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Blockchain and Traceability of Geographical Indication Products

1. Traceability system and geographical indication products

Traceability is a fundamental system of food safety and risk management. What is more, it plays a great role in certification and control processes in geographical indication (GI) products as it provides protection against counterfeits and products of poor quality. To meet these expectations, the traceability system must be efficient and have anti-tampering features. Systems that use blockchain technology are such systems.

Traceability is a process that makes it possible to follow all the steps products go through from creation to final disposal.¹ This is achieved by giving objects unique marks or tags which record data about and all movements of objects.² In other words, the term describes the ability to trace the various steps and locations of products through supply chains. The definition of traceability is included in the European Union (EU) General Food Law (2002),³ art. 3, 15, which describes it as the ability to trace and follow a food, feed, food-producing animal or substance intended or expected to be incorporated into a food or feed, through all stages of production, processing and

¹ https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjQuZKNjZyCAxU1FBAlHd7mBoQQFnoECCAQAQ&url=https%3A%2F%2Ftraining.colead.link%2Fpluginfile.php%2F4150%2Fmod_data%2Fcontent%2F30371%2Fcoleac001-pip-module-2-uk-pp.pdf&usg=AOvVaw2eRQ4jYNvxHtsUN0oVAn9x&opi=89978449 [accessed: 2023.10.29].

² R. Schuitemaker, X. Xu, *Product traceability in manufacturing: A technical review*, 53rd Conference on Manufacturing Systems, "Procedia CIRP" 2020, vol. 93, p. 700.

³ Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety (Document 02002R0178-20220701).

distribution.⁴ There is no doubt that traceability is an important system for controlling the risks which can affect food supply chains.⁵

The significance of traceability was underscored during the European beef crisis caused by bovine spongiform encephalopathy (BSE),⁶ commonly known as mad cow disease, in the 1990s. When it became clear that ingesting meat from cattle infected with BSE could transmit the disease to humans, beef consumption collapsed. During the crisis, the exact origin of BSE was unknown, but it was said to have originated in the United Kingdom.⁷ This crisis provided the impetus for work on European food law 178/2002, which came into force in Member States on 1 January 2005.⁸ The same situation occurred in the Canadian BSE crisis of 2003 where the lack of good traceability systems resulted in losses of CAD5.3 billion for Canadian beef producers by the end of 2004.⁹

Another example which shows the importance of good traceability systems is the outbreak of salmonella in the US in 2008.¹⁰ Initially, the public was warned against consuming tomatoes which were identified as the source by investigators from the Food and Drug Administration (FDA) and the Centers for Disease Control and Prevention. However, a month later, FDA investigators correctly identified the source of the salmonella outbreak as peppers from Mexico. This delay was caused by chaotic record-keeping among growers, distributors, wholesalers and retailers. The cost to tomato growers in Florida alone was estimated at about \$100 million.¹¹

Based on these examples, traceability systems clearly play a significant role in food safety. What is more, they are very useful instrument when it comes to GI products. Traceability systems can be used to guarantee product authenticity and provide credible information to consumers, which is incredibly important for the protection of products. The implementation of food traceability can also add value to niche products such as regional products.¹² GI is a sign or mark used on agricultural, manufactured and

⁴ “[S]tages of production, processing and distribution’ means any stage, including import, from and including the primary production of a food, up to and including its storage, transport, sale or supply to the final consumer and, where relevant, the importation, production, manufacture, storage, transport, distribution, sale and supply of feed” (art. 3, 16 of the EU General Food Law).

⁵ <https://www.precintia.com/en/blog/food-traceability-what-is-it-and-why-is-it-important/> [accessed: 2023.10.15].

⁶ Bovine spongiform encephalopathy – fatal neurodegenerative disease in cattle that causes a spongy degeneration of the brain and spinal cord (M. Didier, G. Day, *History of food traceability*, Boca Raton 2018, p. 15).

⁷ The United Kingdom was the most affected country with more than 179,000 infected cattle (*ibid.*).

⁸ *Ibid.*

⁹ S. Charlebois, B. Sterling, S. Haratifar, S.K. Naing, *Comparison of Global Food Traceability Regulations and Requirements*, “Comprehensive Reviews in Food Science and Food Safety” 2014, vol. 13, p. 1108.

¹⁰ More than 1,300 people across the country contracted the illness.

¹¹ https://www.washingtonpost.com/national-enterprise/traceability-rule-represents-major-adjustment-for-food-industry/2011/01/21/ABG0awD_story.html [accessed: 2023.10.16].

