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## Blockchain Initiatives and Operations Focusing on Agriculture

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By  
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## Background

This is the last of three papers<sup>1</sup> in a series dealing with blockchain technology, cryptoassets, and the agricultural sector. The first paper, entitled “Blockchain and Bitcoin Basics: Applicability to Agriculture,” was designed to introduce readers to the nature of blockchain and cryptoassets. The second paper, entitled “Creating and Using Cryptoassets; Regulatory Implications,” considered a range of practical and legal issues in connection with the potential creation and/or use of cryptoassets, including a review of how cryptoassets are regulated (with a particular focus on U.S. law). This paper briefly examines some of the numerous current blockchain initiatives and applications focused on or at least applicable to agriculture.

Of the existing blockchain applications applicable to agricultural activities, most probably exist to facilitate financing options. This is not surprising given that blockchain technology can reduce information asymmetry in financial transactions; improve speed, accuracy, and security of communication; and decrease costs and delays imposed by conventional financial intermediaries.<sup>2</sup> The second most prevalent

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<sup>1</sup> As is true for all three papers, the footnotes primarily provide links to additional sources of information that is more detailed or technical than the textual discussion. This paper includes more sources for ease in conducting additional research if more details are desired about the various applications described here. Where possible, online sources have been archived for ease of access, but the archival citations include links to the live pages.

<sup>2</sup> “Blockchain is considered to be one of the most promising technologies for secure financial transactions for various economic activities, including agribusiness. In agribusiness in particular, it has the potential to revolutionize



use is probably in connection with optimization of agricultural supply chains. The Covid-19 pandemic clearly illustrated a variety of weaknesses in global supply chains,<sup>3</sup> and blockchain technology offers one approach to resolving some of the concerns. These supply side issues include the need to improve traceability, transparency, accuracy and immutability. One source suggested that blockchain applications in connection with supply chain management are expected to grow at 87% annually, increasing from expenditures of \$45 million in 2018 to over \$3 billion by 2023.<sup>4</sup> Blockchain applications that are designed to improve food safety and integrity are a part of supply chain management. For the third possible major application, some platforms focus on improving the commercial viability of agricultural operations, either by improving customer relations or with a focus on marketing. A fourth potential area of growing significance in the agricultural sector relates to energy use and environmental implications. Agriculture uses energy directly as fuel for machinery and equipment and indirectly for fertilizers and other chemicals used in modern farming. The amount of energy required is not insignificant.<sup>5</sup> Thus, platforms that can enable more efficient energy utilization and carbon offsets have direct relevance to agribusiness and the environment.

The following materials are designed to provide resources for individuals or organizations operating in the agricultural sector interested in these particular potential applications. Brief mention will also be made of a few of the other potential uses for the technology. Note that this paper does not attempt or purport to provide a comprehensive list of current, planned or possible applications, or resources available in any given area.

### **Agribusiness Financial Applications**

There is no doubt that blockchain has the potential to make financial transactions more efficient, less expensive, and more available. There is a continuing global finance shortfall in agriculture, with insufficient financing to meet demand, particularly to fund micro- small- and medium-sized enterprises (MSMEs) in emerging economies. In 2017, the global trade finance gap was estimated to be approximately

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support for financial transactions for agriculture and improve the credit system.” Geneci da Silva Ribeiro Rocha et. al, *Blockchain Applications in Agribusiness: A Systematic Review*, 13 *Future Internet* 95 (Ap. 5, 2021) § 3.2.1 (archived at <https://perma.cc/8UHF-VZJB>).

<sup>3</sup> Serpil Aday & Mehmet Seckin Aday, *Impact of Covid-19 on the food supply chain*, *Food Quality and Safety* (Aug. 24, 2020 (archived at <https://perma.cc/5425-Q866>) (“In the light of recent challenges in food supply chain, there is now considerable concern about food production, processing, distribution, and demand.”)

<sup>4</sup> Andreas Kamilaris, et al, *The rise of blockchain technology in agriculture and food supply chains*, 91 *Trends Food Sci. Technol.* 640–652 (2019) (online citation accessed through University of Arkansas Libraries at <https://www.sciencedirect.com/science/article/pii/S0924224418303686#bbib30>).

<sup>5</sup> “The U.S. consumes more energy each year growing, preparing, and transporting food than the United Kingdom does to power the whole country.” *American food production requires more energy than you’d think*, *Save On Energy* (Dec. 6, 2019) (archived at <https://perma.cc/Q8YK-5AJ6>). For the agricultural phase alone this amounts to 2.1 quadrillion Btu of energy each year to support crops and livestock operations.



\$1.5 trillion.<sup>6</sup> In India alone, the credit gap is estimated by the World Bank at \$380 billion, and crypto proponents have argued that blockchain could help address that shortfall.<sup>7</sup> Back in 2018, a Bain & Company study commissioned by the World Economic Forum indicated that blockchain technology could significantly reduce the global trade finance gap,<sup>8</sup> but as of 2021 this has yet to be fully realized.

If a farmer, rancher, or agribusiness-based enterprise is interested in utilizing blockchain and cryptoassets in connection with financing, it is not necessary to focus solely on companies or applications that have an agricultural focus. There are a number of crypto-businesses offering payment services that are not specifically directed to agricultural enterprises but may be used by them. For example, BitPay is a global crypto-payment service provider that assists third party businesses in accepting and storing Bitcoin payments, and BitPay's integration with e-commerce platforms such as Shopify and WooCommerce allow food retailers (as well as others) to use its services with bank settlements in U.S. dollars, Euros, British Pounds, and more.<sup>9</sup> There are also numerous other companies operating in the U.S. with blockchain platforms designed to improve financial transactions around the world, including such notables as Coinbase,<sup>10</sup> Circle,<sup>11</sup> Binance,<sup>12</sup> and SALT Lending.<sup>13</sup>

Other crypto-financing platforms operate in limited geographic areas. For example, BitPesa facilitates blockchain-based payments in Bitcoin (BTC) in African countries like Kenya, Nigeria, and Uganda,<sup>14</sup> all areas where micro and small-enterprise farming takes place. HUPAYX, a South Korea-based crypto

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<sup>6</sup> Alisa DiCaprio et. al, *2017 Trade Finance Gaps, Growth, and Jobs Survey*, ADB Briefs No. 83, Asian Development Bank (Sept. 2017) (archived at <https://perma.cc/C5ZX-QNU3>).

<sup>7</sup> Sandeep Soni, *MSME credit gap: How Bitcoin, Ethereum, other crypto investors may address small business liquidity crisis*, Financial Express (May 13, 2021) (archived at <https://perma.cc/29PZ-DF2T>). Although stalled at the test and pilot stages, prior efforts have shown first that mobile payment systems can be successful at reaching even remote areas in India. Yining Hu et. al, *A Delay-Tolerant Payment Scheme Based on the Ethereum Blockchain*, 7 IEEE Access 33159–33172 (Mar. 6, 2019) (archived at <https://perma.cc/Z68C-AUME>).

<sup>8</sup> Nicky Morris, *WEF/Bain: Blockchain Trade Finance Could Boost Trade by \$1 trillion*, Ledger Insights (Sept. 17, 2018) (archived <https://perma.cc/67VQ-M7T6>).

<sup>9</sup> See BitPay, *Business* (archived at <https://perma.cc/B9E7-SGFM>).

<sup>10</sup> Coinbase is the largest U.S.-based crypto exchange, helping others buy and sell cryptoassets. Coinbase.com (archived at <https://perma.cc/E2R6-M7B9>).

<sup>11</sup> Circle helps e-businesses to accept and send payments on a unified platform, facilitating digital payments is USD Coin (USDC), a stablecoin pegged to the U.S. dollar. Circle.com (archived at <https://perma.cc/KAB3-UPYG>).

<sup>12</sup> Binance, the world's largest crypto exchange by trading volume, and as such can provide services to agribusinesses around the world. Binance.com (archived at <https://perma.cc/2SB8-WK4E>). It also offers a Binance Visa Card for crypto purchases and also offers crypto loans. Binance.cm, Buy the Things You Love with Crypto (archived at <https://perma.cc/KX73-XJYK>). If you go to the live Binance website and click on "finance" as one of the options across the top of the screen, you can access information about crypto loans.

