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Adopting DOI in Legal Citation: A Roadmap for the Legal Academy

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CONCLUSION

A Digital Object Identifier (DOI) is a unique string of numbers, letters, and symbols used to identify web-based information assets such as articles, multimedia items, and datasets. A digital object minted with a DOI will be persistently discoverable through this identifier, as long as it lives on the Web.

DOIs are already ubiquitous in citations in the medical and scientific literature, primarily because the discovery of, access to, and linkages between the scholarship in these disciplines happens almost exclusively online. As is true with most content on the web, scholarly content in the sciences is published on multiple platforms and may be archived in multiple locations. In light of the fact that one may be hard-pressed to create a reliable static URL that other researchers can refer to under these circumstances, those who publish in the sciences have arrived at a consensus that DOIs are the gold standard for making research outputs easier to find, use, and share.

Why, then, has the legal academy largely eschewed DOIs for legal citation? Discussions are certainly taking place, but currently there are no practical guidelines for implementing DOIs in legal citations. The

Bluebook takes no position on them and authors and law review editors either ignore them or are largely unaware of their benefits.

This paper argues that the implementation and development of a standard for DOI in legal citation is long past due. It will lay out a roadmap for legal scholars, institutions, and vendors for implementing DOI, with helpful tips for authors, librarians, and law journals on minting DOIs; and will provide examples for the Bluebook on what a rule for integrating DOI in legal citation might look like.

Adopting DOI in Legal Citation: A Roadmap for the Legal Academy

Valeri Craigle*

INTRODUCTION

Legal scholarship enjoys high visibility and broad dissemination on the Web today, thanks to the fairly liberal copyright policies of law journals, the wide adoption of article sharing services like SSRN, and the ubiquity of digital publishing platforms, like Digital Commons. But while the discovery and dissemination of these scholarly outputs has met with some success in the web environment, efforts to develop persistent access to legal scholarship in this space have been lacking.¹

At the core of this issue is the dearth of quality metadata associated with digital legal scholarship, which lacks the inclusion of persistent identifiers.² Though there has been much discussion on developing metadata standards, with some progress begin made in the area of legal research ontologies which are used in the development of artificial intelligence

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¹ Richard A. Danner, Kelly Leong, & Wayne V. Miller, *The Durham Statement Two Years Later: Open Access in the Law School Journal Environment*, 103 LAW LIBRARY JOURNAL 39 (2011).

² AARON RETTEEN & MALIKAH HALL, *Persistent Identifiers and the Next Generation of Legal Scholarship* (2021), <https://papers.ssrn.com/abstract=3168863> (last visited Mar 8, 2021).

systems³, the legal education and scholarly communities have thus far failed to develop the standards and best practices that would facilitate persistent access to scholarly outputs.⁴

The inclusion of persistent identifiers, particularly Digital Object Identifiers, or DOIs, in legal citation standards would vastly improve access stability in the legal scholarly record. Persistent identifiers prevent link breakage for online publications, which research has shown effects a sizable portion of online legal periodicals.⁵ Persistent identifiers function by combining a unique ID, with a registration service that keeps track of a digital object over time, and will find the object, even if it changes location. For DOIs in particular, the unique ID is a machine-readable character string whose structure is based on two data streams, which include a pre-assigned data profile unique to a member institution, such as a library, or a university, and metadata, which is deposited each time a digital object is “minted” with a DOI by that member.

There are a number of registration agencies (RAs) that can generate unique ID’s for use in scholarly publishing. Crossref, for example, is a popular RA that generates and manages DOIs. DOIs have been universally adopted by authors and publishers in the scientific and medical fields at a rate of over 90%.⁶ DOIs accompany scientific citations on publisher websites and in scientific bibliographic databases like PubMed and Web of Science.

This article will describe the technology and functionality of DOI, and the benefits of using DOI in legal citation. It will also compare and contrast the

³ See generally, Laurens Mommers, *Ontologies in the Legal Domain*, in THEORY AND APPLICATIONS OF ONTOLOGY: PHILOSOPHICAL PERSPECTIVES 265–276 (Roberto Poli & Johanna Seibt eds., 2010), http://link.springer.com/10.1007/978-90-481-8845-1_12 (last visited Mar 6, 2021) (discussion of the use of ontologies as a basic framework for knowledge representation).

⁴ See, Benjamin J. Keele & Michelle Pearse, *How Librarians Can Help Improve Law Journal Publishing*, 104 LAW LIBRARY JOURNAL 383 (2012) (“Many law libraries have embraced repositories, but it is questionable whether repository systems are presently fully equipped to deal with the changing, dynamic needs of journals”).

⁵ See, Jonathan Zittrain, Kendra Albert, & Lawrence Lessig, *Perma: Scoping and Addressing the Problem of Link and Reference Rot in Legal Citations*, 127 HARVARD LAW REVIEW FORUM 176 (2014).

⁶ International DOI Foundation, *DOI® System and Persistent URLs (PURLs)*, DOI.ORG (2015), <https://perma.cc/7AQ4-4F7G> (last visited Nov 18, 2020).

DOI system with other persistent identifier schemes and the Perma.cc initiative. Authors and law librarians will be guided through the process of “minting” a DOI and the process of cataloging DOIs in a metadata record. Finally, in an effort to encourage the adoption of DOI, the author suggests the incorporation of DOI into the rules of the Bluebook and to include language in professional guidelines and position statements that include DOI implementation.

Persistent Identifier Systems

Anyone who has done research on the web has had the same experience – the excitement of finding just the right resource, only to discover that the link to the resource is broken and has no forwarding address. Over time the problem of link rot increases, and is even compounded, for legal and government-related content in particular.⁷ Some sobering statistics from a DOI factsheet illustrate the problem. According to the International DOI Foundation, “*only 13% of the web addresses registered in 1998 were still around in 2002 (19% of the sites created in 1999 survived to 2002, as did 33% of the 2000 ones and 51% of those from 2001)*”.⁸ These are troubling statistics, yet the authors and publishers of legal content, even after having experienced the frustrations of link rot in the course of their own research, continue to accept URLs as the sole access point to web-based works.

