

LEGAL EDUCATION IN THE BLOCKCHAIN REVOLUTION

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Abstract

The legal profession is one of the most disrupted sectors of the consulting industry today. The rise of Legal Tech, artificial intelligence, big data, machine learning, and, most importantly, blockchain technology is changing the practice of law. The sharing economy and platform companies challenge many of the traditional assumptions, doctrines, and concepts of law and governance, requiring litigators, judges, and regulators to adapt. Lawyers need to be equipped with the necessary skillsets to operate effectively in the new world of disruptive innovation in law. A more creative and innovative approach to educating lawyers for the 21st century is needed.

Keywords: Legal Education, Legal Profession, Disruptive Innovation, Artificial Intelligence, Machine Learning, Big Data, Blockchain Technology, Platform Company, Platform Economy, Decentralization, Decentralized Autonomous Organization, Social Media, Technology, Trust.

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I. Introduction

Law firms and in-house legal departments generally agree that Legal Tech impacts their future. Legal Tech startups are revolutionizing the legal industry by increasing the speed, accuracy, and performance of legal services or by replacing them altogether with new ideas.¹ Conferences, seminars, and professional magazines are dedicated to debating Legal Tech and its future implications for the legal industry. Some consensus exists among legal industry representatives that adopting Legal Tech helps law firms and legal departments improve client engagement and satisfaction.² Legal Tech allows clients to be more involved and provide feedback for

¹ Roland Vogl, *The Coming of Age of Legal Technology*, LEGAL AGGREGATE (Sept. 26, 2016), <https://law.stanford.edu/2016/09/26/184188/>. (“In recent years, we have witnessed what can be best described as a legal tech start-up boom.”)

² See GEORGETOWN LAW CENTER FOR THE STUDY OF THE LEGAL PROFESSION & THOMSON REUTERS PEER MONITOR, 2016 REPORT ON THE STATE OF THE LEGAL MARKET (2016), https://www.law.georgetown.edu/news/upload/2016_PM_GT_Final-Report.pdf. (“The reactions of the law firm market to the rapidly changing environment in which firms operate parallels in some respects the story of Kodak. The current challenge in the legal market is not that firms are unaware of the threat posed to their current business model by the dramatic shift in the demands and expectations of their clients. Instead, as in the case of Kodak, the challenge is that firms are *choosing* not to act in response to the threat, even though they are fully aware of its ramifications.”) *Id.* at 2. (“While neither of these studies [Altman Weil’s 2015 LAW FIRMS IN TRANSITION and a Sept. 2015 Thomson Reuters Peer Monitor Study] is conclusive, both strongly suggest that firms that are proactive in pursuing new strategies to meet the concerns and expectations of their clients are more likely to achieve stronger financial results than those firms that merely react to specific client demands.”) *Id.* at 13. The Thomson Reuters Peer Monitor study reported the following major operational changes that upper-tier firms are implementing: “Use of software that allows firm lawyers to monitor the progress of matters, resource commitments, and budget status in real time on a matter basis” (71%), “Efficient and easily usable knowledge management system that provides lawyers with ready access to the firm’s prior work product” (71%), “Document review software using predictive coding based on ‘seed sample’ of documents provided by firm lawyers” (71%), “Client ‘self-help’ tools that allow clients to perform tasks directly that previously required active participation by firm lawyers” (29%), “Use of e-learning systems (65%).” *Id.*

legal services.

Yet, a closer look often reveals that law firms and legal departments themselves often struggle with innovation and the required level of innovating. While the better firms often find innovative solutions to their clients' problems, even those firms are reluctant to fully embrace Legal Tech innovations. Only those firms and legal departments that believe Legal Tech could give them a significant competitive advantage have introduced the position of chief innovation officer (CIO) or a functional equivalent.³ To receive an outside perspective, law firms sometimes appoint non-lawyers in some roles.⁴ Their role is simple and straightforward: accelerate innovation and take it to the next level.

³ See, e.g., Press Release, Bryan Cave LLP, *Bryan Cave Announces Chief Innovation Officer* (Apr. 16, 2015), <https://www.bryancave.com/en/news-events/bryan-cave-announces-chief-innovation-officer.html>. (“The global law firm Bryan Cave LLP has named Denver-based Partner Katie DeBord Chief Innovation Officer.”); *Baker Donelson Appoints William Painter as First Chief Innovation Officer*, LEGALIT INSIDER (Sept. 27, 2016, 12:29 PM), <https://www.legaltechnology.com/latest-news/baker-Donelson-appoints-first-chief-innovation-officer/>.

⁴ See, e.g., John Sterling, *Non-Lawyers: A Critical Success Factor for the Law Firm of the Future*, STERLING STRATEGIES (Dec. 5, 2013), <http://sterlingstrat.com/non-lawyers-a-critical-success-factor-for-the-law-firm-of-the-future.html>. (“More sophisticated law firms will be (are being) forced by clients and competitors to embrace technology, knowledge management, project management, lean process, and other management tools more common outside the legal industry. Successfully adopting any of those management tools requires attracting great people – well-trained, highly capable, hard-working and client focused – whose professional training is grounded in engineering, information technology, organizational psychology, management, and other fields.”); Manju Manglani, *‘Successful’ Law Firms of the Future Will Have Non-Lawyer CEOs*, SOLIC. J. (July 23, 2015), <https://www.solicitorsjournal.com/news/business-strategy/successful-law-firms-future-will-have-non-lawyer-ceos> (noting that “In the next five to ten years, most UK law firms will ask non-lawyer managers to make strategic business decisions on the partners’ behalf,” predicts Steve Billot, managing director of the global restructuring advisory practice at Duff & Phelps who “believes that non-lawyer managers are critical to law firms being run as commercially-successful businesses.”); Nell Gluckman, *Three Big Firms Hire New Diversity Officers*, AM LAW DAILY (Oct. 12, 2016), <http://www.americanlawyer.com/id=1202769805740/Three-Big-Firms-Hire-New-Diversity-Officers?slreturn=20170031193618>.

Key lawyer characteristics and lawyers' core skillsets in the existing legal education and regulatory framework are incompatible with the demands on lawyers of the 21st century. Traditionally educated lawyers are not usually known for key characteristics such as agility and the capacity to innovate.⁵ While some litigators in a common law system can achieve new legal grounds that could not have been accomplished by legislators in the same time frame, e.g., *Brown v. Board of Education*⁶ and *Roe v. Wade*⁷, the majority of lawyers in both civil and common law legal systems tend to be reactive, waiting for Congress/Parliament to provide new legal initiatives and legal guidance.⁸ Key skills emphasized in the existing law school education include precision, in-depth analyses and syntheses, substantive legal knowledge, and policy considerations. Yet, disruptive innovation in law⁹ obviates many if not most of the traditional legal skills and characteristics of traditional lawyers. The ABA, lawyers, and law schools cannot afford to ignore the new demands on lawyers of the 21st century.¹⁰

The legal profession is one of the most disrupted sectors of

⁵ See, e.g., RICHARD SUSSKIND, TOMORROW'S LAWYERS 53-54 (2013) (noting, "I find that most traditional practices are not changing much. They are not yet adopting alternative methods of working. This is partly an issue of change management, in that law firms tend to be so busy serving clients and meeting their own financial targets that they allow little time for internal reform—it is not easy to change a wheel on a moving car. It is also, in part, a structural matter, because most law firms still aspire to the old textbook, broad-based pyramidal structure . . . ; whereas alternative methods of sourcing call for a revision if not rejection of that model.").

⁶ *Brown v. Bd. of Educ.*, 349 U.S. 294 (1955).

⁷ *Roe v. Wade*, 410 U.S. 113 (1973).

⁸ See, e.g., GUIDO CALABRESI, A COMMON LAW FOR THE AGE OF STATUTES 163 (1985) (noting that "[C]ourts are not capable of writing speedily enough most of the rules that a modern society apparently needs.").

⁹ See, e.g., Mark Fenwick, Wulf A. Kaal & Erik P.M. Vermeulen, *Regulation Tomorrow: What Happens When Technology Is Faster Than the Law*, Am. Univ. Bus. L. Rev. (forthcoming 2017), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2834531.

¹⁰ A minority of law schools, including Northwestern University's Pritzker School of Law and Chicago-Kent College of Law, have started to integrate law and technology into their curriculum and/or opened centers and other initiatives to prepare students for demands placed on them by future clients. At the time of publication of this article, the majority of law schools in the United States have engaged in marginal attempts to recognize the demands on 21st century lawyers.

the consulting industry today.¹¹ Legal Tech, artificial intelligence, machine learning, legal automation, big data applications, and blockchain technology are changing the way lawyers practice law.¹² The sharing economy challenges many of the traditional assumptions, doctrines, and concepts of law and governance.¹³ Litigators, judges, and regulators are forced to reconsider traditional approaches because of disruption via platform technologies.¹⁴

The challenges presented by Legal Tech, the new economy, and platform technologies justify a more creative and innovative approach for legal education in the 21st century. The curriculum of American law schools has only marginally changed over the last 30 plus years.¹⁵ Yet, as law firms increasingly embrace Legal Tech, the new economy, and platform technologies¹⁶ law schools of the 21st

¹¹ See, e.g., Bernard Marr, *How Big Data Is Disrupting Law Firms and the Legal Profession*, FORBES Jan. 20, 2016, 2:31 AM),

<http://www.forbes.com/sites/bernardmarr/2016/01/20/how-big-data-is-disrupting-law-firms-and-the-legal-profession/#7836ac0a5ed6>; Jane Croft, *Artificial Intelligence Disrupting the Business of Law*, FIN. TIMES (Oct. 5, 2016), <https://www.ft.com/content/5d96dd72-83eb-11e6-8897-2359a58ac7a5>.

¹² See, e.g., Marr, *supra* note 11; Joe Dewey & Shawn Amual, *Blockchain Technology Will Transform the Practice of Law*, BLOOMBERG LAW (June 25, 2015), <https://bol.bna.com/blockchain-technology-will-transform-the-practice-of-law/>; Jane Croft, *More Than 100,000 Legal Roles to Become Automated*, FIN. TIMES (MAR. 15, 2016), <https://www.ft.com/content/c8ef3f62-ea9c-11e5-888e-2eadd5fbc4a4>.

¹³ See Benjamin G. Edelman & Damien Geradin, *Efficiencies and Regulatory Shortcuts: How Should We Regulate Companies Like Airbnb and Uber?* STAN. TECH L. REV. (forthcoming), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2658603.

¹⁴ *Id.*

¹⁵ See A. Benjamin Spencer, *The Law School Critique in Historical Perspective*, 69 WASH. & LEE L. REV. 1949, 1973-2062 (2012).

¹⁶ See, e.g., Erin Coe, *Lawyers at Risk for Layoffs As Firms Embrace Technology*, LAW 360 (June 25, 2013, 10:51 PM EDT), <https://www.law360.com/articles/452967/lawyers-at-risk-for-layoffs-as-firms-embrace-technology>; INT'L LEGAL TECH. ASS'N, 2016 ILTA/INSIDELEGAL TECHNOLOGY PURCHASING SURVEY (2016), http://insidelegal.typepad.com/files/2016_ILTA_InsideLegal_Technology_Purchasing_Survey.pdf; THOMAS S. CLAY & ERIC A. SEEGER, 2015 LAW FIRMS IN TRANSITION: AN ALTMAN WEIL FLASH SURVEY 55-56, 82-83 (2015), http://www.altmanweil.com/dir_docs/resource/1c789ef2-5cff-463a-863a-2248d23882a7_document.pdf; ROBERT HALF LEGAL, FUTURE LAW OFFICE:

century will recognize the new reality and adapt to new demands seamlessly. Such adaptation will likely entail incorporating AI into the classroom, adopting teaching by hypos via AI, and active machine learning in class, among many other possible innovations.¹⁷ Curricular innovations may include coding for lawyers¹⁸ and law and technology courses or course modules,¹⁹ among many others. With curricular changes, adaptation to changes in technology, and new teaching methodologies that lend themselves more to technological adaptation, the law schools of the 21st century should be able to equip 21st century lawyers with the necessary skillsets to operate

TECHNOLOGY'S TRANSFORMATION OF THE LEGAL FIELD (2013), https://www.roberthalf.com/sites/default/files/Media_Root/Images/RHL-PDFs/RHL_FLO_evolvingLegalProf.pdf. For background on the Legal Tech market, see Tom Wilson, *Legal Tech – Managing Disruption*, MEDIUM (July 12, 2016), <https://medium.com/@taw/legal-tech-mapping-disruption-3e6685fc4a5c#eiufshoue>.