<sup>13</sup> SALT Lending offers, among other things, crypto-backed business loans. SALTlending.com (archived at <https://perma.cc/S935-2FVF>).

<sup>14</sup> BitPesa has approximately 26,000 customers and can complete transactions in under two hours at a cost that is approximately 10% of that for conventional financial transfers in such areas. *How Blockchain Could Disrupt Banking*, CBInsights (Feb. 11, 2021) (archived at <https://perma.cc/T9QA-F9EN>).



payments startup, has created a payments network designed to operate in conjunction with South Korean stores, which obviously includes sales of varied agricultural products.<sup>15</sup>

One of the largest players in the world of international finance through blockchain or distributed ledger technology is Ripple, which is based in California. Financial institutions have been utilizing the Ripple blockchain to facilitate cross-border transactions for several years.<sup>16</sup> Ripple has a product named xRapid that provides a low-cost option for financial institutions engaged in cross-border payment transactions. There is no need to rely on pre-funded accounts, and transactions occur in minutes rather than days. As of mid-2020, there were 365 participating banks and commercial platforms utilizing xRapid, not only reducing costs and minimizing delays but also addressing potential issues such as data and compliance requirements.<sup>17</sup>

Groups of conventional financial institutions have also sometimes combined forces to develop financial applications that can be of use in the agricultural sector, even if the platforms are not limited to such use. An early example involved a group of major European banks that developed a permissioned blockchain platform suitable for use with small and medium enterprises.<sup>18</sup> The platform was originally called Digital Trade Chain, but was rebranded in 2017 as we.trade. This particular program has proven to be quite successful and has grown to include 16 banks across 15 countries, referring to itself as the “largest

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<sup>15</sup> HUPAYX, *Crypto Payment Startup HUPAYX to Tap into Four Hundred Thousand Stores in S. Korea*, Intrado Global Newswire (Aug. 9, 2019) (archived at <https://perma.cc/X3SR-YX95>).

<sup>16</sup> For example, in 2017, Ripple helped the Siam Commercial Bank make real-time remittance payments between Japan and Thailand. *SCB, Ripple Launch First Blockchain-powered Payment Service between Japan and Thailand*, Ripple.com (June 29, 2017) (archived at <https://perma.cc/RZ88-WE94>).

<sup>17</sup> Carlo R.W. De Meijer, *Blockchain and European payments: banks in the defensive mode*, FinExtra (Apr. 8, 2020) (archived at <https://perma.cc/LL7S-89X7>). One caveat should be noted with regard to Ripple. xRapid is a liquidity solution for banks that utilize the XRP token to facilitate transactions. Nicolas Tang, *XRP vs. xRapid: What Are The Differences?* Phemex (Dec. 23, 2020) (archived at <https://perma.cc/JKY3-B9NL>). In December 2020, the SEC initiated legal proceedings against Ripple, alleging that its XRP token was a security. See Carol Goforth, *SEC vs. Ripple: A predictable but undesirable development*, CoinTelegraph (Dec. 27, 2020) (archived at <https://perma.cc/XBT6-3LWP>). The eventual outcome of the SEC’s case may have implications for the long-term use and effectiveness of XRP.

<sup>18</sup> Sanne Wass, *Banks unveil roadmap for we.trade blockchain platform*, Global Trade Rev. (Oct. 24, 2017) (archived at <https://perma.cc/2ULT-BJQK>). The banks were Deutsche Bank, HSBC, KBC, Natixis, Rabobank, Santander, Société Générale and UniCredit.



network in Europe today.”<sup>19</sup> There have been similar groups in India,<sup>20</sup> Asia,<sup>21</sup> and elsewhere.<sup>22</sup> For example, the Contour Blockchain (formerly Voltron) is a Singapore-based group that exists for the purpose of digitizing letters of credit.<sup>23</sup> In addition to private consortia, Hong Kong<sup>24</sup> and the BRICS<sup>25</sup> nations have governmental level trade finance initiatives underway in cooperation with private enterprises. In the U.S., R3 and Trade IX launched the MarcoPolo Network which has global applications.<sup>26</sup> MarcoPolo Network was named as one of the outstanding innovators in finance in 2021 by Global Finance.<sup>27</sup>

In addition, there are also crypto-businesses that are specifically working to incorporate blockchain technology into agribusiness financing. For example, AgriDigital, an Australian agtech company with a blockchain-enabled platform focused on making “agricultural supply chains simple, easy and secure - from farmer to consumer,”<sup>28</sup> is credited with the first settlement of an agricultural transaction on the

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<sup>19</sup> We.trade, *Home* (page archived at <https://perma.cc/D9Z9-B7XM>).

<sup>20</sup> Finbarr Bermingham, *Infosys and Indian banks form blockchain network for trade finance*, *Global Trade Rev.* (May 23, 2018) (archived at <https://perma.cc/YNH6-W9DP>) (describing a blockchain-based financial network with seven Indian banks).

<sup>21</sup> Roxanne Uy, *What are Asian banks doing with blockchain?* *Asian Banking and Finance* (2017) (archived at <https://perma.cc/5MSR-55QM>). Current efforts in Asia appear to be more focused on central bank digital currencies (CBDCs) rather than private blockchains. Greg Thomson, *Major Asian banks unite to form ‘multiple’ CBDC pact on blockchain*, *CoinTelegraph* (Feb. 23, 2021) (archived at <https://perma.cc/KUE9-UG8R>). Although beyond the scope of this paper, a CBDC is a digital asset issued by a nation’s primary banking authority and thus likely to be legal tender with government backing.

<sup>22</sup> By 2017, there were more than 40 consortia exploring blockchain technology, most in financial services. Peter Gratke & David Schatsky, *Banding together for blockchain*, *Deloitte Insights* (Aug. 16, 2017) (archived at <https://perma.cc/VTF6-6WLU>).

<sup>23</sup> “Contour blockchain is a Corda backed open industry platform for creating, exchanging, approving, and issuing the letter of credit.” Hasib Anwar, *Contour Blockchain (Voltron): A Milestone For Trade Finance*, *101 Blockchains* (Feb. 9, 2020) (archived at <https://perma.cc/5ETP-XQ2X>). Although the project originally had 12 banks and financial companies, it now has more than 50 corporates and banks, and its platform is currently limited to customers of member banks.

<sup>24</sup> In March 2017, the Hong Kong Monetary Authority (HKMA) completed a blockchain-based proof-of-concept project in collaboration with several banks. Based on that work, the HKMA facilitated the creation and October 2018 launch of eTradeConnect, “a blockchain-based trade finance platform fully funded by a consortium of major banks in Hong Kong...” Hong Kong Monetary Authority, *Trade Finance* (archived at <https://perma.cc/5ZCV-AFAP>).

<sup>25</sup> BRICS is the acronym referring to five major emerging economies: Brazil, Russia, India, China, and South Africa. In 2018, the member countries entered into a Memorandum of Understanding on collaborative research on blockchain technology between participating banks, in order to improve operational efficiencies. Mark Barley, *BRICS agree to explore blockchain for trade finance*, *Ledger Insights* (Sept. 14, 2018) (archived <https://perma.cc/9CX5-ZUSL>).

<sup>26</sup> MarcoPolo consists of more than 30 financial institutions, 7 technology partners, and more than 20 corporate participants. MarcoPolo.finance (archived at <https://perma.cc/63MX-2DHM>). It describes itself as the largest trade finance trial leveraging blockchain technology.

<sup>27</sup> *Marco Polo and Pole Star named as ‘The Innovators 2021’ by Global Finance*, MarcoPolo.finance (May 21, 2021) (archived <https://perma.cc/M34F-DAV4>).

<sup>28</sup> 2021 Australian Trade and Investment Commission, *AgriDigital - allows local Australian farmers to connect to the global supply chain* (archived at <https://perma.cc/DM4B-FGQ4>).



blockchain in December 2016.<sup>29</sup> By demonstrating applicability of blockchain technology to facilitate grower payments, the company helped pave the way for a billion of dollars in blockchain-enabled payments in the global grains and cotton industries across thirty different countries. By 2019, the company claimed 37 customers and more than 3000 active users. According to Agridigital’s self-description, it launched its platform in the U.S. in 2019 and had plans to extend operations into Canada as well.

