives while ensuring transparency, accountability, and security but not without the inevitable challenges.

Blockchain Technology

A blockchain[1] is a digital ledger of transactions that is broadcast across a network of computers. Each transaction event is indexed in a block, and each block is linked to the previous block in the chain,

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1. Pinyaphat Tasatanattakool and Chian Techapanupreeda, "Blockchain: Challenges and Applications," 2018 International Conference on Information Networking, April 23, 2018, https://doi.org/10.1109/icoin.2018.8343163. Accessed on July 21, 2023.

making an immutable record of all transactions. The chain of blocks is maintained by a network of computers, and each block contains a unique code called a hash, which is generated using complex mathematical algorithms. The security of the blockchain is averred through the use of cryptographic hashes. Once a block is added to the blockchain, its hash cannot be altered without also altering the hash of every ensuant block in the chain. This makes it virtually impossible to tamper with the data stored in the blockchain, as any changes would be instantly detectable.

The concept of blockchain technology was first innovated in 2008 by an unknown person or group of people using the *nom de guerre* Satoshi Nakamoto. Nakamoto's goal was to create a decentralised system for digital currency[2] transactions that would be secure, transparent, and immune to fraud.

Today, blockchain technology has many potential applications beyond cryptocurrency, including supply chain management, healthcare, real estate, and more. It is being used to create more effective and dependable systems for storing and channelising data, as well as enabling new forms of digital identity and ownership. The blockchain's potential uses are still being explored and developed, and, in this paper, I dwell upon this technology to associate with defence diplomacy.

Defence Diplomacy

Defence diplomacy is a form of diplomacy[3] that focusses on military and security cooperation amongst countries. It calls for the use of military and security resources to build up and fortify relationships between countries, encourage peace and stability, and administer common security challenges. Some of the key activities involved in defence diplomacy include:

2. P. Shamili and B. Muruganantham, "Blockchain Based Application: Decentralized Financial Technologies for Exchanging Crypto Currency," 2022 International Conference on Advances in Computing, Communication and Applied Informatics, April 28, 2022, https://doi.org/10.1109/accai53970.2022.9752485. Accessed on July 11, 2023.
3. Constance Duncombe, "Digital Diplomacy: Emotion and Identity in the Public Realm," *The Hague Journal of Diplomacy*, vol. 14, no. 1–2, April 22, 2019, pp. 102–16, https://doi.org/10.1163/1871191x-14101016. Accessed on July 12, 2023.

- **Military-to-Military Engagements**: Involve exchanges of personnel, information and ideas between military organisations that helps build trust and understanding and boosts peace and stability.
- **Joint Military Exercises**: Refer to the participation of military personnel from multiple countries to increase interoperability and trust between military organisations.
- **Defence Industry Cooperation**: Demands the sharing of technologies and expertise between defence industries in different countries to improve the capabilities of all the parties involved and promote regional stability.
- **Capacity Building**: Implies offering training and assistance to military and security entities in foreign nations with the aim of enhancing their abilities and effectiveness while also promoting stability by empowering them to independently address security challenges and enhance their resilience.
- **Security Sector Reform**: Supporting the reform of security sector institutions in other countries, including the military, police and other security organisations to improve their governance, accountability and effectiveness, and promote stability and security.
- **Military Aid and Assistance:** Provision of military equipment, supplies and funding to other countries to affirm their respective military and security capabilities and boost regional stability.
- **Military Diplomacy**: Refers to the use of military personnel and assets to elevate diplomatic goals. For example, military personnel may be used to pitch in with humanitarian aid, take part in peace-keeping missions or pursue other activities aimed at promoting peace and stability.
- **Defence Attachés**: Military officers who are stationed in foreign countries to alleviate military-to-military contacts and cooperation and provide a point of contact for military organisations from different countries.
- **Military-to-Civilian Engagement**: Defence diplomacy can also imply military organisations engaging with civilian populations in other countries. This can include providing humanitarian

aid, participating in disaster relief efforts, or working with local communities to address security challenges.