¹² https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjQuZKNjZyCAxU1FBAIHd7mBoQQFnoECCAQAQ&url=https%3A%2F%2Ftraining.colead.link%2Fpluginfile.php%2F4150%2Fmod_data%2Fcontent%2F30371%2Fcoleac001-pip-module-2-uk-pp.pdf&usq=AOvVaw2eRQ4jYNvxHtsUN0oVAn9x&opi=89978449 [accessed: 2023.10.29].

natural goods to protect and distinguish them from other products on the market.¹³ It is a distinctive sign used to identify products and the quality, reputation or other such characteristics of which stem from their geographical origin.¹⁴ The protection of products with GI provides producers with global recognition and consumers with information on original products from specific areas.¹⁵

GI plays a significant role in food protection while promoting high-quality foodstuffs and regional and traditional products.¹⁶ It is designed to support development in rural areas where such products are produced. What is more, GI creates interest in products among consumers, who very often make purchases relying on the guarantee of quality which is confirmed by geographical origin.¹⁷ Traceability plays a crucial role in certifications and control processes in GI. Today, consumers, the final link in supply chains, want to have complete information about the products they purchase, and they will pay higher prices for goods for which they can trace production stages and be sure of product origins. There is no better sales promotion than full information on product origin, ingredients or what it is made of. Thus, with GI products, traceability is not only linked to safety, it also provides producers with new tools to promote the authenticity of products, their origins and is additional protection against counterfeit products.¹⁸

There are two main models of traceability systems. Manual systems based on paper documents are used in companies or by producers where the number of documents is limited. The second model is computerised systems.¹⁹ The first type can include documents affixed to a product, e.g. labels. There is no doubt that computerised models of traceability are easier to manage as they reduce paper storage requirements and reaction times to create data reports.²⁰

The computerised traceability model, which is simply a data recording system, can be based on barcodes, QR-codes and radio frequency identification (RFID), which are usually tags for items, boxes or pallets.²¹ However, the risks of data tampering,

¹³ S. Bashir, *The Potential Geographical Indications in Pakistan*, "Journal of Social Sciences Review" January 2023, p. 335.

¹⁴ https://policy.trade.ec.europa.eu/enforcement-and-protection/protecting-eu-creations-inventions-and-designs/geographical-indications_en [accessed: 2023.10.17].

¹⁵ S. Bashir, *The Potential Geographical Indications...*, p. 335.

¹⁶ The examples of GI are: Truskawka kaszubska/kaszëbskô malëna (Kashubian strawberry – Poland), Scotch whisky (United Kingdom), Champagne (France), Parmigiano Reggiano (Italy), Banana de Corupá (Brazil), Chanderi sari (India).

¹⁷ I. Barańczyk, *Ochrona prawna oznaczeń geograficznych*, Warszawa 2008, p. 15.

¹⁸ O.-V. Zisis, *Do PDO and PGI Foodstuffs have value added to stakeholders?*, 2014, p. 45, <https://edepot.wur.nl/312731> [accessed: 2023.10.17].

¹⁹ <https://www.gov.mb.ca/agriculture/animal-health-and-welfare/traceability/food-processing/print,index.html> [accessed: 2023.10.17].

²⁰ https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwj5s_722v2BAxUc2wIHRTGD5UQFnQECDEQAQ&url=https%3A%2F%2Ftraining.colead.link%2Fpluginfile.php%2F4150%2Fmod_data%2Fcontent%2F30371%2Fcoleac001-pip-module-2-uk-pp.pdf&usg=AOvVaw2eRQ4jYNvxHtsUN0oVAn9x&opi=89978449 [accessed: 2023.10.17].

²¹ <https://www.uc.edu/content/dam/uc/ce/docs/OLLI/Page%20Content/PRODUCT%20IDENTIFICATION%20CODES%20BAR%20QR.pdf> [accessed: 2023.10.17].

transparency and information disclosure are rife in traditional traceability systems.²² This indicates that traceability systems can only be fully effective when they are it based on modern IP technologies,²³ of which blockchain is certainly one.

2. Using blockchain in the traceability of geographical indication products

Blockchain is a nearly ideal instrument to record and secure data exchanges because it is immutable.²⁴ Its data structure is designed to support applications of distributed digital ledgers where data are stored safely in chained blocks.²⁵ It facilitates storing data in chronological order, and there is no possibility of manipulating it afterwards.²⁶ Finally, blockchain is used as a instrument to tamper-proof large amounts of data generated by traceability systems.²⁷ It creates information trails while also ensuring security and data immutability.²⁸ All of these aspects make blockchain an instrument that allows greater confidence about the product provenance, authenticity and quality. Since GI is primarily based on the values of provenance, authenticity and quality, blockchain is a natural match for this.²⁹ Blockchain has already been used successfully in traceability systems for GI products, and examples include providers of Yangcheng Lake hairy crab who have cooperated with the Jingdong quality traceability anti-counterfeiting alliance and the Jingdong blockchain anti-counterfeiting traceability platform. Chinese Gannan navel oranges have also been given a unique anti-counterfeiting label through the use of blockchain.³⁰

²² <https://temera.it/en/applications/sourcing-traceability.html> [accessed: 2023.10.17].

²³ http://briansoft.home.pl/autoinstalator/wordpress/?page_id=2414&lang=en [accessed: 2023.10.15].

