Blockchain and Geographical Indications: A Natural Fit?

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ABSTRACT

Blockchain technology has garnered an enormous amount of excitement, particularly surrounding more recently developed blockchain platforms, smart contracts, and applications outside of cryptocurrency. One of the most successful applications to date is in food supply chains, which benefit from the features of blockchain that allow greater confidence in a good's provenance, authenticity, and quality. Blockchain technology is a natural fit for Geographical Indications (GIs), because GIs are grounded in the values of provenance, authenticity, and quality. As a result, it is worthwhile to take a critical look at how blockchain could be used in connection with GI foodstuffs, as well as the practical implications and hurdles to such an application. A broad look at the common legal requirements for protecting GIs in the United States and European Union demonstrates that blockchain would add little value to a GI seeking to establish protection initially, but has substantial potential to be beneficial in maintaining and enforcing GI rights. Combining blockchain technology with smart contracts and Internet of Things solutions will enhance those benefits. A blockchain application for GIs could also bring value for GIs by improving communication with consumers and facilitating the support of sustainability goals. There are criticisms of this type of application and challenges a successful application would face (both those stemming from blockchain generally and the nature of GI producers more specifically). To overcome these challenges, a blockchain application for GIs would need to incorporate a private, permissioned blockchain with a trusted intermediary. The trusted intermediary would serve as a central coordinating force for producers; the role could be filled by the producer groups, Monitoring Parties, or even WIPO for a broader solution.

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I. Introduction

Blockchain is a lightning rod—attracting both starry-eyed entrepreneurs and industry behemoths. Discovering the technology's transformative potential has become routine: Blockchain could "revolutionize the financial services industry,"[1] "revolutionize legal practice as we know it,"[2] "revolutionize the supply chain sector;"[3] and is "one of the most widely heralded technological breakthroughs [in] the fight against corruption;"[4] and even could be "the next disruptive leap forward in data sciences, on par with the advent of the Internet itself."[5] This excitement has gone mainstream; at the Cannes advertising festival there was a "blockchain yacht" and a "blockchain villa," and at Davos there was even a "blockchain lounge."[6]

While it is tempting to put all this down to unwarranted hype, significant resources have been invested in blockchain technology. McKinsey & Co. estimated that in a year's time venture funds invested more than $1.2 Billion in blockchain startups.[7] In the U.S., several states and municipalities are piloting blockchain applications,[8] and the EUIPO created a Blockchain Observatory and Forum to "accelerate blockchain innovation… and so help cement Europe's position as a global leader in this transformative new technology."[9] The International Data Corporation forecast that governments will have spent $2.1 Billion on blockchain in 2018.[10] Given this substantial investment, and despite the current backlash to the hype, it seems clear that blockchain technology will have a long life outside of cryptocurrency. [11]

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[1] Ronald J Colombo, 'Bitcoin: Hype or Harbinger?' (2016) 16 J Intl Bus & L 1, 3.
[2] Justin Evans, 'Curb Your Enthusiasm: The Real Implications of Blockchain in the Legal Industry' (2018) 11 Journal of Business, Entrepreneurship & the Law 273, 274.
[3] Kristoffer Just Petersen, 'Blockchain in Supply Chain: An Inevitability?' (2017) <https://medium.com/coinmonks/blockchain-in-supply-chain-an-inevitability-cd5afb9ab198>.
[4] Jesse Marks, 'Distributed Ledger Technologies and Corruption the Killer App' (2018) 20 Columbia Science and Technology Law Review 42, 44.
[5] Adam Sulkowski, 'Blockchain, Business Supply Chains, Sustainability, and Law: The Future of Governance, Legal Frameworks, and Lawyers' (2019) 43 Delaware Journal of Corporate Law 303, 305.
[6] Andrew Ross Sorkin, 'Demystifying the Blockchain' *New York Times* (27 June 2018).
[7] Marks (n 4) 49.
[8] Evans (n 2) 274.
[9] EUIPO, 'The European Union Blockchain Observatory and Forum: About' (*EUBlockchainForum.eu*) <https://www.eublockchainforum.eu/about> accessed 29 June 2019; European_Commission, 'Blockchain Factsheet' (*Digital Single Market*, 2019) <https://ec.europa.eu/digital-single-market/en/news/how-can-europe-benefit-blockchain-technologies>.
[10] Nathaniel Popper, 'What Is the Blockchain? Explaining the Tech Behind Cryptocurrencies' *The New York Times* (27 June 2018).
[11] Sulkowski (n 5) 310.

The big question is where will blockchain technology be put to use? A huge variety of applications have been proposed: from validating the origins of journalism,[12] registration and licensing of copyright rights,[13] to humanitarian uses.[14] This enthusiasm has been harshly characterized as "a solution in search of a problem,"[15] but the work to find successful applications has not slowed. One of the most longstanding and successful blockchain applications is supply chains, particularly food supply chains. Blockchain's ability to more efficiently and effectively trace goods, its near immutability, and its capacity to increase coordination amongst disparate parties are all touted as bringing greater transparency and assurance of a product's origin and quality.

A blockchain application for Geographical Indications ("GIs") is a logical extension from the application in food supply chains, because GIs are "signs used on products that have a specific geographical origin and possess qualities or a reputation that are due to that origin."[16] Blockchain's ability to shore up confidence in a product's provenance, authenticity, and quality is a natural fit for GIs given the values and purposes underlying their protection. However, as of yet, it appears no in-depth analysis of such an application has been published.

This dissertation undertakes such an analysis, and provides a critical look at how blockchain technology could be used in connection with GI foodstuffs, and the challenges to implementing such an application.[17] Section II provides blockchain's history and technological background. Section III describes recent developments including the growth of applications in food supply chains. Section IV explains how the features of blockchain technology that benefit supply chains are a natural fit for the values and purposes of GIs. Section V then analyzes the IP protection schemes for GIs in both the E.U. and U.S. to determine whether blockchain technology would be useful in establishing, maintaining, or enforcing a GI's rights. This

[12] Sasha Koren, 'Introducing the News Provenance Project' (New York, 23 July 2019) 1 <open.nytimes.com/introducing-the-news-provenance-project-723dbaf07c44>.
[13] Birgit Clark, 'Blockchain and IP Law: A Match Made in Crypto Heaven?' (*WIPO Magazine*, 2018) <https://www.wipo.int/wipo_magazine/en/2018/01/article_0005.html> accessed 2 March 2019; Marshall Taylor, 'The Advantages of Blockchain Beyond Speculation' (*Coincentral*, 2018) <https://coincentral.com/advantages-of-blockchain-beyond-speculation/> accessed 23 February 2019.
[14] Taylor (n 13).
[15] Sulkowski (n 5) 306.
[16] 'WIPO: Geographical Indications' (*WIPO Website*) <https://www.wipo.int/geo_indications/en/> accessed 2 March 2019.
[17] This dissertation will focus on GI foodstuffs; not wine, spirits or any other type of product for which GI protection is available. To the extent I refer to "GIs" generally, I refer only to GI foodstuffs.

includes an exploration of how smart contracts could aid in only bringing compliant products to market, as well as the hurdles posed by the "garbage-in, garbage-out" problem and questions of evidentiary admissibility. Section VI examines additional benefits that blockchain technology may bring to GIs, including benefits to communication with consumers and sustainability. Section VII provides an assessment of the practical implications of any blockchain application for GIs, how a successful application may be undermined, and proposed solutions. Finally, Section VIII concludes.

II. Blockchain Technology

Blockchain has been described as a "spreadsheet in the sky,"[18] but in reality, it is a complex and customizable electronic ledger platform. Blockchain was brought to prominence in 2008 with the introduction of Bitcoin.[19] Satoshi Nakamoto, the pseudonymous creator of Bitcoin, sought to create a new model for online payments after the global financial crisis which did not require middlemen, financial institutions.[20] The concept was to replace human trust with cryptographic proof.[21] Blockchain technology, as put to use for Bitcoin, was a public and permissionless platform—meaning anyone could view transactions on the ledger and anyone could participate as a user.[22] The Bitcoin-style blockchain technology was "distributed" and so owned and maintained by all participants, not one central party (like a bank).[23] While there has been inconsistency and some ambiguity about the precise meaning of the term "blockchain," Jean Bacon and her co-authors have helpfully explained blockchain technology and its applications for non-experts.[24] As described by Bacon, blockchain refers to "a specific type of database that uses certain cryptographic functions to achieve the requirements of data integrity and identity authentication" and "aims to create a persistent, tamper-evident record of recent

[18] Ruth Burstall and Birgit Clark, 'Blockchain, IP and the Fashion Industry | Managing Intellectual Property' [2017] *Managing Intellectual Property* <http://www.managingip.com/Article/3667444/Blockchain-IP-and-the-fashion-industry.html> accessed 23 February 2019.
[19] Satoshi Nakamoto, 'Bitcoin: A Peer-to-Peer Electronic Cash System' (2008) <https://bitcoin.org/bitcoin.pdf>; Marks (n 4) 45.
[20] Marks (n 4) 46; Jean Bacon and others, 'Blockchain Demystified: A Technical and Legal Introduction to Distributed and Centralized Ledgers' (2018) 25 Richmond Journal of Law Technology 1, 28.
[21] Nakamoto (n 19) 1; Marks (n 4) 46.
[22] Bacon and others (n 20) 7.
[23] Marks (n 4) 47.
[24] See generally Bacon and others (n 20).

transactions."[25] Bacon provides an excellent explanation of the complicated technology that underlies a blockchain,[26] but this dissertation will not go into that level of technological detail. However, a brief background of how blockchain technology operates in the Bitcoin context is necessary to understand its key features; it will allow a better understand of more recent developments in the technology and criticisms of blockchain applications outside cryptocurrency.

a. Data Integrity

The function of a blockchain is to record a series of transactions by grouping individual transaction records into "blocks" and "chaining" blocks together using a process called "hashing."[27] This process preserves the integrity of the transaction records, the order of the transactions, and makes any attempt to tamper with the records obvious to all who use it.[28] The blocks contain not only transaction records, but also certain metadata such as timestamps.[29] This structure gives the users confidence that they have a tamper-evident and near-immutable ledger of transactions.[30]

b. Digital Signature

Blockchain also incorporates a digital signature system for when a user wants to propose a new transaction for the ledger, made up of a pair of private and public keys.[31] This prevents a bad actor from posing as another party and proposing a new transaction (for example: the bad actor sending someone else's Bitcoins to an address the bad actor controls).[32] The private key is how a user accesses the blockchain platform and "signs" a transaction to show it was that user's transaction.[33] The public key is published to the blockchain to outwardly represent the user who

[25] ibid 9.
[26] Bacon and others (n 20). Marks also provides helpful explanation of the technology. Marks (n 4).
[27] Bacon and others (n 20) 9–10.
[28] ibid 9.
[29] ibid 12.
[30] Notably, tamper-*evident* is not the same as tamper-*proof* or fully immutable, because if 51% of the computing power of a blockchain decide to take control and tamper with the blocks, that would be possible (though unlikely). ibid 26.
[31] ibid 14–15; Marks (n 4) 49; Kevin T McCarthy, 'Unanswered Legal Issues: Blockchain "Smart Contracts"' (2018) 60 DRI for the Defense 1, 2.
[32] Bacon and others (n 20) 14–15.
[33] ibid 15; Marks (n 4) 49.

holds the private key.[34] To "sign" a transaction, a user encrypts the transaction record with their private key (establishing that the transaction originated with that user) and for the transaction to be recorded, the other users need to accept the transaction with the public key that was published.[35] Because the "two keys are mathematically linked," if the wrong public key was published or the transaction was not digitally signed by the correct private key, the transaction will be rejected.[36] Therefore, no one can propose a transaction without a private key, and users have their identity verified and recorded within the transaction on the block. [37]

c. Distributed Ledger

Blockchain technology is a distributed (or decentralized) electronic ledger; there is no one master copy, various users each store a copy of the chain. [38] This distributed nature means blockchain is less likely to be tampered with by a centralized party or overtaken by a bad actor, but the way blockchain accomplishes this is complex.