¹⁷ It is conceivable that first mover law schools which make the financial investment in artificial intelligence, machine learning, and blockchain will have a comparative advantage vis-à-vis their peers, regardless of the ranking of such school, because the demand for lawyers adequately trained in artificial intelligence, machine learning, and blockchain is likely to increase sharply at a threshold point of law firm adoption.

¹⁸ Jason Krause, *Does Learning to Code Make You a Better Lawyer?* ABA J. (Sept. 1, 2016, 2:00 AM CDT), http://www.abajournal.com/magazine/article/lawyer_learning_code_zvenyach_ohm/?utm_content=buffer8442b&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer; Chelsea Strauss, *How I Learned Coding in Law School*, SUFFOLK U.L. SCH.: STUDENT VOICES, <http://theroadto1l.blogs.law.suffolk.edu/general/student-voices-how-i-learned-coding-in-law-school/> (last visited mar. 15, 2017).

¹⁹ On Sept. 29, 2016, the Florida Supreme Court announced that it would require a minimum of three technology-related CLE credits in each three-year CLE reporting cycle, thus increasing the number of mandatory CLE credits from 30 to 33. Victor Li, *Florida Supreme Court Approves Mandatory Tech CLE Classes for Lawyers*, ABA J. (Sept. 30, 2016, 8:45 AM CDT), http://www.abajournal.com/news/article/florida-supreme-court-approves-mandatory-tech-cles-for-lawyers?utm_source=Newsletter+email+list&utm_campaign=0ae9e44e21-EMAIL_CAMPAIGN_2017_02_21&utm_medium=email&utm_term=0_28957849de-0ae9e44e21-

effectively in the new world of disruptive innovation that is emerging rapidly.²⁰

This article has five parts. After this introduction to the basic tenets of the article, Part II introduces emerging changes in Legal Tech and their implications for lawyers. These changes include the emergence of virtual law firms, the changes mandated by the sharing economy, Legal Tech innovations in several areas of the law, and changes in the practice of law. After defining blockchain ledger technology and smart contracts, Part III evaluates the effects of blockchain technology's unprecedented decentralization and its disruptive effects on the practice of law and society at large. Part III also discusses the existing but slowly resolving limitations of blockchain ledger technology. Part IV analyzes the implications of Legal Tech and blockchain ledger technology for legal education more generally and for law schools' efforts in educating lawyers who are practice ready for the 21st century. Part V concludes.

II. Legal Tech's Disruptive Legal Innovation

Legal technology (Legal Tech) has evolved from support systems to fully integrated and automated services for lawyers that increasingly disrupt the practice of law. Legal Tech can generally be defined as information technology services and software, as well as platforms and their applications.²¹ Since the 1970s, with the invention of the first legal databases,²² Legal Tech has supported

²⁰ As law schools adapt to legal technology, a learning process is likely to set in that allows a gradual, and/or in some cases more radical, appreciation of impending exponential changes and their meaning for the law school communities.

²¹ "Broadly speaking, the Legal Tech market covers companies (mostly startups) utilising technology to build products solving problems faced both by industry (i.e. law firms, corporates [sic] etc.) and consumers related to legal services." Wilson, *supra* note 16.

²² William G. Harrington, *A Brief History of Computer-Assisted Legal Research*, 77 L. LIBR. J. 543, 553 (1984-85) (noting that Lexis was introduced in 1973 and Westlaw was introduced in 1975). For a good overview of the online services and databases available to lawyers by the mid 1980s, see S. Blair Kauffman, *Electronic Databases in Legal Research: Beyond LEXIS and WESTLAW*, 13 RUTGERS COMPUTER & TECH. L.J. 73 (1987), http://digitalcommons.law.yale.edu/fss_papers/1293/. In 2004 Bloomberg began offering B-Law. "During the 1990s . . . [t]he Internet became another electronic medium for legal publishing . . . [C]ourts themselves began to host their own free

existing ways of operating and practicing law and, in fact, created the need for additional lawyers to evaluate the new and increasing numbers of legal materials made available faster and more easily accessible by technology. At first, Legal Tech made law firms and lawyers more efficient in performing their activities. Examples include automated billing, document storage, practice management, and accounting software.²³ In the early 2010s, Legal Tech became more advanced and started to include technology that assisted legal professionals in due diligence and e-discovery processes.²⁴ Since

websites.” Lynn Foster & Bruce Kennedy, *Technological Developments in Legal Research*, 2 J. APP. PRAC. & PROCESS. 275, 281-82 (2000), <http://lawrepository.ualr.edu/appellatepracticeprocess/vol2/iss2/4/>. In the mid 1990s firms such as VersusLaw and Loislaw began to offer solo and small firm lawyers lower-cost (but less comprehensive) online alternatives to Westlaw and Lexis. Robert Ambrogì, *Shake-Up in Legal Research: Fastcase Acquires Loislaw from Wolters-Kluwer*, LAW SITES (Sept. 21, 2015), <http://www.lawsitesblog.com/2015/09/shake-up-in-legal-research-fastcase-acquires-loislaw-from-wolters-kluwer.html>. Those services were followed in 1999 by Fastcase and Casemaker, which are notable for offering their services free to members of subscribing state bar associations. Mary Whisner, *Getting to Know Fastcase*, 106 L. LIBR. J. 473 (2014); Michael A. St. Pierre, *Casemaker: Making Technology Work for You*, R.I. BAR J., Sept./Oct. 2002, at 5. HeinOnline launched in 2000. *The History of Hein and HeinOnline*, WILLIAM S. HEIN & CO, INC., <http://home.wshein.com/about/history/>. In 2010 Lexis, Westlaw, and Bloomberg introduced new versions of their research products (products which became known as WestlawNext, Lexis Advance, and Bloomberg Law), and Google Scholar entered the legal research business. Jill Schachner Chanan, *Exclusive: Inside the New Westlaw, Lexis and Bloomberg Platforms*, ABA J. (Jan. 25, 2010, 3:00 AM CST), (http://www.abajournal.com/news/article/exclusive_inside_the_new_westlaw_lexis_bloomberg_platforms/). More recently, companies such as Ravel Law are introducing new ways to search, analyse, and visualize content. *See, e.g.*, RAVEL, <http://ravellaw.com/who-we-are/>.

²³ *See, e.g.*, SHARON D. NELSON, JOHN W. SIMEK & MICHAEL C. MASCHKE, THE 2010 SOLO AND SMALL FIRM LEGAL TECHNOLOGY GUIDE 95–117 (2010), For more recent developments, *see, e.g.*, Abdi Shayesteh & Elnaz Zarrini, *Man Vs. Machine: Or, Lawyers Vs. Legal Technology*, LAW 360 (Nov. 14, 2106, 12:14 PM EST).

²⁴ *See, e.g.*, John M. Facciola, *A History of Electronic Discovery*, in MANAGING E-DISCOVERY AND ESI 13 (Michael D. Berman, Courtney Ingraffia Barton & Paul W. Grimm eds., 2011); BRUCE A. OLSON & TOM O’CONNOR, ELECTRONIC DISCOVERY FOR SMALL CASES (2012); Julie Sobowale, *How Artificial Intelligence Is Transforming the Legal Profession*, ABA J. (Apr. 1, 2016, 12:10 AM CST), http://www.abajournal.com/magazine/article/how_artificial_intelligence_is_transfo

2015, Legal Tech has continued to evolve in unprecedented ways. Multiple startup companies and their investors have started to capitalize on technologies, and their applications are already replacing some junior lawyers and disrupting the existing parameters for the practice of law.²⁵

Four categories of startups in LegalTech can be distinguished. The first category includes startup companies that offer a range of online legal services, removing the in-person legal consultation process and guidance process for clients.²⁶ The second legal startup category involves online “matching” platforms that

[rming the legal profession](#) (noting the launch of e-Brevia’s Diligence Accelerator among other developments); Wilson, *supra* note 16.

²⁵ See, e.g., Thomas H. Davenport, *Let’s Automate All the Lawyers?*, WALL STREET J. (Mar. 25, 2015, 12:18 PM ET), <http://blogs.wsj.com/cio/2015/03/25/lets-automate-all-the-lawyers/>; Peter Nussey, *How Much of What Lawyers Do Can Be Automated? A Look at New Research*, LEGALIT INSIDER (Jan. 22, 2016, 1:44 PM), <https://www.legaltechnology.com/latest-news/guest-post-how-much-of-what-lawyers-do-can-be-automated-a-look-at-new-research/>; DELOITTE, THE ROBOTS ARE COMING (2015), <https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/finance/deloitte-uk-finance-robots-are-coming.pdf>.

²⁶ Some of these services, including JUSTIA, <https://www.justia.com/>; LAWYERS.COM, <http://www.lawyers.com/>; and Avvo, <https://www.avvo.com/>, are free or have free components. Avvo, for example, allows a user to ask a question for free anonymously. It notifies the questioner when a lawyer responds to the question, which it says is usually within 12 hours. AVVO, <https://www.avvo.com/ask-a-lawyer#!> (last visited Mar. 18, 2017). Some of these services are fee-based or have a fee-based component. For example, in addition to its free service, Avvo also offers fixed fee legal services in multiple practice areas, and it offers a flat fee option for talking directly by phone for 15 minutes with one of its top-reviewed lawyers. AVVO, https://www.avvo.com/advisor?avvo_campaign=avvo_advisor&avvo_medium=ask_a_lawyer_page_top&avvo_source=avvo (last visited Mar. 18, 2017). While providing some free legal advice and documents, Legal Zoom offers personal and business prepaid legal service plans that offer 30-minute consultations for each unique legal matter and a one hour annual legal checkup. LEGALZOOM, <https://www.legalzoom.com/attorneys/> (last visited Mar. 18, 2017). Rocket Lawyer focuses on helping subscribers create personal and business legal documents, providing step-by-step instructions for customizing the documents, and offering review of the documents by an attorney for a set subscription cost. It also provides access to affordable representation by licensed attorneys. ROCKETLAWYER, <https://www.rocketlawyer.com> (last visited Mar. 18, 2017).

connect lawyers with clients.²⁷ Such platform startups help consumers find a fitting lawyer without the costly involvement of a law firm. The third category entails startups that use A.I. tools to take over their lawyer clients' time-consuming and expensive legal research activities such as reviewing, understanding, evaluating, and reapplying contracts.²⁸ Finally, startups with expertise in blockchain technology attempt to replace lawyers as intermediaries in certain types of transactions.²⁹

²⁷ Such startups' platforms help consumers find the right lawyer without the costly involvement of a law firm. Examples include UPCOUNSEL, <https://www.upcounsel.com/> (last visited Mar. 18, 2017); LAWGIVES, <https://www.lawgives.com/> (last visited Mar. 18, 2017); and LEGALHERO, <https://www.legalhero.com/> (last visited Mar. 18, 2107). *See generally* Shannon Achimalbe, *Will Client-Matching Services Turn Participating Lawyers into Uber Drivers?*, ABOVE THE LAW (Dec. 3, 2014, 3:19 PM), <http://abovethelaw.com/2014/12/will-client-matching-services-turn-participating-lawyers-into-uber-drivers/>; Jennifer Smith, *Online Matchmakers Offer New Way to Find Legal Help*, WALL STREET J. (Dec. 2, 2013), <http://www.wsj.com/news/articles/SB10001424052702303464504579107231443311754>.