Private participants have also explored blockchain-based financing alternatives in agriculture, typically seeking to reduce costs and increase settlement speed. As an illustration of this kind of project, a transaction between Louis Dreyfus Company as the seller of 60,000 tons of soybeans from the U.S. and Shandong Bohi Industry, a Chinese buyer, relied exclusively on digitized documentation in 2018,<sup>30</sup> which (according to the parties) made it “the first time ever in the agricultural sector that a trade included a full set of digitised [sic] documents – including the sales contract, letter of credit and certificates – as well as automatic data-matching.”

### **Walmart and the IBM Food Trust Supply Chains**

In addition to these finance-focused blockchain platforms, companies have been particularly active in working on blockchain applications for supply chain management, including the agricultural and food supply chains. This may not be surprising given the fact that Walmart, the largest company in the world by revenue and employees, has taken a leading role in this area, partnering with IBM and others in the IBM Food Trust.<sup>31</sup>

Walmart’s utilization of blockchain technology in connection with supply chains dates back to October 2016, when the company announced two proof of concept projects. One of these initiatives involved mangos and the other Chinese pork, with blockchain technology being used to trace the origins of slices of mango and to track movement of pork in China.<sup>32</sup> The articulated concerns that lead Walmart to investigate the new technology included limiting foodborne diseases, combating food fraud, preventing illegal production, and facilitating recalls with improved traceability and transparency. Once the proof of concept was successful, the next step was to collaborate with IBM and the IBM Food Trust, involving food giants such as Nestle and Unilever. Today more than 300 suppliers and buyers have joined the network.

The IBM Food Trust is a blockchain-based network that connects participants in food chains through a private, permissioned, permanent and shared record of data. The platform is customizable, offering the

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<sup>29</sup> This sale involved approximately 23 tons of grain. Kamilaris, *supra* note 4.

<sup>30</sup> Sanne Wass, *Major banks and traders test blockchain platform for commodity trade*, Global Trade Rev. (Jan 24, 2018) (archived at <https://perma.cc/FE57-N53F>).

<sup>31</sup> *How Walmart Strives for Food Quality And Safety Using Blockchain Technology Solutions*, PixelPlex Blog (Oct. 21, 2020) (archived at <https://perma.cc/9QTE-DYLD>). Walmart has not limited its work with distributed ledger technology to IBM’s Food Trust.

<sup>32</sup> More detail about the project can be accessed at *How Walmart Strives for Food Quality And Safety Using Blockchain Technology Solutions*, PixelPlex Blog (Oct. 21, 2020) (archived at <https://perma.cc/9QTE-DYLD>).



following potential benefits: increased supply chain efficiency, increased brand trust, better food safety, increased sustainability, improved food freshness, decreased food fraud, and more limited food waste.<sup>33</sup>

The IBM Food Trust provides users with immediate access to supply chain data, including the complete history and current location of any item of food, along with relevant accompanying information, which might be anything from certifications, test results, temperature, etc.<sup>34</sup> Data obtained in this way can be used to identify and correct inefficiencies and bottlenecks, better forecast demand, and optimize structures and processes. All of the data associated with the platform is stored on the digital blockchain ledgers, “protected with the highest level of commercially-available, tamper-resistant encryption.”<sup>35</sup> Participants in a given supply chain can access only the data for which they are given permission, meaning that the organization that owns the data retains full control over who can view the information. As explained by IBM, “Users can quickly locate items from the supply chain, in real time, by querying food product identifiers such as Global Trade Item Number (GTIN) or Universal Product Code (UPC), using the product name, and filtering on dates.”<sup>36</sup>

Built on the open standard Hyperledger foundation, the IBM Food Trust offers integrated modules for adoption and adaptation for new users, including options for tracing and documentation. IBM also offers onboarding services and has developers available for consultation. For data entry, IBM has application programming interfaces (APIs) that allow IT teams within the user’s organization or network to load existing supply chain data to the IBM Food Trust network. Smaller organizations have the option of onboarding data through a web-based experience designed to be easy to use. Once data is uploaded, participants are able to access both desktop and mobile interfaces. The documentation module allows regulatory and inspection certifications and other documents to be uploaded for sharing as appropriate.

Although the IBM Food Trust platforms are private, and the identity of network participants are known to the creator of a particular supply chain, the digital ledger of transactions is decentralized, which improves transparency, security, and efficiency. While Walmart could have forced its suppliers to use a centralized database, it concluded that “blockchain technology offers a simpler and more secure process than barcodes, scanners and paper forms, according to Frank Yiannas, head of food safety at Walmart.”<sup>37</sup>

### **Other Supply Chain Applications, including Food Safety and Integrity**

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<sup>33</sup> IBM Food Trust, *7 Benefits of IBM Food Trust* (archived at <https://perma.cc/T963-GMKJ>).

<sup>34</sup> IBM Food Trust, *About IBM Food Trust* (archived at <https://perma.cc/XKU7-52EK>).

<sup>35</sup> This description comes from IBM in the document referenced in note 34.

<sup>36</sup> *Id.*

<sup>37</sup> Mark van Rijmenam, *Seven Use Cases of Enterprise Blockchain Solutions*, DataFloq (Oct. 11, 2018) (archived at <https://perma.cc/J4RX-JFHX>). Shortly after that report, in December 2018, Frank Yiannas left Walmart to become the Deputy Commissioner for Food Policy and Response at the Food and Drug Administration.



Walmart and the IBM Food Trust, although major players on the world stage with many other partners,<sup>38</sup> are far from the only blockchain companies involved in agricultural supply chain initiatives. As noted at the outset of this paper, blockchain applications in connection with supply chain management have become increasingly common. Supply chain management certainly has economic implications for agribusiness, as efficient tracking can reduce costs and improve productivity. It also has the possibility of combatting food fraud and improving food safety. These are huge concerns since food fraud is estimated to cost the global food industry \$30-40 billion each year.<sup>39</sup> In addition, the cost of foodborne illness is staggering. Conservative estimates place the annual cost in the U.S. alone at approximately \$17.6 billion.<sup>40</sup> Other estimates have been as high as \$152 billion when non-economic losses are included.<sup>41</sup> Using conventional resources, consumers, businesses, and governmental agencies lack the ability to effectively trace a product's movement along the supply chain, making it difficult to address these concerns.<sup>42</sup> Blockchain technology offers the potential for a solution to this information gap, helping companies, consumers, and regulators.

This section will provide a very brief overview of some of these applications. The first few options are limited to particular geographic areas or involve niche functions, which will not be applicable to every agricultural operation. Broader applications are then considered.

For businesses or operations interested in working in or with partners from Australia, AgriChain (formerly BlockGrain) is an Australian blockchain company focused on enabling peer-to-peer agricultural transactions and processing. Among other options, it offers blockchain-based solutions for stock management, contracting, supply chain tracking, logistics automation, and traceability.<sup>43</sup> "AgriChain provides modules for farmers needing grain storage, logistics companies needing to plan and track their fleet, as well as modules for grain traders and brokers, storage operators, processors such as flour mills, and end users such as feedlots. The company automates the entire delivery process, ensuring data is collected and time stamped at each point along the supply chain."<sup>44</sup>

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<sup>38</sup> For an example of other companies utilizing the IBM Food Trust platform, Rainforest Alliance, which is primarily focused on sustainability and environmental issues, partnered with Nestlé, a Swiss food and beverage company very familiar in the U.S., in April 2020 so that Nestlé's customers could trace the origins of select editions of Zoégas coffee in Sweden through the IBM Food Trust blockchain platform. *Nestlé expands blockchain to Zoégas coffee brand*, Nestlé News, Nestle.com (archived at <https://perma.cc/5QEJ-HZHX>).

<sup>39</sup> Denis Storey, *The Real Cost of Food Fraud*, TraceGrains (Jan. 31, 2020) (archived at <https://perma.cc/TC6G-SBNX>).

<sup>40</sup> USDA, *Cost Estimates of Foodborne Illnesses* (updated 2021) (archived at <https://perma.cc/P5XX-RZ2T>).

<sup>41</sup> Rory Harrington, *Foodborne illnesses cost United States \$152bn a year- report*, Food Navigator-U.S.A. (Mar. 3, 2010) (archived at <https://perma.cc/K988-6P6P>).