The problem with URLs is that they point to the physical location of a server that hosts a digital file. This process happens through the use of the internet Domain Name System, or DNS. The domain name for the Harvard Law Review, for example; harvardlawreview.org, is accessed through the DNS system through a specific address associated with a server that hosts the content for this journal. The server might live at Harvard, or some other institution, but getting to the content on that server relies on a specific IP address associated with a machine, or location. IP addresses and server locations can change, which makes the DNS system highly susceptible to failure.

To stabilize access to legal scholarship published on the web, we must transition away from URLs to persistent identifiers. This article will assert

⁷ L. Jay Jackson, “*Link rot*” is degrading legal research and case cites, December ABA JOURNAL (2013), <https://perma.cc/EHS4-P7MP>.

⁸ International DOI Foundation, *supra* note 6.

that DOI should be the preferred form of persistent identifier for legal scholarship, based on a number of factors, but to provide some context, other persistent identifier schemes are described below.

Persistent Identifier Schemes

There are a number of persistent identifier schemes in use today. A persistent identifier can be used for a digital object, an organization, or an individual. An ORCID ID or Scopus author ID are examples of persistent identifier schemes used for individuals. An ROR ID, or Research Organization Registry is a type of identifier used for an organization. For digital objects, persistent identifiers include DOIs, Handles, ARKs, PURLs, and URIs.

Handle:

Handles are persistent identifiers for resources published on the internet, that use a central registry to resolve current URLs. Handles provide an ID for a digital object, and the organization which created or now maintains the object. DOIs are a special type of Handle, which relies on the technical infrastructure of the handle system.⁹

ARK:

ARK stands for Archival Resource Key and is a type of URL that provides a method to identify any sort of information object. There is no central resolver for ARKs in the way there is with the DOI system, but as the overseer of the ARK system, the California Digital Library (CDL) coordinates with organizations who would like to be issued a Name Assigning Authority Number (NAAN). Once approved, an organization can assign ARKs as well as host their own infrastructure for resolving ARKs. Over 650 organizations worldwide are currently registered to assign ARKs.¹⁰

A positive of the ARK system is that unlike with the DOI system, there is no fee associated in assigning or using an ARK. The process to obtain a NAAN so that you can create ARK identifiers is simple – after filling out a five-step

⁹ Alain Durand, *Digital Object Architecture and the Handle System* 39 (2019).

¹⁰ N2T - California Digital Library, *Archival Resource Key (ARK) Identifiers ARK*, N2T (2021), https://n2t.net/e/ark_ids.html (last visited May 25, 2021).

online form, an organization will be assigned a 5 digit NAAN to use. Information can be easily updated online as well.

PURL (Persistent Uniform Resource Locator System):

PURLs are URLs which use standard HTTP protocols to redirect a user requesting an internet resource to the location of the requested source. Since PURLs contain a command to redirect to a request to a resource's current location, even as the location changes over time, it is considered a persistent link.

URI and URN:

A Uniform Resource Identifier (URI) identifies a name or a resource on the Internet by the use of a string of characters. Examples are the ubiquitous "http:" at the beginning of webpage addresses as well as "mailto:", "ftp" and "urn"¹¹.

A URN (Uniform Resource Number) is a type of URI that identifies a specific item, such as an article, a page or a book by name. However, it does not provide access to the item itself in the way that a URL (Uniform Resource Locator) would. Instead, a URN operates similarly to an ISBN in the book world. The ISBN 978-0578666150 identifies the 21st edition of *The Bluebook: A Uniform System of Citation* and no other book, but it doesn't provide access to it or tell you where to find it either online or in the physical world.

As such a URN has limited ability to provide perpetual access to an item such as a scholarly law review article. While it may provide accurate and perpetual identification of a particular article, it will not tell you how or where to find a copy of it.

Digital Object Identifiers (DOI)

Finally, the Digital Object identifier scheme, or DOI, introduced in the year 2000, functions by combining a unique identifier with a resolver that tracks

¹¹ See generally, URI: The Uniform Resource Identifier Explained, , IONOS DIGITALGUIDE , <https://www.ionos.com/digitalguide/websites/web-development/uniform-resource-identifier-uri/> (last visited Mar 6, 2021).

a digital object over time through a process called “resolution”¹². DOIs provide a viable means to ensure content will be discoverable in the future, regardless of changes to a digital object’s location. This is especially necessary as more legal publications migrate to online-only publication.¹³ For a more thorough explanation of DOI, Benjamin Keele of Indiana University has published an excellent primer on the subject.¹⁴

Online content is usually accessed via an IP address, which contains a domain name that leads to a webpage that hosts the content. The Harvard Law Review’s address and domain name, for example, is harvardlawreview.org. Harvard University is a well-established institution with the resources to support a stable infrastructure, but technically, the IP address, or domain name of harvardlawreview.org could change or be modified at any time. If that happened, all the links to that domain, which relies on the Domain Name System (DNS) would break unless a forwarding address were provided. The DOI system does not rely on the DNS system to function, rather, it is an implementation of the Handle System, an internet-based architecture that manages the identity of digital objects.¹⁵ For the DOI with the following string of characters: 10.26054/OKFFY1GN4Y, 10.26054 would be considered the handle.

The handle system facilitates the creation and management over time of a persistent identifier, but it also manages the resolution function that keeps track of a digital object on the web. Resolution is the process by which a request is made to a network service to receive information about the current location of a digital object, based on its unique identifier.¹⁶ This request can be made by simply entering a DOI string into the search box of a browser. Digital objects minted with DOIs are found by locating the URL that was placed in the metadata deposited during the DOI minting process.

¹² See generally, DOI International Foundation, *DOI Resolution Documentation*, DOI.ORG , <https://www.doi.org/factsheets/DOIProxy.html> (last visited Nov 12, 2020).

¹³ See, Katharine T. Schaffzin, *The Future of Law Reviews: Online-Only Journals*, 32 *TOURO LAW REVIEW* 243 (2016)(Since 2007, the number of journals hosting online-only content has grown exponentially, inspired by what the author estimates is the \$40,000/year cost of printing a 4-issue law review).

¹⁴ See generally, BENJAMIN JOHN KEELE, *A Primer on Digital Object Identifiers for Law Librarians* (2017), <https://osf.io/dv9fz> (last visited Apr 23, 2020).

