Academic Law Libraries’ New Frontier—
The Post-truth Cognitive Bias Challenge and
Calls for Behavioral and Structural Reforms*

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This article highlights the functional vulnerability of academic law libraries to the post-
truth challenge and suggests both behavioral and structural reforms to combat that effect.
These reforms include moving librarians into the role of information activists and using
blockchain applications for enhanced integrated library system design.

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Introduction: A New Challenge Surging

¶1 The post-truth phenomenon has captured modern times as part of a growing international trend. The Oxford Dictionaries selected “post-truth” as 2016’s word of the year and defined it as “relating to or denoting circumstances in which objective facts are less influential in shaping public opinion than appeals to emotion and personal belief.” The post-truth concept is not amenable to easy interpretation or comprehension. Although the post-truth concept does not exist in a vacuum, it is more clearly manifested through vigorous interaction with a variety of sociopolitical contexts, such as the 2016 U.K. Brexit vote and the 2016 U.S. presidential election.

¶2 The post-truth discussion points to two concepts: disinformation and misinformation. The distinction between them is somewhat debated. Nicole Cooke defines misinformation as incomplete and vague information which the sender still believes to be true and accurate; disinformation, she writes, refers to the dissemination of deliberately false information borne of malicious or ill intent. Dictionary.com, which named “misinformation” its word of the year for 2018, defines misinformation as “false information that is spread, regardless of whether there is intent to mislead.” It describes disinformation as “deliberately misleading or biased information; manipulated narrative or facts; propaganda.” Hence, disinformation carries with it the deliberate intent to spread information known to be incorrect. By contrast, misinformation is not manifestly intended to create falsity though having the potential to result in the inaccurate conceptualization due to the lack of the adequate verification process serving to counterbalance the imperfection.

¶3 The post-truth phenomenon rapidly predominating in the modern society has caused an increasing number of challenges, including many for law libraries. For example, it implicitly creates cognitive biases and distorts information seekers’ reasoning and decision-making processes. It also disrupts with no perceptible or cognizable allusion to the mechanics of how it functions. Two of its most powerful disruptions have been to the mainstays of democracy: freedom of information, the right to access information held by public bodies; and freedom of the press, as guaranteed by the First

2. Id. at 1.
Amendment. The discourse on the post-truth challenge gives particular salience to two facts. First, the post-truth phenomenon can direct the press to erroneously and aberrantly perform its essential function as an information provider or disseminator. Second, it can lead the press to malfunction, frustrate, or undermine its functional leverage for political purposes to the detriment of people’s rights to know. Recent international cases represent how the post-truth phenomenon takes the form of threats to journalism generally and political persecution of individual journalists specifically. With this in mind, this article first argues that the fundamental right of freedom of information is best guaranteed in a society in which the democratization of information is fully established and the press reasonably and duly functions to maximize information accessibility for public citizens. Therefore, the article articulates the contours of the post-truth challenge, which impinges on or distorts the positive and vital role of the press as a watchdog safeguarding and promoting freedom of information. It calls attention to the notion that freedom of information may not necessarily coincide with freedom of the press, although both freedoms are conceptually deemed coterminous in general. However, the post-truth challenges have significantly impeded the role of the press to the detriment of the democratization of information. The article illustrates how the post-truth phenomenon destabilizes the freedom of the press by egregiously decrying or stigmatizing the press as orienting itself astray.

Furthermore, the article claims that media bias can act as the enemy within and exacerbate the post-truth challenge, which in turn misguides the information behavior of citizens and further dislodges rational persons from their ordinary strategic orbits of information retrieval, analysis, and reasoning process.

The article next suggests academic law libraries be subject to behavioral and structural reforms to enable them to rectify growing cognitive bias challenges in the organization and retrieval of legal information. It first captures the evolving role of law libraries as called for by a current socio-scientific climate confronted with inevitable challenges to information credibility and accuracy. In light of behavioral reform, the article argues that law librarians should reframe their role as information activists. In turn, it contends the significance of structural reform by recommending that law libraries should adopt and implement functionally enhanced integrated library systems (ILS)

- of-information/ (visited July 7, 2021). Nevertheless, how to delineate the legitimate realm of freedom of information has depended upon state practices. How and to what extent freedom of information should be protected and guaranteed varies by state and is decided on a case-by-case basis. National law and the policy of each state have consistently shaped legal standards and developed practices in ways to best reflect their own unique sociocultural characteristics. The emerging post-truth challenges have menaced the established norms by bringing about cognitive bias and impeded or weakened humans’ reasonable discernment as necessary to handpick reliable and objective information. Accordingly, freedom of information has remained inevitably vulnerable to the growing pitfall of significant derogation and restriction.

as an optimal institutional design for the information retrieval and sharing process. In particular, it proposes the well-defined information architecture based on blockchain platforms whose functionality is properly designed, coordinated, and supervised by law libraries. The article concludes with guidance for a future course of action.