<sup>42</sup> PWC, *Food Fraud Vulnerability Assessment and Mitigation: Are you doing enough to prevent food fraud?* (Nov. 2016) (archived at <https://perma.cc/6AVY-R5NF>).

<sup>43</sup> *Introducing Agrichain*, Agrichain.com (archived at <https://perma.cc/SWX2-6AR7>).

<sup>44</sup> Lynda Kiernan, *Cornerstone Growth Invests A\$6m In Australia's AgriChain*, Global Ag Investing (Feb. 14, 2020) (archived at <https://perma.cc/KWK4-J56U>).



For those seeking entrée into Taiwan (admittedly a limited market), OwlTing, headquartered in Taipei, is a privately held company that claims to be a leading e-commerce platform for safe food products connecting vendors and farmers in Taiwan. It claims to have launched the first food provenance system hosted on the Ethereum blockchain in May 2017.<sup>45</sup> As of mid-2021, the company continues to be looking towards significant growth,<sup>46</sup> focused on Taiwanese farmers.

For companies hoping to do business in China, JD.com (a well-known Chinese e-commerce giant) is a publicly held company headquartered in Beijing. It has actively sought partners in its effort to boost consumer confidence. Its first foray into blockchain involved a partnership with Walmart in which JD.com sought to improve consumer confidence by authenticating steaks.<sup>47</sup> The result of that effort was that in 2017 JD.com, Walmart, IBM, and Tsinghua University National Engineering Laboratory for E-Commerce Technologies launched the Blockchain Food Safety Alliance, a platform designed to improve tracking, tracing and safety of food in China. JD.com has also collaborated with Kerchin (a Chinese meat producer) and InterAgri, an exporter of Australian meat products.<sup>48</sup>

Another huge publicly owned Chinese tech company, Alibaba, is also very active in developing blockchain applications useful for agribusiness. In particular, Alibaba has been concerned about the “number of counterfeit food and false certification scandals” greatly impacting consumer confidence in the country.<sup>49</sup> In March 2017, Alibaba and Australia Post, a 200-year old privately held Australian financial enterprise, began an exploration of blockchain technology in an effort designed to combat food fraud.<sup>50</sup> The pilot partnership, which was probably initiated in part to keep up with the Walmart-IBM Food Trust initiative, was a Food Trust Framework operated as a Tmall Global project tracking a particular brand of fish oil and certain dairy brands.<sup>51</sup> Since that time, Alibaba has continued to be incredibly active in the blockchain space in China, receiving more blockchain patents in 2017 than any other person except for the People’s Bank of China.<sup>52</sup> It also works directly with farmers and agricultural hubs to convert rural produce into

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<sup>45</sup> “OwlChain” Launched as the World’s First Food Blockchain Provenance System, Cision PR Newswire (May 26, 2017) (archived at <https://perma.cc/4PUC-VPVB>).

<sup>46</sup> Sammi Huang & Adam Huang, *Blockchain startup OwlTing aims at explosive growth*, DigiTimes (May 20, 2021) (archived at <https://perma.cc/7HG3-M7EA>).

<sup>47</sup> Becky Peterson, *The Amazon of China is putting its high-end beef imports on the blockchain*, Business Insider (Mar. 3, 2018) (archived at <https://perma.cc/8HM8-N4MR>).

<sup>48</sup> *JD Ramps up Australian Imports with InterAgri Partnership on Pure Black Angus Beef*, JD.com Blog (Mar. 2, 2018) (archived at <https://perma.cc/5RSJ-UYBC>).

<sup>49</sup> *Food Safety: Chinese Supermarkets Bet on Blockchain*, SQLI Digital Experience blog (Ap. 21, 2020) (archived at <https://perma.cc/GV6F-Q6BR>).

<sup>50</sup> Tas Bindi, *Alibaba and AusPost team up to tackle food fraud with blockchain*, ZDNet (March 24, 2017) (archived at <https://perma.cc/LZ3B-KCY5>).

<sup>51</sup> *Alibaba deploys blockchain to tackle food fraud*, WARC (Ap. 30, 2018) (<https://perma.cc/94W8-CUZL>).

<sup>52</sup> “Of the 406 patent applications related to blockchain in 2017, Alibaba had 43, second only to People’s Bank of China (PBOC) who filed 68. Alibaba’s blockchain patents covered areas of invention, design, and utility.” Andreas Kaplan, *How Alibaba is championing the application of blockchain technology in China and beyond*, Smartereum (Jan. 5, 2021) (archived at <https://perma.cc/626M-DQNP>).



marketable products for mass consumption.<sup>53</sup> While much of Alibaba Group’s attention is focused inside China, AntChain (a blockchain platform created by Ant Group, a member of the Alibaba community) has “a global trade platform for small and medium sized companies to track, verify and execute trading orders with financial institutions.”<sup>54</sup>

Not all blockchain companies with a specific goal or objective in mind operate in a limited region. For example, persons specifically looking at a blockchain company with a focus on food tracing and documentation in an increasingly regulated environment might consider Ambrosus. Ambrosus is a privately-owned Swiss tech firm that aims to use blockchain (distributed ledger technology), smart contracts and high-tech sensors to trace food and pharmaceutical supply chains.<sup>55</sup> It uses what it describes as “a public permissioned blockchain ecosystem with more than 500 decentralized node operators securing the network. Robust and scalable by design, the Ambrosus blockchain is optimized for interconnectivity with IoT devices, sensors, existing ERP systems, and other enterprise management software.”<sup>56</sup> Ambrosus offers open-source developer kits with a set of tools and services for those interested in utilizing the Ambrosus Network.

For agribusinesses interested in a wider range of blockchain services, there are also companies with a broader focus operating worldwide. One of the largest is SAP, a publicly owned operation headquartered in Germany, offering blockchain solutions for 18,300 worldwide partners in 78 countries. Obviously with a partner/client portfolio this large, SAP operates in many industries,<sup>57</sup> but it certainly has operations involving food and agriculture.<sup>58</sup> SAP offers a variety of alternative products as well, including supply side management but also a range of other options (such as financial services, customer experience, personnel engagement, and business technology). With regard to goals specifically related to agricultural supply chains, SAP offers options to help partners accomplish such things as creating “supply plans aligned with business goals”; optimizing “warehouse operations and inventories”; maximizing “supply chain logistics”;

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<sup>53</sup> Cecilia Li, *Alibaba Ramps Up Digital Support to Revitalize China’s Rural Economy*, Alizila (May 25, 2021) (archived at <https://perma.cc/C6P4-VJNF>).

<sup>54</sup> Shuyao Kong, *Why Alibaba Needs to Go All In On Blockchain*, Decrypt.com (Apr. 13, 2021) (archived at <https://perma.cc/WL7K-ZETW>). Bayer Crop Science has also collaborated with Ant Financial, running a blockchain pilot project in Anhui province, China, with pear farmers. This partnership enabled farmers to provide high-quality products to be sold by Alibaba. Richard Meyer, *Bayer Crop Science has agreed to work with Ant Financial, the payments affiliate of Alibaba, to develop a blockchain-based system for agricultural product monitoring*, CoinDesk (Sept. 30, 2019) (archived at <https://perma.cc/5HB7-82K8>).

<sup>55</sup> Annie Massa, *Someone Figured Out How to Put Tomatoes on a Blockchain*, Bloomberg (Nov. 9, 2017) (archived at <https://perma.cc/FT42-K6VQ>).

<sup>56</sup> *Welcome to Ambrosus*, Ambrosus.io (archived at <https://perma.cc/5ZV8-ZQVC>). This description is somewhat confusing as normally permissioned blockchains are regarded as private.

<sup>57</sup> *All Industries*, SAP.com (archived at <https://perma.cc/B7JE-L462>). This includes businesses involved in energy and natural resources, service industries, consumer industries other than agribusiness, public services, financial services, and certain discrete industries.

<sup>58</sup> *Industry/Consumer Products – Agribusiness*, SAP.com (archived at <https://perma.cc/HJ68-FQZB>).



and complying with regulations.<sup>59</sup> SAP offers software and support services including long term plans, embedded teams and remote support.<sup>60</sup> Their support portal includes a launchpad and extensive, searchable knowledge base, while their help portal provides a listing of products as well as documentation relating to those products. Their customer portal facilitates interaction with SAP options.

