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Agriculture & Blockchain: Identifying Liability and Guaranteeing Quality

*Morgan Crider**

I. INTRODUCTION

Blockchain is being considered, and in some cases used, for foodborne illness origin identification.[1] In September 2018, Walmart and Sam's Club announced that they would require their suppliers to begin using an IBM blockchain platform to allow for greater transparency and traceability in the production of leafy green vegetables in the event of an Escherichia Coli (E. coli) outbreak.[2] The companies' efforts were further highlighted in the midst of an extensive romaine lettuce based E. coli outbreak that lasted from December 2018 to January 2019.[3] This was the second time in 2018 that there was a foodborne illness outbreak related to romaine lettuce.[4] Sixty-two people from sixteen different states and the District of Columbia were reported as being infected by the strain of E. coli at issue, and the outbreak did not officially end until January 9, 2019.[5] When investigating the outbreak, the United States Food and Drug Administration (FDA) advised the public to stop eating lettuce completely because there was no way to quickly and accurately identify the source of contamination.[6]

Being able to identify the source of contamination in a foodborne illness outbreak is not only an important issue for public safety but also essential in

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1. *See* Kate Rooney, *Walmart is Going to Use Blockchain to Stop the Spread of E. Coli and Other Diseases in Lettuce*, CNBC (Sept. 25, 2018), https://www.cnbc.com/2018/09/24/walmart-is-going-to-use-blockchain-to-stop-the-spread-of-e-coli-in-lettuce.html; *cf. From Shore to Plate: Tracking Tuna on the Blockchain*, PROVENANCE (July 15, 2016), https://www.provenance.org/tracking-tuna-on-the-blockchain (outlining a blockchain system used for tuna fishing in Indonesia that allows consumers to see the fair labor and sustainability aspects of fish they buy).

2. *See* Rooney, *supra* note 1.

3. *See Outbreak of E. Coli Infections Linked to Romaine Lettuce*, CTRS. FOR DISEASE CONTROL & PREVENTION (Jan. 9, 2019), https://www.cdc.gov/ecoli/2018/o157h7-11-18/index.html.

4. *See* Maggie Fox, *The FDA thinks Walmart May Have One Solution to Romaine Lettuce Recalls*, CNBC (Nov. 27, 2018), https://www.nbcnews.com/health/health-news/fda-thinks-walmart-may-have-one-solution-romaine-lettuce-recalls-n940826.

5. *See Outbreak of E. Coli Infections Linked to Romaine Lettuce*, *supra* note 3.

6. *See* Fox, *supra* note 4.

enabling people to have a legal remedy for the damages incurred.[7] To succeed on a defective food product liability claim, it is imperative for a plaintiff to know the source of the contaminant so as to identify the proper defendant.[8] Product liability laws vary by state in that not all states permit plaintiffs to bring forth a claim with multiple defendants based on the likelihood that one or several of the named defendants was the source of contamination.[9]

Blockchain technology is essentially an electronic ledger that provides a detailed history of previous interactions between collaborating parties, and such a ledger cannot be easily altered.[10] Through the use of blockchain, companies are able to see the chain of custody for a food product and are capable of accounting for any product issues that may have occurred earlier on.[11] Blockchain provides an effective and efficient way to achieve data and transaction transparency.[12] This Comment will focus on the use of blockchain technology in the agriculture industry and how the use of a verifiable blockchain platforms would resolve judicial ambiguity in food product liability litigation.

II. THE CHALLENGE OF FOODBORNE ILLNESS INVESTIGATIONS AND LITIGATION

When addressing a foodborne illness outbreak, the focus is on safety and regulatory solutions.[13] The law generally defaults to looking at the place of origin as the source of liability, but by implementing blockchain technology into food production, there would be greater transparency about the chain of ownership which would promote a broader and a more informed approach to agricultural product liability.[14]

7. Angela Holt, *Alternative Liability Theory: Solving the Mystery of Who Dunnit in Foodborne Illness Cases*, 2 PITT. J. ENVTL. & PUB. HEALTH L. 105, 108 (2008).

8. *See id.*

9. *See id.* at 116.

10. *See* Maryanne Murray, *Blockchain Explained*, REUTERS GRAPHICS (June 15, 2018), http://graphics.reuters.com/TECHNOLOGY-BLOCKCHAIN/010070P11GN/index.html.

11. *See Blockchain: The Solution for Transparency in Product Supply Chains*, PROVENANCE (Nov. 21, 2015), https://www.provenance.org/whitepaper.

12. *See id.*

13. *See* Alexia Brunet Marks, *Check Please: Using Legal Liability to Inform Food Safety Regulation*, 50 HOUS. L. REV. 723, 724 (2013).

14. *See id.* at 725; *Blockchain: The Solution for Transparency in Product Supply Chains*, *supra* note 11.

A. The Origination and Investigation of Foodborne Illnesses

A foodborne illness is generally an infection caused by bacteria, viruses, or parasites carried by contaminated foods.[15] Food may be contaminated at any point during growing, harvesting, processing, storage, and shipping.[16] Further contamination may take place during the preparation process if handlers do not wash their hands, utensils, or kitchen surfaces after coming into contact with raw foods, which will likely lead to cross contamination.[17] In the United States, the top five germs that cause foodborne illnesses are: (1) Norovirus; (2) Salmonella; (3) Clostridium perfringens; (4) Campylobacter; and (5) Staphylococcus aureus.[18] Raw foods such as meat, poultry, fish, and fresh produce frequently contain bacteria that cause foodborne illnesses.[19]

A patient with a foodborne illness typically presents gastrointestinal or neurologic symptoms.[20] Healthcare providers must consider the symptoms of the patient, foods and beverages recently consumed by the patient, and the medical history of the patient.[21] Identifying the source of the foodborne illness can be challenging because there is typically a viral incubation period.[22] Illness causing pathogens can have an incubation period of several days before symptoms appear.[23] Therefore, by the time the symptoms do appear, it is much harder for the patient to identify the source of his illness.[24] Further, an outbreak may begin with a patient who is not severely ill, therefore physicians have to approach claims of gastrointestinal distress with careful suspicion.[25] If the physician believes that a foodborne illness is the cause of the symptoms, then the physician must submit the appropriate samples from the patient for laboratory testing.[26] Subsequently, the physician must formally report to the state or local health department regarding the possible out-

15. *See Food Safety*, CTRS. FOR DISEASE CONTROL & PREVENTION, https://www.cdc.gov/foodsafety/foodborne-germs.html (last updated Feb. 16, 2018).

16. *See Symptoms & Causes of Food Poisoning*, NAT'L INST. OF DIABETES & DIGESTIVE & KIDNEY DISEASES (June 2019), https://www.niddk.nih.gov/health-information/digestive-diseases/food-poisoning/symptoms-causes#causes.

17. *See id.*

18. *See Food Safety*, *supra* note 15.

19. *See Symptoms & Causes of Food Poisoning*, *supra* note 16.

20. *See Diagnosis and Management of Foodborne Illnesses*, CTRS. FOR DISEASE CONTROL & PREVENTION (Apr. 16, 2004), https://www.cdc.gov/MMWR/preview/mmwrhtml/rr5304a1.htm.

21. *See id.*

22. *See id.*

23. *See* Holt, *supra* note 7, at 108.

24. *See id.*

25. *See Diagnosis and Management of Foodborne Illnesses*, *supra* note 20.