- **Cyber Security Cooperation**: With the increasing importance of cyber security in modern warfare, defence diplomacy can involve cooperation and information sharing on cyber security issues between military organisations from different countries. This can assist to build trust and enhance cyber security capabilities, which are vital in addressing emerging security challenges.

Overall, defence diplomacy activities are planned to build trust and understanding, promote stability and security, and address common security challenges among countries interacting vide a military window.

BLOCKCHAIN FOR DEFENCE DIPLOMACY

By leveraging blockchain technology, defence diplomacy actions can be made more efficacious, secure and transparent. Some ways in which the blockchain can be used to support defence diplomacy are enumerated and discussed below.

Enhanced Security

Blockchain technology allows for a high level of security[4] and can assist to prevent fraud, fiddling and unauthorised access which can be especially useful for activities such as military aid and assistance. Blockchain technology provides enhanced security for defence diplomacy activities in several ways:

- **Immutable Record-Keeping**: All transactions on a blockchain are indexed in a tamper-proof and immutable ledger[5] which provides a high level of security for classified defence diplomacy data.

4. Saurabh Singh, A. S. Hosen, and Byungun Yoon, "Blockchain Security Attacks, Challenges, and Solutions for the Future Distributed IOT Network," *IEEE Access*, January 14, 2021, pp. 13938–59, https://doi.org/10.1109/access.2021.3051602. Accessed on July 22, 2023.
5. Jainshaid Iqbal Janjua, Mehwish Nadeem, and Zubair Ahmad Khan, "Distributed Ledger Technology Based Immutable Authentication Credential System," 2021 4th International Conference of Computer and Informatics Engineering, September 14, 2021, https://doi.org/10.1109/ic2ie53219.2021.9649258. Accessed on July 18, 2023.

- **Decentralised Architecture**: Blockchain networks are decentralised, meaning that there is no central authority commanding the data which abbreviates the risk of a single point of failure and makes it more arduous for bad actors to tamper with the data.
- **Trust**: Blockchain technology can help to build trust among different parties and stakeholders by providing a secure and transparent platform for collaboration that can help to abbreviate the risk of misunderstandings, conflicts, or disputes.
- **Cryptographic Security**: Cryptographic algorithms are cardinal to the blockchain and, thus, secure transactions and data on the network.
- **Permissioned Access**: Private blockchain networks can be set up to restrict access to certain users, assuring that only authorised parties can view or edit data. This can be particularly useful for defence diplomacy activities, where sensitive data must be kept secure, confidential and access controlled.
- **Smart Contracts**: Blockchain-based smart contracts[6] can be used to automate certain security-related processes, such as confirmation of identities or the deliverance of military aid and assistance.

Improved Transparency

Blockchain technology enables transparent and tamper-proof record-keeping,[7] which can be useful for activities such as joint military exercises or capacity building. This can help to build trust between participating organisations and ensure that everyone is held responsible for their actions. This means that participating organisations can view the same data in real-time, promoting transparency and accountability. Given below is an example of how blockchain technology can improve transparency in defence diplomacy:

6. Bhabendu Kumar Mohanta, Soumyashree S Panda, and Debasish Jena, "An Overview of Smart Contract and Use Cases in Blockchain Technology," 2018 9th International Conference on Computing, Communication and Networking Technologies, October 18, 2018, https://doi.org/10.1109/icccnt.2018.8494045. Accessed on July 1, 2023.
7. Jiachen Yang, et al., "Blockchain-Based Sharing and Tamper-Proof Framework of Big Data Networking," *IEEE Network*, vol. 34, no. 4, July 22, 2020, pp. 62–67, https://doi.org/10.1109/mnet.011.1900374. Accessed on June 15, 2023.

