Blockchain in the Military

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Abstract: Blockchain technology is digitally signed and time-stamped data clusters that are published and linked together like a chain. It allows multiple users to publish at the same time through a secure algorithm in multiple cyber locations without the risk of data manipulation. It is one of the emerging technologies with the potential to transform society, especially the military. Blockchain is drawing the attention of researchers due to their potential applications beyond finance where it emerged. It is a revolutionary development that has transformed how military defense and operations are conducted. It is a promising technology that can have immense potential to provide decentralized trust, data security and integrity, traceability, transparency, visibility, and auditability across various areas in defense industries. In this paper, we explore how Blockchain could play a pivotal role in shaping the future of the military Army.

1. Introduction

Contracts, transactions, and their records are critical, defining structures in our economic, legal, and political systems, but they have not being able to keep up with the world's digital transformation. Blockchain (BC) promises to solve this problem. It came as a solution to the longstanding user's trust problem. It is a technology that builds a trustworthy service in an untrustworthy environment. It refers to a highly secure and decentralized ledger system on which information can be stored but cannot be altered. It has evolved beyond cryptocurrencies to general purpose and can be used across an array of applications. It has proven to be another revolutionary technology that will impact many industries and transactions.

Blockchain (also known as "distributed ledger technology") is a peer-to-peer network that sits on top of the Internet. Blockchain technology is an innovation which is regarded as the center of Industry 4.0 revolution and it has become part of our lives. It is a system that stores data in a special way. Blockchain technology has some interesting properties, such as its decentralized nature, immutability, decentralization, transparency, and permissionless, that may be used to address pressing issues in many sectors. Although this technology finds its first application in the financial sector, it has become possible to use it in all sectors which can be integrated with technology today.

Before Blockchain technology, people turned to gold or real estate when inflation hit its peak. Today, governments all over the globe have started opening up to Blockchain and crypto. By using blockchain, governments can reduce administrative costs, increase transparency, and improve service delivery. Blockchain

is revolutionizing the digital world by bringing a new perspective to security, efficiency, and stability of systems and data. It is network of computers that is decentralized. Blockchain keeps track of distributed data and provides encrypted transaction tracking. It has attracted attention with its unique characteristics, such as irrevocability and security. It will be a part of our everyday life [1,2]. Technology giants, such as IBM, Accenture, and Goldman Sachs are focusing on utilizing blockchain technology to enable cost-effective, secure, and transparent business operations.

2. What is Blockchain?

Blockchain, a type of distributed digital ledger technology (DLT), is a relatively new and exciting way of recording transactions in the digital age. It is a decentralized and distributed digital ledger technology that securely records and verifies transactions across multiple computers or nodes in a network. Basically, it is a chain of blocks in which each block contains a list of transactions. The blockchain technology was created as the foundational basis for Bitcoin – a digital currency in which secure peer-to-peer transactions occur over the Internet. It is expected that the spending on blockchain solutions worldwide would grow from 4.5 billion USD (2020) to an estimated value of 19 billion USD by 2024 [3].

Originally developed as the accounting method for the virtual currency Bitcoin, Blockchains are appearing in a variety of commercial applications today. Blockchain technology is a type of distributed digital ledger that uses encryption to make entries permanent and tamper-proof and can be programmed to record financial transactions. It is used for secure transfer of money, assets, and information via a computer network such as the Internet without requiring a third-party intermediary. It is now being adopted across financial and non-financial sectors. As a catalyst for change, the Blockchain technology is going to change the business world and financial matters in major ways.

The first Blockchain was conceived in 2008 by an anonymous person or group known as Satoshi Nakamoto, who published a white paper introducing the concept of a peer-to-peer electronic cash system he called Bitcoin [4,5]. Bitcoin and Ethereum are the first two mainstream Blockchains. Other modern Blockchains include Namecoin, Peercoin, Ether, and Litecoin. Figure 1 shows different components of Blockchain [6].
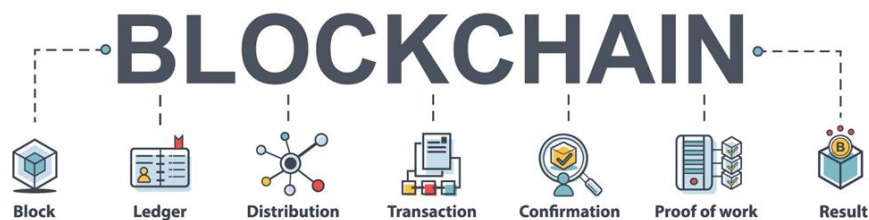

Figure 1: Different components of Blockchain [6].