The Bitcoin-style blockchain is entirely decentralized and trustless: anyone can become a user by running software to generate private and public keys and propose transactions. Similarly, any user can become a "node" on the users' peer-to-peer network and store a copy of the blockchain if they have sufficient bandwidth and storage space.[39] This is the "distributed" nature of the ledger. However, because it is distributed, a crucial part of blockchain's technology must be ensuring that each node holds a consistent and updated copy of the blockchain.[40] This is called "achieving consensus" and a complicated software solution has been created to accomplish it (a "consensus protocol"). When a user broadcasts its proposal to add a new transaction to the blockchain, a "miner" assembles it with other transactions into a block and "broadcasts" the block to nodes on the network.[41] Because in a permissionless blockchain anyone can become a miner, the system creates a cost for mining new blocks to safeguard

[34] Bacon and others (n 20) 14–15.
[35] ibid 15; McCarthy, 'Unanswered Legal Issues: Blockchain "Smart Contracts"' (n 32) 2.
[36] McCarthy, 'Unanswered Legal Issues: Blockchain "Smart Contracts"' (n 32) 2.
[37] Bacon and others (n 20) 15; Marks (n 4) 49; McCarthy, 'Unanswered Legal Issues: Blockchain "Smart Contracts"' (n 32) 2.
[38] Blockchain *can* be one species of a DLT, but, as will be discussed later, newer blockchain technologies are often not distributed, and so not a DLT. Bacon and others (n 20) 6.
[39] Bacon and others (n 20) 19.
[40] Popper (n 10).
[41] Bacon and others (n 20) 20; Marks (n 4) 47.

against bad actors (who could otherwise create fraudulent blocks and take over the system).[42] The cost of mining is called "proof of work" (the "consensus mechanism") and is a very difficult computational puzzle which requires miners to invest significant computing power and technology to solve.[43] There must be "proof of work" for a node to accept a miner's new block.[44] When a node receives a new block from the miner, it checks whether the proof of work is valid, and if it is, inserts it in the local copy and also "broadcasts" it to the other nodes.[45] Miners are compensated for this with transaction fees or newly minted coins.[46] This distributed process makes it extremely difficult for any single entity to take control of the blockchain and change the data within it, and so nearly immutable.[47]

III. Blockchain Developments

More recent developments have focused on adjusting the features of blockchain to accommodate different kinds of information and operate in different applications.[48]

a. Smart Contracts

One major advancement in blockchain technology has been the ability of platforms to support smart contracts.[49] A smart contract is a set of software instructions that automatically performs a user's obligations in an "if-then" manner.[50] A user's entry on the ledger triggers a smart contract, which executes code, and both the fact of the smart contract being triggered and the output code are included in the block on the chain (and the nodes all execute and verify the smart contract as part of the block's validation).[51] As McCarthy helpfully described,

> [S]ay that Company A agrees to purchase 500 widgets from Company B. The parties then translate this agreement into blockchain coding. The block of coding states, "if Company B delivers 500 widgets to Company A by December 1, 2017,

[42] Marks (n 4) 48; Bacon and others (n 20) 23.
[43] Bacon and others (n 20) 23–25; Marks (n 4) 48. The mining process uses a huge amount of energy, it is estimated that the yearly energy consumption of bitcoin mining is similar to the yearly energy consumption of 200,000 to 1.2 Million E.U. households. Bacon and others (n 20) 25–26.
[44] Bacon and others (n 20) 23–24.
[45] ibid 20.
[46] ibid 20–21.
[47] ibid 26–27; Marks (n 4) 53.
[48] Popper (n 10).
[49] Importantly, the phrase "smart contract" has no bearing on whether these software executions are legally valid contracts. Evans (n 2) 282; McCarthy, 'Unanswered Legal Issues: Blockchain "Smart Contracts"' (n 32) 3.
[50] Bacon and others (n 20) 46; McCarthy, 'Unanswered Legal Issues: Blockchain "Smart Contracts"' (n 32) 2.
[51] Bacon and others (n 20) 48.

> at 5:00 PM ESD, then Company A delivers $10,000 USD to Company B." The blockchain can then be linked to sources known as "oracles." An oracle is an outside source that provides information to the blockchain smart contract…. In our hypothetical smart contract… the oracles would be Company A's computerized delivery database and the two companies' bank accounts. Once Company B's delivery of 500 widgets is confirmed in Company A's system, the blockchain will automatically trigger Company A's bank account to transfer $10,000 to Company B's bank account without any required action by the parties or any verification by a third-party clearinghouse.

Smart contracts can be used to automate series of transactions, such as the complicated verifications necessary as goods travel through an international supply chain.[52]

b. Private and Permissioned Blockchains

Blockchain technology development has moved to "private" (or "closed") and "permissioned" blockchains to address several challenges that blockchain applications outside of cryptocurrency face:[53] First, to apply blockchain outside of cryptocurrency developers must create a suitable consensus protocol that does not rely on proof of work and currency rewards.[54] Second, a consensus protocol that uses proof of work and mining is extremely costly, limiting how much data can be processed.[55] And finally, many private companies may not be comfortable with data on a blockchain being accessible to any user. A private and/or permissioned blockchain can address these challenges. A private blockchain replaces the network of decentralized open nodes and miners with a "trusted intermediary" or small number of trusted nodes.[56] A trusted intermediary would store copies of the blockchain and determine which blocks to add (taking the place of miners and nodes); this obviates the need for a costly consensus protocol.[57] A small number of trusted nodes would have similar advantages, scaling down the costs and process times.[58] Further, the platform could be permissioned, customizing which users are given access for different activities.[59] A platform could could be made entirely

[52] ibid 46.
[53] Nikhil (UCL Centre for Blockchain Technologies) Vadgama, 'Distributed Ledger Technology in the Supply Chain' (2019) 8 <http://blockchain.cs.ucl.ac.uk/wp-content/uploads/2019/08/DLT-in-the-Supply-Chain_UCL-CBT.pdf>.
[54] Popper (n 10).
[55] Bacon and others (n 20) 24–26; Popper (n 10).
[56] ibid 29; Marks (n 4) 56.
[57] Bacon and others (n 20) 29.
[58] ibid; Marks (n 4) 56.
[59] Bacon and others (n 20) 29–30; Burstall and Clark (n 18).

private, or choose to prioritize transparency and allow any user to view the blockchain but only permissioned users could propose transactions.[60]

There is substantial debate, however, whether such private, permissioned blockchains are worthwhile investments over traditional databases. Bacon posits that a private and permissioned blockchain could improve transparency and data integrity over traditional databases.[61] In contrast, a significant number of others argue that *complete* distribution is at the heart of blockchain technology, and removing that guts its very purpose.[62] The purpose of the Bitcoin-style blockchain was to remove intermediaries because there was no trust in the financial industry after the 2008 market collapse.[63] Blockchains that reintroduce intermediaries have been criticized as over-complicated and unnecessary solutions because traditional centralized databases would suffice.[64] Critics have also raised public interest concerns, arguing the libertarian ideals of blockchain have now been corrupted by large corporations like Facebook promulgating "fake" blockchains, which do nothing to help the public.[65]

c. Food Supply Chain Applications

One of the most longstanding and successful applications of blockchain has been to increase transparency and track goods in supply chains.[66] The food and agricultural industries are particularly suited to the advantages of blockchain. Supply chains involve frequent transactions as products flow to market, so a complete and accurate record of those transactions is important.[67] Trust in the food industry is severely lacking; for both consumers and companies

[60] Bacon and others (n 20) 30–31.
[61] ibid 29.
[62] Burstall and Clark (n 18).
[63] Marks (n 4) 46; Bacon and others (n 20) 28; Laurence Dodds, 'Inside the World's Biggest Bitcoin Conference, Where Facebook Is Enemy Number One' *The Telegraph* (San Francisco, 27 June 2019); Angel Versetti, 'EUIPO Blockchain Observatory Forum', *February 19, 2019 EUIPO Blockchain Conference*.
[64] Sorkin (n 6); Dodds (n 64).
[65] Dodds (n 64).
[66] Emily R Lyons, 'What Blockchain Means for the Agriculture and Food Industries' (*Michael Best & Friedrich LLP*, 2018) <https://www.michaelbest.com/Newsroom/192905/What-Blockchain-Means-for-the-Agriculture-and-Food-Industries> accessed 23 February 2019; Marks (n 4); Clark (n 13); Bitcoin Exchange Guide News Team, 'Blockchain for the Food Industry: Manufacturers and Retailers' Dream for Tracking Transparency?' (*Bitcoin Exchange Guide*, 2018) <https://bitcoinexchangeguide.com/blockchain-for-the-food-industry-manufacturers-and-retailers-dream-for-tracking-transparency/> accessed 2 March 2019; EU Blockchain Observatory & Forum, 'May Newsletter' (*EU Blockchain Observatory and Forum*, 2019) <https://www.eublockchainforum.eu/news/may-newsletter-eu-blockchain-observatory-forum> accessed 12 August 2019; Vadgama (n 53) 7.
[67] Marks (n 4) 51.

the provenance, quality, and safety of food is of enormous significance.[68] Blockchain is seen as especially advantageous in quickly tracking goods that need to be recalled to ensure food safety.[69] A Walmart executive concerned with the safety and authenticity of Walmart's grocery products called blockchain possible "holy grail" for its ability to allow efficient consensus on the current state of transactions and its near immutability.[70] IBM's Food Trust blockchain platform (a permissioned platform with a series of trusted nodes) has been piloted by Walmart and other grocery companies to gain efficiencies and better ensure food safety,[71] and Walmart has implemented it to trace all lettuces.[72] Walmart estimated for its product in China that blockchain reduced the time to trace mangos from farm to store from weeks to seconds.[73] Auchan has similarly piloted TE-Food's FoodChain blockchain platform (a permissioned blockchain which can be made private) to track its food supply in five countries by "register[ing] a product's information at each point in the distribution process."[74]

While these are only selected examples of blockchain applications in food supply chains, they demonstrate that blockchain is being implemented to build confidence in a product's provenance, authenticity, and production standards.

IV. Geographical Indications and Blockchain Are a Natural Fit

The benchmark definition for GIs comes from the TRIPS Agreement, which defines them as "indications which identify a good as originating in the territory of a Member, or a region or locality in that territory, where a given quality, reputation or other characteristic of the good is

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[68] Tim Rosenberg and Jose Souto, 'Panel Discussion by Tim Rosenberg (COO Great British Chefs) and Jose Souto (Chief Lecturer in Culinary Arts, Westminster Kingsway College)', *April 1, 2019 Brand Dialogue Workshop: The Value of GI Brands and Brexit* (2019); Lyons (n 67); Jean-Paul Oury, 'Blockchain: A Strong Link to Rebuild Confidence in the Agriculture of the Future?' (*European Scientist*, 2018) <https://www.europeanscientist.com/en/editors-corner/blockchain-a-strong-link-to-rebuild-confidence-in-the-agriculture-of-the-future/> accessed 2 March 2019; Bitcoin Exchange Guide News Team (n 67); Sulkowski (n 5) 311.

[69] Samantha Radocchia, '3 Innovative Ways Blockchain Will Build Trust In The Food Industry' (*Forbes*, 2018) <https://www.forbes.com/sites/samantharadocchia/2018/04/26/3-innovative-ways-blockchain-will-build-trust-in-the-food-industry/#3a48e01c2afc> accessed 2 March 2019; Coinify, 'Blockchain Technology May Be the Future of the Food Industry' (*Coinify.com*, 2018) <https://coinify.com/news/blockchain-technology-food-industry/> accessed 2 March 2019.