- Suppose two countries A and B are conducting a joint military exercise, and they need to keep a record of all the resources used during the exercise such as ammunition, fuel, and food supplies. By using a blockchain-based platform, both countries A and B can index all the resource records used in real-time[8] on the blockchain that can be accessed by the countries, ensuring that everyone is aware of the resources used and their associated costs.
    - In this example, blockchain improves transparency by furnishing a tamper-proof shared record of all resources used during the joint military exercise. This helps to build trust between the participating organisations, as each party can be assured that the other is bestowing its fair share of resources. Moreover, any divergence can be easily identified as the data is accessible to both parties.

Streamlined Procurement Processes

By using blockchain-based platforms, defence organisations can streamline their processes and reduce paperwork and bureaucracy that can free up resources and allow more time to be devoted to more important activities. Here are a few examples of how blockchain technology can streamline the defence diplomacy processes:

- **Transparent Supply Chain:** By using blockchain technology to create a shared and transparent ledger of all supply chain transactions,[9] participating organisations can streamline the procurement operations and abridge the risk of fraud, errors, and delays.
- **Aid and Assistance Delivery**: Blockchain-based platforms can be used to shape the delivery of military aid and assistance to foreign countries during peace-keeping missions.
- **Cross-Border Payments**: In international defence diplomacy, cross-border payments can be slow, expensive, and prone to errors. By using blockchain-based payment systems, like CBDC

8. Ajayvikram Chauhan, et al., "A Blockchain-Based Tracking System," 2020 IEEE International Conference on Service Oriented Systems Engineering, September 1, 2020, https://doi.org/10.1109/sose49046.2020.00020. Accessed on June 16, 2023.
9. Shivani Bhalerao, et al., "Supply Chain Management Using Blockchain," 2019 International Conference on Intelligent Sustainable Systems, November 21, 2019, https://doi.org/10.1109/iss1.2019.8908031. Accessed on July 21, 2023.

(Central Bank Digital Currency) participating organisations can facilitate cross-border payments[10], reduce the time and cost of transactions, and step-up the speed and security of payments.

- **Inter-Organisational Communication**: Blockchain-based platforms can be used to facilitate real-time communication[11] and collaboration between participating nations in defence diplomacy.

Improved Logistics

Logistics is a critical component of defence diplomacy as it demands the management and transportation of resources, including equipment, supplies, and personnel, across different geographic locations. Given below are some examples of how the blockchain can improve logistics in defence diplomacy:

- **Asset Tracking**: By using blockchain-enabled sensors, participating organisations can track the location and condition of assets in real-time, ensuring that they are decently maintained and accounted for.
- **Supply Chain Management**: Managing the supply chain is decisive to ascertaining that resources are delivered to the right place at the right time in defence diplomacy events. A blockchain can help to reduce the risk of fraud, errors, and delays, and assure that resources are delivered expeditiously and efficaciously.
- **Personnel Management**: In defence diplomacy, dealing with the movement of personnel[12] across different locations can be complex and time-consuming. By using blockchain technology participating organisations can process personnel management events such as transactions, reduce errors and delays, and

10. Md. Mainul Islam, et al., "A Low-Cost Cross-Border Payment System Based on Auditable Cryptocurrency with Consortium Blockchain: Joint Digital Currency," IEEE Transactions on Services Computing, September 16, 2022, pp. 1-14, https://doi.org/10.1109/tsc.2022.3207224. Accessed on July 19, 2023.
11. Zhonghua Zhang, et al., "Integration of Communication and Computing in Blockchain-Enabled Multi-Access Edge Computing Systems," *China Communications,* vol. 18, no. 12, December 29, 2021, pp. 297-314, https://doi.org/10.23919/jcc.2021.12.019. Accessed on July 5, 2023.
12. Xin Wang, et al., "Human Resource Information Management Model Based on Blockchain Technology," 2017 IEEE Symposium on Service-Oriented System Engineering, June 8, 2017, https://doi.org/10.1109/sose.2017.34. Accessed on July 2, 2023.

ascertain that personnel are deployed to the right location at the right time.