Blockchain combines existing technologies such as distributed digital ledgers, encryption, immutable records management, asset tokenization and decentralized governance to capture and record information that participants in a network need to interact and transact. As illustrated in Figure 2, a complete blockchain incorporates all the following five elements [7]:
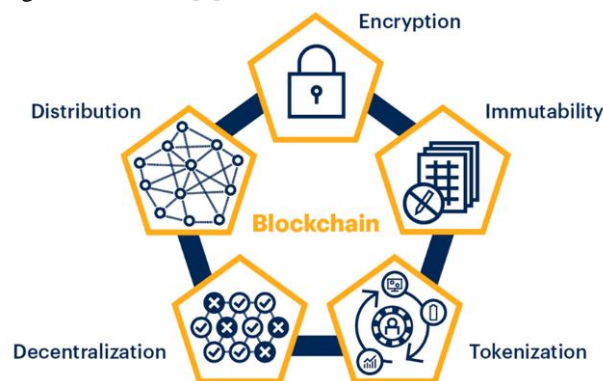

Figure 2: Five key elements of Blockchain [7].

• **Distribution:** Digital assets are distributed, not copied or transferred. A protocol establishes a set of rules in the form of distributed mathematical computations that ensures the integrity of the data exchanged among a large number of computing devises without going though a trusted third party. A centralized architecture presents several issues including a single point of failure and problems of scalability.

• **Encryption:** BC uses technologies such as public and private keys to record data securely and semi-anonymously. Completed transactions are cryptographically signed, time-stamped, and sequentially added to the ledger.

• **Immutability:** The Blockchain was designed so these transactions are immutable, i.e. they cannot be deleted. No entity can modify the transaction records. Thus, Blockchains are secure and meddle-free by design. Data can be distributed, but not copied.

• **Tokenization:** Value is exchanged in the form of tokens, which can represent a wide variety of asset types, including monetary assets, units of data or user identities.

• **Decentralization:** No single entity controls a majority of the nodes or dictates the rules. A consensus mechanism verifies and approves transactions, eliminating the need for a central intermediary to govern the network.

Bitcoin and its underlying blockchain technology increasingly impact all facets of society. Bitcoin's status as digital gold is merely the tip of this technology. Figure 3 shows Bitcoin [8]. Although blockchain technology will for all time be associated with Bitcoin due to their common genesis, it has broader applications. Cryptocurrency will increasingly become a factor in family law issues as well.

Figure 3: bitcoin [8].

3. Military Blockchain

Blockchain has the potential to transform several industries, including the military. Integration of blockchain into military operations can significantly improve security, resource allocation, fraud reduction, and operational resilience. Data sharing through a blockchain can increase trust in detailed accounts, improve seamless communication, reduce data variation, and mitigate friction points when information transfer needs to be timely and actionable. Blockchain technologies can also support food safety and health care challenges on the battlefield, build health data sharing platforms for increased security and efficiency, track, and trace the food supply chain to prevent food related outbreaks.

Blockchain data immutability drastically improves the security of data being shared across all branches of the military. It could also help secure personal data confidentiality, 3D printing data, soldiers registers or smart contracts. The smart contracts can be used to track ammunition supply in a battlefield, verify aircraft components configuration, authenticate battlefield entities through registration, certify crew certificate, and audit battlefield operations.

4. Applications of Military Blockchain

In a secure environment, blockchain has potential for military application at each planning level and across all supply classes. Blockchain technology is being used in the military for a variety of purposes such as information

security, authentication, data integrity, resilience, operations management, supply chain management, logistics. etc. The specific applications include the following [9-12]:

1. Managing Supply Chain: The Department of Defense's (DOD) supply chain network is one of the largest and most complex in the world, with thousands of supply chain partners across the globe. The defence supply chain is vital to national security. Secure supply chain management ensures timely availability of equipment, materials, and information for military response to threats and emergencies. Blockchain has the potential to significantly transform DOD supply chain networks. It may help military organizations ensure their supply chains are robust and secure. Adding blockchain technology to defense supply chain management systems will improve military security, efficiency, and transparency. Defense supply chain management application security is a global military priority. Blockchain's decentralized, immutable, and trust-based nature can help to improve the security and transparency of defense supply chains. Its decentralized, immutable, and trust-based characteristics can improve defense supply chain security and transparency. For example, blockchain can be used to record every transaction in a weapon's supply chain, creating a transparent history that can be audited by authorized stakeholders. Blockchain may offer the Army a solution it needs to secure the "digital thread" integral to the additive manufacturing supply chain. However, integrating blockchain into military operations requires a holistic approach that considers technology, regulatory compliance, data privacy, training, and maintenance.