¹⁵ See generally, Alain Durand, *Digital Object Architecture and the Handle System* 39 (2019)(The International DOI Foundation was one of the earliest adopters of the Handle system) .

¹⁶ DOI International Foundation, *supra* note 12.

If there are several URLs associated with one DOI, the handle system will perform multiple resolution. For example, if a law review article was cataloged with metadata that included an SSRN DOI, Heinonline identifier, or Archival Resource Key (ARK) number, the handle system would perform multiple resolution on each of these URL's and retrieve all of the items at their Current URL's.

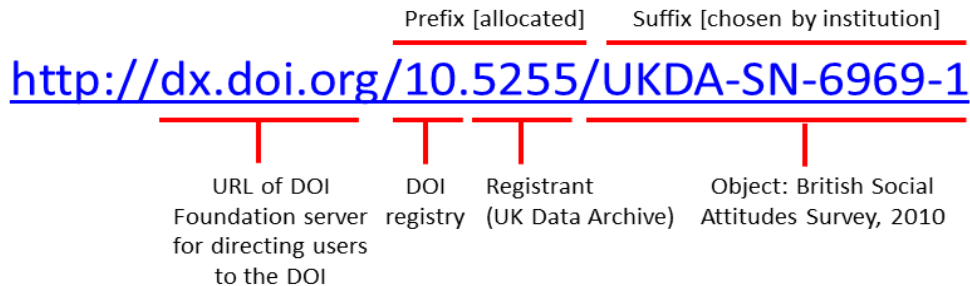
Multiple resolution can even relate digital objects to each other, if certain metadata elements are present. To see a real-world example of multiple resolution, copy and paste the DOI: 10.1111/jgs.16539 into a web browser. In the results set for the article: "*Rationing Limited Healthcare Resources in the COVID-19 Era and Beyond: Ethical Considerations Regarding Older Adults*", you will see links to the article in the Wiley database that contains the journal where the article is published, bibliographic records for the article in PubMed and PubMed Central, and several other URLs for websites that cite to the article. There is even a link to the American Geriatrics Society because the organization is registered as a publisher through the DOI system and is identified within this system by the numerals 1111.

Because the process of DOI resolution relies on the presence of current URLs in a digital object's metadata, whomever is depositing the digital object metadata must ensure that this information is up to date, and that DOI registrations agencies are alerted when major changes to URLs take place.

A DOI has three components: The URL of the DOI foundation server, a prefix, and a suffix. The DOI: <http://dx.doi.org/10.26054/OKFFY1GN4Y>, has a foundation server of dx.doi.org, a prefix of 10.26054, and a suffix of OKFFY1GN4Y. A DOI prefix will always begin with 10, as that is the number specific to the DOI scheme. The number that appears after the 10 in the prefix is unique to the institution subscribing to the DOI registration agency, which could be a library, a publisher, a consortium, etc. The structure of the suffix is up to the subscribing publisher or institution and can contain any combination of characters, or even other types of persistent identifiers. The DOI 10.26054 /ISBN 4567, for example, is an identifier for a digital book, as denoted by the ISBN number in the suffix.

In the example below, the number 5255 is assigned to the UK Data Archive. The suffix, which is chosen by the archive, can use any

combination string of numbers and letters. In this case, the UK Data Archive has used its own set of sequential characters.¹⁷



DOI Registration Agencies

Internationally, there are a number of DOI registration agencies, or RAs, but in the United States we have two to choose from: Crossref and DataCite. Both focus on registering DOIs for research outputs and scholarly materials, but there are some notable differences. Crossref members tend to be professional publishers, academic societies, and university presses. DataCite members tend to be universities, consortia, and service providers, like bibliographic management companies, or scholarly reference databases. There are also significant differences in fee structure. Both Crossref and DataCite are non-profits, but each one charges an annual membership fee and additional fees for metadata deposits.

Below is a comparison of the most recent fee structures for Crossref and DataCite. Crossref's annual membership is structured on the basis of an organization's or publication's annual revenue or expenses. Crossref membership fees only include the base RA service, not the content deposit fees, which are \$1/per journal article and 25 cents per pre-print or book chapter¹⁸.

Table 1 - Crossref Fees

¹⁷ Laurence Horton, *Digital Object Identifiers: Stability for Citations and Referencing, But Not Proxies for Quality*, LSE IMPACT BLOG (2015), <https://blogs.lse.ac.uk/impactofsocialsciences/2015/04/23/digital-object-identifiers-stability-for-citations/> (last visited Nov 6, 2020).

¹⁸ See generally, Laura J. Wilkinson, *Crossref Fees*, CROSSREF, <https://www.Crossref.org/fees/> (last visited Mar 7, 2021) (The \$275 annual membership fee would apply to almost all law reviews and legal society publications).

Total publishing revenue or expenses	Annual membership fee
<USD 1 million	USD 275
USD 1 million - USD 5 million	USD 550
USD 5 million - USD 10 million	USD 1,650
USD 10 million - USD 25 million	USD 3,900
USD 25 million - USD 50 million	USD 8,300
USD 50 million - USD 100 million	USD 14,000
USD 100 million - USD 200 million	USD 22,000
USD 200 million - USD 500 million	USD 33,000
>USD 500 million	USD 50,000

DataCite’s annual membership fees¹⁹ are considerably more expensive in comparison to Crossref. Direct membership in DataCite is €2,000 Euros, or about \$2,440 USD per year. DataCite allows partner organizations to offset these costs through a consortia membership option that must consist of “*five or more non-profit organizations that are under different administrative structures*”. One real-world example of how this works is the Texas Digital Library’s consortia membership which allows numerous libraries to share the costs of the DataCite membership and services. The 24 Texas library members in the consortium are able to share the costs of the annual membership fees, as well as organization fees and service fees that are charged in addition to the yearly membership fee. In this case, the Texas Digital Library acts as administrator of the DataCite service, pays all fees at the beginning of the year, and collects from its partners in the consortium in separate transactions. The fees below are those charged in addition to the annual DataCite membership fee.

Table 2 – 2020 DataCite Fees

¹⁹ See generally, DataCite Fee Model 2020, , <https://datacite.org/feemodel.html> (last visited Mar 7, 2021)(Even larger organizations, such as AALL, or AALS, if they decided to subscribe to DataCite would not exceed the ranges for Tier 1).