[70] Marks (n 4) 80.

[71] IBM, 'About IBM Food Trust' (*IBM Website*, 2018) <www.ibm.com/food>.

[72] Michael Corkery and Nathaniel Popper, 'From Farm to Blockchain: Walmart Tracks Its Lettuce' *The New York Times* (24 September 2018).

[73] Radocchia (n 70).

[74] Bitcoin Exchange Guide News Team (n 67); 'Introduction of TE-FOOD's Technology - TE-FOOD - Medium' <https://medium.com/te-food/introduction-of-te-foods-technology-732cdd90bb16> accessed 24 August 2019.

essentially attributable to its geographical origin."[75] The E.U. and U.S. systems differ, but each protects GIs as IP and provide protection to align with the TRIPS definition and protections for GIs.[76] Well-known examples of protected GIs are Darjeeling Tea, Idaho Potatoes, and Prosciutto di Parma.

a. Blockchain's Features Are a Natural Fit for Geographical Indications Given the Values and Purposes Underlying their Protection

The features of blockchain technology most useful in food supply chains are its near immutability, seamless coordination amongst disparate parties, and more efficient and effective goods tracing.[77] Blockchain's structure and capacity for users to digitally "sign" transactions can be used to more seamlessly coordinate the many parties of a supply chain and record certifications as the goods are transferred, eliminating the paperwork nightmare that has plagued many supply chains.[78] Blockchain technology's near immutability ensures that records remain unchanged, and the structure of the chained blocks allows quick traceability such as the kind being touted by Walmart. These features have been put to use by supply chains to increase confidence in the provenance, authenticity, and quality of their goods.[79]

GIs, by their nature, highly value provenance, authenticity, and certification of quality standards. The U.S. and E.U. authorities have reflected this: The USPTO describes GIs as source-identifiers and guarantees of quality[80] and the 2012 E.U. Regulation's recitals remark on the consumer demand for quality products with identifiable characteristics linked to geographic origin.[81] The 2012 E.U. Regulation also counsels that "the added value of the [GI] is based on consumer trust" and is "only credible if accompanied by effective verification and controls."[82] Academics support the essential nature of these values as well, finding that "trust and authenticity are implicit in GIs" and the benefits of GIs include "assurance of qualities or

[75] Agreement on Trade--Related Aspects of Intellectual Property Rights 1994 s 3, art 22.
[76] Regulation (EU) No 1151/2012 of 21 November 2012 on quality schemes for agricultural products and foodstuffs [2012] OJ 341/1 recital 22; USPTO, 'Geographical Indication Protection in the United States' (*USPTO Website*) 1 <https://www.uspto.gov/sites/default/files/web/offices/dcom/olia/globalip/pdf/gi_system.pdf>.
[77] Vadgama (n 53) 14–15.
[78] ibid 7.
[79] IBM (n 72); Fabian Sander, Janjaap Semeijn and Dominik Mahr, 'The Acceptance of Blockchain Technology in Meat Traceability and Transparency' (2018) 120 British Food Journal 2066; Vadgama (n 53) 43.
[80] USPTO (n 77) 1.
[81] Regulation (EU) No 1151/2012 of 21 November 2012 on quality schemes for agricultural products and foodstuffs [2012] OJ 341/1 recital 2.
[82] ibid recital 46.

characteristics and authenticity" and "traceability."[83] Blakeney explains origin-based marketing is highly relevant today as a reaction against globalization, and that it gives local producers a way to distinguish their products.[84] Recognizing the significance of these values seems universal: at this year's Brand Dialogue Workshop on The Value of GI Brands, representatives from producer groups, WIPO, and the culinary arts almost unanimously touched on the importance to GI brands of provenance, authenticity, and assuring quality.[85]

GIs are grounded in the values of provenance, authenticity and quality. Supply chains have been implementing blockchain to build confidence in the provenance, authenticity and quality of their goods. So, the same features of blockchain that can shore up confidence in supply chains, are a natural fit for GIs.

b. A Potential Blockchain Application for Geographical Indications Has Been Raised

This natural fit between GIs and blockchain has been noted by some bloggers[86] and commentators.[87] They focus on blockchain's ability to shore up provenance and build authenticity in the eyes of the consuming public. Burstall and Clarke, in an exploration of blockchain applications in fashion and IP-reliant industries, raise the idea of blockchain being useful for certification trademarks.[88] GI foodstuffs are not directly discussed, but they note that private blockchains are "ideally suited" for certification marks, with "the added bonus that fake certificates could almost immediately be identified as such."[89] Others have explored the role blockchain could play in ensuring geographic origin and compliance with production standards

[83] Daniele Giovanucci and others, 'Guide To Geographical Indications Linking Products and Their Origins' 3, 21 <http://www.origin-gi.com/images/stories/PDFs/English/E-Library/geographical_indications.pdf>.
[84] Michael Blakeney, *The Protection of Geographical Indications* (Edward Elgar Publishing 2014) 74 <http://www.elgaronline.com/view/9781782546719.xml> accessed 4 March 2019.
[85] 'April 1, 2019 Brand Dialogue Workshop: The Value of GI Brands and Brexit' (2019).
[86] Nigel Barron, 'Artisans on the Blockchain | Nigel Barron' (*www.nigelbarron.net*, 2018) <http://www.nigelbarron.net/artisans-on-the-blockchain/> accessed 2 March 2019; The Food Cons, 'BLOCKCHAIN, ETHEREUM AND SMART CONTRACTS... 3 SUSPECTS FOR A NEW FOOD REVOLUTION' (*The Food Cons Blog*, 2018) <https://www.thefoodcons.com/blog/blockchain-ethereum-and-smart-contracts-3-suspects-for-a-new-food-revolution> accessed 2 March 2019.
[87] Burstall and Clark (n 18); David Lizerbram & Associates, 'Trademarks and the Blockchain' (*Keep It Legal Blog*, 2018) <https://lizerbramlaw.com/2018/06/29/trademarks-and-the-blockchain/> accessed 23 February 2019; Oury (n 69).
[88] Burstall and Clark (n 18).
[89] ibid.

of certification marks.[90] Oury focused using blockchain to build confidence in the agricultural industry, and noted that with the high awareness around quality labels such as PDO, PGI, organic, fair trade etc. that "[w]e can perfectly well imagine then, that these blockchain solutions could play an important role… with regard to the certification of origin of production."[91] To my knowledge, though, an in-depth analysis of the legal and practical impacts of applying blockchain technology to GI foodstuffs has not been undertaken.

This dissertation will attempt to undertake such an analysis, and examine whether a permissioned, private blockchain platform could be useful for GIs in establishing, maintaining, and enforcing GIs IP rights. This includes an assessment of potential benefits to GIs outside the IP protection framework and the practical implications of a GI blockchain application.

V. Applying Blockchain to Support Geographical Indications' Rights

While the systems differ, both the U.S. and E.U.'s protection scheme for GIs implicate the values of provenance, authenticity, and quality—and therefore producer groups and rights holders may benefit from a blockchain application. To assess whether an application would actually be helpful in supporting GI's rights, I look to three touchpoints in the life of a legally registered GI: establishing protection, maintaining protection, and enforcement. After a brief background of the E.U. and U.S. GI protection schemes, for each touchpoint I will review the common legal requirements for protection and analyze whether a blockchain application would be beneficial.

a. Background of E.U. and U.S. GI Protection Schemes

The E.U. and U.S. represent the two major models of GI protection schemes that exist globally, and therefore serve as good examples for our analysis.[92] The E.U. and U.S. systems differ in precisely how to protect GIs, but there are commonalities in their requirements and both reflect the values of provenance, authenticity, and quality.[93]

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[90] Clark (n 13); Susan Kayser and Anna Raimer, 'BLOCKCHAIN CAN CHANGE EVERYTHING Even Trademark Transactions' (2018) 11 Landslide 26 <https://www.americanbar.org/groups/intellectual_property_law/publications/landslide/2018-19/september-october/blockchain-can-change-everything/>.

[91] Oury (n 69).

[92] Giovanucci and others (n 84) 49.

[93] This dissertation makes no attempt to detail *all* requirements for GI protection in the US and EU, instead it focuses on key commonalities.

The E.U. has a *sui generis* system of protection for GIs, primarily provided for under the E.U. 2012 Regulation.[94] The system allows producers to apply for protection of product names which represent an "intrinsic link" between the product's characteristics and its geographic origins.[95] There are two primary categories of protection for foodstuffs, the PDO and PGI.[96] A PDO is a name which identifies a product originating in a specific geographic area whose quality or characteristics "are essentially or exclusively due to" that area; all production steps must take place in the defined geographic area.[97] A PGI is a name which identifies a product originating in a specific geographic area whose "quality, reputation, or other characteristic is essentially attributable to" that area and at least one production step takes place there.[98] The applications for protection[99] are made by producer groups, who must include standards that the product must meet (the "specification"); the specification is most often created by the producer group or managing consortium within the product's code of practice, which itself must comply with any legal guidelines and the definitions for PDO or PGI.[100]

The U.S. provides GI protection within its trademark scheme— primarily through collective and certification marks.[101] The most common means to protect GIs are certification marks,[102] which are often understood to be the closest equivalents to E.U.-style GI protection.[103] Certification marks can be "any word, name, symbol, or device… used… to certify regional or other origin, material, mode of manufacture, quality, accuracy, or other characteristics of such

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[94] Regulation (EU) No 1151/2012 of 21 November 2012 on quality schemes for agricultural products and foodstuffs [2012] OJ 341/1. Member states within the EU may also have other systems of protection, for example the UK has schemes for certification and collective trademarks.
[95] ibid Recital 17; David Keeling and others, 'Chapter 13 Geographical Indications and Appellations of Origin', *Kerly's Law of Trade Marks and Trade NAmes* (16th edn, Sweet & Maxwell 2019) ss 13–007, 13–010.
[96] Giovanucci and others (n 84) 59. There is also separate protection for Traditional Specialties Guaranteed, but that category is not relevant to this dissertation's analysis.
[97] Regulation (EU) No 1151/2012 of 21 November 2012 on quality schemes for agricultural products and foodstuffs [2012] OJ 341/1 art 5.
[98] ibid Article 5.
[99] The process and general requirements for establishing and maintaining protection for a PDO and PGI are the same, and so I consider them together.
[100] Giovanucci and others (n 84) xi–xii, 62, 80; Regulation (EU) No 1151/2012 of 21 November 2012 on quality schemes for agricultural products and foodstuffs [2012] OJ 341/1 rectial 57.
[101] USPTO (n 77); 'USPTO Trademark Manual of Examining Procedure: Section 1306, Certification Marks' (2018) <https://tmep.uspto.gov/RDMS/TMEP/current#/current/TMEP-1300d1e585.html>; Thomas McCarthy, '3 McCarthy on Trademarks and Unfair Competition § 19:90-102', *McCarthy on Trademarks and Unfair Competition* (5th edn, Thomson Reuters 2018).
[102] Giovanucci and others (n 84) 66.
[103] Thomas McCarthy, '2 McCarthy on Trademarks and Unfair Competition § 14', *McCarthy on Trademarks and Unfair Competition* (5th edn, Thomson Reuters 2018) s 14:1.50; Giovanucci and others (n 84) 57.