26. *See id.*

break.[27] The possibility of foodborne illnesses may also be detected through public health surveillance, where health officials gather reports of illnesses to determine if there is a large number of people in one location in a given period of time being diagnosed with the same illness.[28] Private citizens may also call the local health department to report a possible foodborne illness outbreak.[29] In addition, for certain pathogens such as E. coli, state laboratories will report the unique DNA identifier of the strand to the PulseNet database.[30] PulseNet is a national laboratory network that connects foodborne illness cases to detect outbreaks.[31] PulseNet's database allows public health officials investigating outbreaks to quickly identify if a recently reported pathogen matches the DNA strand of a specific strain of pathogen in the database.[32] If an investigation indicates that a large number of infected people have significant similarities in their diagnosis, the illnesses are then classified as an outbreak.[33]

After a foodborne disease outbreak is detected, public health and regulatory officials work to collect information rapidly in order to find out which pathogen is causing the outbreak and where the contamination originated.[34] In an investigation, there are three types of data collected: (1) epidemiologic; (2) traceback; and (3) environmental testing.[35] Epidemiologic data is the "patterns in the geographic distribution of illnesses, the time periods when people got sick and past outbreaks involving the same germ."[36] Traceback data is the information obtained from stores and restaurants to determine the point of contamination in the food processing chain.[37] Lastly, food and environmental testing data is the DNA data linking illness-causing germs found in a food item obtained from a diagnosed patient's home or food production location and germs found in other environments that resulted in people be-

27. *See id*; *see also Foodborne Outbreaks—Step 1: Detect a Possible Outbreak*, Ctrs. for Disease Control & Prevention, https://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/investigations/detection.html (last updated June 20, 2018).

28. *See Foodborne Outbreaks—Step 1: Detect a Possible Outbreak*, *supra* note 27.

29. *See id.*

30. *See id.*

31. *See id.*

32. *See id.*

33. *See id.*

34. *Investigating Outbreaks*, Ctrs. for Disease Control & Prevention, https://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/index.html (last updated June 12, 2018).

35. *See id.*

36. *See id.*

37. *See id.*

coming sick.[38] However, even with all of this data, health officials are not able to solve every outbreak, either because of the ambiguity in tracing or because the outbreak ends before enough information can be gathered.[39]

With these three types of data, the health officials will develop hypotheses about the origination of the outbreak.[40] During this process, health officials will conduct interviews with diagnosed patients to determine what and where they ate and how long before they began exhibiting symptoms.[41] Health officials will combine the three different sets of data with the information obtained from the interviews to determine the source of food contamination.[42]However, due to the incubation period of certain viruses, the reliance on patient memory and personal knowledge can be challenging, because the patient may not remember what they ate several weeks ago and may not be able to identify what ingredient was contaminated.[43]

To determine the validity of the developed hypotheses, health officials will compare the statistical information regarding sick patients against individuals who had similar exposure to a contaminated food.[44] Health officials will determine the strength of the association with respect to a specific food item that was reported more often by sick patients than individuals who were in good health.[45] Pivotal factors in interpreting the results of the data with the hypotheses are the amount of exposure to the particular food, "the strength of the statistical association," and "[t]he food's production, distribution, preparation, and service."[46]

Food testing also takes place to identify the DNA of the bacteria in food products matching the original contaminant.[47] Identifying bacteria with matching DNA is an additional form of data used to confirm the hypotheses concerning the source of contamination.[48] However, food testing is not al-

38. *See id.*

39. *See id.*

40. *See Foodborne Outbreaks—Step 3: Generate Hypotheses about Likely Sources*, CTRS. FOR DISEASE CONTROL & PREVENTION, https://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/investigations/sources.html (last updated June 20, 2018).

41. *See id.*

42. *See id.*

43. *See id.*

44. *See Foodborne Outbreaks—Step 4: Test Hypotheses*, CTRS. FOR DISEASE CONTROL & PREVENTION (last revised June 20, 2018), https://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/investigations/hypotheses.html (last updated June 20, 2018).

45. *See id.*

46. *See id.*

47. *See id.*

48. *See id.*

ways dependable, especially when the particular food has a short shelf-life, has become spoiled, is in an open container, or if there is no accurate test for the specific pathogen.[49]

Once an outbreak is determined, public health officials act swiftly to disinfect the food facilities, temporarily close the location of contamination, inform the public how to make the food safe or to not eat the food item, and tell people to throw away any suspect food remaining in their homes.[50] The Center for Disease Control (CDC) will likely warn the public of the current risk when the investigation identifies the food item linked to the series of illnesses.[51] However, there are instances where the hypotheses fail to link food to an illness or any specific food.[52] Such failures may be on account of a number of reasons, including: (1) the investigation taking place too long after the outbreak; (2) no specific hypothesis being formed; (3) too few illnesses being available to study; (4) patients not remembering the food they ate; (5) food testing either not being done or not revealing a pathogen; or (6) not enough resources being available to conduct the investigation.[53]

In 2018, the CDC estimated that each year "48 million get sick from a foodborne illness, 128,000 are hospitalized, and 3,000 die."[54] In 2011, the Grocery Manufacturers Association surveyed three dozen international companies, more than half of which reported being impacted by a food recall at least once in the past five years.[55] Of those surveyed, the reported financial impact as result of food recalls ranged from $30 to $100 million, but the heftiest cost was the reputational damage done to the companies.[56] In light of all of the ambiguities and difficulties caused by each step of the investigation, there is a considerable need for the aid of technological advancement to provide efficiency and reliability.

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49. *See id.*

50. *See Foodborne Outbreaks—Step 6: Control an Outbreak*, CTRS. FOR DISEASE CONTROL & PREVENTION, https://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/investigations/control.html (last updated June 20, 2018).

51. *See id.*

52. *See Foodborne Outbreaks—Step 5: Solve Point of Contamination and Source of the Food*, CTRS. FOR DISEASE CONTROL & PREVENTION, https://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/investigations/contamination.html (last updated June 20, 2018).

53. *See id.*

54. *Foodborne Illnesses and Germs*, CTRS. FOR DISEASE CONTROL & PREVENTION, https://www.cdc.gov/foodsafety/foodborne-germs.html (last updated Feb. 16, 2018).

55. Beth Kowitt, *Why Our Food Keeps Making Us Sick*, FORTUNE (May 6, 2016), http://fortune.com/food-contamination.

56. *See id.*

B. Meeting the Burden of Proof in Product Liability

Food safety laws exist at all levels of government with their own regulating agencies.[57] At the federal level, the FDA, Food Safety and Inspection Service (FSIS), and CDC are responsible for regulating and enforcing federal food safety rules.[58] The FDA's regulatory jurisdiction encompasses safety standards over a wide range of products found in food.[59] Specifically, the FDA is responsible for ensuring the safety and security of the nation's food supply.[60] FSIS is an agency within the United States Department of Agriculture (USDA) responsible for ensuring the safety of meat, poultry, and processed egg products by reviewing the labeling for accuracy and enforcing federal food safety standards on specific food items,[61] while the role of the CDC is to detect and respond to emerging health threats, such as foodborne illness outbreaks.[62] The CDC also helps state and local health departments conduct efficient foodborne disease surveillance and outbreak response.[63] The controlling agencies vary at the state level.[64] For example, in Texas, the Texas State Department of State Health Services regulates food safety.[65]

Foodborne illness litigation is based on products liability law.[66] The legal theory of product liability concerns the liability of parties along the chain of product manufacturing that has caused damage to a party.[67] Manufacturers are typically held strictly liable for harm to a person induced by "any product

57. *See* Marks, *supra* note 13, at 726.