Tier	Annual DOI range	Organization Fee	DOI Fee	Annual service fee per organization
Tier 1	0 - 1,999	500€	Graded tier 0.80€ per DOI	500€ + 0.80€ per DOI
Tier 2	2,000 - 10,000	500€	1,600€	2,100€
Tier 3	10,001 - 100,000	500€	2,500€	3,000€
Tier 4	100,001 - 250,000	500€	3,500€	4,000€
Tier 5	250,001 - 1,000,000	500€	8,500€	9,000€

In comparing the various fees, one could surmise that Crossref would be better suited for law reviews and smaller legal societies, and DataCite for larger legal education and law library societies, such as AALL, AALS, and the ABA.

For those concerned about DOI being cost-prohibitive, consider that many law reviews continue to pay to print four to five issues per year, some journals spending up to 20-40 thousand dollars annually.²⁰ Also consider the costs associated with organizing a conference for AALL, or AALS. One would hope that in light of the ability of a law review, or a legal organization to come up with these kinds of funds, a journal could certainly find \$275 per year and \$1 per DOI, and a consortium perhaps comprised of a partnership between AALS, AALL, and the ABA could find a few thousand dollars a year to provide stable access to the publications they produce.

If money is an issue, there is a no-cost option for law reviews. The law libraries that often support their home journals have the ability to piggy-

²⁰ Katharine T. Schaffzin, *supra* note 13.

back on Crossref or DataCite memberships already established at by their universities, or main campus libraries.

Tables 1.2 and 1.3 below show the latest membership rosters for each DOI registration agency. Based on these distributions it is clear that DataCite membership is comprised mostly of large universities, national consortia, and big service providers like OCLC. Crossref in comparison, has a large membership list of academic publishers and societies and a smaller list of large universities and consortia.

Table 3 - DataCite Members²¹

University	Consortium	Publisher/Society	Service Provider
American, Auburn, Columbia, Cornell, Dartmouth, Florida International, Rice, Indiana, Michigan State, NYU, Northwestern, Notre Dame, Penn State, Princeton, Rutgers, Stanford, Temple, Cincinnati, Colorado Boulder, Iowa,, Kentucky, Maryland, Massachusetts, Miami, Michigan, Minnesota, UNLV, New Mexico, Pittsburgh, Southern California, Utah,	California Digital Library, Center for Open Science, Orbis Cascade Alliance, Texas Digital Library	Elsevier IEEE Sage	Figshare OCLC ORCID ResearchGate

²¹ DataCite, *DataCite - Members* (2021), <https://datacite.org/members.html> (last visited May 25, 2021).

Wisconsin, Washington U., St. Louis, Yale			
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Table 4 - Crossref Members²²

University	Consortium	Publisher/Society	Service Provider
Clemson, Cornell, Duke, Iowa State, Lincoln, NYU, Texas tech, Miami, Nebraska, Wisconsin, Wayne State	California Digital Library	Behavior & Law Journal, Cambridge University Press, Emerald, Indiana Univ. Press, Inst for Law of Sci. and Tech., IEEE, Interdisciplinary J. Phil., L. and Econ., International U. Business and Law, JSTOR, OUP, PNAS, PLoS, Sage, Wiley	

A Word about Perma.cc

Perma.cc is not a persistent identifier system, but it has become a popular tool for legal scholars to create relatively stable URL's for citing to web-based resources.²³ Being that necessity is the mother of invention, one could argue that Perma.cc owes its existence to the absence of persistent URLs in web-based content, including law review

²² CrossRef, *CrossRef Depositors* (2021),

<https://www.crossref.org/06members/51depositor.html> (last visited May 25, 2021).

²³ See, Ian Chant, *Perma.cc Aims to Bring Staying Power to Online Legal Citations*, LIBRARY JOURNAL (2013), <http://lj.libraryjournal.com/2013/10/academic-libraries/perma-cc-aims-to-bring-staying-power-to-online-legal-citations/> (To the extent that Harvard will be able to continue to support it and its partners continue to maintain their memberships).

articles. Before Perma came into being, the rules for citing to scholarship in electronic form included: not citing to the electronic version at all; citing to the resource only if it is hosted in a “reliable” archive (which few law journals are); or appending the print citation with a URL, which most of us now know is unsustainable in the long-term.

In addition to scholarly content, sometimes authors want to cite to a news article or a blog post. Citing to these kinds of sources can be challenging because the content is susceptible to information updates, server location changes, and subscription paywalls. Perma.cc allows authors to capture this content at a specific moment in time and refer their readers to an archived version of the snapshot via a stable URL. Even the Bluebook acknowledges the benefits of this service in Rule 18.2.1(d), apparently recognizing perma.cc as a “reliable archival tool”.

Perma.cc was developed by the Harvard Library Innovation Lab, which utilizes industry-standard web-archiving methods, which includes archival server redundancy, to preserve archived files. The integrity of permalinks is assured by a robust administrative infrastructure and the utilization of multiple third-party servers, one being the Internet Archive.²⁴

As a non-profit focused on a long-term archive, Perma’s survival is heavily dependent on institutional support. Currently, hundreds of libraries administer its services, most of them law libraries.²⁵ These partner libraries are called “registrars”.²⁶ Most academic libraries can become registrars and can manage their own research communities and groups.

Some of the technical problems that can occur with creating perma.cc links include access issues imposed by subscription-based websites and news organizations, challenges with capturing dynamically generated content, and problems capturing pages that include the meta tag “noarchive” embedded in them. Perma.cc incidentally provides

²⁴ Perma.cc, *Perma.cc Contingency Plan* (2020), <https://perma.cc/contingency-plan> (last visited Nov 30, 2020).

²⁵ Perma.cc, *About Perma.cc* (2020), <https://perma.cc/about> (last visited Nov 30, 2020).

²⁶ perma.cc, *Perma.cc user guide For Libraries and Other Registrars*, <https://perma.cc/docs/libraries>.

instructions for creating noarchive meta tags out of respect for those content providers who wish to avoid perma.cc captures.