person's goods or services…."[104] Two types of certification mark are relevant to GIs: [105] those that certify (1) that "authorized users' goods or services originate in a specific geographic region," and (2) that "authorized users' goods or services meet certain standards in relation to quality, materials, or mode of manufacture."[106] In contrast to the E.U., the holder of a certification mark cannot produce or market goods itself;[107] because "[a] judge should not also be a contestant."[108] The standards with which the goods must comply and relevant geographic region are decided by the certifier, and must be filed with the application for a certification mark. However, the standards do not have to have been originally created by the certifier, they can have been previously established by another party (such as a government agency or private research organization).[109]

b. Could Blockchain Be Useful in Establishing GI Protection?

i. Legal Requirements

Applications to protect a GI in the U.S. and E.U. both require an identification of the product, submission of the specification or standards, designation of the relevant geographic area, and a certain level of recognition by the public that the product is linked to the geographic area.[110]

The E.U. requires that the specification provided in the application include, amongst other things: a defined geographic area, evidence that the product originates in the geographic area, and the method of obtaining the product.[111] The application must also include details establishing the link between the applicable quality, reputation, or characteristic of a product and the geography, including as appropriate the "specific elements of the product description or production method justifying this link."[112] Similar to the U.S. certification mark which can be

[104] Lanham Act § 45, 15 U.S.C. § 1127.
[105] There are a wide variety of product names that can be protected by certification marks, but in this dissertation we will focus only on how certification marks apply to GIs.
[106] 'USPTO Trademark Manual of Examining Procedure: Section 1306, Certification Marks' (n 103).
[107] ibid.
[108] McCarthy, '3 McCarthy on Trademarks and Unfair Competition § 19:90-102' (n 103) s 19:92.
[109] 'USPTO Trademark Manual of Examining Procedure: Section 1306, Certification Marks' (n 103).
[110] Giovanucci and others (n 84) 17, 23, 66.
[111] Regulation (EU) No 1151/2012 of 21 November 2012 on quality schemes for agricultural products and foodstuffs [2012] OJ 341/1 s art 7.
[112] ibid art 7, 8.

cancelled if the holder refuses to certify the goods of a producer who meets the standards, [113] in the E.U. any operator marketing a product conforming to the specification can use the PDO or PGI name.[114]

U.S. registration requirements are comparatively less difficult to meet because the linkage required between the origin of the good and its quality (or other characteristics) is much looser, and there is more freedom to create the GI's standards.[115] Part of the application requirements are a filing basis, a statement of what will be certified, a definition of the geographic region, a copy of the certification standards, and an affidavit of use including a statement that "the application is exercising legitimate control over the use of the certification mark in commerce."[116] The USPTO has said the "issue in determining whether a designation is registrable as a regional certification mark is whether the public understands that goods bearing the mark come only from the region named in the mark" not whether the consumer is aware of the certification function of the mark.[117]

ii. A Blockchain Application Would Add Little Value

A blockchain application would likely add little value to the process of establishing protection for GIs. The features of blockchain technology most helpful in supply chains (and therefore likely to be most helpful in any GI application) are blockchain's near-immutability, more efficient and enhanced traceability, and better coordination amongst parties. The requirements for establishing protection for GIs do not implicate these features in any substantial way. This is clear when we examine the two most difficult aspects of obtaining protection in the E.U., the strictest protection regime: establishing the necessary link to geography and defining the geographic region.

In the E.U., perhaps the most demanding part of a GI application is establishing the link between the geography and the quality, reputation, or other characteristics of the product.

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[113] McCarthy, '3 McCarthy on Trademarks and Unfair Competition § 19:90-102' (n 103) s 19:92; Giovanucci and others (n 84) s 55.
[114] Regulation (EU) No 1151/2012 of 21 November 2012 on quality schemes for agricultural products and foodstuffs [2012] OJ 341/1 s art 12; Keeling and others (n 97) ss 13–005.
[115] Giovanucci and others (n 84) 58.
[116] 'USPTO Trademark Manual of Examining Procedure: Section 1306, Certification Marks' (n 103) s 1306.02(b)(i).
[117] ibid 1306.05(a).

Putting aside a link based on reputation for the moment, evidence of link based on quality or other characteristics often consists of information about a particular micro-climate, explanation of local methods, or other evidence grounded in the relevant geography.[118] For example, the Buerre de Bresse PDO application references the geography's hilly contours, "sustained and regular rainfall exceeding 800 mm/year," and "soils with a clayey matrix."[119] The application goes on to cite the area's "isolation and a particular organisation of the agricultural area" and the resulting inclusion of grass and maize in the cattle feed.[120] These are concrete (and often scientific) facts that are being used to support a link. Applicants would be, and in fact have been, sufficiently able to garner that information and demonstrate it in their application without the use of blockchain. The beneficial features of blockchain (near immutability, more efficient and enhanced traceability, and better coordination amongst parties) will not impact on the geography of a region, its soil content, rainfall, or what the traditional methods of production may be. And so, it is unlikely blockchain technology would add any value in these sorts of applications. This thinking also applies to the requirement to define the designated geographic area, which is often a highly contentious and political endeavor.[121] While blockchain could be useful in confirming materials or products came from that area, the initial drawing of the lines would not be helped.

Establishing a link to geography based on reputation may be slightly more receptive to the benefits of blockchain. The EC Guide to a PDO/PGI Application counsels that applicants must "[s]how that the reputation of the product is linked to the name and attributable to the geographical area…. with elements like awards, references in professional books or press, special mentions in cooking publications."[122] For example, the application for Anglesey Sea Salt's PDO quotes food writers and chefs' opinions of the product.[123] Many applicants draw on historical reputation as well, even though not explicitly required. The Anglesey Sea Salt application cites Roman history of the region's salt production.[124] The Roquefort 2007 PDO

[118] Giovanucci and others (n 84) 17.
[119] '"Beurre de Bresse" PDO Application Publication; Official Journal C335' (2013) <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2013:335:0022:0027:EN:PDF>.
[120] ibid.
[121] Giovanucci and others (n 84) 97–98.
[122] 'Registration of the Name of a Quality Product | European Commission' (*European Commission Website*, 2019) <https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/food_safety_and_quality/documents/guide-to-applicants-of-single-document_en.pdf> accessed 4 March 2019.
[123] '"Anglesey Sea Salt" PDO Application Publication; Official Journal C232' (2013) <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2013:232:0017:0020:EN:PDF>.
[124] ibid.

application cites the products' long history, including that "[m]entions of Roquefort cheese dating back to the 8th century can be found in many documents."[125]

Because this type of historical evidence of reputation is not required, it is possible blockchain could help create a contemporaneous reputation by providing consumer access to provenance and quality information via a consumer-facing mobile application. This could create the association between the GI's reputation and the geographic area in consumers' minds. The ability to construct reputation in this way could be useful for new producers (or experienced producers who lack documents from the 8th century). However, I believe applying blockchain to this problem would be excessive. The necessary reputation to establish a link to geography could be created by savvy traditional marketing.[126] Applying blockchain would be a needlessly expensive and complex way to accomplish this.

Blockchain seems to be of little practical use in establishing GI protection. This was demonstrated by looking at the most demanding portions of the application process in the E.U.; and if a blockchain application would not be a beneficial solution there, it clearly would not add any value in the simpler aspects of gaining protection either. This applies to the U.S. requirements for gaining protection as well, which are relatively easier than the E.U. In the U.S., no detailed evidence of a link between quality, characteristics or reputation and geography is required; the public must merely "understand[] that goods bearing the mark come only from the region named in the mark."[127] This lower bar is fairly easily hurdled as is, and blockchain would be of little benefit.

c. Could Blockchain Be Useful in Maintaining GI Protection?

i. Legal Requirements

The primary requirement of maintaining GI protection in the E.U. and U.S. is ensuring compliance with the GI standards. The E.U. system mosty relies on public authorities to ensure compliance with the specification of the PDO and PGI.[128] Under the E.U. 2012 Regulation,

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[125] EU, '"Roquefort" PDO Appilcation Publication; Official Journal C298' (2007) <https://ec.europa.eu/agriculture/quality/door/registeredName.html?denominationId=626>.
[126] Giovanucci and others (n 84) 17.
[127] 'USPTO Trademark Manual of Examining Procedure: Section 1306, Certification Marks' (n 103) s 1306.05(a).
[128] Marcus Höpperger, 'Presentation by Marcus Höpperger, Senior Director, WIPO', *April 1, 2019 Brand Dialogue Workshop: The Value of GI Brands and Brexit* (2019).

member states must designate a "competent authority" that is responsible for "official controls" of PDOs and PGIs to verify compliance with the specification and to monitor the use of registered names on the market.[129] The E.U. 2012 Regulation provides that the competent authority can do this, or delegate it to a Union accredited control body.[130] For PDOs and PGIs originating outside the E.U., verification can be done by public authorities or product certification bodies.[131] Producer groups can develop complementary activities to ensure compliance with specifications.[132] The specification should include the detailed measures that will ensure the product originates from the designated geographic area and the procedures that operators have in place to prove origin. [133] There is also a manner of privately ensuring compliance—through oppositions and cancellations. An opposition can be brought against an application if the product does not meet the definition of PDO or PGI, or if the specification is not being complied with.[134] A registration can be cancelled if compliance with the specifications is not ensured or if no product is placed on the market under the protected name for 7 years.[135]

In the U.S., assurance of compliance with standards is done privately— or as the USPTO describes it, the system is "self-policing."[136] A sworn statement of compliance use has to be submitted in the five years after registration and upon renewal of the mark each ten years—without this statement, the mark will be cancelled.[137] Beyond that, though, it will be competitors and customers who ensure compliance with a GI's standards, by opposing registration and bringing cancellation proceedings.[138] A certification mark can be cancelled (or refused registration) if the certifier participates in production or marketing, allows the mark to be used for non-certification purposes, discriminately refuses to certify goods of anyone who meets the

[129] Regulation (EU) No 1151/2012 of 21 November 2012 on quality schemes for agricultural products and foodstuffs [2012] OJ 341/1 s art 36.
[130] ibid arts 37, 39.
[131] ibid art 37.
[132] ibid art 45.
[133] COMMISSION IMPLEMENTING REGULATION (EU) No 668/2014 of 13 June 2014 laying down rules for the application of Regulation (EU) No 1151/2012 on quality schemes for agricultural products and foodstuffs [2014] OJ 179/36 recital 5, art 4.
[134] ibid art 10; Keeling and others (n 97) ss 13–016.
[135] Regulation (EU) No 1151/2012 of 21 November 2012 on quality schemes for agricultural products and foodstuffs [2012] OJ 341/1 Art 54.
[136] USPTO (n 77) 2.
[137] 'Trademark FAQs | USPTO' (*USPTO Website*) <https://www.uspto.gov/learning-and-resources/trademark-faqs#type-browse-faqs> accessed 24 August 2019.
[138] ibid; Giovanucci and others (n 84) 78–79.

standards, or does not or cannot exercise "legitimate control over the use of the mark".[139] This last point is perhaps the most pertinent. There are two ways a certifier can fail to exercise the appropriate controls: By giving permission to use a mark without ensuring the standards are met, or by failing to control the use of the mark by the non-certified so that it loses all meaning.[140] Caselaw has shown that there does not need to be 100% control or enforcement on the part of the certifier, but courts have looked for level of diligent monitoring.[141] If the certifier of a GI is entirely failing to account for standards, then competitors, customers or other private citizens can seek to have the protection revoked. This is an incentive for compliance, as are the customer perception and public relations issues that would likely follow discovery of noncomplying products.

Both the E.U. and U.S. systems expect substantial control over compliance with the GI's standards to maintain protection. This goes to the heart of GIs: the standards specify the features of the product that contribute to its quality and establish its provenance, and ensuring compliance ensures the authenticity.

ii. A Blockchain Application Could Be Beneficial in Several Ways

Maintaining GI protection is fertile ground for a beneficial blockchain application. Both E.U. and U.S. requirements for maintaining protection come down to ensuring that producers are complying with standards for quality and geographic source. There are several potential ways blockchain could be put to use to help ensure compliance with GI standards.