ChainVine is a global operation using blockchain technology to improve supply chain data. Headquartered in the U.K., it is still privately owned. As it describes its own operations, “ChainVine is a digital platform that manages supply chain data across different industries in a highly secure manner.”<sup>61</sup> Many of its clients have nothing to do with agriculture, but ChainVine does have some clients from the agricultural sector. In October 2020, the Seychelles began using ChainVine to increase efficiency in the fisheries sector.<sup>62</sup> Earlier agricultural applications include efforts undertaken in connection with HMRC (Her Majesty’s Revenue and Customs, the U.K. taxing authority) to reduce friction in trade involving Australian wine and spirits.<sup>63</sup> To facilitate this kind of innovation, ChainVine has a team of expert advisors working with its founders and directors. It has completed a fully digital customs and import system together with HMRC and the UK Food Standard Agency, and it enables secure asset tracing.

AgriLedger is also a privately-owned U.K. project. Formed in 2016, it has designed its operations to provide support to farmers by offering services that allow for tracing food origins, obtaining easier access to financing, and storing transactions data.<sup>64</sup> AgriLedger identifies a number of potential problems for farmers that it hopes to address.<sup>65</sup> These include the possibility that farmers may lack a digital identity, which may limit their ability to access services and benefits. AgriLedger also seeks to provide farmers with all available, important information relevant to their operations, while giving them the ability to efficiently track and trace products along the supply chain. AgriLedger works with companies and other agricultural enterprises on a worldwide basis to develop workable solutions. The company also has a social enterprise aspect to its operation, specifically targeting contamination of food products.<sup>66</sup>

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<sup>59</sup> *Food Supply Chain Management*, SAP.com (<https://www.sap.com/industries/agribusiness.html?pdf-asset=281c73d8-1a7d-0010-87a3-c30de2ffd8ff&page=1>).

<sup>60</sup> *Services and Support from SAP*, SAP.com (archived at <https://perma.cc/A7A2-XAAA>).

<sup>61</sup> *Connecting Goods & Data*, Chainvine.com (archived at <https://perma.cc/WWM7-GVFN>).

<sup>62</sup> *Seychelles Embraces ChainVine to Increase Business Efficiencies in Fisheries Sector*, ChainVine Press Release (Oct. 14, 2020) (archived at <https://perma.cc/54F7-6R5E>).

<sup>63</sup> *Intelligent Wine*, ChainVine.com (archived at <https://perma.cc/T7SA-TT28>).

<sup>64</sup> *Revolutionising the Agricultural Supply Chain with Blockchain*, Agriledger.io (archived at <https://perma.cc/FEP9-XSWD>).

<sup>65</sup> *AgriLedger, Democratizing Agriculture Data Using Blockchain*, ASPioneer (archived at <https://perma.cc/J3QZ-Y3LT>).

<sup>66</sup> *Revolutionising the Agricultural Supply Chain with Blockchain*, Agriledger.io (archived at <https://perma.cc/FEP9-XSWD>). Specifically designed to improve traceability to facilitate “tracking and recalling specific contaminated products throughout the supply chain....” Id.



Arc-net is a private company headquartered in Belfast in the U.K.<sup>67</sup> It was originally focused on distilleries and breweries with DistilledID, but it has expanded to support tracking and tracing activities in food and farming generally, utilizing HarvestID. Its goal is to help farmers “[u]se precision farming techniques to track your ... [produce] through their complete lifecycle from growth to packaging, logistics and retail.” Similarly, ranchers can “[a]ssociate ... meat products with DNA records or use GPS data to identify cereals from the field in which they were grown for maximum traceability.”<sup>68</sup>

OriginTrail is a privately owned E.U. company based in Slovenia. Dating back to 2011, its peer-to-peer decentralized network enables trusted data sharing between companies, organizations, and blockchains.<sup>69</sup> Its “network is comprised of nodes and an off-chain technology stack that was designed to allow the blockchain to interface with legacy software systems and other blockchains.”<sup>70</sup> OriginTrail uses the TRAC cryptoasset to compensate data creators, holders, and consumers, and incentivizes nodes to perform consensus checks. Existing use cases include a wide variety of industries, and case studies include safeguarding the validity of regulatory certifications, ensuring the validity of security audits, and promoting sustainable agricultural practices in Europe.<sup>71</sup> One of the nice features is that the Trace Alliance is free for the first couple of months, allowing potential members to become accustomed to the OriginTrail solutions, protocols, and benefits.

Provenance is a privately owned UK start-up focused on traceability and transparency in the agricultural sector.<sup>72</sup> It operates by associating physical products with a “digital passport” sufficient to verify identity, origin, and the record of its transportation.<sup>73</sup> Its stated goal is that “one day, every great product, whether a bottle of wine or a pair of jeans, will come with Provenance: accessible, trustworthy information about origin, journey and impact.” Provenance promises to assist clients with a team to help “align stakeholders on a transparency strategy.” Its original pilot program involved tracing of tuna, but it currently has businesses “from Sidney to San Francisco” using Provenance to make “their products transparent and trackable, reducing risk and increasing sales.”<sup>74</sup>

TE-FOOD is a private company founded in 2016. It is headquartered in Hungary and specializes in supply side management, specifically focused on identification tools to enable farm-to-table food traceability. It

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<sup>67</sup> See Arc-net website (archived at <https://perma.cc/VLF7-56LZ>).

<sup>68</sup> *We have a solution for your industry*, arc-net.io (archived at <https://perma.cc/T4N7-PZKV>) (you will need to access to live page and click on Food & Farming to access this information).

<sup>69</sup> OriginTrail Explained, *Quick Summary* (archived at <https://perma.cc/WMV3-SZ3Z>).

<sup>70</sup> Steve Walters, *OriginTrail (TRAC) Review: Blockchain Supply Chain Tracking*, CoinBureau (Mar. 21, 2021) (archived at <https://perma.cc/J752-AP8S>).

<sup>71</sup> *Leaving Traces*, OriginTrail.io (<https://origintrail.io/case-studies>).

<sup>72</sup> For those doing additional research, this company should not be confused with Provenance Blockchain, a financial services blockchain. See *Provenance Mission*, Provenance.io (archived at <https://perma.cc/5MJM-XZ87>). Instead, be sure to look at *Every product has a story*, Provenance.org (archived at <https://perma.cc/76Y7-ZX2H>).

<sup>73</sup> J. Steiner, et al., *Blockchain: The Solution for Transparent in Product Supply Chains*, Provenance Whitepaper (Nov. 21, 2015) (archived at <https://perma.cc/6GDE-AUFU>).

<sup>74</sup> These statements come from the Provenance website at <https://www.provenance.org/>.



also claims to be the number one solution in this endeavor.<sup>75</sup> This company works with food companies, consumers, and government organizations in offering identification tools to help trace livestock, and fresh food throughout the entire supply chain.<sup>76</sup>

For those particularly interested in dealing with businesses headquartered in the U.S., Ripe is a private American company, using blockchain technology combined with scanners and specialized sensors, to improve data in order to increase consumer confidence, build brand integrity, and improve yields of higher-quality produce.<sup>77</sup> Its goal is to transform “the food system narrative by working with every actor along the food supply chain to create a world in which access to data equals brand integrity, transparency, security and better food for all.”<sup>78</sup> Clients include food producers, distributors, and retailers and restaurants, and the company webpage invites interested parties to contact Ripe directly.<sup>79</sup> Ripe has also been working specifically on food traceability and safety. In one instance, Ripe partnered with Neogen to improve analysis of beef genomics on the animal protein supply chain.<sup>80</sup>

FoodLogiQ is another private company based in the U.S., with headquarters in Durham, North Carolina. FoodLogiQ’s website says it has “built the leading food industry software solution that specializes in Supplier Management, Food Safety Compliance, Quality Incident Management, Recall Management, and Whole Chain Traceability.”<sup>81</sup> FoodLogiQ works with restaurant operators, food and retail grocery, consumer packaged goods, food distributors, food importers, growers, packers, and shippers.<sup>82</sup> It is also working on improving interoperability with other blockchain applications working in food traceability.<sup>83</sup> They have onboarding services with a project team assisting with the process of configuring business requirements, building a team within the client’s organization, working toward a soft launch and final solution launch. For additional assistance, there is a managed services team and continuous training and support.<sup>84</sup>

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<sup>75</sup> *The #1 end-to-end food traceability solution on blockchain*, TE-Food.com (archived at <https://perma.cc/WCA2-W4PG>).

