PAPER • OPEN ACCESS

Blockchain –killer of illegal wood

To cite this article: M Lobovikov *et al* 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **806** 012018

View the article online for updates and enhancements.

Blockchain –killer of illegal wood

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 e-mail:maxim.lobovikov@mail.ru

Abstract. Distributed Ledger Technology (DTL) is a leading technologies in the current "digital revolution". The new technology is a real boon for the national forest sector. It may bring the Russian forest sector to the forefront of competitiveness and efficiency. However, the internal shortcomings, dangers, and threats of the new technology should be timely studied and eliminated. The "digit" is as strong as nuclear power. It is able to bestowhumanity or cause a global catastrophe if mishandled andmistreated. This fully applies to the forestry sector.

1. Introduction

Illegal logging is a long lasting and systemic problem of the Russian forest sector [1]. According to the official estimates of the Councill of Federation of the Federal Assembly of the RF (Resolution No. 17-SF dated January 30, 2019) [2], the illegal wood in 2018 reached up to 16% of all wood harvesting in Russia. Many experts believe that this figure is underestimated. They say that real illegal timber trade may reach a quarter, and in some regions up to 80% of the annual cuts. Society requiresthe government to restore order in the forest and eliminate illegal logging. However, the measures taken to combat the crime, as current practice shows, are extremely costly and ineffective. They are based on traditional timber accounting technologies of the last century. New technologies of the 21st century can solve this problem at a lower cost and much more efficiently. It's about distributed ledger technology, more precisely the blockchain. Literally blockchain is a chain of blocks. The technology appeared in 2009 [3], but by now it has managed to impress the thinking of politicians, the financial world and the lives of ordinary citizens. Modern crypto-currencies are based on this technology, which is rapidly changing the world.

2. Methods and Materials

In general terms, blockchain is a data structure and program code for encryption and data storage. The blocks are encrypted and completely protected from future changes. They are transparent and available to sellers, buyers and anyone else. All payments under contracts are made immediately, bypassing

banks and financial intermediaries. This saves time and transaction costs. In addition to killing illegal logging, blockchain raises the quality of forestry and international timber trade to a fundamentally new level never seen before [4]. Blockchain is a young and promising technology. Its rapid development in recent years in various industries reveals both advantages and disadvantages that require careful consideration during mass implementation. The main method is comparison and identification of the merits and demerits of the new technology. The material for the article is the experience of blockchain use in the forestry sector and other sectors of the economy in Russia and in the world.

2.1. Advantages and benefits of blockchain
Blockchain has the following advantages over traditional transaction accounting technologies:

The transition to industrial revolution 4.0 in the forestry sector. The industrial revolution is a rapid restructuring of economy under the influence of innovative technologies [5]. Industrial Revolution 1.0 began with the invention of the steam engine in 1778. Industrial Revolution 2.0 was driven by electricity and conveyor production (conventionally, 1870-1914). Industrial Revolution 3.0 - Nuclear power, automation, computer numerical control (CNC) and robotics (since the early 1960s). Industrial Revolution 4.0 (early 21st century) - digitalization based on new technologies. It optimizes production to the utmost. It does not bring a new type of energywith it, like the previous industrial revolutions, but it saves huge amount of energy and other resources for society [6]. The arrival of blockchain in the forest sector flags the arrival of industrial revolution 4.0.

Extreme transparency, confidentiality and accuracy. Blockchain provides open and fast access to data for verification of the entire supply chain. In this case, the information is immediately encrypted and remains completely anonymous. The observer is able to see only impersonal codes. At the same time, sellers and buyers of forest (not only wood) products will know everything about their origin. Transaction transparency is achieved by the way of time and place markers for the products. Each harvested log is entered into a database with GPS coordinates and is delivered to the consumer along the planned route. Any deviation from the route is automatically recorded, flagged andthus excludes creation of the next information block. Thus, the problem of illegal timber trade is resolved.

Actual impossibility of data falsification. The data in the chain structure is collected in special blocks. The blockchain creates a decentralized block system, where each subsequent transaction depends on the previous one. Therefore, information about any transaction in the blockchain cannot be deleted or changed. Data encryption and cryptography provide reliable protection against hacker attacks and data breaches. This completely excludes the possibility of changing the terms of transactions and fraud.

Corruption, embezzlement and deception are excluded. Loggers use mobile blockchain applications. They enter the GPS coordinates of each felled tree into the database. Further, the wood processor compares the data with the database on allowable cut and protected areas. Any inconsistency makes it impossible to create the next block in the blockchain. Resale of timber becomes impossible. Any deviation will indicate an illegal timber trade. The blockchain is able tolight up the entire path of wood from the stump to final consumption.