1. Collecting Information for Submission to Monitoring Parties

Blockchain can be used to more efficiently harness information that needs to be provided to the competent authority, control body, certifier, or producer group ("Monitoring Parties"). Just as with food supply chains,[142] each move of a good through the production and supply steps

[139] McCarthy, '3 McCarthy on Trademarks and Unfair Competition § 19:90-102' (n 103) s 19:92; Giovanucci and others (n 84) 78–79.
[140] McCarthy, '3 McCarthy on Trademarks and Unfair Competition § 19:90-102' (n 103) s 79; Giovanucci and others (n 84) 19:92.
[141] McCarthy, '3 McCarthy on Trademarks and Unfair Competition § 19:90-102' (n 103) 19:92.
[142] Cynthia (Pacifical) Asaf, 'Gustav Gerig Launches Blockchain For Pacifical MSC Tuna Products' (*PRWeb.com*, 2019)

could be recorded as transaction in the blockchain.[143] We will use the Roquefort USPTO certification mark registration as a simplified example, which has three parts to the standard: (1) the cheese is made only from sheep's milk, (2) the cheese has been cured in natural caves, and (3) those caves are in the community of Roquefort.[144] Roquefort producers could input information into the blockchain ledger to complement and support the certification standards: the source of the milk (which farm, which sheep), the name of the cave used, the temperature and humidity the batch was kept at, GPS coordinates of the batch, and any other useful inputs. Each point of information would be immutably stored as a successive transaction in blocks, allowing all users of the blockchain platform to verify the life of the good in ways that correlate to the certification standards.

The Monitoring Parties could be given access to a permissioned blockchain to aid in their assessment of compliance. Monitoring Parties could easily access—at one time, and in one format—information for all producers and all goods. The automated and uniform input of information into a blockchain could eliminate the time and effort that Monitoring Parties spend adjusting to each producer's own particular methods of recordkeeping.[145] Further, by having all of this information at their fingertips, Monitoring Parties could more clearly and quickly identify those goods out of compliance.[146] This would be a significant step forward from current tracking efforts, like Prosciutto di Parma's systems of physical product stamps.[147] Such an application is already being tested in the non-GI food world: the UK Food Standards Agency successfully completed a pilot using blockchain as a regulatory compliance tool in a cattle slaughterhouse.[148] The pilot was chosen because slaughterhouses "require[] a lot of inspection and collation of results;" transparency was increased by using a permissioned blockchain application which allowed the FSA and slaughterhouse to access data, and to collect and communicate inspection

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<https://www.prweb.com/releases/gustav_gerig_launches_blockchain_for_pacifical_msc_tuna_products/prweb15951113.htm> accessed 2 March 2019; Corkery and Popper (n 73); Oury (n 69).

[143] Sulkowski (n 5) 313.

[144] 'USPTO Trademark Electronic Search System Status: Roquefort' (2019) <http://tmsearch.uspto.gov/bin/showfield?f=doc&state=4809:2e3ka4.2.6>.

[145] See Maryn McKenna, 'The Fix for E. Coli Outbreaks Could Be... the Blockchain' [2018] *Wired* <https://www.wired.com/story/the-fix-for-e-coli-outbreaks-could-be-the-blockchain/>.

[146] Bureau_Veritas, 'Food Traceability: The Blockchain Revolution' (2017) <http://origin.bureauveritas.com/>.

[147] Stefani Fanti, 'Presentation by Stefano Fanti, Director, Parma Ham Consortium', *April 1, 2019 Brand Dialogue Workshop: The Value of GI Brands and Brexit* (2019).

[148] UK Food Standards Agency, 'FSA Trials First Use of Blockchain | Food Standards Agency' (*UK Government Website*, 2018) <https://www.food.gov.uk/news-alerts/news/fsa-trials-first-use-of-blockchain> accessed 12 August 2019.

results.[149] A blockchain application which more efficiently and effectively provides information to Monitoring Parties is an extremely promising way to support the maintenance of a GI right.

2. Recording Certifications on a Blockchain

Inspections, certifications, and other interim validations of a GI product could also be recorded on a blockchain. Bureau Veritas, an organization that undertakes lab testing and certifications as a control body (for instance for Beurre Brasse), has proposed such a use with its Origin blockchain platform.[150] By recording the result of inspections or various validations, it would immediately become apparent to any user (including fellow producers, control bodies, and potentially consumers) if an inspection or certification was failed. This increased transparency for all stake-holders would help the GI rights holder clearly record and communicate the compliance of the goods.

3. Preventing the Indication from Becoming Generic

A blockchain application could also be a technique to combat any creeping claims that the GI has become generic. Genericness is the boogeyman of trademark and GI protection holders,[151] because if a name becomes generic it loses all protection. If a GI blockchain solution could incorporate a consumer mobile application, such as the sustainably fished tuna project,[152] then each consumer would be made aware of the source of the GI product, its link to the geography, and the resulting high quality. This could help educate and reaffirm in the eyes of the public that there is an association between the name and unique geographic character, and also demonstrate in the face of any challenge that the name is not considered generic by the public.

[149] ibid.
[150] Bureau_Veritas (n 148).
[151] Whether terms have become generic is the source of many trade disputes between "old world" nations and the "new world." Giovanucci and others (n 84) 15.
[152] Asaf (n 144).

4. Applying Smart Contracts to Validate Compliance and Prevent Non-conforming Products from Reaching Market

Finally, smart contracts could be layered on to a Blockchain traceability solution to not only automatically validate compliance with standards, [153] but perhaps even to prevent out of compliance products from reaching market.

A smart contract is a set of software instructions that automatically execute the terms of a contract.[154] By inputting the correct information as a transaction on the blockchain, an output is automatically triggered in an "if-then" format, and the output is also recorded in the next transaction on the blockchain. To illustrate how a smart contract would benefit GIs, we can analyze moving a batch of fictitious "Poughkeepsie Cheese" from the hands of a producer to a packing plant. The only three standards the cheese must comply with for GI protection are (1) the cheese is made from cows' milk, (2) the cows are reared and milked in Poughkeepsie, New York and (3) the cheese is stored at 7° Celsius at all times. The producer, perhaps through a combination of human inputs and electronic sensors, would enter the points of information that support the GI specification into the blockchain: what kind of milk was used, which cows the milk came from, where those cows were kept, and temperature at which the cheese was kept. Then the producer would physically transport the cheese to the packing plant. A smart contract can be registered to be triggered if the blockchain received the right inputs from a producer. In our example, if the inputs confirm the cheese came from Poughkeepsie cows and was kept at the correct temperature, then a smart contract would automatically execute to record in the blockchain that the batch was in compliance with standards at the time of the plant's receipt.

Using a smart contract to validate compliance would be beneficial alone, but one could imagine going further and using smart contracts to prevent noncompliant cheese from getting to market. A process could be put in place whereby once the packing plant physically receives the shipment of Poughkeepsie Cheese, it records its physical receipt in the blockchain. Then, only once the blockchain contains (1) confirmation of physical receipt, and (2) the smart contract output validating compliance of the batch, would the virtual supply chain of Poughkeepsie Cheese be allowed to proceed (this could be accomplished the operation of another smart contract). Only when those two pieces are in place could the plant input its own information

[153] The Food Cons (n 87).
[154] Bacon and others (n 20) 46.

into the blockchain and proceed with physically packing the cheese. If one of the initial inputs by the producer is out of compliance (the cheese was kept at 10° Celsius) the smart contract will not execute and (1) the packing plant would know the batch was not in compliance and (2) the virtual supply chain would not progress because that smart contract did not execute. The packing plant would not be able to enter their inputs into the blockchain, which would have ripple effects down the rest of the chain (if, say, the store who is the final recipient must confirm the completeness of the virtual supply chain before stocking its shelves). The batch of nonconforming cheese could therefore be prevented from getting to market.[155]

iii. Hurdle to Implementation: The Garbage-in, Garbage-out Problem

There is broad opportunity to put blockchain to use in maintaining GI protection, however there is a well-recognized hurdle to gaining blockchain's benefits in this way: the garbage-in, garbage-out problem. A major criticism of any blockchain application seeking to track physical assets is that the information input into the blockchain must be accurate and truthful, but the technology does nothing to ensure this.[156] Even if the information is input by an authorized user with the appropriate keys for access, the information inserted could still be a lie.[157] So while near-immutability is a laudable feature, if the information contained in the transactions recorded on the blocks is not accurate, then the entire system is compromised.[158] Hence, garbage-in, garbage-out. As discussed during the EUIPO's Blockchain Workshop, a traditional food supply chain may be particularly vulnerable to this problem.[159] Say there is a bar code on a box of lettuce that gets scanned as it progresses along the supply chain with blockchain recording each scan; the blockchain records will have no indication if something else had been put in the box instead of lettuce. Similarly, what if a producer inserts information into the

[155] Incentives could be even be escalated if releasing payment to parties was contingent upon smart contract execution. Artificial Lawyer, 'End of The Beginning For Smart Contracts' (*Artificial Lawyer*, 2019) <https://www.artificiallawyer.com/2019/06/11/end-of-the-beginning-for-smart-contracts-accord-forum-write-up/> accessed 25 August 2019.
[156] Frederick Mostert and Jue Wang, 'THE APPLICATION AND CHALLENGES OF BLOCKCHAIN IN INTELLECTUAL PROPERTY DRIVEN BUSINESSES IN CHINA' (2018) 11 Tsinghua China Law Review 13; Petersen (n 3); Jemima Kelly, 'Blockchain Is No Silver Bullet against the Black Market' *Finanacial Times* (1 July 2019) 9.
[157] Sulkowski (n 5) 322; Vadgama (n 53) 13.
[158] Sulkowski (n 5) 322.
[159] Versetti (n 64).

blockchain that his animals were only given conforming high-quality feed, when in reality they were fed whatever was handy on the farm?

It is clear then, that when endeavoring to link the digital and physical worlds via blockchain, some other validation of inputs must be used must.[160] The lettuce box example demonstrates that things like QR codes on their own are unreliable, either they cannot control the content of a package or the code itself easily be replaced.[161] Given the widespread nature of the garbage-in, garbage-out problem, there has been substantial work done on solutions for food supply chains which could also apply to GIs.

One idea is to couple blockchain technology with DNA testing, which has already been used to detect fraudulent food.[162] In the meat traceability context, one study proposed that using DNA in addition to blockchain could help "ensur[e] credible and reliable product information through the entire meat supply chain, from farm to fork."[163] However, not all products may be easily authenticated via DNA and many of the GI standards that must be complied with cannot be verified via DNA— things like specific origin, traditional methods used, or aging time. Therefore, I do not believe DNA testing would add much value to a GI blockchain solution.

A more promising project is an Internet of Things ("IOT") solution which ensures the integrity of blockchain inputs and links the physical supply chain to the virtual one. [164] Sensors or other internet enable devices could automatically take readings for temperature, chemical makeup, location, and other key inputs which would then be recorded on a blockchain.[165] As one article discussing the plans of Ambrosus, a company developing an IOT blockchain solution, envisioned:

> "Imagine being able to equip all your supply chain actors, plants and warehouses[,] raw materials and finished goods packages with smart-labels, sensors, tracers and cameras able to perform the count of the goods, quality control, chemical and biological tests, keep monitoring the traceability of the products, the integrity of the package… and then register all the data into the blockchain."[166]

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[160] Vadgama (n 53) 38.
[161] Mostert and Wang (n 158) 33; Vadgama (n 53) 38.
[162] Giovanucci and others (n 84) 24.
[163] Sander, Semeijn and Mahr (n 80) 2077.
[164] Versetti (n 64); Ambrosus, 'Ambrosus - Enabling Sensors to Talk to Blockchain' (*Abrosus Webpage*) <https://ambrosus.com/#mission> accessed 13 August 2019.
[165] Versetti (n 64); Vadgama (n 53) 41–42.
[166] The Food Cons (n 87).

