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LEGAL EDUCATION IN A DIGITAL AGE
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WHY ‘CODING FOR LAWYERS’ MATTERS

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ABSTRACT

In this paper, we explain the benefits of introducing a “Coding for Lawyers” course in the legal curriculum, and present our initial experiences with the course in Europe and the United States. The paper outlines the broader context of the transformation of education in a digital age; describes the importance of computer code in a legal context, particularly in terms of on-going changes in the legal profession; and, introduces the main features of the course and its initial reception. The main argument is to suggest that the lawyers of the future will be “transaction engineers” and that to perform this function effectively, legal professionals need to be able to understand the basic concepts and power of coding.

Keywords: algorithms, Bitcoin, blockchain, coding, digital, digital transformation, Ethereum, legal education, legal tech, smart contracts, software, transaction engineers, trust

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“In short, developers will be at the center of solving the world’s most pressing challenges. However, the real power comes when every developer can create together, collaborate, share code and build on each other’s work. In all walks of life, we see the power of communities, and this is true for software development and developers.”¹ Satya Nadella (CEO, Microsoft)

I. Introduction

We all now live in a world of “ubiquitous computing.” Computers are embedded in all aspects of our everyday lives. As a result, computer code now provides the unseen and unnoticed architecture structuring our whole existence: work, recreation, communication, consumption, travel, and education/research.²

Think about how much of our lives is spent interacting with devices that are, at some level, structured by computer code. Such experiences can be direct and proximate – interacting with a smartphone or computer, for instance – or more “distant” – traveling to work on a subway system that is automated in various ways. In both cases, it is code that makes the experience possible and code that, ultimately, provides the structure for that experience.

The world today is a world structured by computer code or – as venture capitalist and serial entrepreneur, Marc Andreessen, rather

¹ Satya Nadella, *Microsoft + Github = Empowering Developers*, MICROSOFT: OFFICIAL MICROSOFT BLOG (Jun. 3, 2018), <https://blogs.microsoft.com/blog/2018/06/04/microsoft-github-empowering-developers/>.

² Erik P.M. Vermeulen, *Why I Want My Students to Code: The Importance of Coding in Education*, MEDIUM: HACKERNOON, (Apr. 1, 2018), <https://hackernoon.com/why-i-want-my-students-to-code-b358a2b97770>.

dramatically puts it – “software is eating reality.”³ Code provides the fundamental architecture that sets the terms on which life in a digital age is lived. Code determines how easy it is to protect personal information or express ourselves. It determines whether access to information is open or whether specific information or space is zoned and access limited. Code affects who sees what, or who or what is monitored. It determines how machines communicate in the Internet of Things.⁴ The deep architecture of a digital world can regulate in a host of ways, ways that one cannot begin to see (or understand) unless you consider the nature of such code and how it operates.

Code raises all manner of substantive legal issues. But, computer code and digital technologies are also transforming what it means to be a lawyer. In that respect, all lawyers will be affected by the on-going digital transformation.⁵ If Satya Nadella is right that developers will be at the “center” of “solving the problems of a today’s world,” then lawyers must be able to “speak” the language of code to participate in the crucial task of engaging with and solving these problems.

³Marc Andreessen, *Why Software is Eating the World*, Wall St. J. (Aug. 20, 2011), <https://www.wsj.com/articles/SB10001424053111903480904576512250915629460>; Jeetu Patel, *Software is Still Eating the World*, TECHCRUNCH (Jun. 7, 2016), <https://techcrunch.com/2016/06/07/software-is-eating-the-world-5-years-later/>.

⁴ *Internet of Things (IoT)*, TechTarget: IoT Agenda, <https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT> (last visited Aug. 28, 2018); Limor “Ladyada” Fried, *All the (Internet of) Things*, CODECADEMY NEWS (Apr. 19, 2018), <https://news.codecademy.com/internet-of-things/>.

⁵ Daniel Newman, *Top 5 Digital Transformation Trends in Legal*, FORBES (Aug. 29, 2017, 6:14 AM), <https://www.forbes.com/sites/danielnewman/2017/08/29/top-5-digital-transformation-trends-in-legal/#2610caac76f8>

Historically, lawyers have been at their most effective – and socially useful - when they operate as “transaction engineers,” i.e., facilitating new forms of business and other social relationships.⁶ It seems obvious that the “engineering” of the near-future will, to a large extent, be code-based. This does not mean that lawyers are irrelevant or that they will disappear. Rather, the digital transformation will disrupt the legal profession and demand a different set of skills and capacities than have traditionally been taught in law school or used in legal practice.

It is for this reason that we decided to introduce a “Coding for Lawyers” course in our legal education programs. We are convinced that “coding” can help us in solving many contemporary economic, environmental and social issues and that to participate in the “multi-disciplinary” teams of the future, lawyers will need to develop some coding skills.

It is perhaps not entirely surprising to discover that this initiative has been met with a certain amount of skepticism. “Is it really necessary for law students to learn how to code?”; “What is the value-added for us (non-technologists) of understanding code?”; or, “Isn’t this all just a waste of time?” These are some of the typical responses of colleagues.