58. *See About Foodsafety.gov*, FOODSAFETY.GOV, https://www.foodsafety.gov/about/federal/index.html (last visited Jan. 28, 2019).

59. *See Food Safety—An Overview*, NAT'L AGRIC. LAW CTR., https://nationalaglawcenter.org/overview/food-safety/ (last visited Feb. 17, 2020).

60. *See What We Do*, FOOD & DRUG ADMIN., https://www.fda.gov/AboutFDA/WhatWeDo/ (last updated Mar. 28, 2018).

61. *See Inspection for Food Safety: The Basics*, FOOD SAFETY & INSPECTION SERV., https://www.fsis.usda.gov/wps/portal/fsis/topics/food-safety-education/get-answers/food-safety-fact-sheets/production-and-inspection/inspection-for-food-safety-the-basics/inspection-for-food-safety-basics (last updated Aug. 9, 2013).

62. *See CDC Regulations*, CTRS. FOR DISEASE CONTROL & PREVENTION https://www.cdc.gov/regulations/index.html (last updated June 30, 2016).

63. *See About Foodsafety.gov*, *supra* note 58.

64. *See id.*

65. *See Food Manufacturers, Wholesalers, and Warehouses*, TEX. DEP'T STATE HEALTH SERVS., https://www.dshs.texas.gov/foods/default.aspx (last updated Jan. 14, 2019).

66. *See* Holt, *supra* note 7, at 108.

67. *See Products Liability*, CORNELL L. SCHOOL: LEGAL INFO. INST., https://www.law.cornell.edu/wex/products_liability (last visited Jan. 12, 2020)

in a defective condition unreasonably dangerous to the user."[68] An "unreasonably dangerous product" is one that was dangerous in a way that could *not* be contemplated by an ordinary consumer "with the ordinary knowledge common to the community as to its characteristics."[69] In the Restatement (Third) of Torts, defective food product liability qualifies "a harm-causing ingredient" as defective "if a reasonable consumer would not expect the food product to contain that ingredient."[70] To succeed on a claim of defective food product, a plaintiff must show that the product was defective at the time of distribution and that he suffered harm as a result of the defectiveness.[71] Generally, the three product liability theories impacting foodborne illness litigation are: (1) manufacturing defect; (2) design defect; and (3) failure to provide adequate warning instructions.[72]

Under the manufacturing defect theory, a product's design is considered safe but the actual product was flawed because it was faultily made,[73] likely due to a lack of quality control.[74] The legitimacy of a manufacturing defect claim comes from the difference between the defective product and other products resulting from the same design.[75] Design defect product liability is based on the concept that the product is aligned with the intentional design of the manufacturer, but the product still presents an unreasonable risk of danger to the consumer.[76] In contrast, failure to provide adequate warning instructions is based on the assumption that had the consumer received adequate warning of the danger, the consumer would have acted on such warning.[77] Therefore, the failure to warn is the proximate cause of a consumer's injuries.[78] However, each state has its own interpretation of this theory.[79] There are no federal food product liability laws, so each state has

68. RESTATEMENT (SECOND) OF TORTS § 402A (AM. LAW INST. 1965).

69. *Id.* § 402A cmt. i (1965).

70. RESTATEMENT (THIRD) OF TORTS: PROD. LIAB. § 7 (AM. LAW INST. 1998).

71. *Id.* § 7 cmt. (a)–(b) (1998).

72. *See Liability for Foodborne Illness & Injury*, PUB. HEALTH LAW CTR., https://www.publichealthlawcenter.org/resources/liability-foodborne-illness-and-injury (last visited Feb. 17, 2020).

73. AMERICAN LAW OF PRODUCTS LIABILITY 3D § 31:5 (Richard E. Kaye rev. ed. 2019).

74. *Id.* § 31:2.

75. *Id.* § 31:5.

76. *See id.*

77. 8 AM. JUR. 3D *Proof of Facts* § 547 (1990).

78. *See id.*

79. *See id.* (contrasting Ohio caselaw which follows the presumption of adequate warning versus Texas caselaw, which does not apply the presumption that consumers would heed an adequate warning).

adopted its own statutory standards of what legal elements must be satisfied for a plaintiff to prevail and whether product liability is even considered a strict liability.[80]

To prove a prima facie case of negligence in non-strict liability states, a plaintiff must establish: (1) actual damages; (2) the existence of a legal duty to exercise reasonable care; (3) a breach of said duty; (4) that the breach was the cause in fact of the harm suffered by the plaintiff; and (5) that the harm was within the scope of liability.[81] The key issue in such cases is a question of identification, no matter the state's rules on product liability claims.[82] Under a strict liability approach, the plaintiff must show that the defendant's food product was in defective condition at the time of purchase and that the defect caused the plaintiff's illness.[83]

Foodborne illness litigation presents challenges in that the plaintiff must show that the illness resulted from a specific food item, which is more feasible if the plaintiff believes he contracted the infection from contaminated food identified in an illness related outbreak.[84] In such cases, the plaintiff will notify her doctor of her suspicions and be tested to show that the DNA of the infecting pathogen matches that of the strain linked to the outbreak.[85] However, the plaintiff runs into an issue if the doctor she consulted with did not order the correct diagnostic tests or if the pathogen had not fully incubated at the time of the test.[86] Confirmation that the plaintiff's pathogen is from the same strand as an outbreak is important, because identifying the source of contamination is vital to a defective food product strict liability lawsuit.[87]

In terms of a strict liability defective food product lawsuit, the most challenging aspects are identifying the food item which caused the harm, proving the food carried the pathogen, and locating the point in the produc-

80. *See Liability for Foodborne Illness & Injury*, *supra* note 72 (explaining Minnesota requires plaintiffs to show a product was in defective condition different from its intended use, defective at time of purchase, and was the proximate cause of injury); *see also* American Tobacco Co., Inc. v. Grinnel, 951 S.W.2d 420, 434 (Tex. 1997) (reasoning that for a plaintiff in Texas to prevail on a manufacturing defect claim, the product at issue must have deviated from its planned specifications in addition to showing defect and injury).

81. *See* Marks, *supra* note 13, at 757.

82. *Determining Legal Responsibility for Foodborne Illness & Injury*, PUB. HEALTH L. CTR., http://publichealthlawcenter.org/sites/default/files/resources/phlc-fs-Det-Legal-Resp-Foodborne-Illness-2016.pdf (last updated Oct. 2016).

83. *See id.*

84. *See id.*

85. *See id.*; *see also Step 1: Detect a Possible Outbreak*, *supra* note 27.

86. *See Determining Legal Responsibility for Foodborne Illness & Injury*, *supra* note 82.

87. *See id.*

tion process where the food was contaminated.[88] Most food products go through a chain of multiple processors before reaching an individual, which not only allows multiple opportunities for the food to become contaminated, but also makes it challenging for plaintiffs to identify the source of contamination.[89] In such cases, plaintiffs may bring suit against several parties who are potentially responsible for the contamination, but the plaintiff then faces an issue of credibility with respect to convincing the jury of the sufficiency of evidence against the defendants in the case.[90] Because of the considerable difficulty for a plaintiff to identify the proper tortfeasor and then prevail in a lawsuit, there is little to incentivize food manufacturers to monitor the quality of products along the chain of production.[91]

There is also an issue of allocating damages in foodborne illness lawsuits.[92] For example, under the joint and several liability theory,[93] a plaintiff may receive full recovery where there has been a judgement against one or multiple defendants in a lawsuit involving several defendants.[94] In applying this theory of liability to foodborne illness litigation, anyone in the chain of distribution and production of the contaminated food product could be held liable for the entire amount of damages caused to unsuspecting consumers.[95] Therefore, under joint and several liability, a defendant may end up paying more than his portion of actual fault.[96] Because of this concept, distributors, grocers, or restaurants may contract with farmers to allocate certain liability to the growers of the food in the event products cause foodborne illness.[97]

Contributory negligence is another form of liability raised in outbreak cases where the defense asserts that the plaintiff is partially to blame for his injuries.[98] This is a defense usually raised in strict liability claims.[99] Where an injured plaintiff knew or should have known of the risk of consuming the

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88. *See* Marks, *supra* note 13, at 758–59.