This would greatly limit the opportunity for human error or manipulation of inputs to the blockchain.

Yet another proposed solution comes from Proof of Trust, which focuses on the "oracles" which translate real world information into computer code to input into a smart contract.[167] At a very basic level, the solution proposes layering in a network of accountable delegates who can confirm the real world inputs.[168] Proof of Trust would be mostly useful after the fact, should disputes arise about whether the inputs that triggered the smart contract execution were correct.[169]

Realistically, any food production—and particularly GI foodstuffs production—is a deeply human project. The premium we place on GI foodstuffs not only relate to their geography, but often the traditional methods of production employed, and the care put into production by human producers. To gain this premium, we have to grapple with inevitable opportunities for human error or manipulation. However, I believe by layering on proposed solutions like IOT or Proof of Trust, the gaping hole in blockchain that the garbage-in, garbage-out problem creates can be reduced to a reasonable window for error.

d. Could Blockchain Be Useful in Enforcing GI Protection?

i. Legal Requirements

Both the E.U. and U.S. GI schemes have provisions for enforcing a GI right if infringement is taking place. This includes infringement by competitors from outside the geographic area and producers within the region who are not complying with the GI standards.[170] Without such protection, the association that consumers make between a geographic region and the product, and the product and its quality standard, will be weakened.[171] The protection afforded by the E.U. 2012 Regulation is broad: It protects against use on "comparable" products "not covered by the registration," where "using the name exploits the reputation of the protected name," and any "misuse" including use by nonconforming products and products not from the

[167] Proof of Trust:, 'Proof of Trust: Assuring Smart Contract Settlement' <https://docsend.com/view/siy5mbp> accessed 25 August 2019.
[168] Proof of Trust, 'PoT Protocol - Proof of Trust (PoT) Protocol' <https://theproofoftrust.com/> accessed 25 August 2019.
[169] Proof of Trust: (n 169).
[170] Giovanucci and others (n 84) 15.
[171] ibid; Blakeney (n 85) 367.

geographic region.[172] The E.U. 2012 Regulation requires member states to surveille the market to ensure compliance.[173] The E.U. 2012 Regulation also provides that producer groups can monitor the use of a name, inform competent authorities if suspected infringement is found, and take action to enforce legal protection of their rights.[174] The U.S. relies on private actors for enforcement,[175] and the certification mark owner must monitor and protect its mark from infringement.[176] Certification marks are entitled to the same protection as trademarks under the Lanham Act.[177] Infringement could consist of continued use of a mark by an ex-licensee, use of the mark on goods that were not certified, or the importation of goods bearing counterfeit marks.[178] The enforcement measures anticipated by the E.U. and U.S. systems serve to ensure the validity of the quality, authenticity, and provenance claims of the GI product are not undermined by bad actors, and that customers get the product they expect.

ii. Facilitating the Identification and Demonstration of Infringement

A GI blockchain application would add value to the enforcement of GI's legal rights. Enforcing GI rights, under either the U.S. or E.U. systems, requires an assessment of whether an infringement occurred, and marshalling of the evidence of infringement for the relevant authority.[179] A blockchain application for GIs could help with both of these parts. To demonstrate, we will look at how blockchain could help identify two different types of infringers: (1) a producer from within the relevant geographic region who has not achieved the proper certification or standards, but is still putting out product under the protected name (*e.g.* a producer falling out of compliance); and (2) an actor from outside the geographic area and unrelated to the rights holder who is putting non-conforming products on the market under the protected name (*e.g.* an unrelated counterfeiter).

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[172] Regulation (EU) No 1151/2012 of 21 November 2012 on quality schemes for agricultural products and foodstuffs [2012] OJ 341/1 art 13.
[173] ibid art 38.
[174] ibid art 45.
[175] Giovanucci and others (n 84) 14.
[176] USPTO (n 77) 2; Giovanucci and others (n 84) 79.
[177] Lanham Act § 4, 15 U.S.C. § 1054.
[178] McCarthy, '3 McCarthy on Trademarks and Unfair Competition § 19:90-102' (n 103) s 19:92.50; 'International Information Systems Security Certification Consortium, Inc. v. Security University, LLC, 823 F.3d 153 (2d Cir. 2016)'.
[179] Giovanucci and others (n 84) 15.

Identifying an infringer like the out-of-compliance producer could be facilitated by a blockchain application functioning as described above: If a producer was using the blockchain application, but input information that did not meet the appropriate standards in some way, it would be a simple matter for the producer group and any Monitoring Party to identify the out-of-compliance producer. This could work whether the producer's own inputs showed the good was out of compliance (*e.g.* a sensor reading on temperature was too high) or if there was a certification that was missing or failed.

Identifying an unrelated counterfeiter would also be easier using blockchain technology. As an initial matter, if it was the case that the GI's standards mandated that producers use the designated blockchain platform, then any products marketed using the GI label, but not capable of being tied to a registered product on the blockchain would clearly be an infringement. Even if using blockchain was not a standard, though, blockchain could still provide a better solution for ensuring authenticity of products beyond the standard logos, UPC codes, or stamps.[180] As Birgit Clark described it,

> "[a] ledger showing who owns what, who is an authorized licensee, and so on would enable everyone in the supply chain… to validate a genuine product and distinguish it from a fake. Blockchain ledgers holding IP rights information allow for provenance authentication, since they can record objectively verifiable details about when and where products are made, and details about their manufacturing process and sources of raw materials. These types of blockchain solutions… enable users to verify the authenticity of a product and provide confidence and reassurance for businesses, authorities, consumers and insurers."[181]

There have already been many efforts to use blockchain to prove authenticity and undercut counterfeiting outside of GIs. The EUIPO sponsored a "Blockathon" to develop use cases for blockchain that would undermine counterfeiting, and the winning team proposed a "virtual twin" solution whereby goods were tokenized into a unique identity—a virtual twin of the good.[182] Each time the good changed hands in the physical world, the virtual twin was exchanged in a transaction recorded on the blockchain.[183] As the Blockathon report explains, the

[180] David Lizerbram & Associates (n 88); Arijit Chakrabarti and Ashesh Kumar Chaudhuri, 'Blockchain and Its Scope in Retail' (2017) 4 International Research Journal of Engineering and Technology 2395, 3055; Clark (n 13).
[181] Clark (n 13).
[182] 'EUIPO Blockathon Report' (2018) 4–6 <https://euipo.europa.eu/tunnel-web/secure/webdav/guest/document_library/observatory/documents/Blockathon/Blockathon_Report.pdf>.
[183] ibid 6.

combination of that "unique product identity and the continuous transferal of the digital identity between wallets will create a mathematical proof that the goods are genuine."[184] Several other projects have already put blockchain to use, particularly in the luxury goods space. Everledger has used blockchain to secure diamonds and wines' provenance,[185] and LVMH is launching a blockchain application to better authenticate their goods.[186] Using blockchain to help enforce IP rights and undermine counterfeiting is one of the applications that has gone furthest in providing real-life solutions. This could be a practical way to successfully apply blockchain to GIs.

iii. Hurdle to Implementation: The Admissibility of Blockchain Evidence

One potentially significant hurdle to using blockchain to facilitate enforcement of a GI right is whether information secured by blockchain ("blockchain evidence") would be admissible in court or by other relevant authorities.[187] The GI rights holder may want to demonstrate infringement by pointing to information input into the blockchain. It is not clear, though, whether the authority reviewing infringement claims would accept information secured by blockchain as valid evidence. As the technology is new, there has not been much chance for consideration of the issue.[188] I believe courts are likely to first encounter this question in the context of cryptocurrency disputes, but the precedent will be relevant for any GI blockchain application.

Courts and authorities in the U.S. seem to have not yet determined whether blockchain evidence is admissible, but it seems the hearsay rule may be implicated.[189] The hearsay rule

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[184] Anti-Counterfeiting Blockathon Forum, 'Blockchain Use Case' (2019) 6 <https://euipo.europa.eu/tunnel-web/secure/webdav/guest/document_library/observatory/documents/Blockathon/Blockathon-Forum_Blockchain-Use-Case.pdf>.

[185] Eric Annino, 'SAP BrandVoice: How Blockchain Can Restore Trust In The Wine Industry' (*Forbes*, 2017) <https://www.forbes.com/sites/sap/2017/09/11/how-blockchain-can-restore-trust-in-the-wine-industry/#2997cfed1874> accessed 2 March 2019; Kelly (n 158).

[186] Kelly (n 158).

[187] Note, to the extent a truly decentralized blockchain solution is used, that will create jurisdictional and other liability issues. McCarthy, 'Unanswered Legal Issues: Blockchain "Smart Contracts"' (n 32) 5.

[188] Notably, courts in China were first to accept blockchain secured evidence. Wolfie Zhao, 'China's Supreme Court Recognizes Blockchain Evidence as Legally Binding - CoinDesk' (*Coindesk*, 2018) <https://www.coindesk.com/chinas-supreme-court-recognizes-blockchain-evidence-as-legally-binding> accessed 12 August 2019.

[189] Neil Gray and Maxwell J Eichenberger, 'Blockchain: Immutable Ledger, But Admissible Evidence ?' *New York Law Journal* (14 December 2018) <https://www.law.com/newyorklawjournal/2018/12/14/blockchain-immutable-ledger-but-admissible-evidence/>; AJ Bosco, 'BLOCKCHAIN AND THE UNIFORM ELECTRONIC TRANSACTIONS ACT' (2019) 74 Business Lawyer 243; Concord-Law-School, 'The Admissibility of Blockchain as Digital Evidence' (*Purdue University*, 2019) <https://www.concordlawschool.edu/blog/news/admissibility-blockchain-digital-evidence/> accessed 9 August 2019; McCarthy, 'Unanswered Legal Issues: Blockchain "Smart

serves to protect against unreliable second-hand and out-of-court statements being made to assert the truth of a matter.[190] Information secured on a blockchain is certainly out of court, can be argued to be second-hand, and would likely be put forward in court to prove the truth of a transaction or event recorded in the blockchain.[191] This question is if this constitutes a "statement." The *United States v. Lizarraga-Tirado* case out of the Ninth Circuit considered the admissibility of machine statements, namely GPS generated pinpoints of a defendant's location.[192] The Ninth Circuit found the information was *not* inadmissible hearsay because Google Earth generated the information without human interaction, and so it could not be considered a "statement."[193] Some argue this decision poses potential issues for blockchain evidence, because while the transaction is not generated by a human, blocks are added to the chain and cryptographically "signed" which is the direct result of human action; therefore it could be said to be a human "statement."[194]

Even if considered hearsay, though, blockchain evidence would likely be admissible under the business records exception.[195] The exception is for business records that were kept in the normal course of business activity and made as a regular business practice.[196] The security and near-immutability of information secured by blockchain technology is the sort of reliable record intended to be included under the exemption.[197] I believe qualifying under the exception will depend on the type of blockchain used. If the blockchain platform is an open, permissionless blockchain, there could be arguments that information secured by the blockchain is not a business record of one party, instead it is public information. Further, if the blockchain is permissionless, many users participate in the creation of records—these may not be considered a regular practice of the particular business. However, the type of platform envisioned by this dissertation for GIs, a permissioned and private blockchain, would more likely be considered a

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Contracts"' (n 32); Angela Guo, 'BLOCKCHAIN RECEIPTS : PATENTABILITY AND ADMISSIBILITY IN COURT' (2017) 16 Chicago-Kent Journal of IP 440.
[190] Guo (n 191) 444; Concord-Law-School (n 191).
[191] Guo (n 191) 444–45.
[192] ibid 445; Concord-Law-School (n 191).
[193] Gray and Eichenberger (n 191); Guo (n 191) 445; Concord-Law-School (n 191).
[194] Guo (n 191) 446–47; Concord-Law-School (n 191).
[195] Gray and Eichenberger (n 191); Guo (n 191) 448; McCarthy, 'Unanswered Legal Issues: Blockchain "Smart Contracts"' (n 32) 4; Peter A Crusco, 'The Admissibility of Blockchain Evidence in New York' [2019] *New York Law Journal* 6; Concord-Law-School (n 191).
[196] Guo (n 191) 448.
[197] Gray and Eichenberger (n 191).

business record, as it would be used in the ordinary course to organize and support the GI's business.