No doubt, there is something to these concerns. For a start, we don’t need to have any understanding of code to successfully navigate the digital world. “Users” of digital devices don’t need to be able to

⁶ Dan Mangan, *Lawyers Could Be the Next Profession To Be Replaced By Computers*, CNBC: FUTURE OF WORK (Feb. 17, 2017, 1:55 PM), <https://www.cnbc.com/2017/02/17/lawyers-could-be-replaced-by-artificial-intelligence.html?&qsearchterm=lawyers%20could%20be%20replaced%20by%20artificial%20intelligence>.

code for themselves. After all, we use technology all the time, without ever really understanding it. We can drive a car perfectly well, without understanding much about how automobile engines work and the overwhelming majority of users of the Internet don't necessarily understand the ins and outs of TCP/IP protocols. Moreover, coding isn't easy. Acquiring competency takes a significant investment of time and even if law students do feel the need to learn how to code, there are thousands of available resources (on- and off-line) out there that can teach them. It isn't effective or necessary to add "another course" to the curriculum.

To be clear from the start, however, we are not suggesting that law students should become professional coders. After all, coding is complicated and to become a serious coder does take time. However, we do believe that the ability to understand and communicate with coders is a necessary skill for the lawyer of the future. As such, we think that law students will benefit from understanding the basic concepts and power of coding. Not only by reading or hearing about it but by participating in and experimenting with coding projects in a classroom environment.

The "Coding for Lawyers" course has generated a lot of interest, so this paper aims to introduce the background, content and initial experience of the course. Section 2 outlines the broader context of the transformation of education in a digital age; Sections 3, 4 and 5 describes the importance of computer code in a legal context, particularly in terms of technology-driven changes to the legal profession; Section 6 introduces the main features of the course and its initial reception; and Section 7 concludes.

II. Education in a Digital Age

We are experiencing a “digitization of reality,” as a result of the global proliferation of new technologies.⁷ We live in a “digital world” that is characterized by fast-paced, technology-driven social, economic and cultural change.⁸ And, with ever-shorter innovation cycles, it seems obvious that new technologies are going to continue to transform every aspect of how we live and work. Constant technological disruption is now the “new normal” and, as a consequence, “old world” concepts, paradigms and ideas are becoming increasingly less relevant.⁹ At least, they are being challenged and disrupted by a new networked world of interconnected digital technologies.

The resulting uncertainties create a massive challenge for all educators and not just lawyers. What should we be teaching our students today? How can we prepare students for the complex and uncertain world of tomorrow?

Teaching has always tended to be “backward-looking” and knowledge-based.¹⁰ Transmitting the settled knowledge of the past has been the starting point for our whole approach to education. For instance, in a legal context, students have traditionally analyzed existing laws, regulations, and cases. The idea has been that if you understand and examine historical developments, you would be

⁷ Erik P.M. Vermeulen, *Education in a Digital Age*, by Professor Vermeulen: *How to Prepare the Next Generation for the Uncertain Things to Come*, MEDIUM: STUDENT VOICES (Feb. 22, 2018), <https://mystudentvoices.com/education-in-a-digital-age-by-professor-vermeulen-7d3b69f43de3>.

⁸ Erik P.M. Vermeulen, *Technology is Changing Us: We Must Be Much Smarter About the Digital Transformation*, MEDIUM: HACKERNOON (May 27, 2018), <https://hackernoon.com/technology-is-changing-us-e3c6bf7f9888>.

⁹ Vermeulen, *supra* note 7.

¹⁰ *Id.*

able to solve future problems by applying old doctrines and precedents to the new situation. Similar logic can be seen in other fields. MBA programs, for example, employed the same approach in a business context.

The responsibility of the educator was to transmit this settled information/knowledge. In a world of information asymmetries, the educator-student relationship was, by necessity, a hierarchical one. After all, the teacher had all the knowledge and experience. This was the source of their authority and credibility as an educator. But, this model seems ill-suited to a world of fast-paced change and easy access to information. Prior experience may not be relevant to a fast-changing reality and information is only ever one Google search away.

If the future is radically different from the present, it doesn't make sense to focus too much attention on transmitting information that seems likely to be less and less relevant. The result? Education needs to become much more “forward-looking” and skills - rather than content - based. How then do we prepare the next generation for dealing with unknown future problems? This is the question that everyone involved with education now needs to be asking. Denying this change is doing a disservice to our students.

Here a few general suggestions. For a start, everyone is going to need a much better technical grasp of the core technologies surrounding computers, communication networks, and artificial intelligence (“AI”). For many of us, the underlying technologies that are driving social change remain a mystery, and that is a problem. Practical technical knowledge needs to be integrated into many fields of education. Coding and data analysis seem a good starting point. But, we also need to think about other skills and

capacities that are important in a world of constant change. The focus should be on building skills that will assist the next generation in making the “better” decisions under conditions of uncertainty.

The next generation has to be able to think fast and “out of the box.” Dynamic analysis of complex situations and the ability to communicate solutions, in presentations or video form, will be the key. In the future, we will see looser organizations and social platforms. It is therefore important that the next generation find ways to become more productive and self-motivating, i.e., how to operate without a “boss” or supervisor telling them what to do.

As traditional concepts of a “career” become much less relevant in the so called “Gig Economy,” it will become increasingly important to build and communicate a personal “brand” by telling the right kind of story. More open organizations will mean having to work in teams of strangers, often from diverse national or disciplinary backgrounds. The ability to work in such a team, continually adapting to new situations and working patterns, becomes crucial. Finally, many of the problems of the future will be ethically complex. This seems particularly true in the context of robotics and AI, but all new technologies raise difficult ethical issues. Building the capacity of students to think about ethics seems another way that educators can add value. Again, this would seem to put a premium on more inter-disciplinary and inclusive forms of study.

III. Lawyers as Transaction Engineers

When thinking about legal education, it is essential to consider the function and needs of the legal profession. In this regard, it is helpful to examine the role of lawyers in earlier periods of fast-paced technological change.