89. *See* Holt, *supra* note 7, at 108–09.

90. *See id.* at 109–10.

91. *See id.*

92. *See id.*

93. *See Joint and Several Liability*, CORNELL L. SCHOOL: LEGAL INFO. INST., https://www.law.cornell.edu/wex/joint_and_several_liability (last visited Jan. 12, 2020).

94. AMERICAN LAW OF PRODUCTS LIABILITY 3D, *supra* note 73, § 52:1.

95. *See Joint and Several Liability*, *supra* note 93.

96. *See id.*

97. *See Determining Legal Responsibility for Foodborne Illness & Injury*, *supra* note 82.

98. *See Contributory Negligence*, CORNELL L. SCHOOL: LEGAL INFO. INST., https://www.law.cornell.edu/wex/contributory_negligence (last visited Jan. 12, 2020); *see also Determining Legal Responsibility for Foodborne Illness & Injury*, *supra* note 82.

food product which was, at the time, known to be risky, then contributory negligence may come into effect and the plaintiff would only be able to recover partial damages.[100] However, asserting the defense of negligence on the part of the consumer is not permitted where the consumer simply failed to discover the product defect or take precautions against a product defect of which he was not aware.[101]

Lastly, alternative liability has been controversially introduced in a handful of foodborne illness cases.[102] Under this theory of liability, the conduct of two or more defendants is tortious, and the harm brought to the plaintiff is caused by one of them, "but there is uncertainty as to which one has caused it, the burden is upon each such actor to prove that he has not caused the harm."[103] It is necessary for the plaintiff to establish that all defendants being sued were actually negligent in some respect and that they should carry the burden of proof in refuting their guilt, because they are in a better position to identify the party responsible for the damage.[104] Practically, this form of liability requires there to be a small number of defendants, so the plaintiff can accurately and efficiently identify the offending parties responsible for his harm.[105]

Under the theory of alternative liability, the burden of proof is on the plaintiff to show that "of two or more actors, each has acted tortiously, and that the plaintiff has sustained harm resulting from the conduct of some one of them."[106] When the burden is shifted to the defendants, the defendants are presented the opportunity to prove they are not the source of contamination, and if they failed to do so, they may be held jointly and severally liable.[107] However, the application of the alternative liability doctrine in foodborne illnesses has not necessarily been successful, as some courts have refused to apply the theory because plaintiffs were not able to meet their initial burden of proof.[108]

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99. *See* RESTATEMENT (SECOND) OF TORTS § 402A cmt. n (AM. LAW INST. 1965).

100. *See Determining Legal Responsibility for Foodborne Illness & Injury*, *supra* note 82.

101. *See* RESTATEMENT (SECOND) OF TORTS § 402A cmt. n (AM. LAW INST. 1965).

102. *See* RESTATEMENT (SECOND) OF TORTS § 433B cmt. a (AM. LAW INST. 1965); *see also* Holt, *supra* note 7, at 112.

103. *See* RESTATEMENT (SECOND) OF TORTS § 433B (AM. LAW INST. 1965); *see also* Holt, *supra* note 7, at 112.

104. VICTOR E. SCHWARTZ ET AL., *Multiparty Liability Theories—Alternative Liability*, *in* GUIDE TO MULTISTATE LITIGATION § 2:14 (Supp. Nov. 2018).

105. *See id.*

106. *See* Holt, *supra* note 7, at 88.

107. *See id.*

108. *See id.* at 113–14.

According to a study conducted by the USDA in 2001, only 31.4 percent of plaintiffs prevail in foodborne illness lawsuits.[109] The findings of the study illustrated that the plaintiff's ability to establish a causal link between defective food and his illness was hindered by the identification of contaminated food product, the pathogen, and "the appropriate defendant."[110]Attorneys are more likely to take on foodborne illnesses cases if the plaintiffs can be diagnosed with an identifiable pathogen, such as E. coli, and the food product from which the pathogen was consumed can be identified.[111] Even in alternative liability cases not dealing specifically with foodborne illnesses, courts have rejected the application of the theory because not all tortfeasors responsible for the harm inflicted were identified in court.[112]

Without a clear way to identify the source of contamination in a foodborne illness outbreak, such litigation presents an uphill challenge that erroneously deprives victims of a legal remedy. Despite the lack of liability theory consensus across jurisdictions in foodborne illness outbreak cases, there is the common theme of a plaintiff needing to be able to identify with some certainty the source of his injury.[113] For these reasons, transparency in food production is vital to effective judicial remedies for individuals who fall prey to infectious food products.

III. BLOCKCHAIN: A PROMISING TECHNOLOGICAL ADVANCEMENT SURROUNDED BY LEGAL AMBIGUITY

In blockchain, there is not necessarily an infrastructure for confirming the validity of the data entered, so what are the legal implications of an investigation into a widespread foodborne illness outbreak based on information that may or may not be accurate?[114] The legal issues surrounding blockchain include the lack of government regulation concerning blockchain transac-

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109. *See id.* at 108.

110. *See id.* at 108.

111. *See* Marks, *supra* note 13, at 733–36, 754.

112. *See* SCHWARTZ ET AL., *supra* note 104, at n.214 (citing multiple cases illustrating courts' refusal to apply alternative liability because of lack of defendants); *see also* Ryan v. Eli Lilly & Co., 514 F. Supp. 1004, 1017 (D.S.C. 1981) (refusing to apply alternative liability where a plaintiff only joined seven of the 118 potential defendants in the lawsuit).

113. *See generally* Marks, *supra* note 13, at 754.

114. *See* Weizhi Meng et al., *When Intrusion Detection Meets Blockchain Technology: A Review*, 6 INST. ELECTRICAL & ELECTRONICS ENG'GS 10179, 10183 (2018), http://orbit.dtu.dk/files/145448886/08274922.pdf; *see also* Zhuling Chen, *How Should We Regulate Blockchain? It Depends on Which Country You Ask*, FORTUNE (June 25, 2018), http://fortune.com/2018/06/25/blockchain-cryptocurrency-technology-regulation-bitcoin-ethereum/.

tions, the question of contractual certainty guaranteeing the validity of the information entered, and a need for privacy safeguards.[115]

A. What is Blockchain and How Does it Work?

Blockchain is a form of technology that keeps ongoing records of transactions, and the records illustrate how the organization using the technology works internally as well as in its outside relationships.[116] The concept of blockchain was introduced in October 2008 as the underlying technology for the virtual currency Bitcoin.[117] Blockchain presented a way to avoid regulatory supervision, transferring ownership of a product, and efficiently confirming transactions.[118] Generally, blockchain is a database across a network where individual records combine to make a chain that is difficult to alter.[119] A blockchain database consists of a "record" (any information such as a transaction), the "block" (the bundle of records), and the "chain" ("all the blocks linked together").[120]

The process in a blockchain begins where a transaction is recorded, and the record includes all the details of the interaction "including a digital signature from each party."[121] Then, the record is verified by the network of computers on that database called "nodes."[122] After the record is verified, they are added to a block.[123] Each block contains "hash," which is a unique code, and the blocks will also contain the hash of the last block added to the chain.[124] Next, the block is added to the chain, and the hash codes are used to connect the blocks in a particular order.[125] It is very difficult to change the block that has been added to the chain, because the hash is derived from a mathematical function that takes the transactional information and creates a unique alphanumeric identifier for the information.[126] All of the codes generated by the hash are the same length regardless of the amount of information recorded.[127]

115. *See generally* Chen, *supra* note 114.