The Current Environment

Despite this article's criticisms thus far, it is only fair to acknowledge that not all of the legal literature is devoid of persistent identifiers. Large legal publishers such as Thompson Reuters, Oxford University Press, Carolina Academic Press, etc., are minting DOIs as part of their publishing process.²⁷ The Federal Sentencing Reporter, published by the University of California Press, mints DOIs for their journal articles. SSRN has been creating DOIs for articles published on their platform since around 2016, perhaps as a result of the Elsevier acquisition. The focus of critique here are the vast majority of law reviews, legal society publications, and faculty scholarship published in non-traditional venues, such as blog posts and on personal websites, the majority of which rely almost entirely on URLs as access points.

To get our colleagues in the legal academy to the point of implementation, perhaps a starting point may be the design an implementation strategy for DOI, which includes demystification of the process and informing people of their options. Ideally, those wishing to implement DOI would have some technological infrastructure in place for hosting digital collections and understand the importance of developing metadata for those collections that is compatible with DOI registration agency requirements.

Technological prerequisites for DOI Implementation

As a prerequisite of membership, Crossref and Datacite require members to deposit metadata that adheres to their own metadata schemas to ensure that data deposits are compatible with their platforms. Crossref and DataCite each have their own metadata schemas that define the application of rules, properties, and descriptions for metadata deposits.²⁸ These schemas also communicate each organization's purpose. For example, DataCite describes the overarching goal of its schema as

²⁷ See OUP CrossRef and DOIs, ,

https://academic.oup.com/journals/pages/help/technical_support/linking#crossref.

²⁸ CrossRef, *CrossRef Metadata Deposit Schema*,

<https://www.crossref.org/education/content-registration/crossrefs-metadata-deposit-schema/> and DataCite Metadata Schema: <https://schema.datacite.org>.

providing “accurate and consistent identification of a resource for citation and retrieval purposes”.²⁹

DOI registration agencies do not host content, only metadata deposited for a DOI, so members must already have the necessary infrastructure in place for hosting digital collections. For law schools and law libraries, this infrastructure will likely be in the form of an institutional repository or digital collection hosted on Digital Commons.³⁰

The DOI implementation process

Membership with a DOI registration agency is required for DOI implementation, but before diving into a membership and committing to the costs and labor, law journals and legal society publishers must consider the stability of their own organizations and the technological platforms that host their content. Organizational changes affecting funding sources or technology strategic plans, server migrations, and departmental reorganizations that might affect IR or technology personnel will impact DOI implementation and metadata cataloging workflows.

As mentioned in the beginning of this article, the DOI system functions through the interaction of two components; the DOI itself, and the RA service that “resolves”, or finds the digital object associated with a DOI by using the metadata that has been deposited as part of the DOI minting process to track a digital object over time. For the resolution process to be successful, a digital object must have a website landing page that displays the digital object’s citation, DOI, and a way to access the full text. An example of a landing page that meets all of these requirements can be found here: <https://dc.law.utah.edu/ulr/vol2020/iss4/5/>.

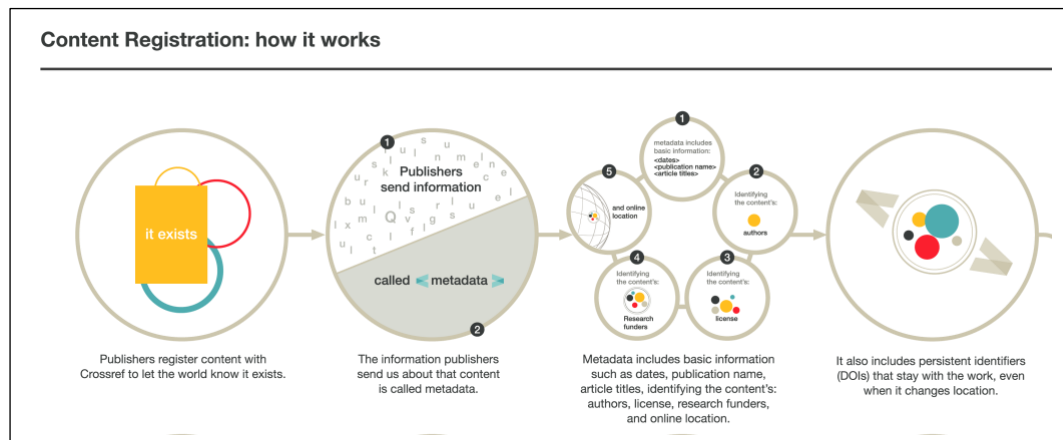
There are several factors to consider when choosing a DOI RA. If a law review wants a DOI prefix specific to their journal, they need to apply as an independent entity, with Crossref likely being the least expensive option for an individual journal. Multiple journals or organizations who wish to collaborate, share the cost burden of a DOI membership and can agree

²⁹ DataCite Metadata Working Group, *DataCite Metadata Schema Documentation for the Publication and Citation of Research Data v4.3* 73 pages (2019).

³⁰ Law Reviews Published with Digital Commons | bepress, , <http://digitalcommons.bepress.com/online-journals-law/> (last visited Jul 26, 2016).

upon a shared data model can enter into multi-institutional or consortia memberships with DataCite to spread out the costs and workflows among their partners. For a no-cost option, law reviews can look into a sponsorship with their law library, which can piggy-back on a university's main library that will likely be involved in consortia agreement with DataCite.

Figure 1 – Crossref Content Registration Workflow



DOI Minting Workflows

Individual and consortia members will receive a DOI prefix unique to them and a login to the DOI registration system and metadata form where metadata deposits are performed. Those under a sponsorship will receive a login to the registration system from their sponsor, but must be aware that they are required to use the DOI prefix of their sponsor. For those creating their own suffix patterns, there are some best practices to keep in mind. A suffix must be unique to its prefix and is case sensitive. In general, it is recommended that suffixes are concise and use spaces and special characters sparingly. Suffix patterns can contain descriptive information such as “ISBN” and “ISSN”, for books and periodicals.

Law reviews will most likely go through the simple process of filling out metadata deposit forms for individual articles. Usually, only 4-5 fields are required in the form (Title, author, publisher, date). Larger organizations producing many publications per year may want to consider uploading

their metadata in a batch process. Once a metadata submission is complete the DOI(s) is sent to the submitter.