Take the growth of Silicon Valley in the early 1970s. While the idea of the “clustering” of similar businesses was a significant source of innovation, there is little doubt that the legal industry is also important as a source of innovation. Law firms and individual lawyers played a crucial role in facilitating innovation. After all, lawyers were responsible for drafting innovative contractual provisions that protected high-risk investors - for instance, angel investors and venture - from the relational and performance risks associated with investing in young and often inexperienced entrepreneurs. Moreover, the lawyers’ involvement in both non-legal and legal activities, such as deal making, matchmaking, gatekeeping, and conciliating, served as an important sorting device for entrepreneurs that needed more than just an investor to start and develop their start-up businesses.¹¹ Finally, the contractual mechanisms and the lawyer-dominated market for reputation reduced the information asymmetries between the entrepreneurs and investors and, as such, were necessary to bring the demand-side and supply-side of “venture capital” together effectively.¹²

In this sense, we can see how lawyers functioned as “transaction engineers,” i.e., crucial intermediaries that brought together in a “safe” environment various parties with different but mutually compatible interests and expertise. The often-neglected

¹¹ Lisa Bernstein, *The Silicon Valley Lawyer as Transaction Cost Engineer?*, 74 *Or. L. Rev.* 239 (1995).

¹² Vijay Mehta, *Principle-Agent Issues in Private Equity and Venture Capital*, (2004) (unpublished manuscript) (on file with Wharton Research Scholars), https://repository.upenn.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1013&context=wharton_research_scholars; Daniel Schmidt, *Entrepreneur’s Choice Between Venture Capitalist and Business Angel for Start-Up Financing*, *GRIN* (Aug. 5, 2013), <https://www.grin.com/document/230839>.

contribution of local law firms to the institutionalization of venture capital and venture capital contracting helps explain the relative success of Silicon Valley.¹³

The problem, however, is that lawyers have often failed to perform this function of being active transaction engineers and have become a hindrance or obstacle to transactions.¹⁴ This can happen for many reasons but the tendency to standardize – or “proceduralize” - legal solutions and to employ standard form “templates” is one major factor. Fixed and standardized solutions are imposed on complex, dynamic transactions resulting in frustration and difficulties.¹⁵ As a result, lawyers have developed a reputation as the least trusted of professions.¹⁶ The list of complaints is familiar: lawyers are verbose, they don't listen, they are unresponsive, they charge too much, they don't care about clients, they spend too much time on trivial issues, they don't keep clients informed, they constantly “over-lawyer”, and they don't communicate clearly and concisely.¹⁷

¹³ Joseph A. McCahery, Erik P.M. Vermeulen, & Andrew M. Banks, *Corporate Venture Capital: From Venturing to Partnering*, in OXFORD HANDBOOK OF VENTURE CAPITAL (Douglas Cumming ed., 2012).

¹⁴ Frederic A. Rubinstein & Audrey M. Roth, *The Life Cycle of a Venture-Backed Company*, in Deal Strategies for Venture Capital and Private Equity Lawyers 3 (2007).

¹⁵ OpenLaw, *Decentralizing the Deal*, Medium (Sep. 25, 2017), <https://media.consensys.net/decentralizing-the-deal-e6af1c0cfdab>; Micahel G. Parsomanikas, *Frustration of Contract in International Trade Law and Comparative Law*, 18 DUQ. L. REV. 551 (1980).

¹⁶ Derek Thompson, *The Least-Trusted Jobs in America: Congress Members and Car Salespeople*, ATLANTIC (Dec. 3, 2012), <https://www.theatlantic.com/business/archive/2012/12/the-least-trusted-jobs-in-america-congress-members-and-car-salespeople/265843/>; *Top 30 Biggest Career Mistakes Made by Lawyers*, LAW OFFICE OF YURIY MOSHES, P.C.: BLOG (Jan. 6, 2018), <https://mosheslaw.com/top-30-biggest-career-mistakes-made-by-lawyers/>.

¹⁷ Felicity Nelson, *Why Do People Hate Lawyers So Much?*, LAWYERS WEEKLY: FOLKLAW (Feb. 18, 2015), <https://www.lawyersweekly.com.au/folklaw/16179-why-do-people-hate-lawyers>.

In a highly competitive and fast-changing world, lawyers need to focus on re-discovering their function as effective transaction engineers that facilitate interactions and reduce costs. In a modern context, many costs need to be cut: agency costs, transaction costs, monitoring costs, regulatory costs and compliance costs. In that respect, the scope for lawyers to “add value” is enormous.

Legal education needs to be more tightly oriented towards preparing prospective legal professionals in achieving this objective. In the context of the digital transformation, an understanding of code is going to be crucial for the lawyer of the future to perform this task effectively. Here are two reasons that we believe are particularly important:

- “Legal tech” will profoundly disrupt the legal profession¹⁸ and since these technologies are code-based lawyers need to be able to understand and talk about code to participate in the design of such legal technologies and to maximize their usefulness in supporting all legal work.
- More and more businesses and industries revolve around code-based products or services. Since all companies are now increasingly managed by and run on software code, facilitating transactions – i.e., being an active transaction engineer - involves coding. This coding will involve multi-disciplinary teams working in collaboration and the capacity of lawyers to actively participate in such teams will be crucial to their success as legal professionals. The development of blockchain technologies and smart contracts are particularly relevant in this regard.

¹⁸ *AI Trends Driving the Legal Industry*, A.B.A.: L. TECH. TODAY (Mar. 28, 2018), <https://www.lawtechnologytoday.org/2018/03/ai-trends/>.

The next two sections consider these issues in turn.