Guaranteed sustainable forest management. The use of blockchain allows for the first time to provide monitoring of forest resources through continuous automatic remote sensing of the earth using aerospace (satellites and drones) and modelsof stand development [7]. Continuous monitoring of forests will increase the safety and availability of forest resources, exclude the possibility of illegal use of forest lands.

Blockchain enhances the competitiveness of the Russian forestry sector. Blockchain technology greatly simplifies and cheapens the process of international certification of forests by FSC, WWF, etc. Blockchain makes products cheaper andacceptable in advanced "green" western markets. It raises the "green" rating of forest products suppliers. As the blockchain expands, the gray market for illegal and semi-legal timber is expected to rapidly disappear.

Saving costs, producingcheaper products. Blockchain implies significant costfor computers, software, electricity and maintenance. These investments will increase production efficiency and

profits. Blockchain virtually eliminates logistics, banking and international intermediaries altogether. All participants in the transaction receive comprehensive information about the progress of the transaction and the promotion of goods and finance on the market. This reduces risks, mobilizes finances, saves resources and makes wood processing products cheaper.

The risk of data loss is eliminated. Blockchain uses Distributed Ledger Technology (DTL). This means that the same database is decentralized across millions of computers. It becomes widely available to everyone and cannot be destroyed.

The emergence of new types of cryptocurrencies based on the forestry sector. An example is Timbercoin, which was introduced in 2018 by Laminate Veneer (LVL), Cross Laminated Timber (CLT), Smart Green House (SGH). Timbercoin is an example of a fundamentally new ecosystem of transaction registration, trade, statistics and data analysis [8].

New opportunities for small and medium-sized businesses. Blockchain technologies create new opportunities for outsourcing of computing contracts to small and medium-sized businesses. Small and medium businesses can serve as hubs for several small, medium and large forest companies and retail chains simultaneously. They will take over most of their routine functions (accounting, financial and legal). Competition between them will increase, reduce the cost of forest products and scale up the digital economyin Russia.

Growth in employment and wages. Blockchain technologies release low-skilled labor, production capacity and costs based on old accounting technologies (bookkeeping, roadblocks, road checkups, video surveillance, labor-intensive security and accounting systems). The transparency of transactions will lead to decreased number of arbitration proceedings, judges, prosecutors and lawyers. On the other hand, blockchain provides new opportunities for the creation of greater share of skilled jobs in accounting platforms based on the new technology. The functions of traditional accountants, managers, traffic police, certification and supervision will gradually shift to programmers and system administrators. Fewer and higher qualified computer staff, lawyers, prosecutors, and judges will be required to resolve trade disputes.

Accelerated digitalization and modernization of remote areas. Russia has colossal sparsely populated territories in the North and East of the country. The arrival of blockchain in these areas will enhance their technical equipment, freight traffic, intellectual and economic development, and put an end to crime and corruption in forest. Blockchain will increase the profitability of forestry companies, life comfort and attractiveness in all forest areas.

Accelerated growth of the domestic digital industry. National digital security of Russia requires the development of native platforms and element base for the blockchain technologies. Blockchain creates high demand. The demand creates supply for digital hardware, electronic chips and technology. The spread of blockchain in the largest country in the world on one-sixth of the planet's land surface will require innovative approaches, large-scale infrastructure projects, space technologies and next-generation digital networks. Blockchain will give powerful impetus to the demand and investment for developing digital economy in Russia.

Growing investment rating of Russia. The country's investment rating will rise due to the absolute transparency of transactions. Domestic and foreign investors will have full access to information on forest transactions and confidence in their reliability.

The growth of green energy. The mining technology is extremely energy intensive and will generate demand for energy from local renewable resources [9]. This will inevitably lead to an increase in green energy and a reduction of carbon emissions in the atmosphere by replacing fossil fuels with renewable energy sources. Increased felling will require increased replacement of old growth with younger and more productive plantations. As a result, the amount of carbon in the atmosphere will fall down.

Cancellation of the 2006 Forest Code. The current illegal logging is a natural product of the existing Forest Code, based on the forest leasing. The anti-national, anti-state and counter productive forest leasing policy was imposed on Russia from abroad in the 90s. Its supreme idea was forest privatization by foreign capital. The modern technology will put end to the idea. It will prove

economic supremacy of the state over private forest property. The current Forest Code will remain in history as a bitter and instructive example of the betrayal of the country's national interests in the early 90s. Small and medium-sized tenants, teetering on the brink of bankruptcy, will cease to exist together with the the current Forest Code. The private forest tenants will evolve into modern, highly qualified and competitive forestry contractors. They will compete with each otherfor logging and forestry contracts and execute them with maximum efficiency and profitability. The profitability of the forestry business will increase without the temptation for illegal wood. State forestry enterprises and forest protection will be restored on a new quality level based on solid scientific and technical foundation. Their main purpose will be to regulate the forest contract market and verify the quality of forestry production. Qualifications of the state foresters will increase. The state forest enterprises (leshozes) will pass over the most production functions to the private sector. They will retain forest planning and control over the public forest land. Leshozedwill outsource themajority of production functions to competitive contractors. Blockchain will minimize paperwork and bureaucracy. Working for thestate forest enterprises (leshozes) will become a privilege. The prestige, respect and wages of the state foresters and private forest operators will increase over time.