Those who wish to do batch metadata deposits for multiple digital objects will work with their metadata in XML format. Digital Commons does export journal data in XML format, but the XML produced by Digital Commons is not compatible with the metadata schemas for either Crossref or DataCite, so it must be converted to XML that will be supported by those platforms.

Georgia Southern University has created an XSL stylesheet that will convert Digital Commons XML to Crossref XML³¹. For XML conversions in other types of digital asset management systems, or to create DOI-compatible metadata from individual documents, a tool called Typeset is recommended. Typeset converts author manuscripts in Word or PDF format to both Crossref and DataCite XML. It will also convert Journal Article Tag Suite (JATS) XML. JATS is a NISO standard XML schema developed initially by the National Center for Biotechnology Information (NCBI) and is now being implemented by the National Library of Medicine (NLM).³² Much of the biomedical literature, is tagged with JATS XML. Unfortunately, Digital Commons XML is not JATS XML, so Typeset cannot convert XML derived from Digital Commons to either Crossref or DataCite XML.

Currently, the easiest option for those publishing their content on Digital Commons who wish to do batch metadata deposits with a DOI registration agency is to be a member of Crossref and use Georgia Southern University's XLS stylesheets to convert Digital Commons XML to Crossref XML.

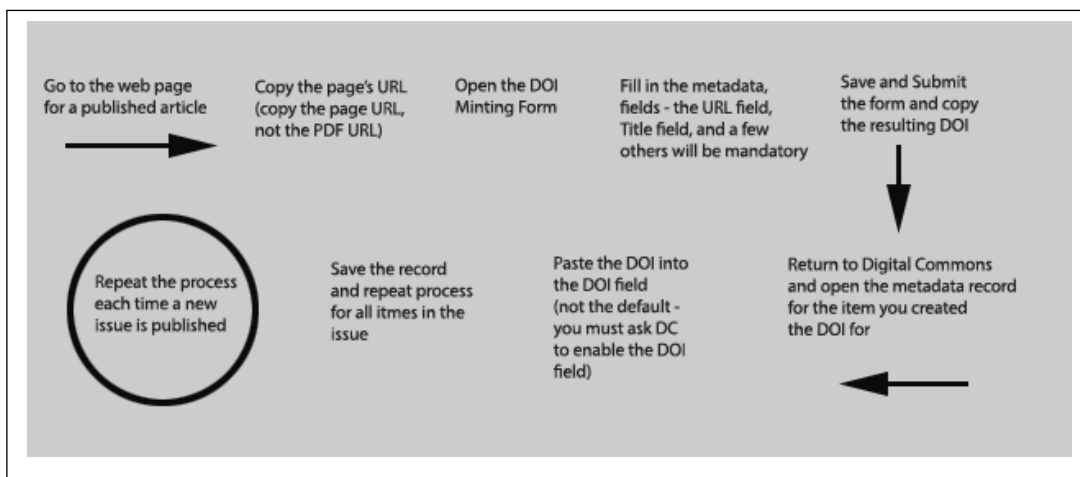
Law reviews publishing 3-5 issues per year can easily deposit DOI metadata manually without having to worry about batch XML conversions. Crossref and DataCite both offer simple forms for creating item-level metadata. As an example of how this works in the real world for one particular law review, the University of Utah's J. Willard Marriott Library currently sponsors journals on their campus through a DataCite membership, which

³¹ Jeffrey Mortimore & Ashley Lowery, *XSL Files for Transformation of bepress Digital Commons Issue-Level Journal XML to CrossRef Deposit XML*, LIBRARY RESEARCH DATA (2016), <https://digitalcommons.georgiasouthern.edu/lib-data/1>.

³² Journal Article Tag Suite, , <https://jats.nlm.nih.gov/> (last visited May 25, 2021).

they have access to as consortia partners of the California Digital Library. The James E. Faust Law Library, also at the University of Utah, piggybacks on Marriott's membership with DataCite to mint DOIs for the Utah Law Review. DOIs are minted on an individual basis using a form that the Marriott Library has granted the Faust Law Library access to. A static version of the form can be found at <http://cdn.law.utah.edu/articles/minting-form.pdf>.

Figure 2 - Flowchart for the Utah Law Review DOI minting process in Digital Commons



The fastest and easiest way to mint DOIs for law reviews published in Digital Commons, is to mint DOIs for articles in published issues, since they already have URLs to work with. The flowchart above depicts the process for minting DOIs in a published issue. It is important that the URL used in the DOI metadata is the landing page URL, not the PDF URL, as the web page itself will have more useful metadata about the publisher and access to the PDF.³³ It is also important to have your Digital Commons support person enable the DOI field, as this is not the default setup.

If law review and legal academy publishers are to adopt DOI, the process of minting DOIs and depositing metadata must be intuitive and user-friendly.

³³ See generally, Laura J. Wilkinson, *Creating a landing page*, CROSSREF , <https://www.crossref.org/education/member-setup/creating-a-landing-page/> (last visited Mar 8, 2021).

Because Digital Commons is the most popular publishing platform for law reviews, the workflow above should apply to the DOI minting process for most law reviews. For larger institutions and organizations wanting to automate their minting services through batch metadata deposits, it would be helpful if Elsevier developed an XML schema and metadata templates for Digital Commons that could be exported to Crossref or DataCite compatible XML. Because DataCite might be the more likely DOI RA for law schools, a DataCite-compatible schema for Digital Commons would be ideal.

Performing DOI Metadata Updates

Once DOIs are created, they can be deleted, but not modified. However, the metadata associated with DOIs can and must be edited if there have been changes to a digital object's physical location or if the content has been significantly altered.³⁴ For small changes, such as spelling corrections or descriptive additions, the metadata record can simply be edited and re-submitted. More significant Edits, such as URL domain changes, significant copyright changes, or publication title changes must be done through certain bulk processes or with direct assistance from Crossref or DataCite.