<sup>76</sup> TE-Food, *2021 Australian Trade and Investment Commission*, Medium (archived at <https://perma.cc/CBY7-V8PB>).

<sup>77</sup> Annie Massa, *Someone Figured Out How to Put Tomatoes on a Blockchain*, Bloomberg (Nov. 9, 2017) (archived at <https://perma.cc/FT42-K6VQ>).

<sup>78</sup> *#knowyourfood*, Ripe.io (archived at <https://perma.cc/X8YN-XJEM>).

<sup>79</sup> *Contact us*, Ripe.io (archived at <https://perma.cc/7UGK-3VNG>).

<sup>80</sup> *Neogen partners with ripe.io to bring blockchain to food safety and animal genomics*, Cision PR Newswire (Feb. 5, 2020) (archived at <https://perma.cc/CP3D-QQR9>); and Jane Byrne, *Neogen and Ripe Technology make strides in feed traceability, beef related genomic analysis*, Feed navigator.com (May 12, 2021) (archived at <https://perma.cc/J9R5-ERUC>). “Ripe.io and Neogen have been working on several projects, in different ways, most notably in the animal protein supply chain and in feed traceability and feed safety.”

<sup>81</sup> *FoodLogiQ connects the world’s food supply chain*, FoodLogiQ.com (archived at <https://perma.cc/8N9J-8MY3>).

<sup>82</sup> *FoodLogiQ’s Food safety, traceability and sustainability blog* (archived at <https://perma.cc/FP8R-S49R>).

<sup>83</sup> Kiecha Berzins, *FoodLogiQ Joins IBM, Ripe.io, SAP to Achieve Interoperability of Food Traceability Systems*, FoodLogiQ News (Jun 10, 2020) (archived at <https://perma.cc/PF53-TPWA>).

<sup>84</sup> *Onboarding & Managed Services*, FoodLogiQ.com (archived at <https://perma.cc/TP9J-AX4H>).



Movilitas is an international operation, still privately held, headquartered in Maryland. Although predominantly associated with pharmaceutical supply chains, in the agribusiness sector, Movilitas is working to improve sustainability, security, adaptability, traceability, and regulatory compliance.<sup>85</sup> Its experience with the highly regulated pharmaceutical sector has positioned Movilitas to help partners implement track and trace solutions to assure compliance. It has, for example, done this in connection with halal certification requirements.<sup>86</sup> Movilitas focuses on using distributed ledger technology to record key events and conditions from origin to destination. Whenever a shipment or product's unique identifier is scanned the related information is captured on the blockchain. Movilitas offers global support services, partnered with SAP (which is described earlier in this section) to help clients deal with limited in-house expertise.<sup>87</sup> Support services can either be bundled or acquired "a la carte," and are available continuously.

### Commerce and Customer Relations

It could probably go without saying that the primary goal for most agribusinesses is providing agricultural products to customers for a profit. Certainly, working with Walmart or improving supply chain management feeds into this objective, but blockchain technology can also focus specifically on improving the ability of farming or ranching operations to attract consumers. This can involve efforts to raise consumer confidence or can impact marketing in other ways. Many of these functions can be achieved through companies that also have other supply chain applications.

Just as partnerships with Walmart and the IBM Food Trust<sup>88</sup> can help agribusinesses in the U.S, in China participation in the Blockchain Food Safety Alliance (with which Walmart and JD.com are associated) is a potentially helpful marketing strategy.<sup>89</sup> Efforts have included a focus on improving food safety, including safety of meat products imported from Australia. Alibaba,<sup>90</sup> JD.com's major competitor in China, also supports blockchain technology in the agricultural sector. It has been particularly active in developing applications that improve consumer confidence in the integrity and safety of food products.<sup>91</sup>

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<sup>85</sup> *Agribusiness & Chemicals*, Movilitas.com (archived at <https://perma.cc/7932-V8S4>).

<sup>86</sup> Carlos Rabadan Escudero, *Authentic Halal: Restore Trust from Traceability and Blockchain*, Movilitas.com (archived at <https://perma.cc/ZM2B-CGWN>).

<sup>87</sup> *SAP Support Services*, Movilitas.com (archived at <https://perma.cc/NL2C-R2KL>).

<sup>88</sup> Walmart and the IBM Food Trust are discussed more extensively at notes 32-38 and accompanying text.

<sup>89</sup> JD.com and the Blockchain Food Safety Alliance are discussed at notes 47-48 and accompanying text. For additional information about how the food safety project has progressed (as well as other applications in China) see *Can blockchain guarantee food safety in China*, Forkast News (updated Ap. 8, 2020) (archived at <https://perma.cc/289B-HVBS>).

<sup>90</sup> Alibaba is introduced and discussed at notes 49-54 and accompanying text. For more information on their food safety initiatives see *Food Safety: Chinese Supermarkets Bet on Blockchain*, SQLI Digital Experience Blog (Ap. 21, 2020) (archived at <https://perma.cc/J3HD-H3U8>).

<sup>91</sup> Danielle Long, *Alibaba launches blockchain technology to improve supply chain integrity and enhance trust in platform*, The Drum (April 30, 2018) (archived at <https://perma.cc/89W4-444X>).



Along the same lines, SAP offers many blockchain services including some that are focused on improving the effectiveness of their clients' marketing efforts, often by helping them focus on their customer experiences. SAP's global operation includes products offering the capability to improve selling effectiveness (ranging from account visibility to visit planning sales analytics, order capture, and store design); personalized commerce (for example, automatic promotion of goods and services based on customer behavior and goals); customer engagement (targeting audiences, offering individualized experiences, real time recommendations, and loyalty management); optimized marketing; sales performance monitoring and management; and single customer focus.<sup>92</sup> SAP can help partners in the agricultural sector create "accurate demand plans by gaining insights to achieve productivity and customer satisfaction" and by "enhancing customer satisfaction."<sup>93</sup> As is true for their other products, SAP offers software and support services including long term plans, embedded teams and remote support.<sup>94</sup>

Unlike SAP, which offers a full range of services and functionality, Connecting Food, a private company headquartered in Paris, France, focuses on improving consumer confidence. Connecting Food has a blockchain-based system designed to give consumers the power to scan a QR code and obtain accurate, complete information about the product origin, agricultural practices associated with it, and commitments relating to sustainability. Connecting Food has been highly ranked, placing in the Top 5 Food Safety & Traceability companies in 2020.<sup>95</sup> The company is also the first blockchain traceability platform with a fully digitized information verification/auditing module, which it has named Live Audit®.<sup>96</sup> For potential customers or partners, Connecting Food offers demonstrations of its products.

Most companies attempting to help agribusinesses improve their marketing efforts through blockchain include that as part of their overall product/service base. For example, AgriChain<sup>97</sup> can help farming and ranching operations with contracting and broker integration, both of which can improve marketing effectiveness. In addition, modules are available for storage operators, grain traders and brokers, processors and end users such as feedlots. Similarly, AgriLedger offers farmers a range of services.<sup>98</sup> It also has a social enterprise aspect to its operations, part of which specifically targets contamination of food

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<sup>92</sup> SAP is introduced back at notes 57-60 and accompanying text. Agribusiness, *Transform and grow to sustainably feed the world*, SAP.com, available online at <https://www.sap.com/industries/agribusiness.html> (click on the "learn more" box under Marketing and Sales).

<sup>93</sup> *Food Supply Chain Management*, SAP.com (<https://www.sap.com/industries/agribusiness.html?pdf-asset=281c73d8-1a7d-0010-87a3-c30de2ffd8ff&page=1>).

<sup>94</sup> *Services and Support from SAP*, SAP.com (archived at <https://perma.cc/A7A2-XAAA>).

<sup>95</sup> *The Top 5 Food Safety & Traceability Companies*, The FoodTech 500 2020, at 15 (can be downloaded at <https://forwardfooding.com/food-tech-reports/>).

<sup>96</sup> *Reconnecting all Consumers With Their Food*, ConnectingFood (archived at <https://perma.cc/Z7KK-XWA7>).

<sup>97</sup> AgriChain is introduced and discussed at notes 43-44 and accompanying text.

