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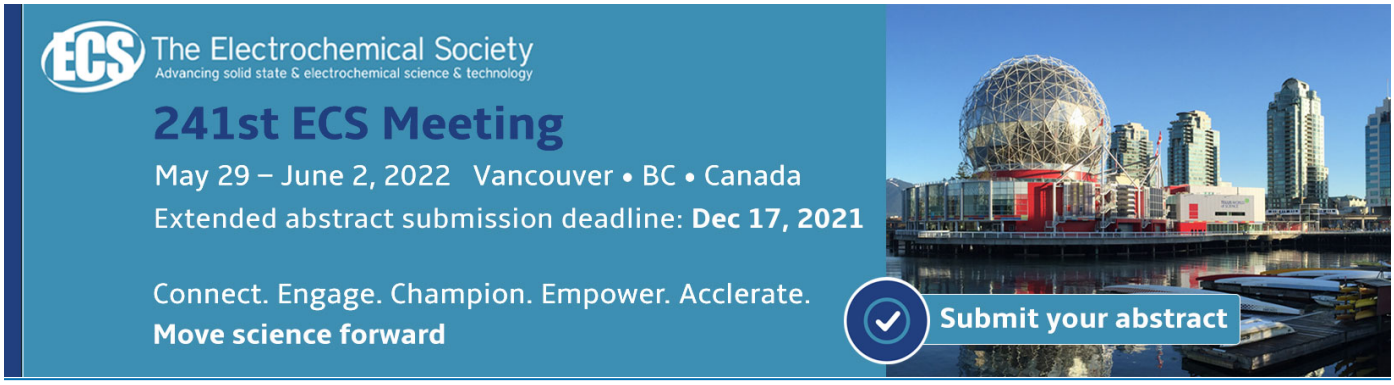

Blockchain –booster of the Russian forest information systems

M Lobovikov[1*], N Pryadilina[2]and I Scherbak[3]

[1]International Center for Forestry and Forest Industry, *Saint Petersburg State Forest Technical University by the name of S.M. Kirov*, Institutskiy Lane 5, Saint Petersburg 194021, Russian Federation
[2]Department of Economics and Economic Security, Socio-Economic Faculty, *Ural State Forestry Technical University*, Siberian tract 37, Yekaterinburg 620100, Russian Federation
[3]*Food and Agriculture Organization of the United Nations (FAO of the UN), Ambassador Extraordinary and Plenipotentiary of the Russian Federation*, FAO Liaison Office with the Russian Federation, Leontievsky Lane 9, Moscow 125009, Russian Federation

*Corresponding email: maxim.lobovikov@mail.ru

Abstract. Digitalization of the Russian forest sector is successfully developing. The first Unified State Automated Information System for timber accounting and transactions (LesEGAIS) has been operating since December 30, 2015 and continues to improve. In 2023, it will be qualitatively transformed into the Federal State Information System of the Forestry Sector FGIS LK. However, these systems continue to be built on centralized databases and rapidly outdated information concepts of the last century. They do not consider the fundamentally new opportunities that the new breakthrough information technology of the distributed ledger (the blockchain) provides to the forest

1. Introduction

1.1. Evolution of information systems (LesEGAIS-FGIS LK)

The Unified State Automated Information System for accounting of timber and transactions with it, abbreviated as EGAIS for timber accounting, simpler LesEGAIS, was created in 2014. It was originally intended to control the origin and turnover of timber. For the first time LesEGAIS was put into operation on December 30, 2015. This system contains a complete database and permits for timber harvesting and other operations in the forest [1].

Since its inception, LesEGAIS has continued to constantly develop and evolve. In 2016, significant work was carried out to improve the quality of data. In 2017, after a change in legislation, lumber was added to the system, as well as data on the export of the most valuable species of wood. At the same time, historical data and previous analytical reports were not affected. Thanks to this information has appeared in the system for the first time on the wood owners, supply chains, harvested, purchased and sold outwood. In 2017, a pilot project to combat "shadow" lumberjacks was successfully implemented in the Irkutsk region within the framework of LesEGAIS.

From January 23, 2019, LeEGAIS data became available in the system of interdepartmental electronic interaction, including the Federal Customs Service, the Ministry of Internal Affairs, the Federal Tax Service, and Rosfinmonitoring. These departments began to receive information automatically and could integrate it into their own information systems. LesEGAIS was extended to all transactions with timber and forest products. Its use has become mandatory for all participants in the timber market [2]. The action plan for decriminalization and development of the forestry sector was approved by the Deputy Chairman of the Government of the Russian Federation V.V. Abramchenkoon 01.10.2020 under No. 9282p-P11 [3].