IV. Legal Tech

Legal technology - or “Legal Tech” - is changing the way lawyers practice law.¹⁹ In this context, Legal Tech refers to platforms, IT services, and software that first made law firms and lawyers more efficient in performing their activities.²⁰ Practice management, document storage and automated billing and accounting software are prominent examples. Legal Tech also assists legal professionals in due diligence and discovery processes.

Legal Tech has evolved from support systems to fully integrated and automated services for lawyers that increasingly disrupt the practice of law.²¹ Legal Tech can generally be defined as information technology services and software, as well as platforms and their applications.²² Since the 1970s, with the invention of the first legal databases. Legal Tech has supported the need for additional lawyers to evaluate the new and increasing numbers of legal materials made available faster and more easily accessible by technology.²³

¹⁹ *Id.*

²⁰ Erik P.M. Vermeulen, *The Future of Law, Lawyers and Law Professors...and the Exponential Growth of Disruptive Technology*, MEDIUM: CHATBOTS LIFE (Mar. 29, 2017), <https://chatbotslife.com/the-future-of-law-lawyers-and-law-professors-and-the-exponential-growth-of-disruptive-technology-b5c979608c9c>.

²¹ A.B.A., *supra* note 18.

²² Joshua Lenon & Bryce Tarling, *The Next Phase of Legal Technology Has Already Been Built*, ABOVE THE LAW: EVOLVE THE LAW (Dec. 7, 2017), <https://abovethelaw.com/legal-innovation-center/2017/12/07/the-next-phase-of-legal-technology-has-already-been-built/>

²³ Catalyst Investors, *LegalTech is Primed for Growth Investments*, ROSS: STARTUPS, <https://rossintelligence.com/legaltech-growth-investments/> (last visited Aug. 28, 2018); Edgar Alan Rayo, AI in Law and Legal Practice – A Comprehensive View of 35 Current Applications, TECH EMERGENCE (Nov. 29, 2017), <https://www.techemergence.com/ai-in-law-legal-practice-current-applications/>.

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.²⁴ In the early 2010s, Legal Tech became more advanced and started to incorporate technology that assisted legal professionals in due diligence and e-discovery processes.²⁵ Since 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.²⁶

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.²⁷ The second legal startup category involves online “matching” platforms that connect lawyers with clients.²⁸ Such platform startups help consumers find a fitting lawyer without the costly involvement of a law firm. The third category entails startups that use AI tools to take over their lawyer

²⁴ Wells H. Anderson & JoAnn Hathaway, *All-in-One Practice Management Applications*, 31 GP Solo 4 (July/Aug. 2014), https://www.americanbar.org/publications/gp_solo/2014/july-august-2014/allinone_practice_management_applications.html; Eileen O’Loughlin, *Legal Document Management Software Buyer’s Guide*, SOFTWARE ADVICE (Aug. 3, 2018), <https://www.softwareadvice.com/legal/document-management-comparison/>.

²⁵ Robert Ambrogi, *The 10 Most Important Legal Technology Developments of 2015*, LAW SITES (Dec. 28, 2015), <https://www.lawsitesblog.com/2015/12/the-10-most-important-legal-technology-developments-of-2015.html>

²⁶ *Id.*; *3 Reasons Why Tech Companies Need a New Kind of Lawyer*, CORNELL TECH: LAW TECH BLOG (Feb. 17, 2016), <https://tech.cornell.edu/news/3-reasons-why-tech-companies-need-a-new-kind-of-lawyer/>.

²⁷ Zoe Andreae, *Legal Tech Startups*, MEDIUM: LEGAL TECH INSIGHTS (May 29, 2017), <https://medium.com/legal-tech/legal-tech-startups-9755b18f93ac>.

²⁸ *Id.*

time consuming and expensive legal research activities such as reviewing, understanding, evaluating, and reapplying contracts.²⁹ Finally, startups with expertise in blockchain technology attempt to replace lawyers as intermediaries in certain types of transactions.³⁰

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 will be replaced by Legal Tech.³¹ Junior legal professionals and legal support staff are likely the first victims of the Legal Tech evolution.³² Legal Tech applications will be able to perform most of the junior lawyers' work soon without the human elements that create imprecision, flaws, inaccuracies, possible lawsuits, and delay.³³ Second, and most 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 rapid re-invention.³⁴

Legal Tech has the potential to rapidly transform law firms and legal departments into virtual law firms. Virtual law firms may dominate

²⁹ *Id.*

³⁰ Erik P.M Vermeulen, *There is No Escape from Blockchains and Artificial Intelligence...Lawyers Better Be Prepared!*, MEDIUM (Jan. 23, 2017), <https://medium.com/@erikpmvermeulen/there-is-no-escape-from-blockchains-and-artificial-intelligence-lawyers-better-be-prepared-2d7a8221c627>.

³¹ Steve Lohr, *I, Robot, Esq.? Not Just Yet*, N.Y. TIMES, Mar. 19, 2017, at B1 (New York Edition); Shannon Farley, *Legal Tech is Opening the System to Those Who Need Legal Representation the Most*, TECHCRUNCH (Mar. 13, 2018), <https://techcrunch.com/2018/03/13/legal-tech-is-opening-the-system-to-those-who-need-legal-representation-the-most/>.

³² Vermeulen, *supra* note 30.