²⁸ Examples include LegalSifter, <https://www.legalsifter.com/> (last visited Mar. 18, 2017); Seal software, <https://www.seal-software.com/> (last visited Mar. 18, 2017); Exigent Group, <http://www.exigent-group.com/> (last visited Mar. 18, 2017); Beagle, <http://beagle.ai/> (last visited Mar. 18, 2107); Brightleaf, <http://www.brightleaf.com/> (last visted Mar. 18, 2017; eBrevia, <https://ebrevia.com/> (last visited Mar. 18, 2017; and Legal Robot, <https://www.legalrobot.com/>. *See generally* Frederic Lardinois, *LegalSifter Helps Designers and Developers Read Their Contracts*, TC (Aug. 7, 2014), <https://techcrunch.com/2014/08/07/legalsifter-helps-designers-and-developers-read-their-contracts/>; *Seal Software: Breaking the Seal to Identify Contract Value*, SOURCING INNOVATION, (Feb. 13, 2107), <http://sourcinginnovation.com/wordpress/category/contract-management/>; Julie Bort, *This Startup Invented a New Category of Search Software So Good Google Uses It*, BUSINESS INSIDER (Feb. 1, 2017, 8:00 PM), <http://www.businessinsider.com/seal-software-invents-search-software-so-good-google-uses-it-2017-2>; *Exigent Launches Hybrid Service for Low Cost Customisable Contract Discovery*, EXIGENT (Jan. 18, 2017), <http://www.exigent-group.com/exigent-launches-hybrid-service-for-low-cost-customizable-contract-discovery/>; *LPO Exigent Teams Up with LexPredict to Provide NLP Contract Discovery Service*, ARTIFICIAL LAWYER (Jan. 18, 2017), <https://artificiallawyer.com/2017/01/18/lpo-exigent-teams-up-with-lexpredict-to-provide-contract-discovery-service/>.

²⁹ Ethereum is one example of a custom-built blockchain platform that runs smart contracts. *See* ETHEREUM, <https://www.ethereum.org/> (last visited Mar. 18, 2017).

The decentralization of law that is a central part of the startup companies' purpose and that disrupts existing legal practices has broad repercussions for the legal profession. First, existing legal services are rendered increasingly irrelevant or are replaced by Legal Tech.³⁰ Junior legal professionals and legal support staff are likely the first victims of the Legal Tech evolution.³¹ Legal Tech applications will be able to perform most of junior lawyers' work in the near future without the human elements that create imprecision, flaws, inaccuracies, possible lawsuits, and delay.³² Second, and most

Legal startups that use blockchain technology for smart contracts include: SmartContract, Hedgy, Mifiel, rainvow, godzillion, and Katalysis. *Blockchains Startups*, <https://angel.co/blockchains> (last visited Mar. 18, 2017). A few of the others include Adjoint Inc., <http://www.adjoint.io/> (last visited Mar. 18, 2017); CommonAccord, <https://commonaccord.wordpress.com/> (last visited Mar. 18, 2017); Clause, CLAUSE BLOG, <https://blog.clause.io/tagged/smart-contracts> (last visited Mar. 18, 2017); and Stash, <http://stashcrypto.com/smart-contracts-info> (last visited Mar. 18, 2017). See generally Rob Marvin, *Blockchain in 2017: The Year of Smart Contracts*, PC (Dec. 12, 2016), <http://www.pcmag.com/article/350088/blockchain-in-2017-the-year-of-smart-contracts>; James Eyers, *Blockchain 'Smart Contracts' to Disrupt Lawyers*, AFRWEEKEND (May 30, 2016, 12:15 AM), <http://www.afr.com/technology/blockchain-smart-contracts-to-disrupt-lawyers-20160529-gp6f5e>.

³⁰ See, e.g., DELOITTE, *DEVELOPING LEGAL TALENT; STEPPING INTO THE FUTURE LAW FIRM* (2016), <http://www.legalfutures.co.uk/wp-content/uploads/developing-legal-talent-2016.pdf>.

³¹ See, e.g. David Kravets, *Law Firm Bosses Envision Watson-Type Computers Replacing Young Lawyers*, ARS TECHNICA (Oct. 26, 2105, 12.06 PM), <https://arstechnica.com/tech-policy/2015/10/law-firm-bosses-envision-watson-type-computers-replacing-young-lawyers/>; Karen Turner, *Meet 'Ross,' the Newly Hired Legal Robot*, WASHINGTON POST (May 16, 2016), https://www.washingtonpost.com/news/innovations/wp/2016/05/16/meet-ross-the-newly-hired-legal-robot/?utm_term=.950014c34c52; Dan Mangan, *Lawyers Could Be the Next Profession to Be Replaced by Computers*, CNBC (Feb. 17, 2107, 1:55 PM ET), <http://www.cnbc.com/2017/02/17/lawyers-could-be-replaced-by-artificial-intelligence.html>; Jacqui Walker, *The Future of Law: Is Technology Stealing Young Lawyer Jobs?*, LEGALER BLOG (Mar.1, 2015), <http://blog.legaler.com/2015/03/01/the-future-of-law-is-technology-stealing-young-lawyer-jobs/>; CHRISTIAN VEITH, MICHAEL BANDLOW, MICHAEL HARNISCH, HARIOLF WENZLER, MARKUS HARTUNG, & DIRK HARTUNG, *HOW LEGAL TECHNOLOGY WILL CHANGE THE BUSINESS OF LAW* 10–12 (2016), http://media.wix.com/ugd/b30d31_7b407b2c8c6b44d697957b7f7fa5db48c8.pdf.

³² See, e.g., Turner, *supra* note 31; Mangan, *supra* note 31.

importantly, the legal profession will be forced by such startup companies to innovate in perpetuity, a task that is not easily accomplished by overextended and—often—cumbersome legal organizations that have lost the capacity for agile re-invention.

1. *Virtual Law Firms*

Legal Tech has the potential to rapidly transform law firms and legal departments into virtual law firms. Virtual law firms may dominate in the future. A virtual law firm is basically a platform with an emphasis on connecting legal and other professionals and collaboration. When implemented successfully, the effect of the platform model will be the creation of a flexible and accessible community of professionals with different skills and experience. The bigger the community, the easier it is to offer solutions tailored to the needs of the clients.

The virtual law firm model attracts a wide spectrum of law firms. One extreme is represented by the traditional law firm characterized by a hierarchy with partners at the top and varying levels of associates, paralegals, and non-lawyers below them.³³ On the other end of the spectrum are those firms that adopt an “*Airbnb*”-type platform organization, mainly providing a match-making/coordination service.³⁴ Enormous variations exist between the two extremes, depending on the level of implementation of Legal Tech.

Legal platforms adopt a variety of approaches. For instance, *UpCounsel* offers entrepreneurs on-demand access to experienced lawyers.³⁵ *LawyerlinQ* in the Netherlands³⁶ and *Digitorney* in Germany³⁷ offer law firms the possibility to insource special

³³ Sullivan and Cromwell LLP, <https://www.sullcrom.com/>; Cravath, Swaine & Moore LLP, <https://www.cravath.com/>; DavisPolk, <https://www.davispolk.com/>; and Debevoise & Plimpton, <http://www.debevoise.com/> are examples.

³⁴ Achimalbe, *supra* note 27; Smith, *supra* note 27.

³⁵ <https://www.upcounsel.com>.

³⁶ <http://about.lawyerlinq.com>.

³⁷ <http://www.digitorney.de/>. Based on Intralinks technology, Digitorney provides corporate law firms and its pool attorneys with a digital tool for virtual collaboration. Its data room enables all parties to upload files and to exchange working results. Digitorney is aimed at large and medium-sized law firms that focus on business law and that want to use external resources for some of their

knowledge and skills for more complex projects.³⁸ Digitorney is the only startup known to the authors that also realized very early the need to bring law students into the new reality of virtual law firms early. Accordingly, Digitorney established the so-called Junior Pool, as a way for law students to work very early in their careers on international mandates and help them establish a track record of excellence in a virtual law firm setting that allows them to take on more senior roles earlier in their careers.³⁹ *LexSemble* is a crowdsourcing platform that allows multiple users to edit legal knowledge entries.⁴⁰ The information gathered from the cloud helps the platform to develop a machine learning analytics engine. This engine can be used to assist in legal decision-making and prediction activities.

2. *Reevaluation of Applicable Law*

Legal Tech's disruptive innovation in combination with the principles established by the sharing economy require lawyers and lawmakers to reevaluate their understanding of many areas of the law. Because of the disruptive effects of the sharing economy,⁴¹ legal doctrines, principles, and concepts need to be redesigned around sharing and decentralized peer-to-peer platforms. Such an undertaking requires out-of-the-box thinking for lawyers who were trained during law school and during their entire careers to think inside the box.

The areas of law that are most clearly affected by the disruptive innovation in law, the sharing economy, machine learning, artificial intelligence, and blockchain technology include property,

legal work. After a briefing by phone or in writing, Digitorney's lawyers provide the requested product or service primarily by means of the securely encrypted Digitorney platform. Upon request, they also provide work in person. Digitorney enables participating law firms to cover peak demands and optimize internal capacity and profitability.

³⁸ For an overview of how to set up a simple virtual law practice, see Chad Burton, *Launching a Virtual Law Firm*, GP SOLO, Jan.-Feb. 2014, at 24, http://www.americanbar.org/publications/gp_solo/2014/january-february/launching_virtual_law_firm.html.

³⁹ <http://www.digitorney.de/2016/11/08/digitorney-junior-pool/>.

⁴⁰ <https://lexsemble.com/>.

⁴¹ See *infra* note 83.

private law, and employment law, to name only a few.

Property is a prime example. In the sharing economy, people will care less over time about ownership, and property law will inevitably have to change. In the sharing economy, products and legal rights pertaining to products and land are becoming less relevant and are iteratively becoming services. As such, ownership, title, and legal rights pertaining to real property and chattel are becoming less relevant. Moreover, as the distinction between commercial property and personal consumption property becomes blurred, other areas of law need to be revised. Such areas may include: tax law, bankruptcy law, and liability and insurance law, among many others.

Privacy law provides another prominent example. With the development and exponential evolution of the internet of things, artificial intelligence, machine learning, big data analytics, blockchain technology, and smart contracts, more and more personal information will be registered, recorded, and analyzed. Existing privacy laws need to evolve to accommodate the developments, while at the same time securing the integrity of the connected systems.

Employment law also may be affected. Companies with few or no assets are becoming more common in the sharing economy. Trust is created through platforms and distributed networks. This encourages a direct “peer-to-peer” contact between the service provider and consumer. Accordingly, consumer protection laws, tax laws, and, of course, labor laws need significant revisions.

3. *Changing Legal Practice*

Legal Tech is replacing the traditional role of legal professionals. Legal professionals play a crucial role in establishing trust and truth in legal transactions.⁴² They negotiate, draft, and

⁴² See, e.g., John O. McGinnis & Russell G. Pearce, *The Great Disruption: How Machine Intelligence Will Transform the Role of Lawyers in the Delivery of Legal Services*, 82 FORDHAM L. REV. 3041, 3055 (2014); *Estate Planning FAQs: What Is the Lawyer's Role?*, AM. BAR ASS'N, http://www.americanbar.org/groups/real_property_trust_estate/resources/estate_planning/the_lawyer_s_role.html (last visited Mar. 18, 2017); Gregory Dent, *Lawyers and Trust in Business Alliances*, BUS. LAW., Nov. 2002, at 45, 55–59, http://scholarlycommons.law.case.edu/cgi/viewcontent.cgi?article=1253&context=faculty_publications.

interpret contracts and help enforce them; create laws and regulations that protect the weaker parties; and design structures that enable the registration and transfer of tangible property and intellectual property. Well-drafted legal contracts help establish trust and confidence in the validity of the transaction and the economic benefits of the transaction for the contracting parties. Important matters, such as the truth about ownership and control, the transfer of ownership, and the allocation of risk and control, are normally covered in a contract. However, the counseling, deal-making, matchmaking, gatekeeping, and enforcing roles are increasingly performed by technology.⁴³ This trend is likely to accelerate in the near future, enabled by blockchain technology and smart contracting.⁴⁴

III. Blockchain Ledger Technology

Leading technologists around the world have hailed blockchain technology as one of the most important technological innovations since the Internet.⁴⁵ The peer-to-peer interactions and

⁴³ McGinnis & Pearce, *supra* note 42, at 3041-43, 3046-55; Benjamin H. Barton, *The Lawyer's Monopoly—What Goes and What Stays*, 82 FORDHAM L. REV. 3067, 3069-80 (2014).