The plan was followed by instructions from the President of the Russian Federation Vladimir Putin after the meeting on development and decriminalization of the forestry sector dated back to 06.11.2020, No. Pr-1816. As a result, requirements were established for recording timber transactions, accompanying electronic documents and for registering timber collection sites [4].

From the beginning of 2021, an experiment to track timber turnover began in Russia, which lasted until June 30, 2021. Since July 1, 2021, this system has spread throughout the country. At all stages of timber movement, accompanying documents are created and recorded in the LesEGAIS system. If the legality of the wood origin is not proven at any stage, then further transactions with this wood will be blocked.

On February 4, 2021, Federal Law No. 3-FZ "On Amendments to the Forest Code of the Russian Federation and Certain Legislative Acts of the Russian Federation in terms of improving the legal regulation of forest relations" was enacted in the Russian Federation [5]. The law is intended to regulate the procedure for controlling the turnover of timber at storage sites. It allowed introducing a balance model of timber accounting in order to identify the thefts. The law also provides for the transition to electronic document management in the field of forestry services. Since January 1, 2022, the Russian authorities bann the export of unprocessed coniferous and valuable deciduous wood from the country. According to various estimates, at present, the volume of illegal timber harvestingis some 10-35% of the legal turnover. At the same time, information about forest resources and their use remains closed to business, civil society, experts and government officials who make fateful decisions on the development of the forest economy. Law No. 3-FZ is intended to change this situation.

After 2023, the law provides for the creation of a federal forestry information system (FGIS LK). It must ensure full traceability of wood from the place of harvesting to the points of storage, processing and export. The system is not limited to wood only. There is also a list of information that must be entered in the state forest register (GLR): documents on forests and their use, protection, custody, reproduction, timber transactions. The law also obliges to create a single electronic map on the Internet, which will reflect the information of the GLR. The map should be free of charge and available for inspection to all interested citizens.

The interest in the LesEGAISdata is constantly growing. At the end of 2015, 23 thousand users were registered in the system. In 2021, the number of active users exceeded 114,000 and continues to grow rapidly. To suppress illegal timber trade and smuggling, access to this system was granted to more than 7 thousand employees of law enforcement and regulatory bodies: the Ministry of Internal Affairs, the Federal Customs Service, the tax service and Rosprirodnadzor.

1.2. Disadvantages of the information systems (LesEGAIS-FGIS LK)

There are a number of generic factors in the current system of control over the origin of timber. They essentially reduce its efficiency and limit the ceiling of its development.

LesEGAIS (FGIS LK after 2023) is based on traditional digital technologies of the last centuryfor the datacollecting and processing. These technologies are inaccurate, time consuming and costly. Data requires expensive monitoring and auditing. They are often subject to inaccuracies and distortions. Only the "white" timber market gets into the system. The"gray" market is not reflected by the traditional methodologies.

The human factor is essential in the current system. It brings about corruption risks, various collusions and falsification of the documents for timber logging, transportation and processing.

The accompanying document for the transportation of timber is not protected. Information about it is not entered into LesEGAIS. Under the current procurement requirements of forest legislation, unscrupulous timber carriers can use the same accompanying document for the transportation of timber more than once. They can forge the accompanying document using the data of the legal loggers, which operate in the region. They can remove timber from illegal logging areas, indicating in the accompanying document the legal procurement.

The system lacks information on the balance of the arrived and processed wood at the logging and wood processing enterprises. There is also no data on the sites of wood storage at the points of purchase, processing and sale of wood.

Until 2021, log accounting started only at the warehouse. Before entering the LesEGAIS, logs were not noted anywhere. Since 2021, according to the instruction of the President of the Russian Federation, each exported log must be registeredstarting from the logging plot up to the point of crossing the foreign border. Nevertheless, LesEGAIS cannot completely solve the problem of illegal timber. There are many different collusion schemes in logging practice and public, that the current accounting system is unable to track.

Illegal logging remains a systemic problem in the Russian forest sector. According to the official data of the Russian Council of Federation, the illegal wood may amount up to 16% of the procurement volume. Many experts believe that this figure is underestimated, and the real illegal traffic can reach from a quarter of logging up to three quarters in several areas.

The existing system is extremely labor intensive and costly. It requires a large number of roadblocks, video cameras, document management, accounting systems, inspections, audits and intensive communications between the law enforcement agencies. This greatly complicates and increases the cost of control. However by no means it excludes the black and gray market and corruption in the forest.