In the absence of judicial opinions, legislation has sought to address the validity of blockchain secured information. The Blockchain Promotion Act is in progress in the U.S. Congress, and it would require the creation of a common definition of blockchain and an exploration of applications; this could eventually speak to this issue.[198] In the absence of federal legislation, though, individual states have stepped up the plate. For example, Vermont has formally recognized data recorded on blockchain as evidence[199] and Arizona gave legal status to records secured by blockchain technology equal to that of an electronic signature.[200] Other U.S. states allow the use of blockchain technology in specific contexts, which seem to favor admissibility. For example, Delaware amended its General Corporate Law to allow the use of blockchain to maintain stock ledgers, shareholder lists, and share transfers.[201]

The E.U. will not create blockchain-specific legislation because Union law is technology-neutral, but the European Commission,[202] European Parliament,[203] and Member States have gone far in supporting research, workshops, and pilots of the blockchain applications. Those European endeavors have not focused on legal recognition of blockchain evidence, but at least one project posits that blockchain evidence should be on equal footing as eIDAS, or electronic

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[198] Marguerite Reardon, 'Senate Moves Blockchain Promotion Act Forward - CNET' (*CNET*, 2019) <https://www.cnet.com/news/senate-moves-blockchain-promotion-act-forward/> accessed 12 August 2019.
[199] Xander Landen, 'Vermont Bullish on Blockchain as New Law Takes Effect - VTDigger' (*VT Digger*, 2018) <https://vtdigger.org/2018/08/28/vermont-bullish-blockchain-new-law-takes-effect/> accessed 9 August 2019; Concord-Law-School (n 191).
[200] JD Caytas, 'Blockchain in the US Regulatory Setting: Evidentiary Use in Vermont, Delaware, and Elsewhere' (2017) June 20, 2 Columbia Science and Technology Law Review <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2988363>; Bosco (n 191).
[201] Jeff John Roberts, 'Delaware Blockchain Law for Shareholders Now in Effect | Fortune' (*Fortune*, 2017) <https://fortune.com/2017/08/01/blockchain-shareholders-law/> accessed 9 August 2019; Delaware 149th General Assembly; Summary of DE SB69 | 2017-2018; Pete Rizzo, 'Delaware Governor Signs Blockchain Bill Into Law' (*Coindesk*, 2017) <https://www.coindesk.com/delaware-governor-signs-blockchain-legislation-law> accessed 9 August 2019; Andrea Tinianow and Caitlin Long, 'Delaware Blockchain Initiative : Transforming the Foundational Infrastructure of Corporate Finance Why Distributed Ledger Shares Would Transform the Foundational' [2017] *Harvard Law School Forum on Corporate Governance and Financial Regulation* <https://corpgov.law.harvard.edu/2017/03/16/delaware-blockchain-initiative-transforming-the-foundational-infrastructure-of-corporate-finance/>.
[202] EUIPO (n 9).
[203] European_Parliament, 'Distributed Ledger Technologies and Blockchains: Building Trust with Disintermediation' (2018) <https://oeil.secure.europarl.europa.eu/oeil/popups/ficheprocedure.do?lang=en&reference=2017/2772(RSP)>.

signatures.[204] A comprehensive report on the legal recognition question is forthcoming from the E.U. Blockchain Observatory.[205] E.U. nations have also piloted blockchain technology in a way that implies a positive view of recognizing of blockchain evidence. For instance, the UK Ministry of Justice piloted DLT to secure digital evidence by creating an audit trail[206] and Austria has used blockchain technology to auction government bonds.[207] It is still very much an open question whether blockchain evidence would be accepted to support claims of infringement, but the signs are that governments look favorably on blockchain evidence, and so courts may too.

As was shown in this Section, there could be great benefit to putting blockchain technology to use in maintaining and enforcing the legal GI protections, even if the technology does not add much value to establishing protection.

VI. Additional Benefits of a Blockchain Application

Blockchain could bring additional benefits to GI foodstuffs, outside the maintenance and enforcement of IP rights. Blockchain can enhance communication with consumers, as well as positively impact sustainability. That these benefits do not directly impact the legal rights of GIs is not to understate their significance— these benefits go to the core of a GI product's success.

a. More Reliably Communicate Provenance and Authenticity to Consumer

Blockchain can help address one of the biggest concerns for GI foodstuffs: reliably communicating provenance and authenticity information to consumers.[208] The E.U. 2012 Regulation recognizes the importance of communication; an objective of the scheme is to provide clear information on products so consumers can be better informed, and it notes that GIs

[204] Tom Lyons, 'EU BLOCKCHAIN OBSERVATORY & FORUM Workshop: Legal Recognition of Blockchains & Smart Contracts' (2018) 8 <https://www.eublockchainforum.eu/sites/default/files/reports/workshop_6_report_-_legal_recognition_of_blockchains.pdf?width=1024&height=800&iframe=true>.
[205] Lyons (n 206); EU Blockchain Observatory & Forum (n 67).
[206] Balaji Anbil, 'How We're Investigating Digital Ledger Technologies to Secure Digital Evidence - Inside HMCTS' (*UK Government Blog: Inside HMCTS*, 2018) <https://insidehmcts.blog.gov.uk/2018/08/23/how-were-investigating-digital-ledger-technologies-to-secure-digital-evidence/> accessed 7 August 2019.
[207] Marie Huillet, 'Austria to Use Ethereum Public Blockchain to Issue $1.35 Bln in Government Bonds' (*CoinTelegraph*, 2018) <https://cointelegraph.com/news/austria-to-use-ethereum-public-blockchain-to-issue-135-bln-in-government-bonds> accessed 12 August 2019.
[208] Fanti (n 149); Andrew Swift, 'Presentation by Andrew Swift, Legal Counsel, Scotch Whisky Association', *April 1, 2019 Brand Dialogue Workshop: The Value of GI Brands and Brexit* (2019).

enhance the credibility of products in the eyes of consumers.[209] Academic studies have confirmed the significance of communication, and at least one found communication of authenticity, typicality of the product, and its benefits to be a key determinant of GI success.[210]

Communication would be important for GIs in any circumstance, but it has become imperative given the recent scourge of fake food.[211] Europol recently seized 150 Liters of doctored sunflower oil masquerading as extra virgin olive oil,[212] counterfeit seasoning was discovered in China which was made using dangerous materials including industrial salt, [213] and the UK and Ireland had a massive scandal involving horsemeat impersonating beef.[214] Fake food is not just a safety concern, it also costs economies major money: counterfeit Italian wines cost Italy €2 Million in 2015.[215] Unfortunately, the consumer cannot rely entirely on their governments to keep food safe; as noted in reporting on romaine lettuce contamination, the U.S. "do[es] a terrible job of tracking the path our produce takes from farm to fork."[216] Given this environment of food safety scares, the transparency and confidence in a product's provenance, authenticity, and quality that blockchain could bring would go a long way to restoring consumer trust.

Blockchain technology can bring a new level of transparency into GI products consumers may purchase. Already the GI name inspires confidence in the high standards required for products, but blockchain technology can allow a much more direct and engaging communication with consumers about the provenance, authenticity, and quality of the product. Information can be provided to consumers via a QR code on the product and mobile application, or other online certification. The mobile app or certification would allow the consumer to access all the

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[209] Regulation (EU) No 1151/2012 of 21 November 2012 on quality schemes for agricultural products and foodstuffs [2012] OJ 341/1 recitals 17, 18.
[210] Ramona Teuber, 'Consumers' and Producers' Expectations towards Geographical Indications: Empirical Evidence for a German Case Study' (2011) 113 British Food Journal 900, 915.
[211] Larry Olmsted, 'Food Scandal: Why You Should Be Wary Of Fake Beer, Wine & Spirits' (*Forbes*, 2017) <https://www.forbes.com/sites/larryolmsted/2017/02/20/food-scandal-why-you-should-be-wary-of-fake-beer-wine-spirits/#3108f2ce18eb> accessed 2 March 2019; Xing Zhao, Moya Kneafsey and Donald Finlay, 'Food Safety and Chinese Geographical Indications' (2016) 118 British Food Journal 217; Sander, Semeijn and Mahr (n 80) 2066.
[212] Europol, '150 000 Litres of Fake Extra Virgin Olive Oil Seized from "Well-Oiled" Gang | Europol' (*Europol website*, 2019) <https://www.europol.europa.eu/newsroom/news/150-000-litres-of-fake-extra-virgin-olive-oil-seized-'well-oiled'-gang> accessed 25 August 2019.
[213] Neil Connor, 'China Busts 50 Factories Making Fake Branded Seasoning with "Dangerous" Ingredients in Latest Food Scandal' *The Telegraph* (London, 17 January 2019).
[214] Sander, Semeijn and Mahr (n 80) 2066.
[215] Sulkowski (n 5) 312.
[216] McKenna (n 147).

information input on the blockchain about their particular product. This model is a key part of TE-Food's blockchain platform solution,[217] and has already been put into use with projects such as sustainable tuna,[218] luxury goods from LVMH,[219] the goods from food retailer Auchan.[220] Consumers would have access to the detailed information increasingly in demand today,[221] be assured of food safety, and also better differentiate a GI product from generic or non-GI product.

b. Support Sustainability Goals

A blockchain application for GIs could also benefit broader sustainability goals. The public is increasingly concerned with sustainability, the source of their food, and how it is produced.[222] Massimo Vittori, managing director of oriGIin, noted that one of the biggest current topics for GIs is sustainability, and GIs are in a privileged position to address the issue because they are run by independent bodies who control production techniques and, in many ways, the geography.[223] Chefs and other members of the culinary world have emphasized the importance of not only ensuring that ingredients come from a quality and sustainable source, but also that that information be reliably communicated to their consumers. [224]

A blockchain application could address these concerns by ensuring compliance with standards like organic, non-GMO, free-range, or grass-fed, in similar ways to ensuring compliance with GI standards.[225] Blockchain technology can ease the collection, organization, and memorialization of the relevant information to demonstrate compliance. Further, the certifications themselves can be entered on a blockchain to prove product labeling claims and build confidence in the authenticity of the designation.[226] For example, Gustav Gerig, a Swiss food company is using blockchain to make a particular range of certified sustainably caught tuna

[217] 'Introduction of TE-FOOD's Technology - TE-FOOD - Medium' (n 75).
[218] Asaf (n 144).
[219] Kelly (n 158).
[220] Auchan, 'Food Traceability: Auchan Retail Is Launching Blockchain Technology Internationally' (2018) 1 <https://www.auchan-retail.com/en/newsroom/articles/food-traceability-auchan-retail-is-launching-blockchain-technology-internationally>.
[221] Vadgama (n 53) 33.
[222] Teuber (n 212) 903.
[223] Massimo Vittori, 'Presentation by Massimo Vittori, Managing Director of OriGIn', *April 1, 2019 Brand Dialogue Workshop: The Value of GI Brands and Brexit* (2019).
[224] Rosenberg and Souto (n 69); John Williams, 'John Williams, Executive Chef of The Ritz, Guest Lecture', *Guest Lecture in Global Digital Intellectual Property Enforcement Class* (2019).
[225] Lyons (n 67); Oury (n 69); Radocchia (n 70); Kayser and Raimer (n 91).
[226] Radocchia (n 70).

traceable from catch to final processing.[227] The consumer can verify that the tuna was sustainably caught, by accessing data on "which captain, vessel, catch timing, method and area, where and when it was processed."[228] Similar initiatives are under way to track sustainably sourced fish by the World Wildlife Fund for Nature.[229] It has even been suggested that blockchain could help track the emission of greenhouse gases and compliance standards.[230]

A blockchain application could also transform the way consumers receive sustainability information from companies. Instead of access being limited by a company's voluntary reporting, a blockchain platform could include information relevant to sustainability which would be automatically available to the consumer. [231] For GIs in particular, the information that would be input on the blockchain to support GI's legal rights is the same sort of information that implicates sustainability; for instance, geographic origin or how animals are reared. Increased communication about sustainability would not only create visibility for the segment of consumers who already demand this information, but will also raise awareness of sustainability issues amongst the rest of consumers. Blockchain technology and sustainability seem to be a good pairing, and GIs are in a place to benefit greatly.