116. *See* Marco Iansiti & Karim R. Lakhani, *The Truth About Blockchain*, HARV. BUS. REV. (Jan.–Feb. 2017), https://hbr.org/2017/01/the-truth-about-blockchain.

117. *See id.*

118. *See id.*

119. *See* Murray, *supra* note 10.

120. *See id.*

121. *See id.*

122. *See id.*

123. *See id.*

124. *See id.*

125. *See* Murray, *supra* note 10.

126. *See id.*

127. *See id.*

The difficulty in altering the record comes from the fact that making any change to the original input would create a new hash.[128] Changing the original information would break the chain because the next block in the chain would still possess the original hash; thus, to keep the chain intact, a hacker would have to recalculate the hash for *every* block in the chain.[129]

Another significant aspect of blockchain is that the database has no centralized third-party supervising the data being entered into the chain.[130] In contrast, a centralized network would have one computer on the network that had the authority to verify transactions, but in a decentralized network, such as blockchain, any computer can access the information and may get in line to add transactional information to the chain.[131]

B. The Lack of Uniformity in Regulating Blockchain Technology

Because blockchain is a new and evolving form of technology, there has been an ongoing struggle to determine the most appropriate way to regulate and integrate blockchain programming into major forms of business.[132] Currently, a comprehensive regulatory response to blockchain does not exist.[133]

Overall, there are three primary types of regulatory blockchain treatment: (1) study-and-wait-and-see; (2) new legislation and regulation; and (3) guidance and sandboxing.[134] "The study-and-wait-and-see" regulators are trying to "conceptualize and understand the potential foundational and transformational implications of blockchains for economies and societies."[135] This approach has both pros and cons; it is good because it avoids a premature regulation that could hinder further technological development, but the approach provides no guidance for businesses to comply with law and avoid conducting " 'unregulated' " business.[136] The "new legislation and regulation" is an approach based on enacting laws to control the use of blockchain, despite the technology being in the early stages of development and the consid-

128. *See id.*

129. *See id.*

130. *See id.*

131. *See* Murray, *supra* note 10.

132. *See* Chen, *supra* note 114.

133. VEDAT AKGIRAY, BLOCKCHAIN TECHNOLOGY AND CORPORATE GOVERNANCE (DIRECTORATE FOR FIN. AND ENTER. AFFAIRS—CORP. GOVERNANCE COMM.), ORG. FOR ECON. CO-OPERATION & DEVEL. (June 6, 2018), http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DAF/CA/CG/RD(2018)1/REV1&docLanguage=en.

134. *See id.*

135. *See id.*

136. *See id.*

erable lack of standards for blockchain programming.[137] Such an approach presents the risk that as the technology continues to evolve, the laws will become obsolete and require amendments or will excessively restrict the use of the technology.[138] The "guidance and sandboxing" position is where governments have chosen to provide regulatory guidance of how new technologies fit into existing legal frameworks and to provide sandboxing opportunities for new models.[139] Sandboxing is a term referring to a safe environment where blockchain developers have the opportunity to test their products without fearing legal repercussion due to regulatory exemptions.[140] The blockchain technology is then employed on a "controlled scale" for a set period of time while under supervision.[141]

Internationally, the use and regulation of blockchain varies.[142] The European Union (EU) has taken a firm stance on data privacy and implemented strict regulations that have serious implication on blockchain applications in any industrial use.[143] On May 25, 2018, the EU passed the General Data Protection Regulation (GDPR) which was intended to unify data privacy protections across the union, requiring that all citizens of the EU have the "'right to be forgotten' online."[144] The purpose of GDPR is to establish that EU citizens possess the right to own control of the use of their data.[145] Therefore, with respect to the transparency and privacy issues for blockchain application, the companies employing blockchain will have to ensure that the programming complies with the GDPR threshold for data ownership.[146] In contrast, East Asian countries have emphasized a pro-business perspective by allowing blockchain programs to operate without oversight, deprioritizing the issue of individual data privacy rights.[147] South Korea stated that the use of blockchain technology was encouraged outside of Bitcoin.[148] Similarly, Japan was part of the initial efforts to make Bitcoin a standard currency by issuing cryptocurrency exchange licenses to businesses.[149] However, aside

137. *See id.*

138. *See id.*

139. *See* Akgiray, *supra* note 133.

140. *See id.*

141. *See id.*

142. *See generally* Chen, *supra* note 114.

143. *See id.*

144. *See id.*

145. *See id.*

146. *See id.*

147. *See id.*

148. *See* Chen, *supra* note 114.

149. *See id.*

from the use of Bitcoin, Japan has not endorsed other forms of business using blockchain based programing.[150]

The regulatory agencies of the United States have treated the use of blockchain technology with tremendous skepticism.[151] The U.S. Securities and Exchange Commission deterred international cryptocurrency companies from establishing roots domestically by requiring that cryptocurrencies be considered assets under governmental purview.[152] While there is no consensus at the federal level on the use of cryptocurrency, the technological advancements offered by blockchain, which permit immutability and decentralization to traditional exchanges, allows for the possibility of efficiency and security of transactions.[153] Further, several states have enacted laws admitting blockchain ledgers as evidence and blockchain-based digital signatures.[154]

Another concern expressed about blockchain is the fact that it is a decentralized network, which would require a greater amount of trust between individuals entering information concerning the validity and accuracy of such information.[155] In certain blockchain applications, such as Bitcoin, users remain anonymous so there is no way to ascertain whether or not the information they entered into this electronic ledger is actually correct.[156] A potential remedy to this issue is to create an application where the only individuals permitted to enter information onto the database are known to each other, such as a company and its employees.[157] Another way to resolve the issue of trust among users are "consensus models," in which the blockchain sets tests that computers must pass when attempting to add information to the ledger.[158] The consensus models would require the database users to "'prove'" themselves by showing the "'work' [they have done] by solving an increasingly difficult computational puzzle."[159]

With respect to data sharing and privacy, blockchain can be used as a decentralized and distributed ledger in a series of person-to-person transactions without the need for third-party supervision.[160] This places some scrutiny on blockchain technology with respect to confirming the validity of the

150. *See id.*

151. *See id.*

152. *See id.*

153. *See id.*

154. *See* AKGIRAY, *supra* note 133.

155. *See* Murray, *supra* note 10.