2. Military Logistics: The pentagon has the world's largest logistics problem. In the context of data sharing within military logistics, blockchain technology is emerging as a valuable tool, due to its decentralized nature and data security capabilities. The development of blockchain technology offers increased data confidence and data availability that can help shape future military logistics and planning. Blockchain technology has significant potential value for complex logistics applications in commercial, public, and military environments. It eliminates data integrity issues and prevents data tampering by providing a single source that all stakeholders can access simultaneously. This makes data sharing much simpler while reducing human errors and time lags occurring when utilizing traditional methods.

3. Military Defense: In an increasingly digital world, the defense of military systems and networks is of utmost importance. Blockchain technology can offer military defense forces a wide range of benefits, particularly in the areas of military logistics and supply chain management. Blockchain can help to protect military communications from cyber threats by making them more secure, transparent, and tamper-proof. Its cryptographic security capabilities can improve military communications by adding an extra layer of authentication for sensitive messages and data stored online. Blockchain's cryptographic hashing and consensus algorithms make it difficult to alter or delete recorded data without the agreement of the network participants. This creates a permanent audit trail that helps to protect critical military information. Moreover, Blockchain technology has the potential to enhance end-to-end visibility into military operations so that planners can make more informed decisions.

4. Data Management: Data management is another area of application. It is paramount to federal communications. One of the most important components of success in military defense is data management. Traditional methods of storing and managing data are susceptible to hacking and fraud. Blockchain technology provides a potential solution since it is much more secure. By improving data integrity through the use of distributed ledgers and automation, it can reduce manual tasks significantly to better manage complex networks. Blockchain can be used to register every entity on the battlefield, including information about vehicles, aircraft, weapons, and warfighters. With blockchain, data is stored in a distributed ledger that is incredibly difficult to tamper with. This makes it an ideal solution for storing sensitive information such as military personnel data including basic information, career path, missions undertaken, and rewards received.

5. Asset Tracking: This is another area where blockchain technology could have a significant impact. In the military, it is important to know the location of all assets, including weapons, vehicles, and communications equipment. Blockchain-based asset tracking would allow for real-time tracking of assets and could help to prevent their loss or theft. With blockchain, each asset can be given a unique identifier that cannot be altered. This would allow the military to keep track of its assets with a high degree of accuracy. Blockchain could also be used to track the movement of assets throughout the supply chain. This would provide greater transparency

and visibility into the supply chain, which would help to prevent theft and other forms of loss. Figure 4 shows a vehicle park of US Army [13].

Figure 4: A vehicle park of the US Army [13].

6. Cybersecurity: Another application is cybersecurity. Cybersecurity is a critical concern for the military, as hackers can potentially gain access to classified information or disrupt critical infrastructure. In today's hyper-connected world, military communication systems face relentless threats from cyberattacks, espionage, and data breaches. Blockchain technology could be used to create a secure, decentralized network that would be resistant to cyber-attacks. Blockchain technology provides greater protection against cyber attacks and threats. The military could implement blockchain to secure data from unauthorized access or alteration. Incorporating blockchain into an effective cybersecurity strategy would significantly strengthen the defense against malicious adversaries in times of crisis.

7. Registration Process: The blockchain-based registration process for defense applications can help to register every battle-field entity. This includes information from various sensors, drones, combat equipment, vehicles, aircraft, smart weapons, and warfighters along with their role in a military operation. Blockchain employs smart contracts for the registration process to ensure that only registered members can read the data stored in the ledger. It also defines the access rights for every battlefield warfighter as it depends on their position in the military hierarchy.

5. Military Blockchain Around the World

Governments across the world are showing interest in blockchain technology. They are starting to embrace blockchain as a secure way to store and manage large amounts of vital data while simultaneously improving overall operational effectiveness. Many governments have implemented blockchain applications within their military forces to improve the organization's data security systems. It is now for sure that military organizations around the world would want to ensure that they stay ahead of others. We consider how some nations employ Blockchain in their military organizations.