DOI Added Bonus: Citation Analytics

Though the primary incentive for adopting DOI in legal citation is persistent access to legal scholarship, one can and should envision potential benefits beyond access to the scholarly record. For decades, law schools and their faculty have looked to scholarly rankings as a determinant of value and prestige.³⁵ Ranking methodologies, like those developed by Professors Richard Leiter & Gregory Sisk, and Professor Bryce Clayton Newell, whose meta ranking of faculty scholarship analyzes citation counts from articles published in legal databases, are seen as the gold standard for determining faculty prestige. But even the architects of scholarly rankings understand that their methodologies do not look at the impact of legal scholarship

³⁴ See *Maintaining Your Metadata*, , <https://www.crossref.org/education/metadata-stewardship/maintaining-your-metadata/>.

³⁵ Michael J. Madison, *The Idea of the Law Review: Scholarship, Prestige, and Open Access*, 10 LEWIS & CLARK LAW REVIEW 901 (2006).

holistically.³⁶ Because scholars increasingly communicate information about their own research and the research of others via social media and online publishing platforms, counting citations, primarily to law review articles, within the confines of a subscription-based legal database as a way to measure scholarly impact, is becoming the subject of increased scrutiny.³⁷

Because DOI registration agencies are constantly tracking the activities of their DOI-registered digital objects, they are also keeping tabs on any activity associated that object. These activities can include the detection of a citation, a download, a twitter mention, or a change of URL. The industry refers to these activities as “event data”.³⁸

Analyzing DOI event data holds great potential for more holistically measuring the impact of legal scholarship. Current methods rely on legal research platforms, such as Westlaw and Heinonline as a data source for bibliographic information on authors and publications. But because the indexing in these platforms can contain errors and duplicates, the resulting metrics are somewhat unreliable.

DOI event data rely solely on the notation of a particular activity affecting a digital object and these events are described in the most platform agnostic, yet detailed terms. Fortunately, these data are available to the public through Application Programming Interfaces, or APIs that are offered for free from Crossref and DataCite, and APIs impose no limit to how large or frequent data queries may become.

The following illustrates the method for finding event data using the Crossref API. This first example will run a query on all of the event data for DOIs associated with articles published on Heinonline. To run a query, begin with the Crossref API base URL:

³⁶ Gregory C. Sisk et al., *Scholarly Impact of Law School Faculties in 2018: Updating the Leiter Score Ranking for the Top Third*, 95 UNIVERSITY OF ST. THOMAS LAW JOURNAL (2018), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3230371## (last visited Jun 17, 2019).

³⁷ J.B. Heaton, *One Pill Makes You Larger: Flaws in Sisk’s Westlaw Methodology Illustrated With Leiter’s Citations*, SSRN JOURNAL (2018), <https://www.ssrn.com/abstract=3233092> (last visited May 26, 2021).

³⁸ Martyn Rittman, *Event Data*, CROSSREF: FIND A SERVICE (2020), <https://www.crossref.org/services/event-data/> (last visited Oct 4, 2020).

<https://api.eventdata.Crossref.org/v1/events>? The API documentation (<https://www.eventdata.Crossref.org/guide/service/query-api/>) which provides parameters and filters, provide a reference for what types of data to include in your query. In this case, we will be using the filter for the object prefix, as what we are looking for is digital objects that have the Heinonline prefix in their DOIs. The filter for an object prefix, as defined by Crossref is: obj-id.prefix. The publisher's prefix for Heinonline is: 10.2139. So, our Crossref API query will look like this:

<https://api.eventdata.Crossref.org/v1/events?obj-id.prefix=10.2139>

Running this query will return almost 800,000 events. The data that you see in the browser is in Javascript Object Notation, or JSON format. JSON is commonly used as a data structure by analytics programs because *"It is easy for humans to read and write. It is easy for machines to parse and generate"*. Because this data is in JSON format, the easiest way to view and download it is to use the JSON Formatter, a free tool that can be accessed at <http://jsonformatter.org>.

To bring the data from our query into the JSON formatter, click on JSON Parser and then click on Load Data and enter the URL used in the query: <https://api.eventdata.Crossref.org/v1/events?obj-id.prefix=10.2139>

Make sure you are in the JSON Parser (tab is located at the top of the page). The parser will put the data into an easily readable tree format. The data can be read in the box on the right, or it can be downloaded in a text delimited file and imported into your word processor of choice.

Below is one event – a twitter mention - that can be broken down into its constituent parts. Events are delimited by brackets. An event begins with a { symbol and ends with a } symbol. As you can see, there is a lot of metadata associated with just one event. The metadata for this event defines it as an object in the public domain and that SSRN had minted this article with the DOI: <https://doi.org/10.2139/ssrn.2911086>. This twitter mention was initiated by the Loeb Institute at:

<https://twitter.com/LoebInstitute/status/832570316048175104>. Clicking on the short URL in the tweet takes you to the object, which is an article published on SSRN at:

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2911086:

{

```
"license": "https://creativecommons.org/publicdomain/zero/1.0/",
"terms": "https://doi.org/10.13003/CED-terms-of-use",
"updated_reason":
"https://evidence.eventdata.Crossref.org/announcements/2018-04-26T00-
00-00Z-ED-16.json",
"updated": "edited",
"obj_id": "https://doi.org/10.2139/ssrn.2911086",
"source_token": "45a1ef76-4f43-4cdc-9ba8-5a6ad01cc231",
"occurred_at": "2017-02-17T12:40:06Z",
"subj_id":
"http://twitter.com/LoebInstitute/statuses/832570316048175104",
"id": "aa90e1a8-7827-40fb-9878-605edd52128a",
"evidence_record":
"https://evidence.eventdata.Crossref.org/evidence/2017021719a0c471-
c568-4e42-b4d5-8291a8d5fbae",
"action": "add",
"subj": {
  "pid":
"http://twitter.com/LoebInstitute/statuses/832570316048175104",
  "title": "Tweet 832570316048175104",
  "issued": "2017-02-17T12:40:06.000Z",
  "author": {
    "url": "http://www.twitter.com/LoebInstitute"
  },
  "original-tweet-url":
"http://twitter.com/LoebInstitute/statuses/832570316048175104",
  "original-tweet-author": null,
  "alternative-id": "832570316048175104"
},
"source_id": "twitter",
"obj": {
  "pid": "https://doi.org/10.2139/ssrn.2911086",
  "url": "https://doi.org/10.2139/ssrn.2911086"
},
"timestamp": "2017-02-17T12:40:18Z",
"updated_date": "2018-05-03T09:32:27Z",
"relation_type_id": "discusses"
}
```


DOI event data can be filtered by specific event types, not just twitter mentions. So, for example, if someone doing a citation analysis for a faculty member's publications wanted to see how many times their author had been cited across multiple databases, they would add those specific data points for inclusion in their event data query. The event data API is highly extensible, allowing for the inclusion of almost any combination of data points. But obviously, event data cannot be obtained from digital objects that have no DOI's associated with them.