156. *See id.*

157. *See id.*

158. *See id.*

159. *See id.*

160. *See* Meng et al., *supra* note 114, at 10184.

information as well as the accuracy.[161] Data sharing requires that collaborating parties have a sense of trust that neither will disclose the data shared in the transaction.[162] Further, there is a vital need for privacy concerning the organization's information, such as IP addresses, exchanged during a transaction.[163] However, blockchain technology can remedy data sharing's issue of balancing mutual trust and data privacy.[164] With respect to the issue of mutual trust, parties involved can sign a data sharing agreement, which can be kept in a blockchain box and "would be public and unalterable."[165] Therefore, no party could unilaterally act outside of the terms to which that the opposing party has already consented.[166]

A solution to concerns regarding private information could be to share "transformed data" as opposed to "raw data."[167] Raw data is any data that has not been processed, either through computer software or manually; an example would be the IP addresses involved in a transaction.[168] In contrast, data transformation is where information is converted from one format to another, typically used in the process of converting documents into a different format such as numerical sequencing.[169] There are steps that can be taken through use of blockchain technology that can resolve the security issues of data sharing, and the implications for industry application.

IV. CURING AGRICULTURE'S LACK OF TRANSPARENCY THROUGH BLOCKCHAIN

Blockchain technology presents an opportunity to be implemented in a food production system so that consumers could check the history of any product they purchase.[170]

161. *See generally* Mike Orcutt, *How Secure Is Blockchain Really?*, MIT Tech. Rev. (Apr. 25, 2018), https://www.technologyreview.com/s/610836/how-secure-is-blockchain-really/.

162. *See* Meng et al., *supra* note 114, at 10184.

163. *See id.*

164. *See id.*

165. *See id.*

166. *See id.*

167. *See id.*

168. *See Raw Data*, Techopedia (last visited Feb. 17, 2020), https://www.techopedia.com/definition/1230/raw-data.

169. *See Data Transformation*, Techopedia (last visited Feb. 17, 2020), https://www.techopedia.com/definition/6760/data-transformation.

170. *See* Murray, *supra* note 10 (suggesting the use of blockchain for a jewelry company, where customers would be able to view the chain to be assured of the diamonds were not from conflict countries).

A. Legislative Action Urges Food Safety Transparency

In January 2011, President Barack Obama signed into law the FDA Food Safety Modernization Act (FSMA) which was designed to strengthen the food safety system.[171] The language of the act was crafted to give the FDA more power to act preemptively rather than retroactively in preventing foodborne illness outbreaks.[172] Part of these preemptive powers is the ability to require food production facilities comply with certain food safety measures.[173] Facilities are required to meet five different criteria in food safety.[174] First, the facilities must evaluate what food safety hazards specific to their products could arise.[175] Second, they must identify what steps will be taken to minimize the hazards.[176] Third, the facilities must monitor the controls they have put in place to detect the possible risks.[177] The facilities are then required to keep consistent records of the monitoring and specify what actions it will take to address food safety problems that do arise.[178] Further, because of FSMA, the food facilities will be "required to keep documenting implementation of their [preventative food safety] plans," and the FDA will have the right to access such records.[179] As a result of these enhanced requirements for documentation of food safety measures, there is a heavier penalty against food production facilities for a lack of transparency.[180]

Blockchain presents an opportunity for food facilities to comply with the new federal standards in a clear and efficient manner.[181] The facilities can interact with other counterparts in the food supply chain through a "permissioned" network, so as to ensure the validity and accuracy of the information being entered into the electronic ledger.[182] Walmart began testing the IBM

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171. *Background on the FDA Food Safety Modernization Act (FSMA)*, FOOD & DRUG ADMIN., https://www.fda.gov/Food/GuidanceRegulation/FSMA/ucm239907.htm (last updated Jan. 30, 2018).

172. *See id.*

173. *See id.*

174. *See id.*

175. *See id.*

176. *See id.*

177. *See Background on the FDA Food Safety Modernization Act (FSMA)*, *supra* note 171.

178. *See id.*

179. *See id.*

180. *See* Merve Unuvar, *The Food Industry Gets an Upgrade with Blockchain*, IBM (Jan. 25, 2017), https://www.ibm.com/blogs/blockchain/2017/06/the-food-industry-gets-an-upgrade-with-blockchain/.

181. *See id.*

182. *See id.*

blockchain program in 2017 before implementing it in September 2018.[183] The program brought such revolutionary efficiency to the traceability of leafy greens that the Vice President of Food Safety for Walmart at the time, Frank Yiannas, was able to identify specific points of information about Walmart's leafy greens within 2.2 seconds.[184] This process previously took nearly seven days to complete before the implementation of IBM's blockchain technology.[185] The technology presents not only the opportunity to identify the source of contamination but also prevents excessive food waste by allowing for selective food recalls rather than a mass ban on a product.[186]

On September 24, 2018, Walmart issued a letter to its leafy green suppliers that starting in 2019, Walmart would be requiring the suppliers with which it collaborates to use an IBM blockchain software in order to increase produce traceability.[187] The company was motivated to make this shift in food production technology as a result of the spring 2018 romaine lettuce E. coli outbreak, which resulted in ninety-six hospitalizations and five deaths before the source of contamination was determined.[188] Sam's Club signed on to the Walmart letter, explaining that the company would be requiring its leafy green suppliers to utilize blockchain technology as well for the purposes of auditing the chain of custody in food production.[189] While Walmart and Sam's Club may be the first to implement the blockchain platform in the United States, they are not the first companies to utilize blockchain as an investigative tool in agribusiness.[190]

B. Agriculture and Blockchain Tested on an International Platform

In 2016, a British company, Provenance, developed its own blockchain software to track tuna through Southeast Asian supply chains, so consumers knew where the fish were caught and each time the fish changed hands before making it to the consumer.[191] Provenance created this technology to

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183. *See id.*; *see also* Rooney, *supra* note 1.

184. *See* Unuvar, *supra* note 180.

185. *See id.*

186. *See id.*

187. *See* Letter from Charles Redfield, Exec. Vice President, Walmart U.S. Food, to Walmart's "Leafy Green Suppliers," Food Traceability Initiative: Fresh Leafy Greens (Sept. 24, 2018), https://corporate.walmart.com/media-library/document/blockchain-supplier-letter-september-2018/_proxyDocument?id=00000166-088d-dc77-a7ff-4dff689f0001.

188. *See id.*

189. *See id.*

190. *From Shore to Plate: Tracking Tuna on the Blockchain*, *supra* note 1; *see also* Rooney, *supra* note 1.

191. *See From Shore to Plate: Tracking Tuna on the Blockchain*, *supra* note 1.

allow consumers to know the origin of their fish and the kind of agricultural practices being employed by the producers.[192]

The technology used by Provenance has been implicated as a tool that could be used to trace not only a piece of meat or vegetable, but also every material in a product.[193] Provenance's blockchain software has been used in seven different case studies by other companies.[194] For example, the Co-operative (Co-op) in Manchester, England, used the blockchain technology to track produce from its place of origin to the marketplace.[195] The Co-op also gathered data about the environmental and social impact of each business that interacted with it on the blockchain.[196] The Provenance software linked together data from the farms, factory, Co-op depot, and retail branches, building a digital history that could be accessed by Co-op and consumers.[197] If a reliable infrastructure platform for block chaining could be implemented, then not only would the proximate cause for foodborne illnesses be more easily identified, but also allow consumers to choose to buy certain foods based on the agricultural practices of the producer.

IBM, like Provenance, has taken an interest in the use of blockchain technology to combat the issue of unethical labor practices in the food production industry.[198] Blockchain is IBM's proposed solution to origin identification in the coffee industry, because it can provide a method of verification to identify whether or not the plantation from which the coffee came used ethical labor practices.[199] First, coffee beans may be traced by using a radio frequency identification device (RFID) attached to the bags, which can be scanned into the blockchain at any point in the supply chain from plantation to retail distributor.[200] A shortage of worker documentation in the coffee industry can lead to a lack of work contracts, forced labor, or low pay, but blockchain provides some remedy by requiring workers to have a unique

192. *See id.*

193. *See Blockchain: The Solution for Transparency in Product Supply Chains*, *supra* note 11 (explaining how blockchain for certification and chain-of-custody could be implemented in both production and manufacturing industries, such as cotton growers and makers of fabric).