Growth of quality of forestry in Russia. Blockchain technology is capable of completely nullifying illegal logging and leaving the notion in the past. Blockchain will also raise the quality forestry, forest management, conservation and protection. Today's huge losses from poor forest management are many times greater than that of the pirate timber trade. Unlike wood, which is transported over huge distances and processed into thousands of different products, the chain of forestry activities is concentrated in a single forest plot (in situ). Therefore, it is much easier, cheaper and effectively better tracked by the new blockchain technology. Blockchain is able to bring order to forestry and rise forest quality to the required level.

2.2. Disadvantages and dangers of the blockchain

The disadvantages of blockchain technology are mostly a continuation of its advantages, as well as a consequence of its novelty:

Lack of competence. Blockchain is a revolutionary technology, one of the main pillars of the incipient industrial revolution 4.0. It requires from the participants a significant increase in the culture of production. It demands new level of competencies and qualifications in education, legislation, technology, forestry policy, economics and management. The acquisition of these competencies will be a prerequisite for the market survival in the context of the ongoing Industrial Revolution 4.0.

Loss of traditional forestry jobs. Blockchain is one of the engines of the industrial revolution 4.0. The practice of past industrial revolutions shows their fundamental impact on the structure of employment and economy. The blockchain threatens to eliminate a large number oftraditional jobs in intermediary non-production structures - in banks, accounting offices, credit and international entities. At the same time, the number of Internet specialists and cryptologists will increase. Entire layers of specialties between producer and consumer will simply cease to exist. Many modern workers will require full or partial retraining.

Noveltyand frightening incomprehensibility. Blockchain is a new technology that was born in 2009. It is rapidly changing the image of the entire world. Cryptocurrency is the most popular application of the blockchain technology. Cryptocurrency has managed to gain popularity in the world financial markets and in the lives of millions of ordinary people. The forestry sector lags far behind finance and other sectors of the economy in the use of blockchain. But it has no lesser potential for the introduction of new technology.

Energy intensity. Data mining is extremely energy intensive and expensive. One bitcoin spends 200 kWh per transaction. It consumes 20,000 times more energy than a regular VISA transaction (0.01 kWh). This energy is enough for an average US household for a month. Today, the energy costs of the two most common cryptocurrencies –the Bitcoin and Ether - are equal to electricity consumption of the entire Austria. However, technologies are constantly improving. More advanced data processing

protocols are being introduced [10]. These measures reduce the energy consumption of the blockchain. The same thing happened when LEDs replaced traditional incandescent light bulbs.

Global warming. Currently, most of the electric energy is still produced from fossil fuels. The energy-intensive blockchain may be a factor of the global warming. In 2017, mining of cryptocurrencies released 69 million tons of carbon into the atmosphere - over 1% of all greenhouse gases (GHG) emissions. According to some forecasts, blockchain could cause a 2 °C rise oftheEarth atmosphere in 20 years. Scientists say that a 1.5°C increase in temperature on the Planet threatens irreversible consequences for the climate. The solution should be found in reducing the energy intensity of the blockchain and in the use of renewable energy sources.

Loss of blockchain data. The user may permanently lose data if she forgets or loses the access key to it.

Weak standardization. Blockchain is a very new technology. Therefore, it is often represented by numerous projects and startups that use different standards and protocols. The juridical courts have not yet developed a unified practice for resolving blockchain disputes. The situation is complicated in the international timber trade. Technology is changing and improving rapidly. This yet makes standardization premature. While it spreads, advances, and matures, blockchain will become a more standardized and unified digital technology.

Increasing competition. Competition in the forestry sector of the economy leads to a wide variety of blockchain platforms. Competition between the platforms is growing. Russian platforms compete with the Western and Chinese ones. The largest financial institutions in the United States and China together account for almost half of all blockchain implementations, 66% of blockchain investments and 89% of blockchain patents. In the face of growing competition, Russia is in danger of becoming an outsider in the implementation of blockchain technologies and a hostage of foreign standards and platforms [11].

Cryptocurrency cashing. International timber transactions are based on cryptocurrency. Different countries approach cryptocurrency regulation differently. Many timber trading partners of Russia prohibit the cryptocurrency miningon their territory ortheyhave not decided yet on their attitude. In these cases, the use of blockchain technology in the international trade becomes problematic.