It is important to remember, however, that blockchain technology which uses a proof of work consensus mechanism consumes an enormous amount of energy, as does the distributed structure. It is estimated that the yearly energy consumption of Bitcoin mining is similar to the yearly energy consumption of 200,000 to 1.2 Million E.U. households.[232] To the extent any blockchain solution is being used to support sustainability goals, the platform will have to find a more environmentally-friendly mode of operation, such as a permissioned system using proof of stake or other consensus mechanism or a trusted intermediary. Otherwise we risk, "the side effects of the cure [becoming] worse than the harm it is attempting to curb."[233]

[227] Asaf (n 144).
[228] ibid.
[229] Coinify (n 70).
[230] Sulkowski (n 5) 315.
[231] ibid 318.
[232] Bacon and others (n 20) 25–26.
[233] Sulkowski (n 5) 321.

VII. Practicalities of Applying Blockchain to GIs

As this dissertation has demonstrated, a blockchain application for GIs could bring valuable benefits—both in relation to the legal GI rights and beyond. However, the practical implications of such an application may pose additional hurdles, beyond the already discussed challenges of the garbage-in, garbage-out problem and evidentiary admissibility.[234]

a. Criticism that Blockchain Is an Overcomplicated and Needlessly Expensive Solution

One of the primary hurdles to a blockchain application for GIs is also a criticism of supply chain applications: it is an over-complicated and needlessly expensive solution. A permissioned, private blockchain solution as proposed for GIs (like the IBM Food Trust)[235] does not take advantage of the entirely distributed "trustless" nature of the permissionless Bitcoin-style blockchain. Instead, an intermediary would permission users and the blockchain would be stored by a "trusted intermediary" or a limited number of "trusted nodes" who determine which blocks get added to the chain.[236] As discussed in Section III.b., critics have argued that the wholly distributed nature of blockchain is its heart, and if that feature is not used, blockchain technology is not necessary.[237] Because some other traditional database or traceability platform would suffice, a blockchain application would be an over-complicated and unnecessary solution.[238] As a Financial Times article assessing the use of blockchain in the luxury market noted, "[i]t is unclear why luxury houses need blockchain technology. They could give customers a product 'life story' using a more straightforward tracking system that includes measures to keep the information safe, for example through standard encryption."[239] The number and variety of efforts to apply blockchain to supply chains demonstrates that not everyone agrees with these critics. I believe the advantages gained by blockchain's increased

[234] Additional hurdles exist including compliance with regulatory requirements like the GDPR. This dissertation will not explore that, because others have. See, e.g., Tom Lyons, Ludovic Courcelas and Ken Timsit, 'Blockchain and the GDPR' (2018) <https://www.eublockchainforum.eu/sites/default/files/reports/20181016_report_gdpr.pdf>.
[235] IBM (n 72).
[236] Bacon and others (n 20) 29.
[237] Burstall and Clark (n 18).
[238] Sorkin (n 6); Dodds (n 64).
[239] Kelly (n 158).

ability to track and trace, near-immutability, and coordination amongst participants can be worth the cost and complication in the right context.[240]

b. Resistance from Traditional Producers

Another potential hurdle to a successful blockchain application is the very thing that makes GI products special: GI producers are proudly traditional and often small scale. Consumers place a lot of weight in the quality that is associated with traditional methods and more local (and therefore often smaller-scale) production of foodstuffs. The reason many of these producers organize and establish protection for a GI is to harness their collective power,[241] but we know coordination amongst these traditional producers remains one of the biggest challenges to success.[242] Introducing a potentially costly and technologically advanced system like blockchain to their production methods may practically be beyond the competence and coordination abilities of the producers.[243]

Even if the coordination or competence was there, however, the mindset of these producers could create resistance. Producers do not want to invest in seemingly unnecessary technology, and many have not even transitioned to electronic operations yet.[244] An article examining blockchain for food traceability argued a major industry commitment is necessary because "small farms [] have more urgent priorities than hooking their harvest pallets to the Internet of Things."[245] Further, in a study of blockchain applications in meat traceability, retail managers and government officials were resistant to the financial burden of a blockchain solution and denied that there was any demand for increased transparency in the system.[246]

c. A Strong Central Force Is Needed to Implement a Blockchain Solution for GIs

To overcome these hurdles, I believe a strong, organized central force is necessary to successfully implement a blockchain solution for GIs. This would be a permissioned, private

[240] Marks (n 4) 80.
[241] Fanti (n 149).
[242] ibid; Giovanucci and others (n 84); Yuta Uchiyama and others, 'The Governance of Geographical Indications' (2017) 119 British Food Journal 2863, 2872–73.
[243] Sander, Semeijn and Mahr (n 80) 2073–2077.
[244] McKenna (n 147).
[245] ibid.
[246] Sander, Semeijn and Mahr (n 80) 2073.

blockchain with a trusted intermediary of the type imagined by Bacon.[247] Clearly, this flies a bit in the face of the decentralized spirit of blockchain. However, given the unique character of the GI world, I believe absent such a strong trusted intermediary, no blockchain solution would get off the ground. The trusted intermediary could partner with appropriate vendors (like IBM, TE-Food, and Ambrosus) to create a blockchain solution for GIs. Then, the blockchain platform could be implemented by providing producers a ready-made solution packaged with the necessary technology and training. While costs would have to be allocated amongst the producer group or absorbed by the trusted intermediary, I believe this approach could sufficiently lower the pain threshold for traditional producers to successfully implement a blockchain solution.

In a way, GIs may already be structured to accommodate such a solution because the GI rights are generally held by producer groups or managing consortia. Strong, organized, and well-funded consortia already exist—for example, the Consorzio del Prosciutto di Parma which is over 50 years old, associates 150 producers, and has revenue in the millions.[248] Admittedly most GIs are not at the level of Prosciutto di Parma, but producer groups are still good candidates to serve as the trusted intermediary. They already have a place of authority over the GI products, and a level of knowledge about the production needs. As a result, they could customize the blockchain solution as needed for their product.

The Monitoring Party is another candidate to implement a blockchain solution and serve as a trusted intermediary. Bureau Veritas could be an example of this; as discussed, Bureau Veritas serves as a control body for GIs, and in promoting its Origin blockchain platform called itself "a natural choice to help put in place food traceability blockchain systems and devise appropriate systems of governance."[249] The Origin blockchain platform is not limited to GIs, but Bureau Veritas's proposed place in the blockchain ecosystem as a trusted intermediary would work nicely within the existing structure of GI production.

A very interesting candidate for the trusted intermediary is WIPO; WIPO could implement a more general blockchain solution that could be customized as needed by GI producer groups. WIPO administers the TRIPS Agreement (which in Article 22 defines a standard of protection for GIs) and covers a wide territory of signatories, so it is a good candidate

[247] Bacon and others (n 20) 29.
[248] Consorzio del Prosciutto di Parma, 'Consorzio Del Prosciutto Di Parma' (*www.proscuittodiparma.com*) <https://www.prosciuttodiparma.com/en_UK/consortium/economic-figures> accessed 25 August 2019.
[249] Bureau_Veritas (n 148).

to coordinate such a solution.[250] It would be a major investment and undertaking, but one of WIPO's functions is to help create global technical IP infrastructures and "to develop shared IP tools, services, standards, databases and platforms"[251] which includes investigating blockchain applications.[252] Admittedly, GIs are a relatively small proportion of IP rights globally and so an investment by WIPO in this way may be outsized, but developing a blockchain solution for GIs aligns with WIPO's goals and so should be explored.

VIII. Conclusion

Despite the massive hype and subsequent backlash surrounding blockchain's potential outside of cryptocurrency, I agree with Andrew Ross Sorkin that "[t]here will be huge failures and misspent money… but a decade from now, it's more likely than not that blockchain will be embedded in our day-to-day lives in ways that, today, we can't even imagine."[253] Blockchain technology is valuable, and worthy of a critical look. That is what this dissertation has done.

I have drawn from the existing application of blockchain in food supply chains to shore up confidence in provenance, authenticity, and quality of goods. GIs are grounded in these same values, and so the ability of blockchain to build confidence in that same way is a natural fit for GIs. This dissertation explored whether a blockchain application would be beneficial to GIs, and the practicalities of implementation. As I have demonstrated, blockchain would add little value to the process of establishing GI rights, but has substantial potential to be of use in maintaining and enforcing GI rights—particularly with the integration of smart contracts. While there are several hurdles to implement a successful blockchain application, they are not insurmountable due to the technological development already occurring and growing recognition by governments.

Given the unique nature of the GI community, I believe any application for GIs would require a permissioned, private blockchain with a trusted intermediary. Several promising candidates for a trusted intermediary exist, including the producer groups and Monitoring

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[250] WTO, 'TRIPS: Geographical Indications - Background and the Current Situation' (*WTO Website*) <https://www.wto.org/english/tratop_e/trips_e/gi_background_e.htm#general> accessed 4 March 2019.
[251] 'Global IP Infrastructure' (*WIPO Website*) <https://www.wipo.int/global_ip/en/> accessed 25 August 2019.
[252] WIPO, 'Artificial Intelligence and IP' (*WIPO Website*) <https://www.wipo.int/about-ip/en/artificial_intelligence/> accessed 25 August 2019.
[253] Sorkin (n 6).

Parties, but a large-scale solution could be instituted by WIPO. There are significant criticisms of putting blockchain technology to use, and perhaps most significant is the criticism that blockchain is an overcomplicated and unnecessarily expensive solution for a problem that does not exist. These critics would be correct if they argued that GIs brands have managed to operate for years without blockchain. But the world is changing. Supply chains are becoming more complex, food counterfeiting is creating serious safety concerns, and the climate crisis is changing how food can be produced. Consumer perception and demand are evolving: Consumers are placing more value on knowing the source of their food, how it was produced, and its quality. Consumers appreciate the value that GIs can provide, and so a blockchain solution that can increase confidence in GI foodstuffs' provenance, authenticity, and quality is a natural fit.

IX. ABBREVIATIONS

U.S. – United States of America

E.U. – European Union

USPTO – United States Patent and Trademark Office

EUIPO – European Union Intellectual Property Office

GI – Geographical Indication

IP – Intellectual Property

E.U. 2012 Regulation – Regulation (EU) No 1151/2012 of 21 November 2012 on quality schemes for agricultural products and foodstuffs [2012] OJ 341/1

PDO – Protected Designation of Origin

PGI – Protected Geographical Indications

DLT – Distributed Ledger Technology

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