• **United States:** The United States Marine Corps adopted an extensive research project that provides its members with an encrypted platform powered by blockchain technology with which they can securely communicate and exchange data with both allied nations and domestic stakeholders. The US Defense Advanced Research Projects Agency (DARPA) is planning to implement blockchain technology in defense and military applications. The US military is already using blockchain in some of its applications [14].

• **China:** Chinese soldiers could be rewarded in cryptocurrency tokens for good performance if the country's armed forces embrace Blockchain technology. Applying the technology to managing the People's Liberation Army (PLA) would drive innovation. Government subsidies received by leading players in China's semiconductor industry have increased significantly. Beijing has doubled efforts to boost technological self-sufficiency amid growing tensions with Washington [15]. The Chinese military could adopt blockchain technology to manage personnel data, boost training and mission performances, and provide soldiers with earned tokens that could be used to collect rewards.

• **India:** India boasts the second-largest and fourth-strongest army globally. Its defense capabilities are evolving with the integration of emerging technologies like artificial intelligence, big data, and blockchain. The journey towards integrating blockchain into the Indian Army has just begun, promising a future where data manipulation is thwarted, decision-making is fortified, and the defense sector stands resilient in the face of

evolving threats. The Defense Minister has emphasized the changing character of warfare and the need to prepare for contingencies while repelling threats from multiple sources. India wants to stay ahead of the curve and ensure that its military remains at the forefront of technological innovation [16].

• **Ukraine:** Crypto was supposed to be Ukraine's launchpad into the future. Instead it is proving to be a necessary lifeline in a country ravaged by war. Since Russia's invasion, Ukraine has raised more than $56 million in donations spread across assets such as bitcoin, ether, polkadot, solana, dogecoin, tether, etc. These funds have gone to help humanitarian agencies distributing aid in the country, procure necessary supplies for soldiers such as food, uniforms, and bullet-proof vests. Digital assets and blockchain technology are meant to help revitalize the Ukrainian economy and bring all government processes online. Blockchain initiatives have been taken to legalize digital assets in the country and make Ukraine one of the most crypto-friendly countries in the world. However, all of those plans went out the window with the Russian invasion. Figure 5 shows soldiers in the Ukrainian army [17].

Figure 5: Soldiers in the Ukrainian army [17].

• **South Korea:** South Korea's Defense Acquisition Program Administration (DAPA) plans to improve the reliability of data in the arms industry by using Blockchain. The agency plans to use Blockchain for secure sharing of data about military acquisition projects. It is seeking to use a Blockchain platform to enable the secure sharing of data about military acquisition projects between relevant governmental organizations and to eliminate data forgery. DAPA also intends to reduce the paperwork associated with applying for state procurement projects, as well as unify its documentation [18].

• **Nigeria:** To address the challenge of certificate forgery and fraudulent issuance in Nigeria, an agency has unveiled an initiative that will use blockchain technology to authenticate National Youth Service Corps (NYSC) certificates. It pioneers the development of an advanced Blockchain-based certificate authentication system. The revolutionary approach is designed to ensure the integrity and validity of NYSC certificates, thereby enhancing transparency and trust in the certification process. Figure 6 shows some graduates serving the NYSC [19].

Figure 6: Some graduates serving the NYSC [19].

6. Benefits

Blockchain is a promising and emerging technology that can have immense potential to provide decentralized trust, data security and integrity, traceability, transparency, visibility, and auditability across various areas in the defense industries. It has the potential to solve major problems in military logistics, such as tracking supplies, managing personnel records, and ensuring data security. Other benefits of blockchain in the military include the following:

• **Cost Reduction:** Blockchain can also save money by eliminating unnecessary middlemen who add little, if any, value. Reducing or eliminating manual processes and reducing fraud can all reduce operational costs and further increase efficiency. Cost reductions are anticipated in regards to information lags, duplication, personnel, movement times, storage, and inventory losses.

• **Improve Operational Performance:** Most defense platforms and systems are staggeringly complex. These assets are very mobile (globally) and require collaboration among a number of entities to keep them operational and mission-ready. Technology can help operators, manufacturers and suppliers "harden" the supply chain and improve operational performance through the entire life cycle, from raw material to retired asset.