⁴⁴ See *infra* Part III on revolutionary role of blockchain technology in law.

⁴⁵ See, e.g., COGNIZANT, MARKETFORCE & PEGASYSTEMS, *THE FUTURE OF RETAIL FINANCIAL SERVICES* 6, 28-30 (2016), <https://www.pegacom/sites/pegacom/files/docs/2016/Jan/the-future-of-retail-financial-services-study.pdf>; John Naughton, *Is Blockchain the Most Important IT Invention of Our Age?* GUARDIAN (Jan. 24, 2016, 4:00 EST), <https://www.theguardian.com/commentisfree/2016/jan/24/blockchain-bitcoin-technology-most-important-tech-invention-of-our-age-sir-mark-walport>; William Mougayar, *The Blockchain Is the New Google*, TC (May 11, 2016) <https://techcrunch.com/2016/05/11/the-blockchain-is-the-new-google/>; MICHAEL CROSBY ET AL., *BLOCKCHAIN TECHNOLOGY BEYOND BITCOIN* 3 (2015), <http://scet.berkeley.edu/wp-content/uploads/BlockchainPaper.pdf>; Kyle Torpey, *Why the Bitcoin Blockchain Is the Biggest Thing Since the Internet*, NASDAQ (Apr. 19, 2016, 9:32:27 AM EDT), <http://www.nasdaq.com/article/why-the-bitcoin-blockchain-is-the-biggest-thing-since-the-internet-cm608228>; Carrie Kirby, *Andreessen at Coin Summit: Bitcoin Today Is the Internet in 1994*, COINDESK (Mar. 25, 2014, 20:21 GMT), <http://www.coindesk.com/marc-andreessen-balaji-srinivasan-discuss-bitcoin/>; Dinis Guarda, *Over 50 Bitcoin and Blockchain Thoughts and Quotes You Need to Read*, TRADERSDNA (Apr. 7, 2016), <http://www.tradersdna.com/bitcoin-and-blockchain/over-50-bitcoin-and->

transactions in a decentralized network where all participants are equal and verification and validation of each transaction is provided by all parties in the network through the blockchain technology provides near unlimited opportunities and applications. For instance, in the financial world a global consensus record of information and transactions creates the much-needed transparency, and at the same time opens global access to finance—including in areas of the world where the banking system—in contrast to a mobile telephone network—is not readily available.⁴⁶ The technology incentivizes direct transactions, including compensation, between the creator and consumer, eliminating the need for intermediation.⁴⁷

Blockchain technology creates a platform for trust through truth and transparency for parties. Because the blockchain (at the least the public blockchain) is in fact public and immutable, the technology increases transparency, while at the same time significantly reducing transaction costs. Intermediaries, including lawyers, are replaced by code, connectivity, crowd, and collaboration.⁴⁸

[blockchain-thoughts-and-quotes-you-need-to-read/](#); Rich Daly, *Blockchain: Wall Street's Most Game-Changing Technology Advance Since the Internet*, FORBES (July 11, 2016, 6:00 AM), <https://www.forbes.com/sites/richdaly/2016/07/11/blockchain-wall-streets-most-game-changing-technology-advance-since-the-internet/#33987a154d87>.

⁴⁶ See, e.g., Michele Chandler, *Mobile Banking Takes Off in Nigeria*, STAN. GRADUATE SCH. BUS. (Jan. 24, 2012), <https://www.gsb.stanford.edu/insights/mobile-banking-takes-nigeria> (noting that in Nigeria, for example, banking transactions are readily executed over mobile phones because no infrastructure exists for consumer banking); Cade Metz, *Why Bitcoin Will Thrive First in the Developing World*, WIRED (Feb. 2, 2016, 8:00 AM), <https://www.wired.com/2016/02/why-bitcoin-will-thrive-first-in-the-developing-world/>; Yessi Bello Perez, *Can Bitcoin Make a Difference in the Global Aid Sector?*, COINDESK (Sept. 9, 2015, 10:30 GMT), <http://www.coindesk.com/can-bitcoin-make-a-difference-in-the-global-aid-sector/> (suggesting that donations and aid to third world countries can finally be provided without the interference of suboptimal bureaucratic organizations that don't allocate the aid as intended by the donor).

⁴⁷ See, e.g., *infra* note 48; Perez, *supra* note 46; Brett Scott, *How Can Cryptocurrency and Blockchain Technology Play a Role in Building Social and Solidarity Finance?* UNRISD Working Paper 2016-1) 6, <http://www.unrisd.org/brett-scott>.

⁴⁸ See, e.g., Eric Piscini, Gys Hyman & Wendy Henry, *Blockchain: Trust Economy*, DELOITTE U. (Feb. 7, 2017), <https://dupress.deloitte.com/dup-us->

1. *Blockchain Technology Defined*

Blockchain technology has been defined in many different ways, and no truly uniform definition seems to exist. Some refer to it as a giant worldwide, distributed, immutable “google spreadsheet” for transactions.⁴⁹ Others define blockchain by focusing on its central elements, e.g., it is a transaction ledger, electronic, decentralized, immutable, and provides cryptographic verification, among several others.⁵⁰ Vitalik Buterin, the founder of Ethereum, perhaps most prominently defined blockchain as follows:

Public blockchains: a public blockchain is a blockchain that anyone in the world can read, anyone in the world can send transactions to and expect to see them included if they are valid, and anyone in the

en/focus/tech-trends/2017/blockchain-trust-economy.html; Don Tapscott & Alex Tapscott, *How Blockchain Will Change Organizations*, MIT SLOAN MGMT. REV., Winter 2017, at 10–11, http://sloanreview.mit.edu/article/how-blockchain-will-change-organizations/?social_token=5393525f2c938c2283f4f53795e343a4&utm_source=twitter&utm_medium=social&utm_campaign=sm-direct; Mohit Kaushal & Sheel Tyle, *The Blockchain: What It Is and Why It Matters*, BROOKINGS: TECHTANK (Jan. 13, 2105), <https://www.brookings.edu/blog/techtank/2015/01/13/the-blockchain-what-it-is-and-why-it-matters/>; *The Trust Machine; The Promise of the Blockchain*, ECONOMIST, Oct. 31, 2015, at 13, <http://www.economist.com/news/leaders/21677198-technology-behind-bitcoin-could-transform-how-economy-works-trust-machine>; Jason Leibowitz, *Blockchain's Big Innovation Is Trust, Not Money*, COINDESK (May 21, 2016, 16:57 GMT), <http://www.coindesk.com/blockchain-innovation-trust-money/>.
⁴⁹ Jonathan Shieber, *Colu Aims To Bring Blockchain Technology Everywhere*, TC (Jan. 27, 2015), <https://techcrunch.com/2015/01/27/colu-aims-to-bring-blockchain-technology-everywhere/>; Craig Leppan, *Who Is Blockchain Going to Affect the Most*, OVATIONS (July 29, 2015), <http://www.ovationsgroup.com/blockchain/>.
⁵⁰ See, e.g., ALAN MORRISON, BLOCKCHAIN AND SMART CONTRACT AUTOMATION: BLOCKCHAINS DEFINED, PWC (2016), <http://www.pwc.com/us/en/technology-forecast/2016/blockchain/pwc-smart-contract-automation-definition.pdf>; Alistair Dabbs, *What Is Blockchain, and Why Is It Growing in Popularity?*, ARSTECHNICA (Nov. 6.2016, 8:00 AM), <https://arstechnica.com/information-technology/2016/11/what-is-blockchain/>; Lee Grant, *Blockchain – Definition, Origin, and History*, TECHBULLION (Sept. 6, 2016), <http://www.techbullion.com/blockchain-definition-origin-history>; DELOITTE, BLOCKCHAIN ENIGMA. PARADOX. OPPORTUNITY 4–7 (2016), <https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/Innovation/deloitte-uk-blockchain-full-report.pdf>.

world can participate in the *consensus process* – the process for determining what blocks get added to the chain and what the current state is. As a substitute for centralized or quasi-centralized trust, public blockchains are secured by cryptoeconomics – the combination of economic incentives and cryptographic verification using mechanisms such as proof of work or proof of stake, following a general principle that the degree to which someone can have an influence in the consensus process is proportional to the quantity of economic resources that they can bring to bear. These blockchains are generally considered to be “fully decentralized”.⁵¹

Rather than attempting to agree on a mutually acceptable phraseology for a definition, a description of the core elements of ledger technology can help define the blockchain. As such, a blockchain is a shared digital ledger or database that maintains a continuously growing list of transactions among participating parties regarding digital assets – together described as “blocks.”⁵² The linear

⁵¹ Vitalik Buterin, *On Public and Private Blockchains*, ETHEREUM BLOG (Aug. 7, 2015), <https://blog.ethereum.org/2015/08/07/on-public-and-private-blockchains/>, contrasting public blockchains (the original idea) with consortium blockchains and fully private blockchains: “Consortium blockchains: a consortium blockchain is a blockchain where the consensus process is controlled by a pre-selected set of nodes; for example, one might imagine a consortium of 15 financial institutions, each of which operates a node and of which 10 must sign every block in order for the block to be valid. The right to read the blockchain may be public, or restricted to the participants, and there are also hybrid routes such as the root hashes of the blocks being public together with an API that allows members of the public to make a limited number of queries and get back cryptographic proofs of some parts of the blockchain state. These blockchains may be considered ‘partially decentralized.’” *Id.* “Fully private blockchains: a fully private blockchain is a blockchain where write permissions are kept centralized to one organization. Read permissions may be public or restricted to an arbitrary extent. Likely applications include database management, auditing, etc [sic] internal to a single company, and so public readability may not be necessary in many cases at all, though in other cases public auditability is desired.” *Id.*

⁵² See, e.g., Michele D’Aliessi, *How Does the Blockchain Work?* MEDIUM (June 1, 2016), <https://medium.com/@micheledaliessi/how-does-the-blockchain-work-98c8cd01d2ae#.w76hifu2>; Monica Pearson, *Blockchain Is the New Buzzword*, EXPERIAN, (Jan. 31, 2016),

and chronological order of transactions in a chain will be extended with another transaction link that is added to the block once such additional transaction is validated, verified, and completed.⁵³ The chain of transactions is distributed to a limitless number of participants, so called nodes,⁵⁴ around the world in a public or private peer-to-peer network.

Blockchain technology removes fraudulent transactions. Compared with existing methods of verifying and validating transactions by third party intermediaries, blockchain's security measures make blockchain validation technologies more transparent and less prone to error and corruption. While blockchain's use of digital signatures helps establish the identity and authenticity of the parties involved in the transaction, it is the completely decentralized network connectivity via the Internet that allows the most protection against fraud.⁵⁵ Network connectivity allows multiple copies of the blockchain to be available to all participants across the distributed network.⁵⁶ The decentralized fully distributed nature of the blockchain makes it practically impossible to reverse, alter, or erase information in the blockchain.⁵⁷ Blockchain's distributed consensus

<https://www.experian.com/blogs/insights/2016/01/blockchain-is-the-new-buzzword/>.

⁵³ See, e.g., D'Aliessi, *supra* note 52; Pearson, *supra* note 52.

⁵⁴ See, e.g., D'Aliessi, *supra* note 52. Participants can be individuals, organizations, and even things. See, e.g., Hemant Saxena, *Blockchain Technology and Microsoft's Plan to Develop Blockchain As a Service*, WINDOWS CLUB (Feb. 16, 2017), http://www.thewindowsclub.com/blockchain-microsoft-plans-develop-service?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+TheWindowsClub+%28The+Windows+Club%29; Sloane Brakeville & Bhargav Perepa, *Blockchain Basics: Introduction to Distributed Ledgers*, IBM: DEVELOPERWORKS (May 9, 2016; updated Dec. 15, 2016), <https://www.ibm.com/developerworks/cloud/library/cl-blockchain-basics-intro-bluemix-trs/>. The only condition for participants is the necessity of an Internet connection. See e.g., D'Aliessi, *supra* note 52.