Adding DOI to Professional Guidelines and Position Statements

Though some individual authors and publishers are already quietly implementing DOI on their own, full implementation of DOI across the legal academy is unlikely without support from academy leadership. Mission statements, strategic plans, and publishing/citation guidelines would ideally include encouragement and instruction on the use of DOIs for legal scholarship published online. Updating the language in the Durham Statement may be helpful. More importantly, the Bluebook could add language regarding the inclusion of DOI in the rule for citing internet resources.

The Durham Statement

The Durham Statement on Open Access to Legal Scholarship, published on February 11, 2009, is a call for "[e]very U.S. law school to commit to ending print publication of its journals and to making definitive versions of journals and other scholarship produced at the school immediately available upon publication in stable, open, digital formats, rather than in print".

Though most law reviews in the U.S. are now published online, only a small portion have ceased print publication altogether.³⁹ The critiques that have circulated in the legal literature and on social media in the decade since, focus on a reluctance to acknowledge that digital scholarship and the technologies that support it are incapable of permanence or stability.⁴⁰

³⁹ Katharine T. Schaffzin, *supra* note 13.

⁴⁰ Richard Leiter, *The Durham Statement*, LIFE OF BOOKS (2009), <http://thelifeofbooks.blogspot.com/2009/06/durham-statement.html> (last visited Nov 27, 2020).

These critiques usually involve a comparison between what is perceived as the indestructible medium of a print publication and the fleeting, fragile digital publication. Ironically, the official version of the Durham Statement itself is published as a web page, with no persistent identifier associated with it.

The infrastructure that can make a digital object permanent – or as permanent as possible on the web – exists and can be implemented through the use of persistent identifiers like DOI. If, as Richard Leiter says, the scholarly process requires that authors “be held accountable and called to defend [their ideas]... in a format that is permanent”,⁴¹ wouldn’t legal publishers want to do everything possible to implement persistent identifiers, particularly for online-only legal scholarship that would “provide a substantially adequate format that can compete with a printed book”?⁴²

Nothing is indestructibly permanent, not even print materials. But embedding a DOI into a digital object and providing a mechanism for tracking that object over the course of its life on the web is a significant improvement to the URL-based access we currently employ. Leiter’s comment that “nothing in any computer format can even begin to approach anything resembling the permanence of a printed book”⁴³ provides some insight into why the Durham Statement has yet not been globally implemented, and why the legal academy has not adopted DOI, or any type of persistent link system for legal citation. The idea that digital objects must somehow supplant the comfort and security some of us feel when interacting with a physical object detracts from our current digital reality and what has been accomplished through the use of persistent identifiers like DOI. Achieving persistent access to legal scholarship, even in all the chaos of the internet, is something that can and should be celebrated and embraced in the legal information profession.

The Bluebook

⁴¹ *Id.*

⁴² *Id.*

⁴³ *Id.*

The broad use of DOI in legal scholarship and the practice of displaying DOIs alongside a standard legal citation⁴⁴ would result in improved access to cited content and improved citation analytics. The Bluebook offers several instructions for citing to Internet sources, but there is currently no rule or instruction for the use of DOIs, or other types of persistent links, even though under Rule 18.2.2, the Bluebook states that “All efforts should be made to cite to the most stable electronic location available”.⁴⁵

Rule 18.2.1(d) offers an encouraging instruction on the use of citations for archived internet sources, providing an example where a perma.cc link is used for a letter posted on the sec.gov website, and another URL that points to the Internet Archive. It is, however, quite frustrating to see no mention of DOIs, or any other type of persistent link example included in rule 18.2.2(d) – The URL.

The use of Rule 18.2.2 seems to be something of a last resort in legal citation. Only if there is no print source available, or an exact electronic copy of that print source, is Rule 18.2.2 allowable. For Rule 18.2.2(d), some mention should be given to persistent links, ideally a *preference* should be given to persistent links.

The basic citation forms described in Bluebook Rule 16 on Periodic materials only include URLs for materials published exclusively online, with no print counterparts. With the recent explosion of online-only law journals,⁴⁶ a URL is insufficient as the only point of access to these types of materials. When an online-only journal, for example, migrates away from Digital Commons to Scholastica, how will all of those URL’s citing to Digital Commons be forwarded to articles now published on Scholastica, or any other website? The potential for link rot and a loss of access to these journals in this scenario is significant and sobering.

With the increase of online-only law journals, the legal academy can no longer think of this looming access crisis as a hypothetical. Rules and actions must reflect the realities of publishing in a digital age. For the Bluebook to acknowledge this new reality with instructions that include

⁴⁴ BENJAMIN J. KEELE, *What If Law Journal Citations Included Digital Object Identifiers? A Snapshot of Major Law Journals* (2010), <https://papers.ssrn.com/abstract=1577074> (last visited Apr 23, 2020).

⁴⁵ The Bluebook Rule 18.2.2 - Citations to Internet Sources, , in THE BLUEBOOK 178 (21 ed.).

⁴⁶ Katharine T. Schaffzin, *supra* note 13.

the use of persistent links for online-only journals would send a powerful message about the importance of data integrity for online legal publications.

Conclusion

Implementing the DOI system for legal scholarship would eliminate the problem of broken links associated with web-based publications, particularly law reviews. DOIs also enhance data collection for scholarly rankings and are an easy way for the publishers and managers of legal information to become better stewards over their own scholarship. There are several mechanisms through which DOI can be implemented in the legal profession, including the integration of DOI in institutional repositories. A rule defining the use of DOI in legal citation, and an update to the Durham Statement, which includes DOI as a way to stabilize access to legal scholarship and facilitate the elimination of print would also provide valuable guidance for authors and legal publishers.