Increased Efficiency

In defence diplomacy, there are often complex operations and workflows that necessitate multiple parties and stakeholders. Given below are some examples of how a blockchain can increase efficiency in defence diplomacy:

- **Automated Processes**: By using blockchain-enabled smart contracts, participating organisations can automate processes and workflows such as inventory management and delivery scheduling.
- **Cost Savings**: By automating certain tasks and processes, blockchain technology can help to reduce costs and increase efficiency which can free resources for other strategic and value-added activities.
- **Improved Collaboration**: In defence diplomacy, collaboration is the key to accomplishing objectives and blockchain technology can render a secure and transparent platform for collaboration, allowing different parties and stakeholders to share information and work together more efficiently.
- **Data Management**: Blockchain technology can help abbreviate errors and inconsistencies in data, improve accuracy and reliability, and enable better decision-making based on real-time data.
- **Reduced Administrative Overhead**: Blockchain technology can help to cut down administrative[13] overheads by automating certain tasks and processes enabled on smart contracts.

CBDC

Central Bank Digital Currency (CBDC) can be supplemented as a tool for defence diplomacy in various ways. Defence diplomacy refers to the use of diplomacy to promote defence and security cooperation

13. Nguyen Thi Quyen and Lam Duc Khai, "Blockchain Based Administration Model: A Small Scale Governance Demo-System," 2021 15th International Conference on Advanced Computing and Applications, January 10, 2022, https://doi.org/10.1109/acomp53746.2021.00009. Accessed on August 22, 2023.

between countries. Some potential ways in which CBDC may be used in this context include:

- **Facilitating Cross-Border Military Payments**: CBDC can be used to facilitate cross-border military payments[14] between allied countries to streamline the process of paying for joint military exercises, equipment purchases, and other collaborative efforts.
- **Enhancing Economic Cooperation:** CBDC can be used to promote economic cooperation between countries by facilitating cross-border transactions and removing barriers to trade with blockchain enabled audits.[15]
- **Improving Financial Surveillance**: CBDC can help improve financial surveillance by providing governments with real-time data on financial transactions and help governments identify potential security threats and take action to prevent them.
- **Promoting Financial Inclusion**: CBDC can be used to promote financial inclusion by rendering access to digital payments[16] to underserved populations which can help promote economic development and stability in the developing countries, which can, in turn, boost regional security.

IN PRACTICE USE CASES

While the basic introduction and advantages that could be derived with the association of blockchain technology and defence diplomacy have been discussed, a few in practice use cases are discussed below:

14. Xuan Han, Yong Yuan, and Fei-Yue Wang, "A Blockchain-Based Framework for Central Bank Digital Currency," 2019 IEEE International Conference on Service Operations and Logistics, and Informatics, January 13, 2020, https://doi.org/10.1109/soli48380.2019.8955032. Accessed on July 11, 2023.
15. George Alexandris, et al., "Blockchains as Enablers for Auditing Cooperative Circular Economy Networks," 2018 IEEE 23rd International Workshop on Computer Aided Modeling and Design of Communication Links and Networks, November 1, 2018, https://doi.org/10.1109/camad.2018.8514985. Accessed on July 8, 2023.
16. Vijak Sethaput and Supachate Innet, "Blockchain Application for Central Bank Digital Currencies," 2021 Third International Conference on Blockchain Computing and Applications, November 15, 2021, https://doi.org/10.1109/bcca53669.2021.9657012. Accessed on Apr 19, 2023.

United Nations Development Programme (UNDP) in Sierra Leone

- UNDP has been working on a pilot project in Sierra Leone[17] that leverages blockchain technology to increase the transparency and efficiency of the country's national election procedures.
- In March 2018, the Swiss blockchain company Agora conducted an unofficial parallel vote tabulation using blockchain technology during Sierra Leone's presidential elections[18]. Agora's system provided real-time vote counting and data sharing through a decentralised network, allowing for a transparent and tamper-proof alternative to traditional vote counting methods.
- While the National Electoral Commission (NEC) of Sierra Leone did not officially recognise Agora's results, the company claimed that its data closely matched the official tally. Agora's use of blockchain technology in the Sierra Leone elections was seen as a potential solution to address concerns around transparency and accountability in elections across the globe.