194. *See Case Studies*, PROVENANCE, https://www.provenance.org/case-studies (last visited Feb. 17, 2020).

195. *See Pioneering a New Standard for Trust in Food Retail*, PROVENANCE, https://www.provenance.org/case-studies/co-op (last visited Jan. 12, 2020).

196. *See id.*

197. *See id.*

198. *See* John Widdifield, *Brewing Blockchain: Tracing Ethically Sourced Coffee*, IBM (Aug. 8, 2018), https://www.ibm.com/blogs/blockchain/2018/08/brewing-blockchain-tracing-ethically-sourced-coffee/.

199. *See id.*

200. *See id.*

trust identifier on the blockchain.[201] Then, workers can receive digitalized payments in which the receipt "is automatically recorded to the blockchain and payment confirmation is shared with organizations downstream."[202]

IBM's blockchain programming has been used to further replicate the concept played out by Provenance in the Finland fish market.[203] The S-Group, a Finnish retail cooperative, has a beta blockchain program based off of IBM's that will allow customers to see the chain of production and retail with respect to the origins of the fish they purchase.[204] By applying the use of blockchain, the S-Group wants to improve the customer experience by providing greater transparency that ensures quality as well as safety.[205] Customers are able to trace a fish back to its place of origin by using the "QR Code on the package of 'Kotimaista-kuhafile' fish, or by logging in to a tracking website."[206] The blockchain allows mutual participation on the part of the producers and retailers, and once the information is entered onto the chain, it cannot be altered.[207] S-Group's technology is "based on modules of IBM Food Trust," which is "a collaborative solution built on IBM Blockchain Platform and The Linux Foundation's Hyperledger Fabric, created to efficiently and securely trace food during each step of the food supply."[208]

The IBM Food Trust has kept track of more than 350,000 food data transactions, allowing consumers to select an entire meal from food tracked exclusively through a blockchain network.[209] Through the use of this blockchain technology, people are able to see not only where their food comes from for the sake of identifying their distributor preference, but also identify more specifically possible sources of contamination. The IBM blockchain technology aims to significantly reduce the amount of money being spent on issues related to foodborne illnesses.[210]

201. *See id.*

202. *See id.*

203. *See* Tomi Lehikoinen, *This Summer, Fishing in Finland Means Food Traceability on the Menu*, IBM (July 2, 2018), https://www.ibm.com/blogs/blockchain/2018/07/this-summer-fishing-in-finland-means-food-traceability-on-the-menu/.

204. *See id.*

205. *See id.*

206. *See id.*

207. *See id.*

208. *See id.*

209. *See* Lehikoinen, *supra* note 203.

210. *See generally* Nigel Gopie, *Taste the Future with a Blockchain Meal*, IBM (July 25, 2018), https://www.ibm.com/blogs/blockchain/2018/07/taste-the-future-with-a-blockchain-meal/; *see also* Dan Flynn, *USDA: U.S. Foodborne Illnesses Cost More Than $15.6 Billion Annually*, FOOD SAFETY NEWS (Oct. 9, 2014), https://www.foodsafetynews.com/2014/10/foodborne-illnesses-cost-usa-

C. Resolving the Weaknesses of Blockchain through Exclusivity and Verifiability

It is also important to scrutinize what blockchain formats are being implemented due to the inherent security and verification concerns.[211] The Walmart IBM blockchain program is on a limited scale; therefore, the only users who would have access to the database are directly known and accountable to Walmart.[212] Further, on the Walmart blockchain, there would be fewer additions to the data chain, which requires less energy to expend on verifying information entered.[213] The technology will be used to tell Walmart stakeholders where, during which harvest, and on what farm a particular head of lettuce came from.[214] Whether or not the information on the system is truthful will not technically be analyzed unless the information comes into dispute, such as in the case of an E. coli outbreak.[215]

D. Blockchain Promotes Sustainable Agriculture Practices while Ensuring Food Safety

The use of blockchain has further fed into the movement of "precision agriculture."[216] Precision agriculture is the practice of ensuring that individual parcels of land receive the exact necessary amount of water, fertilizer, and seed so resources don't go to waste.[217] However, this practice of agriculture can be costly in that it requires intensive monitoring, making blockchain technology a practical, cost effective solution.[218] Blockchain can turn on automatic payments and keep history of exact amounts purchased.[219] Further, the technology can record the entire health cycle of fish and livestock.[220] The most relevant provision of the technology is that through blockchain, individ-

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15-6-billion-annually/#.W1deXY8gnbVp (explaining that foodborne illnesses cost the U.S. economy more than 15.6 billion dollars annually).

211. *See* Jenny Splitter, *What Can Blockchain Really Do For the Food Industry*, FORBES (Sept. 30, 2018), https://www.forbes.com/sites/jennysplitter/2018/09/30/what-can-blockchain-really-do-for-the-food-industry/#781fc74488ef.

212. *See id.*

213. *See id.*

214. *See id.*

215. *See id.*

216. *See* Hy Chantz, *Weather, Wither, Whether: How Blockchain Enables Precision Agriculture*, IBM (May 30, 2018), https://www.ibm.com/blogs/blockchain/2018/05/weather-wither-whether-how-blockchain-enables-precision-agriculture/.

217. *See id.*

218. *See id.*

219. *See id.*

220. *See id.*

uals can isolate diseases or contamination to particular barns, stalls, or pens.[221]

Because a plaintiff will likely have consumed the food in the privacy of his own home, a defendant is more likely to attack the witness's credibility by presenting quality control evidence from some point in the chain of food production.[222] However, there are courts that allow circumstantial evidence of quality control on the part of the defendant to show that the food was not contaminated, or unaltered, when it left the hands of the defendant.[223] Admissibility of whether a food production company was negligent in handling the food will not be sufficient but may serve to show that the producer breached an implied warranty to the consumer that the food product was fit for consumption.[224]

E. Blockchain Technology Can Provide the Clarity to Judicial Ambiguity

The use of blockchain allows for greater transparency in the food supply chain which directly correlates with the recurring issue of defendant identification in foodborne illness cases.[225] To overcome the issue of the credibility of the plaintiff's testimony in the eyes of the jury and the court, the capability to access a clear list of participants in the food chain is crucial in identifying plausible defendants with more precision.

Equipped with a ledger of who interacted with the food, the threshold necessary for strict liability to apply would be much more feasible to meet.[226] Generally, for strict liability to apply, a plaintiff must show that the product was defective at the time of purchase.[227] Using blockchain, who specifically handled the product, as well as who tested the product for the contaminant,

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221. *See id.*

222. *See generally* Pulley v. Pac. Coca-Cola Bottling Co., 68 Wash. 2d 778, 783 (1966); *see also* Restatement (Third) of Torts: Prod. Liab. § 7 (1998).

223. Restatement (Third) of Torts: Prod. Liab. § 7 (1998) (citing Brown v. Gen. Foods Corp., 573 P.2d 930, 934 (Ariz. Ct. App. 1978) (reasoning that manufacturers are often limited to circumstantial evidence because of its availability and may be used to show the "improbability of defect as alleged by the plaintiff").