⁵⁵ See, e.g., Brakeville & Perepa, *supra* note 54. For an in-depth, nuanced discussion of this point, see PETER VAN VALKENBURGH, OPEN MATTERS: WHY PERMISSIONLESS BLOCKCHAINS ARE ESSENTIAL TO THE FUTURE OF THE INTERNET 3–4, 23–26 (2016), <https://coincenter.org/files/2016-12/openmattersv1-1.pdf>.

⁵⁶ See, e.g., D'Aliessi, *supra* note 52.

⁵⁷ See, e.g., Brakeville & Perepa, *supra* note 54; Antony Lewis, *A Gentle Introduction to Immutability of Blockchain*, BITS ON BLOCKS (Feb. 29, 2016),

model, e.g., the network “nodes” verify and validate chain transactions before execution of the transactions, makes it extremely rare for a fraudulent transaction to be recorded in the blockchain.⁵⁸ That model also allows node verification of transactions without compromising the privacy of the parties and is therefore arguably safer than a traditional model that requires third-party intermediary validation of transactions.⁵⁹

Cryptographic hashes further increase blockchain security. Cryptographic hashes are complex algorithms that use details of all previous transactions in the existing blockchain before adding the next block to generate a unique hash value.⁶⁰ That hash value ensures the authenticity of each transaction before it is added to the block. The smallest change to the blockchain, even a single digit/value, results in a different hash value. A different hash value makes any form of manipulation immediately detectable.⁶¹

Smart contracts and smart property are blockchain-enabled computer protocols that verify, facilitate, monitor, and enforce the negotiation and performance of a contract.⁶² The term “smart

<https://bitsonblocks.net/2016/02/29/a-gentle-introduction-to-immutability-of-blockchains/>.

⁵⁸ See, e.g., Francois Janinotto, *The Blockchain Explained to Web Developers, Part 1: The Theory*, MARMELAB BLOG (Apr. 28, 2016), <https://marmelab.com/blog/2016/04/28/blockchain-for-web-developers-the-theory.html>; Razvan Peteanu, *Fraud Detection in the World of Bitcoin*, BITCOIN MAG. (Mar. 26, 2014, 5:50 AM EST), <https://bitcoinmagazine.com/articles/fraud-detection-world-bitcoin-1395827419/> (noting, “Fundamentally, detecting fraud is hard precisely because it is rare, dynamic and not necessarily obviously fraudulent.”).

⁵⁹ For a discussion of privacy on the blockchain, see Valkenburgh, *supra* note 55, at 33–40. For an overview of various consensus mechanisms see SIGRID SEIBOLD & GEORGE SAMMAN, CONSENSUS: IMMUTABLE AGREEMENT FOR THE INTERNET OF VALUE (2016). <https://assets.kpmg.com/content/dam/kpmg/pdf/2016/07/kpmg-blockchain-consensus-mechanism-channel-islands.pdf>; Valkenburgh, *supra* note 54, at 15–40.

⁶⁰ See, e.g., Lewis, *supra* note 57.

⁶¹ *Id.*

⁶² See e.g., ALAN MORRISON, BLOCKCHAIN AND SMART CONTRACT AUTOMATION: INTRODUCTION AND FORECAST, PWC (2016), <http://www.pwc.com/us/en/technology-forecast/2016/blockchain/pwc-smart-contract-automation-introduction.pdf>; Nicolette Kost De Severs & Bradley Cohen, *The Blockchain Revolution, Smart Contracts and Financial Transactions*, DLA PIPER (Apr. 26, 2106),

contract” was first introduced by Nick Szabo, a computer scientist and legal theorist, in 1994.⁶³ An often-cited example for smart contracts is the purchase of music through *Apple*’s iTunes platform.⁶⁴ A computer code ensures that the “purchaser” can only listen to the music file on a limited number of *Apple* devices.⁶⁵

More complex smart contract arrangements in which several parties are involved require a verifiable and unhackable system provided by blockchain technology.⁶⁶ Through blockchain technology, smart contracting often makes contractual legal contracting unnecessary as smart contracts often emulate the logic of legal contract clauses.⁶⁷ Ethereum, the leading platform for smart

<https://www.dlapiper.com/en/czech/insights/publications/2016/04/the-blockchain-revolution/>.

⁶³ *Smart Contracts: The Blockchain Technology That Will Replace Lawyers*, BLOCKGEEKS, <http://blockgeeks.com/guides/smart-contracts/> (last visited Mar. 18, 2017); *Not-So-Clever Contracts*, ECONOMIST, July 30, 2016, at 53, <http://www.economist.com/news/business/21702758-time-being-least-human-judgment-still-better-bet-cold-hearted>.

⁶⁴ See, e.g., HORSTEN KOEPL & JEREMY KRONIK, BLOCKCHAIN TECHNOLOGY—WHAT’S IN STORE FOR CANADA’S ECONOMY AND FINANCIAL MARKETS? 15 (2017), https://www.cdhowe.org/sites/default/files/attachments/research_papers/mixed/Commentary_468_0.pdf; R. Douglas Vaugh & Anna Outzer, *Understanding How the Block Chain Could Impact the Legal Industry*, LAW 360 (Jan. 11, 2107), <https://www.law360.com/articles/879810/understanding-how-blockchain-could-impact-legal-industry>.

⁶⁵ Vaughn & Outzer, *supra* note 64; Jeffrey Glazer, *Smart Contracts Are a Future*, U. WIS. – MADISON: LAW & ENTREPRENEURSHIP CLINIC (Sept. 14, 2105), <https://www.uwle.org/blog/smart-contracts-are-a-future>.

⁶⁶ See, e.g., ETHEREUM, <https://www.ethereum.org/>; Gavin Wood, *Etherium: A Secure Decentralised Generalised Transaction Ledger*, <http://gavwood.com/paper.pdf>; Luke Parker, *Industry Research Papers Highlight Blockchain Technology’s Disruptive Potential*, BRAVE NEWCOIN (July 3, 2016), <https://bravenewcoin.com/news/industry-research-papers-highlight-blockchain-technologys-disruptive-potential/>.

⁶⁷ Mark Anderson, *Smart Contracts and Blockchain Technology*, IP DRAUGHTS (June 18, 2106, 12:14 PM), <https://ipdraughts.wordpress.com/2016/06/18/smart-contracts-and-blockchain-technology/>. See generally Josh Stark, *Making Sense of Blockchain Smart Contracts*, COINDESK (June 4, 2016, 18:39 GMT), <http://www.coindesk.com/making-sense-smart-contracts/>; Josh Stark, *How Close Are Smart Contracts to Impacting the Real World of Law?*, COINDESK, (Apr. 11, 2016, 14:00 GMT), <http://www.coindesk.com/blockchain-smarts-crtracts-real-world-law/>; Ted Mylnar & Ira Schafer, *Why Smart Contracts Will Need ‘Smart*

contracting, describes smart contracting in this context as follows:

Ethereum is a **decentralized platform that runs smart contracts**: applications that run exactly as programmed without any possibility of downtime, censorship, fraud or third party interference. These apps run on a custom built **blockchain, an enormously powerful shared global infrastructure that can move value** around and represent the ownership of property. This enables developers to create markets, store registries of debts or promises, move funds in accordance with instructions given long in the past (like a will or a futures contract) and many other things that have not been invented yet, all without a middle man or counterparty risk.⁶⁸

2. Decentralization

Rapid technological change allows society to shed its centralized past and become increasingly decentralized. Rapid technological change overcomes vertical hierarchies and enables a world of horizontal, open, and autonomous networks.⁶⁹ The Internet enabled a free, fast, and global exchange of information and ideas. Social media further reformed and accelerated the way society exchanges and shares information. Both inventions had a broad and astonishing social impact. Within one generation, every aspect of social interaction has been transformed.

Blockchain technology is transforming society for an even more decentralized future. Figure 1 illustrates the currently shifting and intersecting paradigms of user connectivity and the shift towards decentralization. Corporate decentralization started with firms such

Term Sheets' to Match, COINDESK (Dec. 9, 2016, 14:36 GMT), <http://www.coindesk.com/smart-contracts-will-need-smart-term-sheets-match/>. For an example of what startups hope to accomplish with smart contracting, see Legalese, <https://legalese.com/>.

⁶⁸ ETHEREUM, *supra* note 66.

⁶⁹ See, e.g., Don Tapscott, *Why Blockchain Will Smash Hierarchies*, DUKE^{CE}, (SEPT. 2016), <http://www.dukece.com/article-library/blockchain-will-smash-hierarchies/>.

as Netflix, Amazon, Tesla, and Under Armour, among several others, that favored flatter corporate hierarchies, open communication, a best-idea-wins culture, and a focus on Millennials' preferences. This trend of decentralization has been accompanied by an ever-increasing interconnectivity of users. Figure 2 suggests that around 2015-17 a paradigm shift began that allowed the interconnectivity of users to increase substantially, enabled and supported by smart contracts and blockchain technology, while at the same time blockchain-enabled distributed networks allowed for a radical increase in decentralization.

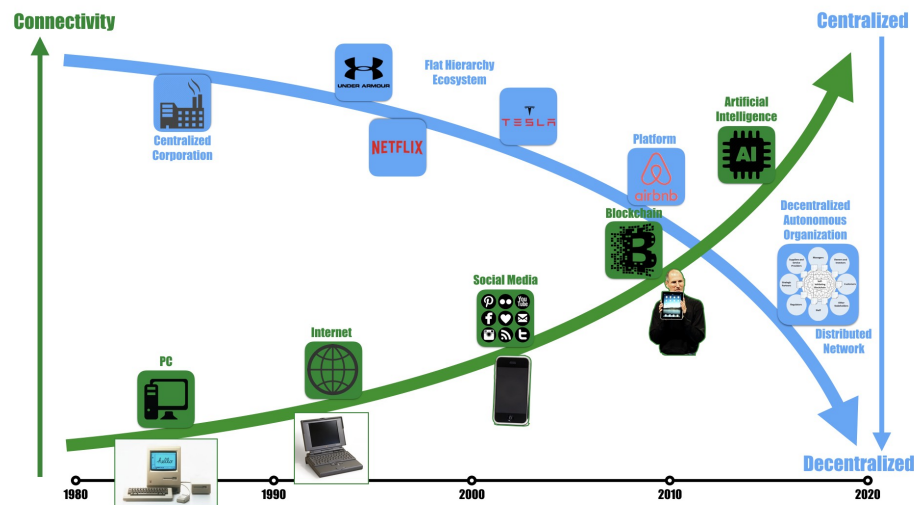


Figure 1: Time Series 1980–2020 societal connectivity and platform decentralization.

These findings have significant implications. Increased connectivity enabled by blockchain technology in combination with increased decentralization allows for the removal of intermediaries, including lawyers, financial intermediaries, and platform companies. Changes in social media platform companies provide a prominent example. Until recently, consumers of information were dependent on centralized media organizations and corporations to disseminate information. However, society relies increasingly on information that is created, produced, and consumed by the crowd. This crowd functionality slowly removes the role of journalists, media, and other

expert intermediaries because crowd-based social media platforms facilitate the real-time exchange of information.⁷⁰ But social media companies such as Twitter and LinkedIn are still just middlemen/platform companies that can be removed with the proliferation of blockchain technology. Take, for instance, Akasha,⁷¹ the next-generation social media network powered by the Ethereum world computer and embedded into the inter-planetary file system (IPFS). Akasha requires no platform company for social media purposes but allows the direct peer-to-peer exchange of content with the difference that user content is published over a decentralized network rather than individual servers. Akasha shows great potential to remove remaining issues with the shifting content generation by the crowd.⁷²

⁷⁰ See, e.g., Michael Barthel, *Newspapers: Fact Sheet*, PEWRESEARCHCENTER (June 15, 2016), <http://www.journalism.org/2016/06/15/newspapers-fact-sheet/> (noting that the number of daily newspapers decreased by more than 100 from 2004 to 2014); Jeffrey Gottfried & Elisa Shearer, *News Use Across Social Media Platforms 2016*, PEWRESEARCHCENTER (May 26, 2016), <http://www.journalism.org/2016/05/26/news-use-across-social-media-platforms-2016/> (noting that 62 % of the adults in the United States now get news on social media); Kalev Leetaru, *Will Facebook Replace the News Media*, FORBES (Sept. 12, 2016, 2:13 PM), <http://www.forbes.com/sites/kalevleetaru/2016/09/12/will-facebook-replace-the-news-media/#17f135d4bd56> (noting that 44% of the public gets its news from Facebook alone).