³³ *Id.*

³⁴ *Id.*; Erin Winick, *Lawyer-Bots are Shaking Up Jobs*, MIT TECH. REV. (Dec. 12, 2017), <https://www.technologyreview.com/s/609556/lawyer-bots-are-shaking-up-jobs/>.

in the future.³⁵ A virtual law firm is a platform with an emphasis on connecting legal and other professionals in a 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 broad spectrum of law firms.³⁶ 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. On the other end of the spectrum are those firms that adopt an “Airbnb-type” platform organization, mainly providing a matchmaking/coordination service. 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. LawyerlinQ³⁷ in the Netherlands and Digatorney³⁸ in Germany offer law firms the possibility to insource special knowledge and skills for more complex projects. Digatorney is one of the first startups known to the authors that also realized very early

³⁵ Companies get access to more than 5,000 lawyers in almost 50 countries. In this respect, Digatorney finds suitable experts in a digital manner and creates case summaries. Moreover, companies can make use of digital templates and premium information sources. At the same, lawyers from corporate law firms of every size and type benefit from innovative business development services: Digatorney helps them grow their business and make legal advisory more flexible, efficient and focused. Digatorney, <https://www.digatorney.com/> (last visited Sep. 5, 2018); *see also* CuroLegal, <https://www.curolegal.com/about/> (last visited Sep. 6, 2018); Culhane Meadoes, PLLC, <https://www.culhanemeadows.com/> (last visited Sep. 5, 2018); VLP Law Group, LLP, <https://www.vlplawgroup.com/> (last visited Sep. 5, 2018); Axiom Law, <https://www.axiomlaw.com> (last visited Sep. 5, 2018).

³⁶ Tera Brostoff, *Virtual Law Offices Offer Flexibility, Ability to Draw Talent*, LITIGATION ON BLOOMBERG LAW (Feb. 17, 2017), <https://www.bna.com/virtual-law-offices-n57982083991>.

³⁷ LAWYERLINQ, <https://about.lawyerlinq.com> (last visited Sept. 5, 2018).

³⁸ DIGITORNEY, <https://www.digatorney.com/> (last visited Sept. 5, 2018).

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 develop 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.

Legal Tech is replacing the traditional role of legal professionals. Legal professionals play a crucial role in establishing trust and truth in legal transactions. They negotiate, draft, and 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 typically covered in a contract. However, the deal-making, matchmaking, gatekeeping, and enforcing roles are increasingly performed by technology. This trend is likely to accelerate soon, enabled by new technologies (such as blockchain technology) and smart contracts.

³⁹ *Id.*

⁴⁰ LEXSEMBLE BY LEXPREDICT, <https://lexsemble.com> (last visited Sept. 5, 2018).

But it will not stop here. Near future technological advances — most obviously, machine learning and deep learning — have already started to replace lawyers and other legal professionals. Artificial intelligence tools help clients to review, understand and even draft legal documents.⁴¹ Data analytics, machine learning and deep learning are not only used to do legal research but also assist in legal decision-making and the prediction of legal cases.⁴²

There is no doubt that LegalTech will automate “legal work,” such as contract drafting, legal risk management, and dispute resolution. If legal work will be dependent on and performed by algorithms in the future, it is crucial for the future lawyers (and lawyers who are at the start of their careers) to get a better understanding of “data analytics” and “artificial intelligence.” Since all of these near-benefits technologies are code based, the benefits of understanding code will be of value in the medium to long-term.

V. Lawyer of the Future

Some commentators suggest that the digital transformation will be the end of lawyers and legal advisors.⁴³ We certainly don't make this claim, but we do think that if the lawyers of the future are to function as effective transaction engineers, they are going to need to understand the power of code.

⁴¹ e.g. LEXPREDICT, <https://www.lexpredict.com> (last visited Sep. 5, 2018); BEAGLE, <https://www.beagle.ai> (last visited Sep. 5, 2018); Legalzoom, <https://www.legalzoom.com> (last visited Sep. 5, 2018); Legal Robot, <https://www.legalrobot.com/> (last visited Sep. 5, 2018).

⁴² Beverly Rich, *How AI Is Changing Contracts*, HARV. BUS. REV.: TECHNOLOGY (Feb. 12, 2018), <https://hbr.org/2018/02/how-ai-is-changing-contracts>.

⁴³ RICHARD SUSSKIND, THE END OF LAWYERS?, (2010).

Firstly, lawyers of the future will need to be able to assume the role of project managers or, at least, active participants in the new multi-disciplinary teams that are going to design the solutions/transactions of the future. As such, the capacity to work in multi-disciplinary teams will take on a much higher significance than has previously been in the case for lawyers. At least, the ability to work with a more diverse set of “partners” will be required. In the digital world, this means that lawyers will not only have to work closely with their traditional professional “partners” such as accountants and financial advisors, but also with engineers, designers, architects and other experts/specialists (depending on the project/transaction at hand). Law firms will become more like legal “platforms” with an emphasis on connecting legal and other experts and managing the collaboration and transaction. In a world of platforms, matchmaking and project-based partnerships, lawyers and other legal advisors will need to be aware of the way network technology, and other code-based technologies work.

Secondly, in pursuing these new solutions, lawyers will be confronted with a very different type of client. Fast-growth technology companies with few assets and fewer employees are central to the “digital world.” Winning companies have used the opportunities of networked technology to develop new business models. Trust, value and wealth are created through platforms, connections, and networks, instead of the management of workers or physical assets.⁴⁴ Crucially, many firms in this new innovation-driven economy adopt new organizational forms and governance

⁴⁴ Erik P.M. Vermeulen, *We All Struggle!*, MEDIUM: HACKERNOON (Aug 19, 2018), <https://hackernoon.com/we-all-struggle-adb0cfc65773>.

structures to deliver their new products and services.⁴⁵ What then are the main features of such organizations? To appeal to millennial “talent” and consumers, such firms have embraced mission-driven and inclusive organizational cultures and practices in which a “best-idea-wins” culture replaces hierarchies.⁴⁶ Significantly, however, many such “new” firms have often struggled to maintain this new governance model and fulfill their initial promise. Lawyers of the future will need to understand the opportunities and challenges of the digital world and will help firms to re-invent their governance structures to be more open and inclusive.