• **Decentralization:** At its core, blockchain's decentralized architecture eliminates the most significant vulnerability of traditional systems: the single point of failure. In contrast to centralized systems, blockchain operates on a decentralized network, where data is not stored in a single location but spread across multiple nodes. This means that even if one node is tampered with or compromised, the integrity of the overall system remains intact.

• **Immutability:** One of blockchain's most compelling features is its immutability. Blockchain's inherent immutability (i.e. once data is recorded, it cannot be altered) ensures that every message sent through military channels remains untampered. This feature is critical in high-stakes defense scenarios, where the integrity of communication can be a matter of life and death.

• **Transparency:** Military operations require precise coordination, and blockchain provides real-time visibility into the communication process. By integrating blockchain, defense forces can monitor every stage of message transmission, ensuring it has not been intercepted or altered. This transparency builds trust in the communication system, allowing faster and more confident decision-making during critical missions.

• **Advanced Encryption:** Blockchain technology uses advanced cryptographic techniques to secure data, making unauthorized access nearly impossible. Unlike traditional encryption methods, which can be cracked over time, Blockchain continually reinforces security through its distributed ledger, securing sensitive defense information.

• **Communication Security:** In an age where secure communication is paramount, blockchain technology is emerging as a game-changer. The decentralized approach makes it nearly impossible for attackers to infiltrate the network, offering unprecedented resilience and security for critical communications. Once data is recorded, it becomes a permanent, tamper-proof entry in the blockchain. For sectors like military communications or high-stakes corporate exchanges, this ensures that records remain intact, verifiable, and immune to tampering. By integrating smart contracts, blockchain automates security protocols, ensuring that communication rules are enforced without relying on intermediaries.

7. Challenges

New technologies such as Blockchain create new challenges and opportunities. Challenges facing Blockchain may require further research on areas such as interoperability, network infrastructure, and a thorough analysis on its regulation. Other challenges of blockchain in the military include the following [9]:

• **Threats to Cybersecurity:** Blockchain integration into defence supply chain management can improve security, but it also shows the rising cybersecurity dangers. As supply chain applications become increasingly networked and data-intensive, sophisticated hackers target them.

• **Scale and Complexity:** To ensure successful implementation and long-term sustainability, defense supply chains must balance transparency and security with their complexity and scale. This requires careful planning, scalable blockchain infrastructure, and effective governance frameworks

• **Supply Chain Resilience**: Defense supply chains are vulnerable to natural disasters and geopolitical crises. Real-time visibility into commodities and asset movement on blockchain's decentralized ledger allows proactive risk assessment and mitigation, improving supply chain resilience.

• **Complexity:** The process of data integration in military logistics can be extremely complex and time-consuming, making it difficult for Blockchain ideation to align with the standards of data sharing within the sector. Military organizations need to develop an effective data integration process that is tailored to their individual needs.

• **Cost-effectiveness:** A major concern is the cost efficiency of incorporating data from existing systems into Blockchain-based ones, while also maintaining a fluid process. Military logisticians must pay attention to cost efficiency when implementing a Blockchain solution for military logistics, in order to ensure optimal performance without breaking the bank.

8. Conclusion

The use of blockchain technology is gaining traction in all industries. It is being used across many industries for many purposes. Organizations around the world are beginning to recognize the value that blockchain technology can bring to their operations. Blockchain is set to transform military communications, offering unprecedented security, transparency, and resilience against cyber threats. As we navigate the complexities of modern warfare, Blockchain technology emerges as a strategic ally, offering unique advantages over conventional cyber defense approaches. However, the nascency of the technology, coupled with relative lack of knowledge of DoD concerning it, has delayed its adoption and integration by the DoD. The future possibilities for blockchain technology in militarized data sharing and logistics operations are exciting. More information about blockchain in military operations can be found in the books in [20-23] and the following related journals:

• **Military Review**
• **Journal of Military Learning**
• **Journal of Defence & Security Technologies**
• **The Cyber Defense Review**

References

[1]. A. Guadamuz and C. Marsden, "Blockchains and Bitcoin: Regulatory responses to cryptocurrencies," Peer-reviewed Journal on the Internet, vol. 20, no. 12, Dec. 2015.

[2]. M. N. O. Sadiku, Y. Wang, S. Cui, and S. M. Musa, "A primer on Blockchain," International Journal of Advances in Scientific Research and Engineering, vol. 4, no. 2, February 2018, pp. 40-44.