⁷¹ AKASHA, www.akasha.world.

⁷² For instance, “fake” news (James Carson, *What Is Fake News? Its Origins and How It Grew in 2016*, TELEGRAPH (Mar. 16, 2017, 1:57 PM), <http://www.telegraph.co.uk/technology/0/fake-news-origins-grew-2016/>), biased information, and the explosion of “native advertisements” (where ads cannot easily be distinguished from the real content) are a rapidly increasing problem on social media. That is not to say that fake news didn’t exist in the “pre-social media” era. *Id.* Yet, many argue that traditional newspapers and other official media outlets (if independent) provide at least some verification for published information. See, e.g., Kenneth Jost, *Digital Journalism: Is News Quality Better or Worse Online?* CQ RESEARCHER, May 30, 2014, at 457, 463, <http://library.cqpress.com/cqresearcher/getpdf.php?id=cqresrre2014053000>; Molly A. Dugan, *Journalism Ethics and the Independent Journalist*, 39 MCGEORGE L. REV. 801, 801–04 (2008); Craig Silverman, *New Research Details How Journalists Verify Information*, POYNTER (Feb. 27, 2013), <https://www.poynter.org/2013/new-research-details-how-journalists-verify-information/203728/>. However, other ways exists to solve these “fake news” issues. The social media platforms themselves can engage in “fact-checking,” or they can introduce a third-party verification system. This will, however, add a

3. *Disruptive Innovation*

Blockchain technology has vast disruptive, innovative properties. Despite the very early stage development of blockchain technology, the possible applications are near limitless. Consider the blockchain-based currency, Bitcoin. Until recently, most commentators viewed Bitcoin as a hype, susceptible to fraud, price manipulation, and corruption.⁷³ Yet, now “[t]he issue is no longer whether cryptocurrency will survive, but rather how it will evolve.”⁷⁴ The high levels of investor activity in the blockchain area appear to provide a reliable indicator of the commercial maturity of blockchain

bureaucratic layer between the “creator” and “consumer.” It will run counter to the decentralization trend we are currently experiencing. *See, e.g.,* Amber Jamieson & Olivia Solon, *Facebook to Begin Flagging Fake News in Response to Mounting Criticism*, GUARDIAN (Dec. 15, 2016, 15:05 EST), <https://www.theguardian.com/technology/2016/dec/15/facebook-flag-fake-news-fact-check>; Clyde Hughes, *Facebook ‘Disputed’ Tag: Fact Checkers Eye Posts Flagged As Fake News*, NEWSMAX, (Mar. 6, 2017, 3:19 PM), <http://www.newsmax.com/TheWire/facebook-disputed-tag-fake/2017/03/06/id/777192/>. A combination of technology and the crowd will likely offer a solution soon. *See, e.g.,* Ass’n for Computing Mfg., *Slowing the Speed of Viral Misinformation: Can Crowdsourcing Help?* HUFFINGTON POST (Dec. 20, 2016, 10:23 AM ET); updated Decemner 21, 2016, http://www.huffingtonpost.com/entry/slowing-the-spread-of-viral-misinformation-can-crowdsourcing_us_58594084e4b0630a254235a7; Jessica Davies, *5 New Automated Fact-Checking Projects Under Way*, DIGIDAY, (Dec. 22, 2106), <http://digiday.com/uk/5-new-automated-fact-checking-projects-underway/>; Dhruv Ghulati, *Introducing Factmata—Artificial Intelligence for Automated Fact-Checking*, FACTMATA (Dec. 6, 2016), <https://medium.com/factmata/introducing-factmata-artificial-intelligence-for-political-fact-checking-db8acdbf4cf1#.3alzobkgh>. These solutions correspond to the peer-to-peer “exchange” of assets and services facilitated by the blockchain technology. *See, e.g.,* Brakeville & Perepa, *supra* note 54.

⁷³ *See, e.g.,* Izabella Kaminska, Simon Taylkor & Carola Hoyos, *Bitcoin and Blockchain: The Future of Money of Just Hype?* FIN. TIMES, Sept. 21, 2106, <https://www.ft.com/content/3bea303c-7a7e-11e6-b837-eb4b4333ee43>; Office of Inv’r Educ. and Advocacy, U.S. SEC, *Ponzi Schemes Using Virtual Currencies* (July 2103), http://www.sec.gov/investor/alerts/ia_virtualcurrencies.pdf.

⁷⁴ MONEY IS NO OBJECT: UNDERSTANDING THE EVOLVING CRYPTOCURRENCY MARKET, PWC (2015), <https://www.pwc.com/us/en/financial-services/publications/assets/pwc-cryptocurrency-evolution.pdf>

technology. Figure 2 shows that venture capital (VC) investment in startup companies that utilize blockchain technology has increased exponentially since 2012. Investor interest in the technology will undoubtedly further increase. Particularly, the applicability of blockchain-based smart contracts to digital marketplaces, the sharing economy, the Internet of Things (IoT), and artificial intelligence will further accelerate its development.

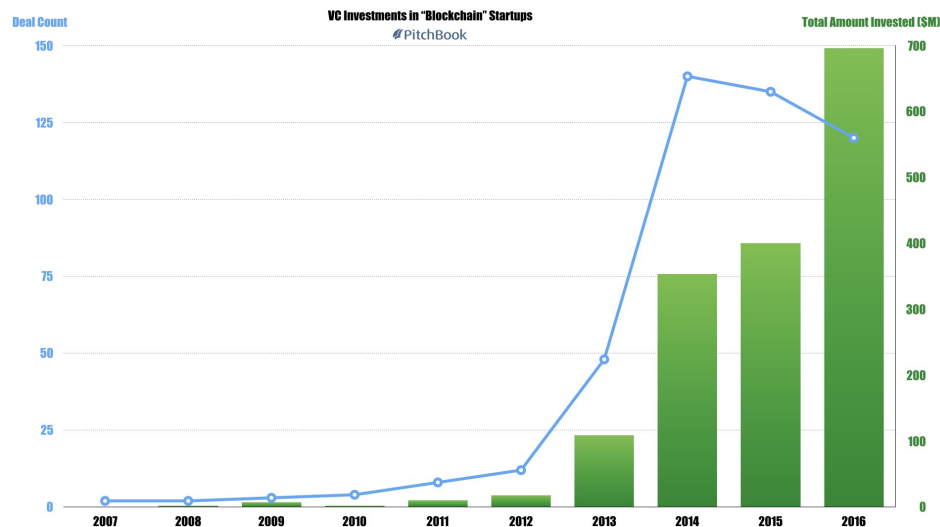


Figure 2: VC investments in blockchain startups from 2007 to 2016.

Blockchain technology startups attempt to replace lawyers as intermediaries in many types of transactions, including and most notably contracts analyses, real estate, and intellectual property.⁷⁵

⁷⁵ Clause is an example. It describes itself this way: "Clause is a revolutionary new platform that enables commercial contracts to 'come alive' and autonomously manage themselves. Our proprietary, patent-pending infrastructure seamlessly integrates legally enforceable contracts with real-time data from the 'internet of things', web services, and business and accounting systems. Clause leaves behind the world of static, paper-based contracts and unleashes the massive potential of dynamic contracts. Prices, warranties, delivery requirements, and other terms update in response to data after the parties form their initial agreement. Clause brings an unprecedented level of speed, integration, and automation to the business world."

But also, such startups have the potential to create lasting societal changes. Some predict a future in which such blockchain startups can remove lawyers altogether from commerce as smart contracts in the blockchain, such as the ones in the Ethereum platform,⁷⁶ regulate commerce entirely, enabled by the trust created between parties through immutable blockchain technology.⁷⁷

Business, administrative, and legal processes that rely on legal intermediaries may become redundant because of advances in and acceptance and implementation of blockchain technology. Forms of keeping legal ledgers such as notary and registry services, motion practice in court, legal title searches, among several others, may be among the first services to disappear in the not too distant future. Similarly, corporate processes that have ledger functionality but rely on legal intermediaries could be streamlined very quickly by implementing blockchain technology. When blockchain technology becomes more widely accepted and applications spread into consumer territory, existing legal processes and structures will likely be among the first processes to become redundant.

The combination of blockchain technology startups with platforms, artificial intelligence, and machine learning offer

We currently have several partnerships with industry and technology leaders in progress.

We invented the infrastructure for ‘intelligent’ or ‘self-managing’ legal contracts. Our proprietary technology leverages cryptography, NLP, RESTful API integrations, and distributed ledgers.” CLAUSE.IO, <https://www.linkedin.com/company/clause> (last visited Mar. 18, 2017); *Dynamic Contracts: Clause and the New Era of IoT Enabled Legal Agreements*, ARTIFICIAL LAWYER (Oct. 25, 2016), <https://artificiallawyer.com/2016/10/25/dynamic-contracts-clause-and-the-new-era-of-iot-enabled-legal-agreements/>; CLAUSE, <https://clause.workable.com>

⁷⁶ See Buterin, *supra* note 51 and accompanying text. “Buterin announces the death of lawyers. Who needs lawyers when the terms of your contract, or the evidence of your ownership of an asset, or even your own identity, are securely encoded within the blockchain and verified by the entire network?” Frances Coppola, *Ethereum: Towards a New Bit Society*, FORBES (Apr. 3, 2016, 1:02 PM), <https://www.forbes.com/sites/francescoppola/2016/04/03/ethereum-towards-a-new-bitsociety/#7e8d17fb3adc>.

⁷⁷ See, e.g., Lewis, *supra* note 57; Michael Kokal, *The Coming Blockchain Disruption: Trust Without the “Middle-Man,”* NAT’L L. REV. (Feb. 23, 2017), <http://www.natlawreview.com/article/coming-blockchain-disruption-trust-without-middle-man>.

opportunities for developing new technologies. Leveraging the big data that is collected by using Legal Tech solutions and blockchain applications in combination with machine learning creates more creative and faster tools. This, in turn, creates a surge of new and innovative platforms with disruptive effects for the legal industry, among others.