Thirdly, many of the “solutions” that the lawyer of the future will be expected to design will be technology based. The transactions that lawyers will be facilitating will be dependent on computer code. It is in this context that blockchain and smart contracts become particularly important.

VI. Blockchain

To understand blockchain technology, it makes sense first to consider the Internet. It enabled a free, fast and global exchange of information and ideas. The blockchain adds another dimension by making it possible to transfer and exchange value (and assets)

⁴⁵ Erik P.M. Vermeulen, *The Future of Law, Lawyers and Law Professors... And the Exponential Growth of Disruptive Technology*, MEDIUM: CHATBOTSLIFE (Mar 29, 2017), <https://chatbotslife.com/the-future-of-law-lawyers-and-law-professors-and-the-exponential-growth-of-disruptive-technology-b5c979608c9c>; Rune Dahl Fitjar, Martin Gjelsvik, and Andrés Rodríguez-Pose, *Organizing Product Innovation: Hierarchy, Market or Triple-Helix Networks?*, 3 TRIPLE HELIX 1 (2014).

⁴⁶ Vermeulen, *supra* note 45.

without the involvement of intermediaries. Also, blockchain technology can be used to store personal and other information in an accessible, but secure environment.

So, what is a blockchain? A blockchain is a shared and distributed digital ledger or database that maintains a continuously growing list of “blocks.”⁴⁷ A block could contain records of transactions regarding digital assets, but could also include facts and information. Once the record is verified and validated, a block is added to the chain with previous records in linear and chronological order.

What makes the blockchain such a revolutionary technology is that the ledger or database is distributed to a countless number of participants (“nodes”) around the world in public peer-to-peer networks (similar to the Internet) or private (or permissioned) peer-to-peer networks (similar to an intranet).⁴⁸ These participants can be individuals or organizations (and even things). The only condition is that they have a cell phone and Internet connection. Everybody with a cell phone can create a real digital ID and interact with other people in the blockchain network. Blockchain technology thus enables and facilitates access to finance, insurance services, stock markets, etc.

The “peer-to-peer” transactions are possible because the technology uses a “distributed consensus model” where the network “nodes”

⁴⁷ Erik P.M. Vermeulen, 3 Reasons Why the Blockchain Revolution Is (Finally) Becoming a Reality!, MEDIUM: STARTUPGRIND (May 5, 2017), <https://medium.com/startup-grind/3-reasons-why-the-blockchain-revolution-is-finally-becoming-a-reality-63bdd90c89e2>.

⁴⁸ Saurabh Gupta, Blockchain – The Next Big Revolution, MEDIUM: BLOCKCHAIN MUSINGS (Jul. 3, 2017), <https://medium.com/blockchain-musings/blockchain-the-next-big-revolution-dabb748d33fa>.

verify, validate and audit transactions before and after they are executed.⁴⁹ This is safer than a traditional model in which transactions can only be accomplished through third-party intermediaries, such as a bank, judiciary or notary.⁵⁰

Network connectivity is also important because it allows for multiple copies of the blockchain to be available across a distributed network. This makes it practically impossible to alter or erase information in the blockchain.⁵¹

The use of cryptographic hashes makes tampering with blockchain records even more difficult, if not impossible.⁵² Cryptographic hashes comprise complex algorithms. Even a minuscule change to the blockchain will result in a different hash value, making manipulation instantly and readily detectable.

Digital signatures help establish the identity and authenticity of the parties involved in the transaction. These security measures make blockchain validation technologies more transparent and less prone to error and corruption than existing methods of verifying and validating transactions via third-party intermediaries.⁵³

In short, blockchain technology creates an independent and transparent platform for establishing truth and building trust.⁵⁴

⁴⁹ *Id.*

⁵⁰ *Id.*

⁵¹ *Id.*

⁵² *Id.*

⁵³ Mark White, Jason Killmeyer, Bruce Chew, Will Blockchain Transform the Public Sector?, Deloitte Insights (Sept. 11, 2017), <https://www2.deloitte.com/insights/us/en/industry/public-sector/understanding-basics-of-blockchain-in-government.html>.

⁵⁴ *Id.*

Intermediaries, bureaucracy and old-fashioned procedures are replaced by the 4 Cs: code, connectivity, crowd, and collaboration.⁵⁵ The technology increases openness and speed, while at the same time significantly reducing costs.

But perhaps the most significant feature of blockchain is that it is so adaptable. There are multiple possible applications relevant to a business context. Most obviously, blockchain can be used to provide new methods of processing digital transactions.⁵⁶ But blockchain can also be used for crypto-currencies, records management (e.g., real estate, corporate or medical records), “e-voting” and identity management (IAM). It is for this reason that blockchain technology has been mentioned as one of the most significant disruptive technological innovations since the Internet.⁵⁷

VII. Smart Contracts

But blockchain gets particularly attractive when combined with so-called “smart contracts.” This term was first introduced by Nick Szabo, a computer scientist, and legal theorist, in 1994.⁵⁸ A smart contract is a computer program code that enables the verification, execution, and enforcement of specific terms and conditions of a contractual arrangement. An often-cited example is the “purchase” of music through Apple’s iTunes platform. A computer code

⁵⁵ Vermeulen, *supra* note 47.

⁵⁶ Gupta, *supra* note 48.