<sup>98</sup> Agriledger is introduced at notes 64-65 and accompanying text.



products,<sup>99</sup> which will obviously benefit customers while simultaneously protecting the reputation of the farmer. Arc-Net, through its tracing technology, can also help combat counterfeit goods and improve marketing.<sup>100</sup> Every product added to Arc-net's Harvest-ID is given a "storybook" built by Arc-net's experts that contains a record for that product's origin and history that can be used to combat counterfeit, contaminated goods or to improve marketing. Provenance also uses blockchain to improve traceability and transparency at least partially in order to increase sales.<sup>101</sup>

TE-FOOD is a private company founded in 2016. It is headquartered in Hungary and specializes in supply side management, specifically focused on identification tools to enable farm-to-table food traceability. It also claims to be the number one solution in this endeavor.<sup>102</sup> This company works with food companies, consumers, and government organizations in offering identification tools to help trace livestock, and fresh food throughout the entire supply chain, with consumer impact as part of its potential impact.<sup>103</sup>

OriginTrail<sup>104</sup> is not focused solely on agriculture or solely on commerce, but it has certainly worked to improve the experience of consumers. As an example of this kind of effort, OriginTrail participated in a European grant-funded trial in China to prevent wine fraud, using "TagItSmart."<sup>105</sup> It has been estimated that tens of thousands of bottles of wine are sold every hour in China, and "[m]any of these wines are mixed with a variety of dangerous additives that can be detrimental to health. ... [the TagItSmart partnership] conducted the first phase of their pilot program, which tracked more than 15,000 unique wine bottles."<sup>106</sup> The hope is that widespread adoption of such technology will make adulteration of wine products impossible because consumers will be able to scan QR codes and learn about the farmers associated with a particular product as well as the environmental conditions under which the crop or livestock was raised.

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<sup>99</sup> *Revolutionising the Agricultural Supply Chain with Blockchain*, Agriledger.io (archived at <https://perma.cc/FEP9-XSWD>). According to this source, Agriledger offers programs specifically designed to improve traceability to facilitate "tracking and recalling specific contaminated products throughout the supply chain...." Id.

<sup>100</sup> Arc.net is described at notes 67-68 and accompanying text.

<sup>101</sup> Provenance is introduced at notes 72-74 and accompanying text. The potential for increased sales is expressly mentioned on the Provenance website at <https://www.provenance.org/>.

<sup>102</sup> *The #1 end-to-end food traceability solution on blockchain*, TE-Food.com (archived at <https://perma.cc/WCA2-W4PG>).

<sup>103</sup> TE-Food, *2021 Australian Trade and Investment Commission*, Medium (archived at <https://perma.cc/CBY7-V8PB>).

<sup>104</sup> OriginTrail is introduced at notes 69-71 and accompanying text.

<sup>105</sup> OriginTrail, *Utilizing Smart Sensors to Prevent Wine Fraud — OriginTrail's Pilot With TagItSmart*, Medium (Feb. 28, 2018) (archived at <https://perma.cc/M88B-R4A5>). More details about the program are available at TagItSmart, *TagItWine Pilot For Brand Protection And Anticounterfeiting In Wine Industry* (Dec. 31, 2018) (archived at <https://perma.cc/9DVQ-3EFQ>).

<sup>106</sup> Darya Yafimava, *Blockchain In the Supply Chain: 10 Real-Life Use Cases and Examples*, OpenLedger at part 6 (Jan. 22, 2019) (archived at <https://perma.cc/GXP2-7623>). The TagItSmart application allows consumers to scan a QR code on one of the tagged bottles, giving them access to detailed product information and history.



For blockchain companies headquartered in the U.S., Ripe<sup>107</sup> offers a number of applications some of which are specifically designed to increase confidence and build integrity of their partners' brands. FoodLogiQ is also based in the U.S., and its products include those that focus on recall management and traceability, working with groceries and in connection with consumer-packaged goods.<sup>108</sup>

### Energy/Environmental Applications

Blockchain technology is also helping businesses in the agricultural sector address energy and environmental concerns. Agriculture is an energy intensive endeavor, so proper management can result in considerable energy savings with corresponding environmental benefits. In addition, properly-managed soil has the capacity to absorb significant amounts of carbon in the form of carbon dioxide, potentially helping to reduce greenhouse emissions.

There are a number of platforms that can assist agricultural operations to improve efficiency, many of which are not limited to agribusinesses. For example, SAP, operating worldwide with more than 18,300 partners, has plans to help clients reduce emissions and ethically source materials.<sup>109</sup> Although SAP covers many more industries than agriculture, it does apply to agribusinesses.<sup>110</sup> Poseidon is a blockchain-based enterprise that developed “reduce,” the first climate action platform to create a financial link between everyday activities and projects to rebalance or renew resources.<sup>111</sup> It supports projects that reduce greenhouse gas emissions by buying carbon credits.<sup>112</sup> It can function with agricultural operations that operate in a manner to reduce energy use, although it is not limited to that kind of business. To accelerate the transition to the green energy economy, SolarCoin<sup>113</sup> creates new possibilities for energy and water trading and for incentivizing energy efficient alternatives.<sup>114</sup> The Rainforest Alliance is another platform that is focused on sustainability and environmental issues, and in the agricultural sphere it “partners with frontline communities to build thriving rural economies rooted in more sustainable growing practices and

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<sup>107</sup> Ripe is discussed above at notes 77-80 and accompanying text.

<sup>108</sup> FoodLogiQ is introduced at notes 81-84 and accompanying text. The information about commercialization comes from *FoodLogiQ connects the world's food supply chain*, FoodLogiQ.com (archived at <https://perma.cc/8N9J-8MY3>).

<sup>109</sup> Enable resilient and sustainable supply chain management processes, SAP.com (archived at <https://perma.cc/R9HV-MVWW>).

<sup>110</sup> See *Industry/Consumer Products – Agribusiness*, SAP.com (archived at <https://perma.cc/HJ68-FQZB>).

<sup>111</sup> *Home*, Poseidon.eco (archived at <https://perma.cc/EB66-CKVG>).

<sup>112</sup> James Mitchell, *The Poseidon Principles: A Groundbreaking New Formula for Navigating Decarbonization*, RMI (June 17, 2019) (archived at <https://perma.cc/5A76-86XS>).

<sup>113</sup> SolarCoin describes itself as a “cryptocurrency that incentivizes a solar-powered planet.” See Solarcoin.org (archived at <https://perma.cc/39F9-TWBQ>). This website explains how the project functions.

<sup>114</sup> For example, in 2019 the German solar inverter manufacturer SMA Solar Technology gave 260,000 customers the ability to claim SolarCoins in exchange for solar energy on top of any other payment they might receive. Jason Deign, *SMA Offers SolarCoin Crypto Cash to 260,000 PV Owners*, Green Tech Media (Feb. 15, 2019) (archived at <https://perma.cc/FQ2X-5NPT>).



forest stewardship.”<sup>115</sup> It works in part by providing consumers with information enabling them to make purchasing decisions that include information about the ecological impact of various products.<sup>116</sup>

The IBM Food Trust, which is focused on the food and agriculture sector, also offers tools to help clients improve energy efficiency.<sup>117</sup> It is not the only agribusiness specific platform. For example, American Certified Brands, doing business as Beefchain, is a Wyoming-based enterprise that provides monitoring and verification for certification of free range, grass fed cattle.<sup>118</sup> This has an environmental impact because the cattle must be organically fed, reducing acidification, excess nutrient runoff, and energy consumption.<sup>119</sup> A more direct focus on the environment is found in Nori, a Seattle based startup that works to pay farmers to adopt farming practices that reduce their carbon emissions.<sup>120</sup> The company has a blockchain-based platform and NFTs that facilitate payment for removing carbon from the ecosystem for a period of at least ten years,<sup>121</sup> while ensuring that the carbon credits are not sold more than once.<sup>122</sup>

There are a range of other pilot programs that have been undertaken using blockchain to improve agricultural efficiency, ranging from efforts to incentivize efficient removal of rural waste in Shanxi Province China<sup>123</sup> to a proposal to stimulate the use of photovoltaic panels to power irrigation of agricultural operations.<sup>124</sup> Other blockchain applications include precision farming which avoids waste and

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<sup>115</sup> Rainforest Alliance, *Livelihoods* (archived at <https://perma.cc/7SNZ-2FZY>).