4. Limitations

Blockchain technology and smart contracts executed on blockchain technology platforms, such as Ethereum.org, are faced with multiple possible technological and legal limitations. First, the world of blockchain and smart contracting has clearly not reached maturity yet.⁷⁸ While blockchain-enabled smart contracts generally do not require legal involvement across the spectrum of transactions, legal professionals often still believe that “code” in smart contracts can only deal with very simple transactions, such as buying music or perhaps a car, arguing that more complicated legal arrangements will necessitate the draftsmanship and negotiations of traditional

⁷⁸ See, e.g., Garrick Hileman, *State of Blockchain Technology Q1 2016: Blockchain Funding Overtakes Bitcoin*, COINDESK (May 11, 2016, 15:15 GMT), <http://www.coindesk.com/state-of-blockchain-q1-2016/>; ALAN MORRISON, BLOCKCHAIN AND SMART CONTRACT AUTOMATION: HOW SMART CONTRACTS AUTOMATE DIGITAL BUSINESS 5–8, PWC (2016), <https://www.pwc.com/us/en/technology-forecast/2016/blockchain/pwc-smart-contract-automation-digital-business.pdf>; Prasad Satavolu & Abhijeet Sangamnerkar, Blockchain’s Smart Contracts: Driving the Next Wave of Innovation Across Value Chains, Cognizant 20-20 Insights, June 2016, at 6–9, <https://www.cognizant.com/whitepapers/blockchains-smart-contracts-driving-the-next-wave-of-innovation-across-manufacturing-value-chains-codex2113.pdf>; Rob Marvin, Blockchain in 2017: The Year of Smart Contracts, PC (Dec. 12, 2016), <http://www.pcmag.com/article/350088/blockchain-in-2017-the-year-of-smart-contracts>; Chris Kanaracus, Don’t Believe the Blockchain Hype: Examining the Weaknesses and Risks, ZDNet (Apr. 13, 2016, 14:22 PDT), <http://www.zdnet.com/article/dont-believe-the-blockchain-hype-examining-its-weaknesses-and-risks/>; 2016: A Pivotal Year for Blockchain, SWIFT (May 12, 2016), <https://www.swift.com/insights/news/2016-a-pivotal-year-for-blockchain>; Laura Shin, Looking to Integrate Blockchain into Your Business? Here’s How, Forbes (May 10, 2016, 8:00 AM), <https://www.forbes.com/sites/laurashin/2016/05/10/looking-to-integrate-blockchain-into-your-business-heres-how/#715aa8911a15>.

lawyers.⁷⁹ Even if more complex transactions could be coded and included in smart contracts, a widespread belief in the legal community suggests that lawyers will remain responsible for drafting the terms and arrangements that would later have to be coded by specialists.⁸⁰

Legal limitations pertaining to smart contracts and blockchain technology originate mostly from concerns over the legal origin of smart contracting. While smart contracts may reflect the underlying contract between parties, lawyers may argue that “smart contracts” are void and unenforceable under the law. Contractual legal rules regarding formation, interpretation, conditions, and remedies require substantive adjustments of smart contracts in contract law.⁸¹

⁷⁹ See, e.g., Kevin Shook, *Self-Enforcing Smart Contracts Will Change Your Life*, CORPORATE COUNSEL (Feb. 6, 2017), <http://www.corpcounsel.com/id=1202778557927/SelfEnforcing-Smart-Contracts-Will-Change-Your-Life?slreturn=20170213090556>; Richad Howlett, *A Lawyer's Perspective: Can Smart Contracts Exist Outside the Legal Structure?* BITCOIN MAG. (July 11, 2016, 2:52 PM EST), <https://bitcoinmagazine.com/articles/a-lawyer-s-perspective-can-smart-contracts-exist-outside-the-legal-structure-1468263134/>; Ira J. Shafer & Theodore Mylnar, *Blockchain Smart Contracts Need a New Kind of Due Diligence*, HOGAN LOVELLS (Sept. 22, 2016), <https://www.hoganlovells.com/en/blogs/fintech-blog/blockchain-smart-contracts-need-a-new-kind-of-due-diligence>; Andy Robinson & Tom Hingley, *Smart Contracts: The Next Frontier?* (May 23, 2016), U. OXFORD: Oxford Business Law Blog, <https://www.law.ox.ac.uk/business-law-blog/blog/2016/05/smart-contracts-next-frontier>; NORTON ROSE FULBRIGHT, SMART CONTRACTS: CODING THE FINE PRINT; A LEGAL AND REGULATORY GUIDE 12 (2016), https://www.accmeetings.com/AM16/faculty/files/Article_471_734F_NRF24493_Smart_Contracts_V6_LR.PDF.

⁸⁰ See, e.g., Shook, *supra* note 79; Shafer & Mylnar, *supra* note 79; Robinson & Hingley, *supra* note 79; Caitlin Moon, *Blockchain for Lawyers 101; Part 2*, LAW TECH. TODAY (Jan. 31, 2017), <http://www.lawtechnologytoday.org/2017/01/blockchain-lawyers-101-part-2/>; Evan Weinberger, *'Smart Contracts' Won't Eliminate the Need for Lawyers*, LAW360, <https://www.law360.com/articles/637833/smart-contracts-won-t-eliminate-need-for-lawyers>.

⁸¹ Matthew McMillan, *Smart Contracts: Legal and Regulatory Challenges of Smart Contracts*, HENRY DAVIS YORK (Dec. 8, 2016), <https://www.hdy.com.au/our-insights/insights/legal-regulatory-challenges-of-smart-contracts>; *Lex Disturbia: The Impact of Smart Contracts on the Law*, GOWLING WLG (Mar. 16, 2016), <http://www.lexology.com/library/detail.aspx?g=0b7cf43a-7032-4750-9220-caca5c529281>; Kate Withers, *Smart Contracts: Opportunities and Legal Risks in*

Blockchain evolution in combination with smart contracting also raises legal concerns regarding privacy, data protection, security, and integrity. While blockchain technology itself offers unprecedented genuine data and privacy protection, the storage of blockchain data across a global network of nodes often will not comply with specific consumer protection rules, directives, and guidelines around the world.⁸² The existing legal issues arising in the context of sharing platforms,⁸³ demonstrate that future blockchain-enabled sharing services may not be accepted quickly and without resistance on the part of incumbents challenged by new ways of delivering a service or product.

A prominent example, the Decentralized Autonomous Organization (DAO), provides ample evidence pertaining to the outstanding technological and legal issues that surround the blockchain technology. The DAO was launched in May 2016,⁸⁴ in

FinTech, NAT'L L. REV. (Nov. 8, 2016),

<http://www.natlawreview.com/article/smart-contracts-opportunities-and-legal-risks-fintech>; Martin von Haller Gronbaek, *Blockchain 2.0, Smart Contracts and Challenges*, Bird & Bird (June 16, 2016).

<https://www.twobirds.com/en/news/articles/2016/uk/blockchain-2-0--smart-contracts-and-challenges>.

⁸² See, e.g., Andres Guadamuz & Chris Marsden, *Blockchains and Bitcoin: Regulatory Responses to Cryptocurrencies* (FIRST MONDAY, Dec. 7, 2015), <http://firstmonday.org/article/view/6198/5163>. For a good overview of the complexities of the global regulation of blockchain technology, see Javier Sebastian Cermeño, *Blockchain in Financial Services: Regulatory Landscape and Future Challenges for Its Commercial Application* 6–18 (BBVA Working Paper 16/20, 2016), https://www.bbvaresearch.com/wp-content/uploads/2016/12/WP_16-20.pdf. For a summary of international law actions relating to digital currencies, see *Digital Currencies: International Actions and Regulations*, PERKINS COIE (<https://www.perkinscoie.com/en/news-insights/digital-currencies-international-actions-and-regulations.html>) (last visited Mar. 15, 2017).

⁸³ Examples include Uber (cars), Airbnb (lodging), ETSY (marketplace), Kickstarter (Crowdfunding), Lending Club (Lending), Open Table (dining), SoundCloud (music), DogVacay (Pet Vacation), and Liquid (bike sharing).

⁸⁴ Christoph Jentzsch, the co-founder of the IoT company *Slock.it*, was one of the “key founders” of *The DAO*, a new style venture capital fund. Carla L. Reyes, Nizan Geslevich Packin & Benjamin P. Edwards, *Distributed Governance* (Dec. 13, 2016), <http://dx.doi.org/10.2139/ssrn.2884978>; Shah Gilani, *This Financial Experiment Could Be Huge...Here's What You Need to Know Before You Invest*, Wall Street Insights and Indictments (May 27, 2016), <http://wallstreetinsightsandindictments.com/2016/05/this-fintech-experiment-could-be-huge-heres-what-you-need-to-know-before-you-invest/>; Cade Metz, *The*

the founders' attempt to set up a corporate-type organization without using a conventional corporate structure. The founders' central idea was that the wisdom of the crowd would lead to smarter and more game-changing investment decisions.⁸⁵ The DAO had to operate as a kind of venture capital fund managed directly by the token holders.⁸⁶

The DAO governance structure was built on software code and smart contracts that ran on the public decentralized blockchain platform *Ethereum*.⁸⁷ The DAO did not have a physical address as it was merely computer code. And it was not an organization with a traditional hierarchy as we know it from traditional corporate structures where authority and empowerment flow downwards from investors/shareholders through a board of directors to management and eventually staff.⁸⁸ Indeed, the DAO had no directors, managers, or employees. Because a series of smart contracts granted DAO token holders voting rights, the blockchain-based smart contracts imitated the role of articles of association or bylaws. Because the DAO code was open source, the token holders would not only vote on "investment proposals," but also on any change made to the

Biggest Crowdfunding Project Ever—The Dao—Is Kid of a Mess, WIRED (June 6, 2016, 7:00 AM), <https://www.wired.com/2016/06/biggest-crowdfunding-project-ever-dao-mess/>.

⁸⁵ See, e.g., Reyes, *supra* note 84, at 2–3; Kyle Torpey, *The Wisdom (or Lack Thereof) of the Dao*, AM. BANKER (June 1, 2016, 4:10 PM EDT), <https://www.americanbanker.com/opinion/the-wisdom-or-lack-thereof-of-the-dao>.

⁸⁶ See, e.g., Reyes, *supra* note 84, at 2–3; Seth Bannon, *The Tao of "The DAO" or: How the Autonomous Corporation Is Already Here*, TC (May 16, 2016), <https://techcrunch.com/2016/05/16/the-tao-of-the-dao-or-how-the-autonomous-corporation-is-already-here/>.

⁸⁷ Clint Finley, *A \$50 Million Hack Just Showed That the DAO Was All Too Human*, WIRED (June 18, 2016, 4:30 AM), <https://www.wired.com/2016/06/50-million-hack-just-showed-dao-human/>; Brent Miller, *Smart Contracts and the Role of Lawyers (Part 2) – About "Code Is Law,"* BIG LAW KM (Oct. 22, 2016), <https://biglawkm.com/2016/10/22/smart-contracts-and-the-role-of-lawyers-part-2-about-code-is-law/>.

⁸⁸ Benjamin P. Edwards, Carla L. Reyes, & Nizan Geslevich Packin, *Companies Face Risk and Opportunity with Distributed Governance Structures*, COLUM. L. SCH.: CLS BLUE SKY BLOG (Jan. 19, 2017), <http://clsbluesky.law.columbia.edu/2017/01/19/companies-face-risk-and-opportunity-with-distributed-governance-structures/>.

code.⁸⁹ Accepted proposals would also be backed by a software code, defining the relationship (in terms of rights, obligations, and performance metrics) between the DAO and the funded proposals.

During a crowdfunding campaign in May 2016, all investors could become DAO participants by purchasing DAO tokens.⁹⁰ The DAO raised more than \$168 million from approximately 10,000 “investors.”⁹¹ DAO tokens were designed to be fully transferable and tradeable on “peer-to-peer” exchanges, similar to shares in a traditional listed corporation. The automated structure was intended to give “participants” in the DAO direct real-time control over contributed funds.

Alas, things went terribly wrong with the DAO. Fundamental flaws in the DAO code enabled hackers to transfer one-third of the total funds to a subsidiary account.⁹² This hack in combination with additional technological limitations brought down the DAO initiative.⁹³

Open legal issues pertaining to the DAO need to be addressed before future DAO setups can operate seamlessly.⁹⁴ Such

⁸⁹ Metz, *supra* note 84; Michael del Castillo, *The DAO Crisis: Or How Vigilantism and Blockchain Democracy Became the Best Hope for Burned Law*, COINDESK (July 13, 2106, 16:05 GMT), <http://www.coindesk.com/author-daos-original-code-minimize-regulatory-backlash/>.

⁹⁰ See, e.g., Gilani, *supra* note 84; Guilio Prisco, *The Dao Raises More Than \$117 Million in World's Largest Crowdfunding to Date*, BITCOIN MAG. (May 16, 2016, 2:09 EST), (<https://bitcoinmagazine.com/articles/the-dao-raises-more-than-million-in-world-s-largest-crowdfunding-to-date-1463422191/>).

⁹¹ Metz, *supra* note 84.

⁹² Nathaniel Popper, *A Hacking of More Than \$50 Million Dashes Hopes in the World of Virtual Currency*, N.Y. TIMES (June 17, 2016), <https://www.nytimes.com/2016/06/18/business/dealbook/hacker-may-have-removed-more-than-50-million-from-experimental-cybercurrency-project.html>.