224. *See Pulley*, 68 Wash. 2d at 783 (explaining "the implied warranty as to the wholesomeness of food . . . is based upon reasoning and public policy considerations to the effect that manufacturers and retailers of food products have a duty to consumers").

225. *See* Holt, *supra* note 7, at 108–9.

226. *See generally Determining Legal Responsibility for Foodborne Illness & Injury*, *supra* note 82.

227. *See id.*

can be identified.[228] Even in non-strict liability cases, plaintiffs would be able to more easily satisfy the requirements of the defendant's breach of duty being the cause in fact of the plaintiff's harm and that the harm was within the scope of liability.[229] Therefore, the ability to know specific defendants who handled the food products and be able to test for contamination through blockchain would be invaluable to plaintiffs in foodborne illness litigation.

In terms of allocating damages, the concepts of joint and several liability as well as alternative liability become less controversial with blockchain. For joint and several liability, the defendants would have greater knowledge than the plaintiff about the degree of fault each one held through using blockchain.[230] As demonstrated in the Provenance case studies, anyone with access to the blockchain would be able to determine who handled the food product and at what point in time.[231] Alternative liability would be more feasible because by knowing who in the blockchain was responsible at a certain point in time for the product, there would be confirmation of a defendant's wrongdoing.[232] The use of blockchain would serve dual purposes from a legal perspective: (1) the shifting of the burden of proof from the plaintiff to the defendant would not be so arduous; and (2) defendants would be able to avoid paying more damages than their actual portion of fault.

With respect to the concept of contributory negligence, defendants may be able to establish whether a plaintiff acted negligently in consuming the contaminated food product more easily. If the food producer uses a technology, like Provenance, that permits the customers themselves to view, but not necessarily alter, the food supply chain, then there could be an argument that the plaintiff was warned of a possible danger.[233] The ability to lower the amount of damages owed would encourage food production companies to invest in technology for transparency with consumers and deter consumers from bringing frivolous lawsuits.[234]

The security concerns about the lack of a centralized network that has the authority to verify transactions is a non-issue in the application of blockchain to food safety transparency.[235] By applying the technology to an exclusive network of producers who are relatively known to each other, there is not only an ability to individually verify the information, but also a smaller

228. *See id.*

229. *See* Marks, *supra* note 13, at 757.

230. *See* Holt, *supra* note 7, at 112; *see also Joint and Several Liability*, *supra* note 93.

231. *See Case Studies*, *supra* note 194; *see also Pioneering a New Standard*, *supra* note 195.

232. *See generally* SCHWARTZ ET AL., *supra* note 104.

233. *See Pioneering a New Standard*, *supra* note 195.

234. *See Contributory Negligence*, *supra* note 98.

235. *See* Murray, *supra* note 10; *see also* Rooney, *supra* note 1.

pool of defendants to pursue legal remedy against.[236] Walmart has sought to preemptively remedy one of the possible legal pitfalls of blockchain by limiting the use of IBM blockchain software exclusively to leafy green producers who work consistently with Walmart.[237] By limiting the number of users specifically to users with an established relationship with Walmart, the company is attempting to ensure the validity of the information entered in to the electronic ledger.[238] Within the realm of agriculture, the ability to limit a network to a number of verifiable individuals not only promotes food safety transparency, but also sustainable work practices by producers of food.[239]

Using blockchain technology, a judicial consensus on a legal theory to apply to foodborne litigation could be formed, which would limit forum shopping that may have been encouraged by the various standards of liability applied to defendants in such cases. Blockchain presents an opportunity to satisfy one of the most crucial elements of a lawsuit: identifying a defendant.

V. BLOCKCHAIN TECHNOLOGY IS THE SOLUTION TO LACK OF FOOD SAFETY TRANSPARENCY AND LEGAL AMBIGUITY

Technology appears to have finally caught up with the massive corporate food industry. Through blockchain, there is now a way to remedy a significant blind spot which has hindered our justice system from being able to hold offending parties accountable. Multiple companies, such as Provenance and Walmart, have taken the steps to not only to ensure the quality management of their food products but also prevent foodborne illness pandemics.[240]

While there are still international discussions going on about how to handle the regulation and application of blockchain technology itself, the use of the technology in an agricultural setting appears to be effectively manageable.[241] IBM has succeeded in developing a blockchain program that has either been applied or replicated by multiple food product-based companies.[242] The concern about confirming the validity of the information entered into the electronic ledger could be remedied by the implementation of the technology in exclusive environments.[243]

236. *See* Rooney, *supra* note 1.

237. *See id.*

238. *See id.*

239. *See generally* Widdifield, *supra* note 198.

240. *See Case Studies*, *supra* note 194; *see also* Rooney, *supra* note 1.

241. *See* Widdifield, *supra* note 198; *see also* Unuvar, *supra* note 180.

242. *See* Lehikoinen, *supra* note 203.

243. *See Rooney*, *supra* note 1.

Under the FSMA, there is a clear legislative push for food product safety transparency.[244] An inability to quickly and accurately identify the source of food contamination presents a considerable threat to the national public, and the legislative branch of government is urging for a change.[245] The CDC has a clear strategy for addressing the issue of foodborne illness.[246] However, the CDC's strategy is heavily dependent upon local governments having their own foodborne illness detection programs in place in a way that encourages the testing of allegedly contaminated food products.[247] Testing a food product may be moot if the source of contamination cannot be ascertained in a timely manner, which may discourage local governments from implementing programs that promote testing for foodborne pathogens. If the application of blockchain based programs became a statutory requirement of food product corporations, there could be a significant increase in testing and terminating foodborne illness outbreaks before they reach a pandemic level.

A technology that was initially only considered as a vehicle for cryptocurrency now presents a revolutionary opportunity to ensure food safety on a national platform.[248] By utilizing a program that tracks not only information pertaining to the handling of the product, but also who is entering said information, there is a way to trace a prolific pathogen and provide an elusive element in foodborne illness litigation. The United States should be motivated to implement blockchain as a statutory requirement in agricultural production rather than to be apprehensive about the regulation of this technology. Blockchain has the potential to remedy the daunting issue of foodborne illness origin identification, and companies in other countries, as well U.S. companies, have begun to implement this technology in beneficial ways.[249]

The case studies done abroad and IBM's leaps in blockchain application indicate a need for a uniform and sustainable form of record keeping.[250] Blockchain is the next logical step in safety standard requirements. Further, by viewing the application of blockchain to agriculture, the government could even learn how to apply the technology to other industries in a manageable manner.

The legally compelling need for plaintiffs to be able to identify the source of contamination in a foodborne illness outbreak is essential in enabling people to have a legal remedy for the damages incurred. Using

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244. *See Background on the FDA Food Safety Modernization Act (FSMA)*, *supra* note 171.

245. *See generally id.*

246. *See Investigating Outbreaks*, *supra* note 34.

247. *See Foodborne Outbreaks—Step 1: Detect a Possible Outbreak*, *supra* note 27.

248. *See generally* Iansiti & Lakhani, *supra* note 116.

249. *See Case Studies*, *supra* note 194; *see also* Rooney, *supra* note 1.

250. *See Case Studies*, *supra* note 194; *see also* Widdifield, *supra* note 198.

blockchain could limit erroneous rulings for damages in litigation and instills a greater sense of security in people with respect to the quality assurance of their food. The security concerns related to blockchain do not outweigh the considerable benefits to be gained by the public through its implementation in the agriculture industry. Blockchain technology will allow parties on both sides of foodborne illness lawsuits to receive a more accurate form of justice.