<sup>116</sup> For example, in April 2020, Nestlé, a Swiss food and drink processing company, partnered with a party certifier, The Rainforest Alliance, “to independently provide data beyond what is usually disclosed by the company.” *Nestlé expands blockchain to Zoégas coffee brand*, Nestlé News, nestle.com (archived at <https://perma.cc/5QEH-THZX>). Nestlé’s efforts allow consumers to trace the origins of launch of select editions of Zoégas whole beans and roast and ground coffee in Sweden through the IBM Food Trust blockchain platform.

<sup>117</sup> *Opportunities of Blockchain for Agriculture*, Brussels Development Briefing No. 55 (Brussels (May 15, 2019) (archived at <https://perma.cc/C9ZL-NZMC>). “IMB Food Trust is aimed at ensuring food is safe and fair traded and as low-carbon footprint as possible.”

<sup>118</sup> USDA, *Official Listing of Approved USDA Process Verified Programs for Service Providers*, originally approved Ap. 9, 2019 (updated May 27, 2021) (archived at <https://perma.cc/V5TP-CQTC>).

<sup>119</sup> For a student evaluating the environmental impact of organically fed cattle, see *Organic Grass-fed Beef is Better for the Environment*, The Cornucopia Institute (May 15, 2018) (archived at <https://perma.cc/P7PB-NGKB>).

<sup>120</sup> *For Growers*, Nori.com (archived at <https://perma.cc/NJ5G-MEED>).

<sup>121</sup> For an explanation of how the process works, see *How the Nori Marketplace Works: Generating NRTs*, Nori.com (archived at <https://perma.cc/3GVH-SN4E>).

<sup>122</sup> Ian Allison, *Climate Startup Nori Raises \$4M to Solve Carbon Market Double-Spending*, CoinDesk (Sept. 24, 2020) (archived at <https://perma.cc/VZE3-Z28R>).

<sup>123</sup> David Zhang, *Application of Blockchain Technology in Incentivizing Efficient Use of Rural Wastes: A case study on Yitong System*, 158 *Energy Procedia* 6707 (Feb. 2019) (available for download at <https://www.sciencedirect.com/science/article/pii/S187661021930027X>).

<sup>124</sup> Florentina Magda Enescu et al., *Implementing Blockchain Technology in Irrigation Systems That Integrate Photovoltaic Energy Generation Systems*, MDPI (Feb. 18, 2020) (archived at <https://perma.cc/UZQ5-R84J>).

This article attempts to describe a solution to provide alternative irrigation systems for small farmers. The solution involves creating associations of small farmers that will use green energy from photovoltaic panels for the irrigation of agricultural lands. The efficiency of the proposed system can be monitored not only through digital hardware connected to photovoltaic panels and water pumps, but also by using the new blockchain



improves yields and facility agriculture that can improve efficiency, both with potential benefits for energy use and environmental impact.<sup>125</sup>

## Conclusion

As noted earlier, this paper does not purport to mention all of the blockchain applications that could be of use to agribusinesses. For example, blockchain and smart contracts can also improve the functionality of crop insurance by facilitating prompt and accurate payouts.<sup>126</sup> There are already a number of blockchain platforms that offer improved crop insurance options for farmers, although most of these are limited in scope.<sup>127</sup> Other platforms operate for the direct benefit of consumers, using blockchain technology to connect consumers with wholesalers rather than grocery stores, usually focusing on manufacturing facilities that process food products.<sup>128</sup> In addition, there are platforms that offer blockchain solutions to authenticate certifications, ratings, or even customer reviews or complaints.<sup>129</sup> At some point in the future, these kinds of operations may be looked to by regulators in order to demonstrate compliance with legal requirements.<sup>130</sup>

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technology that stimulates innovation and growth in the energy and a high level of automation through smart contracts.

<sup>125</sup> A survey of these potential applications can be reviewed at Xing Yang, et al., *A Survey on Smart Agriculture: Development Modes, Technologies, and Security and Privacy Challenges*, 8 IEEE/CAA Journal of Automatica Sinica 273 (Feb. 2021) (available online at <http://www.ieee-jas.net/fileZDHXBEN/journal/article/zdhxbywb/2021/2/PDF/jas-8-2-273.pdf>).

<sup>126</sup> Commentators have observed that the claims process for farmers is often “painfully slow and burdensome ... both on the side of the grower and the company that insures them. Unpredictable weather anomalies make it difficult to correctly estimate and quickly report the exact losses they cause. This leaves room for fraud and makes the process an operational nightmare.” 8 *Blockchain Startups Disrupting The Agricultural Industry*, Start Us Research Blog (archived at <https://perma.cc/TLG9-YFFQ>).

<sup>127</sup> Etherisc – A blockchain startup offering crop insurance to farmers via its decentralized insurance applications. In November 2020, Etherisc announced work on a blockchain-based parametric crop insurance platform for small farmers in Kenya. Etherisc to develop a blockchain-based crop insurance for Kenyan farmers, LedgerInsights (Nov. 16, 2020) (archived at <https://perma.cc/5LXV-FAAZ>). Avenews Agri-Platform, Avenews-gt.com (archived at <https://perma.cc/SM95-N7BU>) links financial institutions and agri-businesses. Provide digital identification (as of 2021 still in beta testing). “Apply for working capital, loans, insurance, and many other services directly on the platform.”

<sup>128</sup> Niamh Michail, *Smart E-commerce: INS Connects Manufacturers and consumers for a Slice of \$8.5 Trillion Global Grocery Industry*, Food Navigator.co (Nov. 23, 2017) (archived at <https://perma.cc/V5QU-Y36X>). This project started with dry and packaged goods but has plans to move into frozen and fresh food items as well.

<sup>129</sup> Greenfence is a California-based company describes itself as “the food industry’s only comprehensive authentication gateway” for certification, ratings and review, authentication, harmonization, interoperability, performance, microbanking and shared value. *Greenfence Home*, Greenfence.com (archived at <https://perma.cc/R9H7-3ESB>). There are no fees to join, and no subscription or maintenance fees. Building primary producing communities by sharing data, collaborating with full transparency.

<sup>130</sup> Mason Marks, *Blockchain and the FDA’s Blueprint for a New Era of Smarter Food Safety*, SLS Blogs (Mar. 10, 2021) (archived at <https://perma.cc/54JG-8EEE>).



Rather than trying to identify every kind of blockchain business or every existing application, this paper provides an introduction into some of the more significant and larger platforms. In reality, the potential of the new technology has barely begun to be tapped, and additional options are certain to develop. The information that appears here is a starting point for agribusinesses large and small considering whether there are potential uses for blockchain that might be of benefit to them. As pointed out at the outset of this paper, the footnotes included here provide links to additional resources.<sup>131</sup>

There are, of course, other sources that list additional blockchain resources.<sup>132</sup> Hopefully the information presented in this series of three papers will help anyone seeking to learn more about this tremendously exciting and rapidly evolving area.

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<sup>131</sup> Most of the information is archived, and in order to click links, it will be necessary to visit the live page, but that can be done from the archival version of the documents.

<sup>132</sup> For example, a 2019 recent survey lists a number of operations that use blockchain technology in agribusiness food chains. Guoqing Zhao et al., *Blockchain technology in agri-food value chain management: A synthesis of applications, challenges and future research directions*, 109 *Computers in Industry* 83 (May 3, 2019) (abstract archived at <https://perma.cc/MGT9-EZAH>). Another source evaluates the merits of six different approaches to blockchain in the food supply chain. Susanne Köhler & Massimo Pizzol, *Technology assessment of blockchain-based technologies in the food supply chain*, 269 *J. of Cleaner Production* 122193 (Oct. 1, 2020) (available at [https://www.sciencedirect.com/science/article/pii/S095965262032240X?dgcid=raven\\_sd\\_recommender\\_email](https://www.sciencedirect.com/science/article/pii/S095965262032240X?dgcid=raven_sd_recommender_email)). A more recent study of the impact of blockchain on agricultural supply chains provides information about the effectiveness of the new technology. Stefanella Stranieri et al., *Exploring the impact of blockchain on the performance of agri-food supply chains*, 119 *Food Control* 107495 (Jan. 2021) (available at <https://www.sciencedirect.com/science/article/pii/S0956713520304114>).