⁹³ See, e.g., *Not-So-Clever Contracts*, ECONOMIST (July 28, 2106), <http://www.economist.com/news/business/21702758-time-being-least-human-judgment-still-better-bet-cold-hearted>; Paul Vigna, *Fund Based on Digital Currency Ethereum to Wind Down After Alleged Attack*, WALL ST. J. (June 17, 2016), https://www.wsj.com/articles/investment-fund-based-on-digital-currency-to-wind-down-after-alleged-hack-1466175033?mod=rss_Technology.

⁹⁴ See, e.g., Drew Hinkes, *A Legal Analysis of the DAO Exploit and Possible Investor Rights*, BITCOIN MAG. (June 21, 2016, 11:57 AM EST), <https://bitcoinmagazine.com/articles/a-legal-analysis-of-the-dao-exploit-and-possible-investor-rights-1466524659/>; Tanaya Macheel, *The Dao Might Be Groundbreaking but Is It Legal?* AM. BANKER (May 19, 2016, 3:12 PM EDT),

legal issues include the following: (1) What legal regime governs the issuance of DAO tokens? (2) Are minority DAO token holders protected and, if so, how? (3) Are DAOs subject to taxation? (4) Do DAO smart contracts create legally binding obligations? (5) Who owns the intellectual property rights generated by the crowd-funded proposals? and (6) How are conflicts between DAO token holders, the DAO itself, and the proposals resolved?

IV. Educating the 21st Century Lawyer

Law schools need to develop approaches to enable their students to get ready for the increasingly disrupted legal world of the 21st century. The exponentially increasing disruptive innovation worldwide will cause clients to frequently ask legal professionals to deal with issues lawyers cannot fully understand, within a legal framework that does not always offer clear or helpful answers. Because of these challenges facing the practice of law, law schools have an obligation to help their students evaluate possible niches in the future legal market.

Increasing law students' capacity to better understand the challenges of today's society can enable them to provide more effective service to clients in the economy of the future. For example, a law school course on "Disruptive Innovation," such as the one taught by the authors,⁹⁵ not only helps law students appreciate emerging technology and the importance of software code, but, more importantly, provides students with the resources and capacities to help them become the much-needed legal professionals in the

<https://www.americanbanker.com/news/the-dao-might-be-groundbreaking-but-is-it-legal>; CLYDE & CO., BLOCKCHAIN AND THE LAW: AN UNCHARTERED LANDSCAPE (2016),

http://www.clydeco.com/uploads/Files/CC010565_Blockchain_brochure_10-06-16_LOWRES.PDF; Reuben Bramanathan, *Blockchains, Smart Contracts and the Law*, COINBASE BLOG (June 24, 2016), <https://blog.coinbase.com/blockchains-smart-contracts-and-the-law-709c5b4a9895#.qnnsleuz5>.

⁹⁵ Wulf Kaal, Disruptive Innovation Why Lawyers Matter [course description], <https://wulfkaal.com/courses/disruptive-innovation-why-lawyers-matter/>; Wulf Kaal, Course Description [blog entry], www.wulfkaal.com. Wulf Kaal, *Future of Innovation and Law*, REVOLUZIONNE (Jan. 12, [2017]), <https://medium.com/@wulfkaal/future-of-innovation-and-law-535d7ef739a#.uzqta5n8l>.

decentralized world.

Law schools need to find ways to educate lawyers who can add value in helping clients and society adjust to our increasing technological environment rather than who will create unnecessary or unwise restrictions on it. Such restrictions will not stop innovations and developments in technology. Take, for example, Spotify, the online music streaming service, which, instead of emphasizing the illegality of its main competitor's (Napster's) business model of peer-to-peer music sharing,⁹⁶ found ways to charge consumers without sacrificing the convenience and accessibility of the streaming service. Similarly, instead of using legal arguments and concerns as barriers to innovation, law schools need to find ways to educate the lawyers of the 21st century to find ways to encourage friction-free interactions and conversations and the creative exchange of assets and services.

Legal Tech and especially Blockchain Ledger Technology present tremendous opportunities for law students. Despite Blockchains' disruptive properties,⁹⁷ legal professionals can in fact benefit from the technology if they focus on the opportunities to enter into contracts in a cheaper and more secure way. Traditional lawyers too often bring a traditional legal "tool kit" to solving the legal problems of the 21st century, which often leads to disastrous outcomes. This approach might have worked adequately when innovation cycles were longer, but in a world where innovations occur exponentially, the traditional legal tool kit is regularly out of touch with the radically different needs of a decentralized world.

⁹⁶ Napster was a peer-to-peer file sharing company which allowed users to share digital music files in the MP3 format over the Internet for free. In 2000 the Recording Industry of America sued Napster under the Digital Millennium Copyright Act for violating copyright. Napster lost the case at both the district and appellate court levels, and when it was unable to comply with the district court order to block infringing uses, it was forced to shut down. *See generally* Corey Rayburn, *After Napster*, VA. J.L. & TECH., Fall 2001, at 1, <http://www.vjolt.net/vol6/issue3/v6i3-a16-Rayburn.html>; Erica D. Rowell, *Court Rules Against Napster*, ABC NEWS (Feb. 12, [2001]), <http://abcnews.go.com/Technology/story?id=98767&page=1>; Matt Richtel, *The Napster Decision: The Overview; Appellate Judges Back Limitations on Copying Music*, N.Y. TIMES (Feb. 13, 2001), <http://www.nytimes.com/2001/02/13/business/napster-decision-overview-appellate-judges-back-limitations-copying-music.html>.

⁹⁷ *Supra*, Part III(3).

Most lawyers and law industry representatives underestimate the implications of the emerging Legal Tech.⁹⁸ Particularly in the case of blockchain technology, law schools should raise awareness of the opportunities associated with the technology for their graduates and alums. In order to advise on blockchain contracts, law students and lawyers have to become familiar with the technology and learn at least basic coding as it pertains to Ethereum smart contracts.⁹⁹

Law students' capacity to work in multidisciplinary teams will take on a much greater significance in the future. Lawyers are becoming increasingly involved in complex, nonstandard legal tasks.¹⁰⁰ The automation and standardization of high volume legal tasks will further transform the role of lawyers and other legal professionals. Big Data and artificial intelligence will make Legal Tech solutions more effective, networked, and intelligent. Increasingly, legal work, such as contract drafting, legal risk

⁹⁸ Anecdotal evidence based on discussions with law firm and corporate lawyers, including lawyers in Asia, Europe, and the United States, among other anecdotal evidence, indicates that very few legal professionals are aware of developments in Legal Tech. Typical reactions to information about the opportunities these new technologies present involve giving several reasons why blockchain-based smart contracts and other developments are unlikely to fundamentally change the need for lawyers or the way that lawyers work.

⁹⁹ *Wolfram Alpha Founder: Lawyers Should Code and Contracts Be Computable*, ARTIFICIAL LAWYER (Oct. 14, 2016), <https://www.artificiallawyer.com/2016/10/14/wolfram-alpha-founder-lawyers-should-code-and-contracts-be-computable/>; David Colarusso, *Hello, World! Should Attorneys Learn to Code*, LAWERIST.COM (Aug. 25, 2016), <https://lawyerist.com/124089/hello-world-attorneys-learn-code/>; Jason Krause, *Does Learning to Code Make You a Better Lawyer?*, ABA J. (Sept. 1, 2016, 2:00 AM CDT), http://www.abajournal.com/magazine/article/lawyer_learning_code_zvenyach_oh_m.

¹⁰⁰ For examples of law firms which have established multidisciplinary practices, see LAURA SHIN, *AS BITCOIN TECHNOLOGY MAKES INROADS, ONE LAW FIRM LAUNCHES MULTIDISCIPLINARY BLOCKCHAIN PRACTICE*, FORBES: WOMEN AT FORBES (Aug. 9, 2016, 8:00 AM), <https://www.forbes.com/sites/laurashin/2016/08/09/as-bitcoin-technology-makes-inroads-one-law-firm-launches-multidisciplinary-blockchain-practice/#41044fc42dab>; *STEPTOE'S BLOCKCHAIN TEAM EXPANDS INTO MULTIDISCIPLINARY PRACTICE*, STEPTOE (Aug. 9, 2016), <http://www.steptoel.com/news-2342.html>.

management, and dispute resolution, will be outsourced to technology and robots.¹⁰¹ Lawyers and legal advisors will increasingly assume the role of project managers and business advisors.

For law students, the growth of multidisciplinary teams in the technology-based society/economy means that they are required to work closely not only with accountants or fiscal advisors, but also and ever increasingly with engineers, designers, and architects. Crucially, lawyers and legal advisors will find themselves operating as a bridge between the diverse range of actors who must now work together in dealing with increasingly complex challenges. A business-oriented perspective means that legal professionals are better placed to help their clients maximize efficiency, enhance client services, and reduce costs.

Specifically, law schools need to enable their students to work in interdisciplinary teams with software engineers. A greater appreciation of the means by which code can be utilized and integrated in legal contexts is essential. Legal Tech startups and software engineers are increasingly using predictive coding and algorithms for legal applications. Lawyers benefit from such algorithmic technology applications in the context of e-discovery, contract drafting, and legal research, among many others. Curricular changes, including the introduction of a course on “coding for lawyers,” can help facilitate a greater understanding of interdisciplinary skill requirements for students. The purpose of a course on coding for lawyers would be for students to gain a general conceptual understanding of the possible applications of innovative and disruptive technologies and their algorithmic implementations in

¹⁰¹ Dana Remus & Frank S. Levy, *Can Computers Be Lawyers? Computers, Lawyers, and the Practice of Law*, SSRN (Nov. 27, 2016; last revised Nov. 30, 2016), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2701092; Jeff Bennion, *Are Robots Going to Take Our legal Jobs?* ABOVE THE LAW (June 21, 2016, 2:02 PM), <http://abovethelaw.com/2016/06/are-robots-going-to-take-our-legal-jobs/>; Chris Holder & Vikran Khurana, *Robotics Process Automation and Outsourcing*, LAWYERISSUE (May 16, 2016), <http://www.lawyerissue.com/robotics-process-automation-and-outsourcing/>; Michael Cross, *Role of Artificial Intelligence in Law*, RACONTEUR (Feb. 19, 2015), <https://www.raconteur.net/business/time-for-technology-to-take-over>.

the context of law.

Law school initiatives should help students evaluate the most important legal applications of algorithmic technology solutions and explain how software engineers are applying code to legal problems to provide efficient legal solutions. Students should learn basic mathematical principles for coded technology solutions in law, including legal applications of big data, artificial intelligence, machine learning, and blockchain technology. Based on the mathematical foundations, students should develop basic conceptual coding skills that enable them to engage with representatives of the hard sciences on a daily basis and develop client solutions in interdisciplinary teams.

V. Conclusion

Lawyers and law schools cannot afford to ignore the changes discussed in this article. The legal profession is one of the most disrupted sectors of the consulting industry today. Legal Tech, artificial intelligence and blockchain technology, the sharing economy, and platform companies are changing legal practice. Traditional legal assumptions and doctrines and concepts of law and governance have to be reevaluated in light of the impending disruptive changes. Law schools' attempts to innovate in order to get their students practice ready for the 21st century and equipped with the necessary skill set to operate effectively in the new world of disruptive innovation require experimentation with new ways and a more creative and innovative approach to the law school curriculum. Legal Tech and especially Blockchain Ledger Technology present tremendous opportunities for law students wishing to get practice ready for the 21st century.

While blockchain-centered legal jobs of the future will be the center piece of any law school reform agenda, the future of non-blockchain-centered legal employment is equally important. For instance, future lawyers will have to be able to distinguish blockchain-based contracting from traditional legal contracting and advise clients on optimal blockchain and non-blockchain contracting allocations. Certain parts of larger legal arrangements/contracts/dealmaking will certainly be blockchainable in the future, providing trust, efficiency, cost savings, and legal clarity. Other parts of dealmaking and other legal tasks will continue

to require the ambiguity and flexibility of the law. For the parts of dealmaking and the other legal tasks that are non-blockchainable, the role for other, non-blockchainable agents of trust may expand. It seems possible that the blockchain-driven disintermediation of law itself creates additional legal tasks that require human lawyer input.