⁵⁷ Martin Hiesboeck, Blockchain is the Most Disruptive Invention Since the Internet Itself – Not Just in Finance, DIGITAL DOUGHNUT (Apr. 6, 2016), <https://www.digitaldoughnut.com/articles/2016/april/blockchain-is-the-most-disruptive-invention-since>.

⁵⁸ Brett Ryder, Not-So-Clever Contracts, ECONOMIST: SCHUMPETER (Jul. 30, 2016), <https://www.economist.com/business/2016/07/28/not-so-clever-contracts>.

ensures that the “purchaser” can only listen to the music file on a limited number of Apple device.

A smart contract could also be an essential part of, for instance, a car loan. If the borrower misses a payment (tracked via a blockchain-like technology), the contract will not allow the use and operation of the car (“enforced” via networked technologies that “disable” the car automatically, rather than a “repo man” physically depriving a driver of access to their car).⁵⁹ Such smart contracts will become more prevalent in the growing world of the Internet of Things.⁶⁰ The more devices are connected to each other, the more “smart contracts” will be used to execute and enforce “legal transactions.” There is no doubt that smart contracts are already disrupting traditional legal assumptions, doctrines, and concepts. For instance, it will give a boost to the sharing economy (with its implications for property law). Another example is the set-up of so-called “decentralized autonomous organizations” (“DAOs) built on software, code, and smart contracts, challenging traditional corporation laws.

DAOs are “merely” computer code. They don’t have any directors, managers or employees. The governance structure is built with and on software, code and smart contracts that ran on a public decentralized blockchain platform (in most cases Ethereum). This automated structure is intended to give “participants” / “investors” in the DAO direct real-time control over contributed funds and where such funds would be distributed.

⁵⁹ Felix Küster, What Are Smart Contracts in Blockchain Technology, CAPTAIN ALTCOIN (Jul. 14, 2017), <https://captainaltcoin.com/blockchain-smart-contracts>.

⁶⁰ Vermeulen, *supra* note 47.

DOAs fit in the flatter, decentralized and automated world. With software code automating procedures and tasks, the focus of “knowledge work” is shifting from the routine “application of procedures” to designing the systems and standardized functions that are then performed by machines.

Unfortunately, law programs have been slow to adapt to these technological developments. Most students are still being prepared for a hierarchical, centralized and “proceduralized” world. In the labor market of the future, however, a premium will be placed on a person’s capacity to design and communicate innovative solutions, rather than comply with pre-established procedures. And since these new solutions will be code-based, an understanding of code and coding will be essential to participate effectively in our digital world.

VIII. No Turning Back

Teaching students the basics of “how to code” and inspiring them to get out of their comfort zone, will be a necessary first step to help them embrace the many future opportunities of a “software-based” environment. Blockchain and smart contracts can solve multiple societal challenges and — in doing so — to facilitate new opportunities for disruptive business models. Consider the following:

- *Health and Wellbeing.* Blockchain technology will transform healthcare, giving the patient more control in the healthcare ecosystem by increasing the security, privacy, and interoperability of health data.

- *Agriculture and Food Security.* Consumers increasingly favor “clean” food. It is usually difficult to verify the integrity of products. A distributed ledger replacing the current supply chain would provide transparency. Fair price-setting and fast payments systems would also be facilitated.
- *Safe, Clean and Efficient Energy Supplies.* We are facing an aggressive growth in distributed energy resources. Think rooftop solar and electric vehicles, for example. Governments, utilities, and other stakeholders need new ways to better regulate and manage the electricity grid. Blockchain has the potential to offer a reliable, low-cost solution for financial or operational transactions to be recorded and validated across the distributed network with no central point of authority.

In each case, a major societal problem can be solved more effectively than current solutions via the use of blockchain technology and smart contracts.

Moreover, in a 20th Century business environment, trust was created and maintained by rules, regulations, and contracts.⁶¹ One way of thinking about the law is as a mechanism for stabilizing expectations and building trust when dealing with strangers.⁶² “I may not know you or even like you, but the fact that we have a contract means that I can (to a certain extent) trust you.”⁶³ In a digital world, trust can be embedded in software code. Recent interest in smart contracts suggests that this is going to be a significant growth area in the near-future. And building trust via

⁶¹ Vermeulen, *supra* note 2.

⁶² *Id.*

⁶³ *Id.*

code is also crucial in machine-to-machine (M2M) based transactions. As M2M interaction becomes normal in an Internet of Things environment, the issue of trust becomes a technical and design problem.⁶⁴

We want students to think about software-based solutions to solving trust and reputation issues that are currently present in the Internet of Things and blockchain environments. Moreover, software code is often delivered as an online/cloud-based service. Again, this will only increase with the rise of the Internet of Things. Cybersecurity becomes an important issue here. But instead of combatting “cybersecurity” with the introduction of “more law in books,” law students should look for technology-based solutions. At the very least, they need to have the necessary knowledge to evaluate technology-based solutions and compare them with the alternatives.

Finally, there are the multiple ethical issues that are created in a code-based world and being aware of these issues is again essential for the lawyer of the future. Consider the example of the driverless car. How do we want our driverless vehicle to react when confronted with an unavoidable accident? Should it minimize the loss of life, even if that means sacrificing the occupants of the car or should it prioritize the lives of the occupants at any cost? Alternatively, should the choice be a random one? This “Trolley problem” is just one example of the ethical challenges associated with new technologies. There are a lot of ethical questions involved with the dominant position of software code in our society, varying from the ethics of video games, the issue of automation of

⁶⁴ *Id.*; CISCO, *Securing the Internet of Things: A Proposed Framework*, <https://www.cisco.com/c/en/us/about/security-center/secure-iot-proposed-framework.html> (last visited Sept 5, 2018).

employment to singularity (when machines are more intelligent than human beings).⁶⁵ Building the capacity of the lawyers of the future to think about the social and ethical implications of code is both essential and inevitable. But, to say something sensible about the ethical aspects of technology, it is necessary to understand both more about coding and coders.

