European Commission

Science for Environment Policy

Blockchain technology could improve traceability of wood through the supply chain

13 June 2019
Issue 527
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Tracing products through the supply chain is a key feature for all businesses and industries; this is currently possible via automated identification systems that link a product to a database to track its progress, and through information-tracing ('infotracing') systems that keep accessible records of this progress. A study now introduces blockchain technology as a way to electronically trace timber as it travels from the forest to final product, using an infotracing system based on open source and Radio Frequency Identification (RFID) technology that retains records in a secure, decentralised, distributed ledger.

This kind of monitoring is important for timber products — the ability to trace wood from a standing tree all the way through to an end product, to verify its origin. Currently, specific markings are pressed into the surface of logs to verify their legality and origin, but technologies such as RFID could be valuable tools with which to optimise operations in terms of time, materials and cost.

There are two certification schemes for sustainable forest management in Europe: one developed by the Forest Stewardship Council (FSC), and one by the Programme for the Endorsement of Forest Certification (PEFC). Regulation prohibits the use and trade of products of illegal origin, and requires due diligence in tracing product flows and certifying the origin of wood products and derivatives placed on the European market.

RFID and blockchain technology could help with this, say the researchers, by offering real-time visibility into supply chains, and allowing producers to connect physical objects to their virtual counterparts. RFID uses tags containing electronically stored information, which may be 'read' without a visible barcode and from greater distances. Blockchain connects multiple time-stamped records — or 'blocks' — together using cryptography to form a linked, linear chain; these blocks cannot be altered retroactively, making such systems highly secure and resistant to manipulation. Each block is connected to the preceding block, validating the transactions, and distributes information throughout a network of users in the form of a decentralised ledger system.

The researchers simulated an entire forest-wood supply chain in the Calabria Region of southern Italy, from 10 standing chestnut trees to their final products, using a blockchain architecture to electronically trace the wood. They used open-source RFID technology in tandem with devices and tags related to the Internet of Things, a concept in which Internet connectivity is extended and embedded into various hardware (for example, 'smart home' devices such as 'smart' appliances).

The 10 trees were marked with RFID tags and cut to form 48 logs. These cut portions were again tagged and then stacked and transported to a sawmill to be processed, with the best-quality pieces tagged with QR codes. These were then formed into RFID- and QR-tagged products, and sold to consumers. Tags contained information such as key dates, location, species, log length, wood quality, and number of logs derived per parent tree. The honest and accurate transference of information from RFID tag to QR code relies on the manufacturer; this potential weakness within the traceability chain can be overcome by passing along the chain information on the number of QR codes generated with respect to the input log. The researchers note that all traceability systems are based on trust, starting with the initial information inserted into the chain.

Continued on next page.

Source: Figorilli, S., Antonucci, F., Costa, C., *et al.* (2018). A Blockchain Implementation Prototype for the Electronic Open Source Traceability of Wood along the Whole Supply Chain. *Sensors* 2018, 18, 3133.

Contact:
simone.figorilli@crea.gov.it

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Blockchain technology could improve traceability of wood through the supply chain *(continued)*

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The researchers used an open-source RFID prototype system and wireless communication for each part of the infotracing flow. RFID tags were read at each step of the supply chain and sent to a customised smartphone app via Bluetooth. Blockchain software was used to collect, analyse, synchronise and store blockchain records, with all systems connected together for optimum visibility and accessibility.

This presents the first implementation of blockchain technology to electronically trace wood from tree to final user. The researchers state that such an architecture offers the possibility of global, georeferenced, real-time monitoring, conducted by forestry administrators, on the status of operations. It could also help to precisely define areas of interest and desired quantities, sizes and species of wood for the European market, or identify — even down to a single tree — the presence of particularly valuable materials. The very nature of blockchain enables 'backwards inferences' to be made through the processing phase, to identify processes or inputs at individual steps of the chain, both backwards and forwards in time.

While blockchain offers a way to electronically track timber, it could be vulnerable to hacking when the smart contract with the relative software procedures are not properly designed. While the researchers say there is not yet a 100% secure log traceability system, they maintain that blockchain can strongly reduce fraud risk. The risk of logs being laundered as a result of the blockchain system was mitigated by integrating control properties, such as the dimension of the logs, within the study.

Such a transparent, immutable system would put strong pressure on illegal cutting, help industry to manage transactions efficiently, and could lead to economic sustainability[1] and, given that timber manufacturers have indicated a willingness to pay a premium of 2–3% for certified wood[2], even a price premium, the study concludes. Blockchain has significant potential for facilitating transparency, reliability, security, and traceability in every sector, say the researchers — potential that will grow with future research.

1.Sperandio, G., *et al.* (2017). Valutazione economica delle tecnologie RFID e open source per la tracciabilità del legno in Calabria, *Forest - Rivista di Selvicoltura ed Ecologia Forestale*, Italian Society of Silviculture and Forest Ecology. DOI: 10.3832/efor2267-014

2. Paletto, A., *et al.* (2017). Certificazione forestale in Calabria: attitudini, preferenze e disponibilità a pagare delle imprese di seconda trasformazione del legno, *Forest - Rivista di Selvicoltura ed Ecologia Forestale*, Italian Society of Silviculture and Forest Ecology. DOI: 10.3832/efor2174-014