Information Systems (LesEGAIS and FGIS LK) generally do not track export operations with wood and wood products, with the exception of certain valuable wood species. The inclusion of new export items in the list makes the already costly scheme prohibitively expensive. The origin of the exported goods is not confirmed by reliable and trusted information systems. This negatively affects the export prices and income of the timber exporters.

IS does not track numerous and varied forest products and services, including non-timber products, recreation, grazing and other products. The procurement of these products is often ad hoc and seasonal. Harvesters, as a rule, are not considered in the total volume of forest use. As a result, they do not pay taxes and are not counted in the pension system.

Another significant drawback of forest information systems is inability to track forest cultivation, including reforestation, planting, thinning, sanitary and other silvicultural measures.

Another drawback is the lack of an information block for forest inventory, land and forest property, fires, etc.

The existing information systems are also unable to track the carbon balance in forests. Meanwhile, carbon around the world is emerging as an important market good, quite similar to wood and other forest products. Russia, with its forestry potential, must have a worthy segment in the global carbon market and a reliable information system for measuring carbon balance. The corresponding module should be built into the state forest information system. However, the technological base of the modern information system is not suitable for it.

IS are based on centralized databases. The data contained in the databases can be subject to cyber attacks with the risk of loss and alteration of the information.

The current (LesEGAIS) and the future information system (FGIS LK) are by nature ordinary centralized databases. They are not meant to be self-governed through smart contracts and do need excessive external oversight and audit.

All these disadvantages cannot be eliminated using only traditional information technologies. New approaches and fundamentally new technological solutions are required in this case.

2. Methods and Materials

2.1. Blockchain is the solution

Society demands to establish order in the forest, to account for all forest products and benefits, and to eliminate illegal forest logging. However, the control measures undertaken so far, as current experience shows, are costly and ineffective. New technologies that appeared at the beginning of the 21st century make it possible to solve long-standing problems on a new technological basis with significantly lower costs and greater effect [6].

We are talking about distributed ledger technology, namely blockchain. The name translates as chain of blocks. The technology is believed to have originated in Japan in 2009. By now, it has managed to boostthe financial worldand alsominds of politicians and regular citizens. This technology is usually associated with the financial markets and notorious cryptocurrencies. However, cryptocurrencies do not exhaust the whole variety of the new family ofdistributed ledger technologies. These technologies are applicable to any supply chain, as well as to data on forest production, inventory, lease, ownership and carbon stock.

Blockchain is a decentralized transaction management technology. In recent years, technology has evolved exponentially. New platforms, projects, startups, applications have been created and now continue growing. Many companies and government organizations and foundations offer their technology platforms, often free of charge. These platforms are driving rapid development and use of blockchain applications. New platforms are being constantly improved, including the blockchain-based Industrial Internet of Things (IoT). Blockchain technology has tremendous potential in the forest industry. This technology effectively links the forestry sector with finance, property rights, leases, smart contracts, carbon stocks, and other forestry issues [7].

In the near future, blockchain technologies will become a critical part of innovation in the forest sector around the globe, including the Internet of Things (IoT). The IoT concept is based on organizing the data transmission network between physical objects (things) equipped with applications for information interaction with each other. It is assumed that the organization of such networks will completely or partially eliminate the human factor from routine business operations. The Russian forest sector has a special need for this technology. Therefore, it is extremely important that Russian forestry operators, companies and research organizations achieve the required level of competence in this area. Russia with its vast forests should be a leader in integrating the blockchain module into existing information systems.

The United Nations confirms that at the government level, the interest in deploying blockchain technology is very high around the world in various industries. Governmental organizations around the world are exploring the use of blockchain to improve efficiency and transparency. The ability to record transactions in distributed ledgers offers governments new approaches to increasing transparency, preventing fraud and building trust [8].

The decision to implement blockchain technology is much broader than the problem of a single subsector. It ties together financing and organization of production in the context of natural resource management.

The introduction of blockchain into the forestry sector of the Russian Federation is timely, since the Russian Forestry Agency and the Ministry of Natural Resources are going through the digitalization process. The political landscape is now favorable for this, as the Government has launched major projects to promote digital governance of the economy.

Blockchain will help creating a social security and pension system for informal forest entrepreneurs involved in non-timber forest products and services.

Over the past 10 years, cryptocurrencies have been the most visible use of blockchain technology. At the same time, the range of blockchain applications is much wider. It is undergoing intensive development and constant diversification.