Democracy Earth

- In 2018, Democracy Earth[19] partnered with the Government of Colombia to develop a blockchain-based platform for voting in local elections. The platform was used in a pilot project in the city of Medellin and was seen as a success in terms of promoting transparency and citizens' participation

Australian Defence Industry Supply Chain Programme

- The Australian Department of Defence (DoD) is testing blockchain technology for its procurement processes and has partnered with a blockchain company to develop a platform that will enable real-

17. Marie Huillet, "UN, Sierra Leone Launch Blockchain-Based 'Credit Bureau of the Future,'" Cointelegraph, September 28, 2018, https://cointelegraph.com/news/un-sierra-leone-launch-blockchain-based-credit-bureau-of-the-future. Accessed on June 14, 2023.
18. Rosie Perper, "Sierra Leone Just Became the First Country in the World to Let Its Citizens Vote Using Blockchain," *Business Insider*, March 14, 2018, https://www.businessinsider.in/politics/sierra-leone-just-became-the-first-country-in-the-world-to-let-its-citizens-vote-using-blockchain/articleshow/63292836.cms. Accessed on June 09, 2023.
19. Santiago Siri, Democracy Earth Foundation, December 12, 2022, https://democracy.earth/. Accessed on June 1, 2023.

time tracking of contracts, reduce the risk of fraud, and improve efficiency.
- In the context of defence diplomacy, this initiative can improve the procurement processes for defence equipment and supplies, making it easier for foreign partners and allies to collaborate with the Australian DoD.

Blockchain and Global Militaries
- Global militaries are using blockchain technology for various purposes such as secure communication, secure data sharing, supply chain management, and voting systems. This highlights the efforts of countries such as the US, Australia, and the North Atlantic Treaty Organisation (NATO) in enforcing blockchain-based solutions for their defence needs. These initiatives aim to enhance the security, transparency, and efficiency of military operations.[20]
- In the context of use in defence diplomacy, these efforts can help encourage transparency and accountability in decision-making processes, improve logistics and supply chain management, and furnish a secure and efficient platform for communication and information exchange among the participating nations.

US Army SIMBAChain
- In August 2021, the United States Army awarded a US$ 1.5 million contract to the SIMBAChain blockchain platform, to build up a secure messaging system for the army's ground vehicles. The system will leverage blockchain technology to enable secure and tamper-proof communication among army personnel in the field.
- In the context of defence diplomacy, SIMBAChain has various potential use cases such as enhancing the security, transparency, and efficiency of military supply chains and logistics, improving the management of military contracts and procurement processes, and enabling secure and decentralised communication and collaboration among military personnel and stakeholders.

20. Analytics Insight, "How Blockchain Is Being Used by Global Militaries: Analytics Insight," October 27, 2022, https://www.analyticsinsight.net/how-blockchain-is-being-used-by-global-militaries/. Accessed on June 23, 2023.

INDIAN CONTEXT

In December 2021, the Ministry of Electronics and Information Technology, Government of India, released the "National Strategy on Blockchain: Towards Enabling Trusted Digital Platforms"[21] document, signifying an essential milestone in leveraging the potential of blockchain technology across various sectors, a few of which are seen in Table 1.