Blockchain can be misused by criminals. Blockchain transactions are completely anonymous and therefore attract increased attention from criminals and terrorists. Blockchain can become a dangerous weapon in the hands of attackers. National security problems require close attention from the government.

3. Results and Discussion

The legal system in Russia is not yet fully prepared to serve blockchain technologies in the forest sector. Juridical practices must accumulate necessary experience and qualifications to service legal claims. Legislation should fill in the gaps. This takes time and money. As technology grows and becomes more sophisticated, laws and jurisprudence will improve.

Cryptocurrency is yet only one branch of the blockchain development, but the most popular one. Cryptocurrency can reduce the cost and optimize transactions with forest products, especially in foreign trade. On January 1, 2021, the law "On digital assets" (ODA) came into force in Russia. Cryptocurrency can be mined, bought and issued, but Russian citizens are prohibited from paying with it. A similar situation exists in many countries that are Russia's partners in timber trade. There is no doubt that these problems will be gradually addressed.

The new blockchain technology is facing technical, legal, economic, and energy problems. In some cases, this leads to rollbacks to traditional transactions. They may temporarily compromise the young and developing technology. Over time, these problems will be addressed as necessary experience is gained.

In the world, the volume of the market for distributed ledger technologies (which includes blockchain) in 2018 amounted to $ 2 billion. By 2024 it will increase to $ 23-54 billion. In Russia, the volume of this market in 2018 amounted to ₽2 billion. By 2021 it will increase up to ₽180-454 billion

($ 2.4-6 billion). This is only a tenth of the world market. For small and medium-sized forestry companies, the cost of entering and maintaining the blockchain amounts to several tens and hundreds of thousands of dollars, depending on the turnover. Businesses that cannot bear these costs may not be able to withstand competition and leave the market in the foreseeable future.

4. Conclusion

According to the Russian Federation Council, illegal timber in Russia may account for 16% of the wood harvest, which is a big challenge for the state government. The fight against illegal logging in the country is not effective. As a rule, it is carried out sporadically based on outdated technologies coming from the last century. Blockchain technology is an innovative achievement of the 21st century. It is capable of eliminatingthe illegal logging. It makes the forest market transparent, and illegal wood-impossible. The new technology is also a new paradigm for the silviculture and processing industry. It means that blockchain is suitable for the entire forest sector – from forest cultivation to harvesting, processing, selling and forest products consumption. Like any revolutionary technology, blockchain has its advantages and disadvantages.

Blockchain is an effective vaccine against the illegal logging pandemic. As with a conventional medical vaccine, extensive blockchain testing in the forestry sector is initially required. The testing should be followed by a large-scale and then mass vaccination of the Russian forest sector with the new "vaccine" against illegal timber trade.

References

[1]   FAO 2012 *The Russian Federation forest sector: outlook study to 2030* ed A P Petrov and M A Lobovikov (Rome, Italy) p 93

[2]   Resolution of the Federation Council of the Federal Assembly of the Russian Federation of January 30, 2019 N 17-SF "On strengthening control over timber turnover and countering its illegal harvesting" (https://docs.cntd.ru/document/566215279)

[3]   Kouhizadeh M and Sarkis J 2018 Blockchain practices, potentials, and perspectives in greening supply chains. *Sustainability* **10 (10)** p 3652

[4]   Figorilli S 2018 A blockchain implementation prototype for the electronic open source traceability of wood along the whole supply chain. *Sensors* **18 (9)** pp 1–12

[5]   Pwc 2016 *Industry 4.0: Building the digital enterprise*. 2nd edition 2016 Global Industry 4.0 (Survey, London, Great Britain) p 36

[6]   Nikolakis W, John L and Krishnan H 2018 How blockchain can shape sustainable global value chains: an evidence, verifiability and enforceability (EVE) framework. *Sustainability***10 (11)** p 3926

[7]   Krause M J and Tolaymat T 2018 Quantification of energy and carbon costs for mining cryptocurrencies *Nature Sustainability***1** pp 711-718

[8]   Timbercoin 2018 TimberCoin (TMB) ICO Details and information (https://www.cripto-valuta.net/en/icos/timbercoin)

[9]   Schwartz D 2016 *Revolutionising Forestry* (www.provenance.org/news/technology/blockchain-enabled-supplychain-transparency-can-help-retailers-suppliers-reducerisk)

[10]   Vilkov A and Tian Gang 2019. Blockchain as a solution to the problem of illegal timber trade between Russia and China. SWOT analysis*International Forestry Review* vol 21(3)

[11]   World Economic Forum, WEF 2017 In 2020 Bitcoin will consume more power than the world does today (https://www.weforum.org/agenda/2017/12/bitcoin-consume-more-power-than-world-2020)