²⁴ S. Kríma, T. Hedberg, A. B. Feeney, *Securing the digital threat for smart manufacturing: A reference model for blockchain-based product data traceability*, US Department of Commerce, 2019, p. 8, https://tsapps.nist.gov/publication/get_pdf.cfm?pub_id=926019 [accessed: 2023.10.17].

²⁵ B.B. Zarpelão, S.B. Junior, A.T. Badaró, D.F. Barbin, *Food Authentication Traceability*, New York 2021. On the use of blockchain for agrifood traceability in: T. Bosona, G. Gebresenbet, *The Role of Blockchain Technology in Promoting Traceability Systems in Agri-Food Production and Supply Chains*, Sensors (Basel), 2023, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10255992/#B17-sensors-23-05342> [accessed: 2023.10.17].

²⁶ J.F. Galvez, J. Mejuto, J. Simal-Gandara, *Future challenges on the use of blockchain for food traceability analysis*, "TrAC Trends in Analytical Chemistry" October 2018, vol. 107, p. 222.

²⁷ R. Schuitemaker, X. Xu, *Product...*, p. 704.

²⁸ T.K. Agrawal, V. Kumar, R. Pal, L. Wang, Y. Chen, *Blockchain-based framework for supply chain traceability. A case example of textile and clothing industry*, "Computers and Industrial Engineering" April 2021, vol. 154, p. 1.

²⁹ S. Aronzon, *Blockchain and geographical indications: A natural fit?*, King's College London Law School Graduate Student Research Paper No. 2018/19-02, 2020, p. 2.

³⁰ S. Zhang, B. Du, *Tracing or not: How can the supplier of geographical indication products benefit from different traceability strategies?*, "Computers and Industrial Engineering" October 2023, vol. 184, <https://www.sciencedirect.com/science/article/abs/pii/S0360835223005405> [accessed: 2023.10.17].

The production of regional agricultural products generates a lot of data pertaining to production cycles and planting and information about soils, temperatures, humidity levels, storage, transport and purchase. Full-process data about production steps ensure the authenticity of GI agricultural products, and, by using blockchain technology, this information pertaining to all of the steps is recorded permanently and cannot be tampered with. If problems occur, for example with the quality or safety of products, it is easy to pinpoint the origin of the problems through the traceability information chain.³¹

Conclusions

In summation, blockchain can be used to create nearly perfect traceability models for GI products. Of course, companies that implement such product traceability systems will incur substantial costs;³² however, efficient traceability systems are worth it. Using blockchain technology can provide reliable traceability systems that reduce the generation of invalid information,³³ which is incredibly important when it comes to GI products. Consumers who purchase GI products want guarantees that they are getting genuine, and not counterfeit, products of the best quality that have properties provided by the producer, and, what is most important, originate from regions in which they must be produced. These properties and product quality can be verified through traceability systems and using blockchain technology is the only way to ensure that traceability systems are fully efficient.

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³¹ Y. Li, L. Yu, Z. Yin, *The Application and Prospects of Blockchain Technology in the Development of National Geographical Indication Agricultural Products*, Atlantis Press, 2023, p. 183, <https://www.atlantis-press.com/proceedings/ecit-23/125989050> [accessed: 2023.10.17].

³² S. Zhang, B. Du, *Tracing or not...*

³³ Y. Li, L. Yu, Z. Yin, *The Application and Prospects...*, p. 184.

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Summary

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Blockchain and Traceability of Geographical Indication Products

Traceability plays a significant role in food supply chains by ensuring food safety through piloting risks and quality. It helps to ensure that all production steps meet specification and quality requirements. It is also a very important tool for geographical indication products as it proves the authenticity of products, indicates their origin and, consequently, prevents counterfeiting. The system must be efficient and have anti-tampering features. Using blockchain technology can render these systems nearly perfect.

Keywords: geographical indication, traceability system, food safety, blockchain, new technology.

Streszczenie

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Blockchain i system identyfikowalności produktów chronionych oznaczeniami geograficznymi

System identyfikowalności produktów odgrywa znaczącą rolę w łańcuchu dostaw żywności, zapewniając bezpieczeństwo poprzez monitorowanie ryzyka i jakości żywności. System ten jest

gwarancją, że wszystkie etapy spełniają wymagania co do specyfikacji i jakości produktów. Identyfikowalność produktów ma również duże znaczenie dla produktów chronionych oznaczeniem geograficznym, gdyż potwierdza autentyczność tych produktów, wskazuje na ich pochodzenie, a co za tym idzie, zapobiega ich podrabianiu. Jednak system ten musi być wydajny i posiadać odpowiednie zabezpieczenia. Korzystanie z technologii blockchain w systemie identyfikowalności produktów może sprawić, że systemy te będą niemalże doskonałe.

Słowa kluczowe: oznaczenia geograficzne, system identyfikowalności produktów, bezpieczeństwo żywności, blockchain, nowe technologie.