Table 1: Blockchain Implementations Across Various Indian Sectors

CDAC	Successfully deployed blockchain pilot projects and aims to develop a national blockchain framework for cross-domain applications
	Also seeks to integrate eSign with blockchain proof-of-existence and deploy large-scale applications.
Academia	IIT Kanpur is working on blockchain technology for e-governance solutions, including feasibility reports, protocol development, and research on tamper resistance.
	IIIT Hyderabad, through the COE with Ripple, explores security, game-theoretic techniques, and machine learning in blockchain.
NITI Aayog	Collaboration with GNFC, PwC, and Intel to develop a blockchain-based system for fertiliser subsidy, leveraging tamper-proof and transparent features.
Governments of Telangana and Tamil Nadu	These have released policy documents embracing blockchain technology, with successful use cases in land registry, farm insurance and digital certificates.
RBI & Financial Institutes	RBI uses blockchain technology for banking and exploring CBDC, while SBI, Yes Bank, Axis Bank, and ICICI Bank have adopted blockchain technology for various banking applications.

Sources: Table 1 prepared by the author based on data from "National Strategy on Blockchain," Ministry of Electronics and Information Technology, Government of India, https://www.meity.gov.in/content/national-strategy-on-blockchain. Accessed on August 8, 2023.

21. Arnab Kumar and Tanmay Mahindru, "National Strategy on Blockchain," *National Strategy on Blockchain*, December 12, 2021, https://www.meity.gov.in/content/national-strategy-on-blockchain. Accessed on August 8, 2023.

Although this document does not particularly discuss the implementation of the blockchain in military diplomacy, it is fair to expect that this aspect may be dealt with in future revisions. This outlook stems from acknowledging the inherent advantages that a blockchain offers while also learning from global best practices. India can leverage blockchain technology to enhance defence diplomacy in several ways:

- Transparent Trust Building
- Secured Communication Channels
- Enhanced Logistics in Supply Chain
- Validating Military Agreements
- Strengthened Cyber Security Measures
- Efficient Cross-Border Transactions
- Better and Transparent Military Exercise Coordination
- Safeguarding Intellectual Property
- Accelerated Conflict Resolution
- Secure Collaborative Data Sharing
- Innovative Diplomacy Showcase
- Transparent Humanitarian Aid Distribution

India's employment of the blockchain for defence diplomacy confronts challenges in technical integration, regulatory alignment, and global cooperation due to various standards and platforms. Success depends upon substantial investment in research, fostering international collaboration, and skill development. Mitigating risks, managing public perception, and addressing legal complexities are essential for efficacious effectuation.

CONCLUSION

Blockchain-enabled defence diplomacy has the potential to enhance security, transparency, and efficiency in military operations and supply chains. By leveraging the unique capabilities of blockchain technology, military organisations can improve their decision-making, logistics, procurement processes, and communication and collaboration among stakeholders. However, there are also challenges that need to be addressed in the adoption and implementation of blockchain technology in defence diplomacy.

- **Integration**: One major challenge is the integration of blockchain systems with existing military infrastructure and processes. This requires significant investment and efforts in new technologies, as well as changes to subsisting processes and workflows, which may be high-priced and time-consuming.
- **Interoperability and Standardisation**: Another challenge is the need for interoperability and standardisation among different globally available blockchain platforms and systems used by various military organisations and their allies.
- **Military Data Privacy and Security**: Moreover, there are also concerns around data privacy and security, particularly in relation to sensitive military information. Research works are currently on for exploiting decentralised storage protocols for better data security.
- **Algorithmic Bias** : In the context of global adoption of blockchain platforms for defence diplomacy, algorithmic bias can have substantial significance. If the algorithms used in the blockchain platform are biased or discriminatory, they can affect existing power asymmetries, reinforce biases, or marginalise certain nations in defence diplomacy campaigns. Therefore, it is crucial to ensure that the algorithms powering blockchain platforms are designed and implemented with transparency, fairness, and inclusivity in mind to deflect perpetuating algorithmic biases and promote equal participation among nations.

So, while there are challenges to adopting and implementing blockchain technology in defence diplomacy, the potential benefits are significant. With the right investments in new technologies, modifications to existing processes, and a focus on interoperability and security, military organisations can harness the power of blockchain technology to improve their operational capabilities and strengthen their security posture.