[3]. C. M. M. Kotteti and M. N. O. Sadiku, "Blockchain technology," International Journal of Trend in Research and Development, vol. 10, no. 3, May-June 2023, pp. 274-276.

[4]. "Blockchain," Wikipedia, the free encyclopedia. https://en.wikipedia.org/wiki/Blockchain

[5]. S. Nakamoto, "Bitcoin: A peer-to-peer electronic cash system," https://bitcoin.org/bitcoin.pdf

[6]. "The beginning of a new era in technology: Blockchain traceability," https://www.visiott.com/blog/blockchain-traceability/#:~:text=The%20Beginning%20of%20a%20New,money%20without%20a%20central%20bank.

[7]. "The CIO's guide to Blockchain," https://www.gartner.com/smarterwithgartner/the-cios-guide-to-blockchain#:~:text=True%20blockchain%20has%20five%20elements,%2C%20immutability%2C%20tokenization%20and%20decentralization.

[8]. "Helping the military adopt Blockchain technology," https://www.pioneeringminds.com/helping-military-adopt-blockchain-technology/

[9]. K. Sahu and R. Kumar, "Blockchain for managing the supply chain in military operations," December 2023, https://www.bcs.org/articles-opinion-and-research/blockchain-for-managing-the-supply-chain-in-military-operations/

[10]. M. T. Simerly and D. J. Keenaghan, "Blockchain for military logistics," November 2019, https://www.army.mil/article/227943/blockchain_for_military_logistics

[11]. "Blockchain for military logistics: What you should know," April 2023, https://nstxl.org/blockchain-for-military-logistics/#:~:text=April%204%2C%202023,records%2C%20and%20ensuring%20data%20security.

[12]. H. H. Ahmad et al., "Blockchain for aerospace and defense: Opportunities and open research challenges," Computer & Industrial Engineering, vol. 151, January 2021.

[13]. E. Broitman, "The Pentagon has the world's largest logistics problem. Blockchain can help," October 2017, https://www.defenseone.com/ideas/2017/10/pentagon-has-worlds-largest-logistics-problem-blockchain-can-help/141500/

[14]. "How Blockchain solidifies defense and military applications," January 2018, https://blockchain.oodles.io/blog/blockchain-military-applications/

[15]. "Reward Chinese soldiers in cryptocurrency, military mouthpiece says," https://www.scmp.com/news/china/military/article/3037592/reward-chinese-soldiers-cryptocurrency-military-mouthpiece-says

[16]. P. Jain, "Unleashing the power of Blockchain: Transforming the Indian military landscape," November 2023, https://www.linkedin.com/pulse/unleashing-power-blockchain-transforming-indian-military-pratik-jain-ryo8f

[17]. S. Ehrlich, "Crypto interrupted: How the Russian invasion dramatically changed Ukraine's Blockchain strategy to focus on the war," March 2022, https://www.forbes.com/sites/stevenehrlich/2022/03/05/crypto-interrupted-how-the-russian-invasion-dramatically-changed-ukraines-blockchain-strategy-to-focus-on-the-war/

[18]. H. Partz, "South Korea State Defense Arm DAPA to build blockchain platform for military acquisition," April 2019, https://cointelegraph.com/news/south-korea-state-defense-arm-dapa-to-build-blockchain-platform-for-military-acquisition

[19]. M. Akuchie, "Why issuing NYSC certificates through blockchain technology is not enough to drive adoption," August 2023, https://technext24.com/2023/08/23/blockchain-nysc-certificate-nigeria/

[20]. M. N. O. Sadiku, Blockchain Technology and Its Applications. Moldova, Europe: Lambert Academic Publishing, 2023.

[21]. U. S. Military, Department of Defense (DoD), T. Doskey, Improve Acquisitions, Procurement, and Supply Chain, Analysis of Private Sector Programs, Purchase Card Pilot Program. Amazon Digital Services LLC, 2019.

[22]. U. S. Military, Department of Defense (DoD), N. Barnas, Blockchains in National Defense: Trustworthy Systems in a Trustless World - The Evolving Cyber Threat, Air Force Should Research and Develop Blockchain Technology to Reduce Probability of Compromise. Independently Published, 2019.

[23]. V. Adams, Potential Uses of Blockchain by the U.S. Department of Defense. Value Technology Foundation, 2020

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