IX. Coding for Lawyers

So, what does the ‘Coding for Lawyer’ course do? Here is a quick overview of some of the topics that are covered. It should be emphasized that this class has a multidisciplinary dimension. Most obviously, the course was taught by lawyers, coders, and mathematicians.

In class, we first discussed the strengths of blockchain and smart contract applications. We explain that these applications inhibit “rent-seeking” and offer transparency. And they are secure. The organization of the DAO was discussed in more detail. For instance, the governance protocols used in a DAO are open source and weaknesses are constantly tested. An openly readable ledger means anyone can check the integrity of transactions. The distributed cooperation component implies that “attackers” must be able to “out-compute” the entire network (which is practically impossible).

⁶⁵ Julia Bossmann, *Top 9 Ethical Issues in Artificial Intelligence*, WORLD ECONOMIC FORUM: AGENDA (Oct 21, 2016), <https://www.weforum.org/agenda/2016/10/top-10-ethical-issues-in-artificial-intelligence>; Susan Schneider et al., *Science Fiction and Philosophy* (2009).

Then we looked at these strengths and advantages, we also concluded (as we did in class) that DAOs will eventually overtake any organization which lacks these incentives and efficiencies. Moreover, DAOs are cheap and straightforward to “clone,” which will potentially lead to more competition. The distributed and anonymous nature of the organizations prevents natural and political monopolies. Of course, we concluded that we aren’t there yet. Blockchains and DOAs still have significant technical and operational shortcomings.

In our discussion, the following weaknesses were highlighted. There is still a lack of decentralization (there are currently no “true” DAOs). For instance, Bitcoin’s proof of work protocol has led to “mining pools” because of economies of scale and unbalanced reward structures. Also, the anonymity in blockchain organizations means that they are prone to “Sybil attacks” and “51% attacks.” We also discussed the many examples in which the anonymity (and autonomy) have led to hacks. Remember that in a truly decentralized system, any mistakes (stolen/lost passwords, programming bugs, etc.) are permanent and irrevocable.

We also discussed cryptography, the role of hash functions, Merkle Trees, and several new blockchain initiatives. For instance, we presented a blockchain-based “reputation verification platform” (Semada.io) that rewards trustful parties and punishes bad actors. This was considered to be important because if the trust were to be created through an eternal reputational record, it would be open to review and driven by proper incentives. In fact, the platform is relying on “storytelling” and “cryptocurrencies” to earn “reputation tokens.”

The students understood that the real challenge is to find a “proof of stake” protocol that offers both trust and security (without unintentionally creating just another centralized validation system). The Semada Proof of Stake protocol (SPoS) is an example that uses its reputation-verification platform to solve the centralization, efficiency, and security problems that afflict existing blockchain consensus protocols.

Finally, students were introduced to the Ethereum platform and given a basic introduction to coding on that platform.

It is worth stressing that a combination of lawyers, mathematicians, and coders taught the course, and the students are encouraged in doing their assignment to partner up with students in other faculties to put together their final assignment. In that sense, the kind of multi-disciplinary teams of the future is re-created in the classroom. And expanding this kind of interaction is something that we plan to formalize in the future.

The assessment for the class involved students coding for themselves. Here are some examples of the kind of project that students submitted:

- Blockchain solutions for the purchase of used cars
- A blockchain-based dispute resolution procedure
- A blockchain-based land and real estate registration system
- Blockchain-based digital identities for refugees or other stateless persons
- Blockchain-based “ridesharing”
- Energy trading schemes
- Smart contracts for political campaign funding
- Blockchain and smart contracts for compliance

- A decentralized social media platform
- Blockchain solutions for art traders

In an increasingly software-driven world, we need to remain smart about technology. And this is what the “Coding for Lawyers” course is really about. It is not about teaching students “how to code,” but about making them realize how important it is to think about our relationship with new technology and technology experts. In this way, students can see the new opportunities that technology creates, but also think about the new issues (practical and ethical) that such technologies create. For this reason, we plan to introduce the basics of machine learning and deep learning to the program.

Coders, programmers, and other developers do not always understand the industry or business environment they target with their software solutions. Nor do they always consider the trust or ethical issues when implementing technology-based business solutions. They are not trained to think in this way. Most tech-education is almost exclusively focused on technical training and skills. A parallel reconfiguration in our technical education is also required.

“Co-creation” involving partnerships between developers and non-developers will be crucial to building a “better” digital future. And understanding coding enables lawyers to constructively engage with coders, programmers, and other software developers. By introducing these “three pillars” of our relationship with code (opportunities, trust, and ethics), the course provides the necessary counter-balance to the technical aspects of coding. The understanding of code creates a new level of experience, which serves as the essential first step for the students to participate in multi-disciplinary teams that will develop the software that (ideally)

has a positive economic and social impact and contributes to a better digital future.

X. Conclusion

We should not feel threatened by the exponential growth of technology and the subsequent changes in society. We should view them more as opportunities. The opportunities for lawyers and other legal professionals are obvious. If the “standardized work” and legal research activities can be performed by algorithms, there is more time for assisting the client with the new and very specific challenges of the digital world.

The same goes for legal education. The new technologies in the digital world has forced us to return to the drawing board. The task is clear: creating new courses in the hopes of retaining relevancy, while ensuring job opportunities for our students now and in the future.