Blockchain is a secure distributed ledger. It contains a digitized and encrypted record of contracts, transactions, transfers and invoices:

- Distributed ledgers can be public or private.
- It is believed that cryptocurrency require high computing power and consume a lot of electricity for mining, that is, for confirming transactions. However, the public sector and authorities prefer to use blockchains to record transactions. These blockchains do not require mining and huge computing power and electricity for the encryption.
- The blockchain is not owned by any single user. It is often hosted by a neutral party and operated by a trusted entity.
- The technology ensures that no changes are subsequently made in the data of completed transactions and the record remains valid.
- Users can be anonymous and registered with free or paid access.

2.2. Pros

The blockchain digital ledger is protected by smart cryptographic features. Therefore, it can develop or use cryptocurrencies. Quantum technologies make the blockchain secure. The data on the blockchain is immutable. The technology has extremely low transaction and energy costs while being easy to use for data management [9]. These traits are the main advantages for a public or private organization when implementing blockchain. It helps achieve good governance and allows organizations to spend valuable resources on productive use instead of being constantly monitored and reviewed by internal or external auditors.

Blockchain is a distributed database that can constantly expand with a proportional decrease in the unit costs of information support. Distributed databases have unlimited storage resources and form chains that cannot be forged or altered. Since every client has a copy of the blockchain, it is impossible to manipulate with the information. In this case, the reliability and origin of the data is checked mathematically.

Registries can be used to confirm ownership and transactions. Blockchain eliminates the need for centralized institutions and ledgers to manually verify ownership. It does not require mediators in disputes and is capable of independently confirming property rights, exercising control, ensuring transparency and high efficiency in the production and trade of forest products and services.

2.3. Cons

A potential drawback is the increase in the size and complexity of the blockchain over time and with the growth in the number of users. This can lead to a slowdown in the speed of the blockchain and an increase in energy consumption by the user community [10]. But these risks are mainly associated with cryptocurrencies such as bitcoins, which attract a large user community and require significant computing (mining). With limited use in the public sector forestry, the size and complexity of the blockchain will remain quite manageable.

3. Results and Discussion

The Russian Federation has all the necessary knowledge and technologies in the field of blockchain. The technology fits well with digital society and e-government initiatives. Natural resources of Russia are one of the most promising testing grounds for the blockchain implementation.

To implement advanced technology, it is necessary to combine various knowledge in the field of resource management, IT, law and finance. System design should preferably follow a bottom-up approach. Implementation of the blockchain as a public-private partnership does not require additional government permits and has no prohibitions or restrictions. The use of the latest technology ensures complete transparency and traceability of financial flows and incomes in the forestry sector. Blockchain can be a useful tool for administering lease and service fees that forest operators are required to transfer to the state budget as tax. The same system is able to effectively meet the tasks of financing the forestry sector, loans, rent, construction of roads and other infrastructure in the forest. All of these measures will strengthen the public funding and control over the Russian forest sector.

The first actual experience of using blockchain in the forestry sector already exists in the large logging and timber processing private companies, such as Segezha Group. Electronic mobile banking

and payment systems are well developed in Russia. Therefore, in Russia there are all the necessary and sufficient conditions for the introduction of the blockchain module in the existing electronic information systems (LesEGAIS and FSIS LC).

4. Conclusion

Blockchain technologies will revitalize the forest information systems (LesEGAIS and FGIS LK) and the Russian forest sector and make it active and competitive in the domestic industrial and global timber market. In general terms, blockchain is a data structure and program code for encrypting it. The blocks are encrypted and fully protected from future changes. They are completely transparent and available to sellers, buyers and all observers. All payments under contracts are made immediately and bypass banks and financial intermediaries. This saves time, resources and transaction costs. In addition to displacing illegal logging, blockchain improves the quality of forestry.

Forest growing is also a chain of events (blocks), which is described by blockchain technology: sowing, planting, tending, cleaning, thinning, etc. Certification of forest products, non-wood products, carbon and international trade are also among the beneficiaries of the new technology.

Blockchain makes the Internet of Things (IoT) possible. Various types of digital assets can be generated, sent out and authenticated. Blockchain allows any transaction with any client in an automatic and self-managed mode. Modern business environment is rapidly changing. Blockchain is able to quickly adapt business to changes in the economic environment. It will increase the efficiency of the use of resources and the supply of goods.

The new technology could revolutionize the country's forest information systems and entire forest sector. It is capable of technologically bringing the Russian forest sector to the forefront of competitiveness in the world in terms of quality management, efficiency and organization.

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