The Conceptual Interface Between Freedom of Information and Freedom of the Press

¶6 Freedom of information was identified by the United Nations as a fundamental right in 1946. Article 19 of the Universal Declaration of Human Rights of 1948 further recognizes this right, stating that freedom of expression encompasses the freedom “to seek, receive and impart information and ideas through any media and regardless of frontiers.”

¶7 The public’s right of access to knowledge and information can be facilitated and promoted by freedom of the press. Indeed, communication often acts as a catalyst for the development of civil society, and the full exercise of free expression enables all parts of society to exchange views and find solutions to social, economic, and political problems. Therefore, free media plays a critical role in building consensus and sharing information, both essential elements to democratic decision making and social development. According to the Commissioner of Human Rights for the Council of Europe, “[f]ree, independent and pluralistic media based on freedom of information and expression” forms the necessary basis or point of departure for any operating democracy. The media does not operate in a vacuum. Free media may play a positive agenda-setting role by arousing public attention to human respect and thereby fostering a social environment accommodating deference to fundamental rights. Even further, free media can play an agenda-building role and thus have a broad range of constructive influence on the public policymaking process.

7. G.A. Res. 59 (I) (Dec. 14, 1946) (stating that freedom of information is an integral part of the fundamental right of freedom of expression).
10. See generally Lutz Erbring, Edie N. Goldenberg & Arthur H. Miller, FRONT-PAGE NEWS AND REAL-WORLD CUES: A NEW LOOK AT AGENDA-SETTING BY THE MEDIA, 24 AM. J. POL. SCI. 16 (1980); David L. Protes et al., UNCOVERING RAPe: THE WATCHDOG PRESS AND THE LIMITS OF AGENDA SETTING, 49 PUB. OP. Q. 19 (1985). In the context of political science, the term “agenda” is generally construed as meaning “a general set of political controversies that will be viewed as falling within the range of legitimate concerns meriting the attention of the polity.” Roger W. Cobb & Charles D. Elder, THE POLITICS OF AGENDA-BUILDING: AN ALTERNATIVE PERSPECTIVE FOR MODERN DEMOCRATIC THEORY, 33 J. POL. 892, 905 (1971).
stresses “the importance of the environing social processes” and “inextricable and mutually interdependent relation between the concerns generated in the social environment and the vitality of the governmental process.”\footnote{Id. at 911.} In this agenda-building framework, free media is more deeply involved in “the development and formulation of public-policy issues” and contributes to redressing derogation from human rights by holding governments accountable.\footnote{Id. at 912; see also Coun. of Eur., supra note 9 (“Instances of torture, discrimination, corruption or misuse of power many times have come to light because of the work of investigative journalists.”).}


¶9 Classic freedom of the press, however, does not always comply with the internationally recognized fundamental right of freedom of information. Although press freedom generally gives the media the right to publish and distribute without restrictions, its products are apt to be by nature hierarchical, biased, or noninteractive. Thus, press freedom in and of itself does not always ensure the public’s full accessibility to information. Published information is distributed through its own platforms, and territorial and linguistic factors further limit worldwide information availability.

¶10 Although the media can promote democracy and good governance in certain of its practices, it remains vulnerable to the decision-making bias inherent in the process of obtaining, creating, producing, and distributing information.\footnote{The media’s contribution to democracy is evident given that the media can play a critical role in “elevating issues to the systemic agenda and increasing their chances of receiving consideration on institutional agenda,” and “act as opinion leaders in bringing publicity to a particular issue.” Cobb & Elder, supra note 10, at 909.} Media bias may not stand out as an obstacle to the promotion of freedom of the press, but it can work to the detriment of the public’s right of access to knowledge and information.

The Post-truth Phenomenon as a Significant Impediment to Information Democratization

¶11 Most scholars argue that a certain level of information is crucial to “citizens’ performance of their civic duties.”\footnote{David Tewksbury & Jason Rittenberg, News on the Internet: Information and Citizenship in the 21st Century 145 (2012).} Conventional hegemonic rivalry between ruling class and subjugated citizen class was more often than not over territory, personal liberty, and pursuit of habeas corpus, whereas confrontation between citizens and elites in modern times marks a tug-of-war contest over public information or knowledge. Thus, citizens have often had limited access to important public information. By contrast,
elites have long monopolized a vast majority of information resources and controlled public knowledge.\textsuperscript{17}

\textsection{12} Traditional understanding of the relationship between democracy and information addresses three issues: (1) to what extent citizen responsibility for political information is a necessary, or even an important, component of democratic government; (2) who bears the responsibility for originating and circulating political information; and (3) whether citizens will—or even can—handle an increased responsibility for political information.\textsuperscript{18} In the digital information era, where the public can exercise substantial direct control over content by engaging in “the full range of involvement that the internet facilitates,” information democratization may be better defined as “the increasing involvement of private citizens in the creation, distribution, exhibition, and curation of civically relevant information.”\textsuperscript{19}

\textsection{13} The notion of democratization of information is predicated heavily on the ubiquitous access to ideas, opinions, and knowledge; the free exchange thereof; and decentralized editorial control.\textsuperscript{20} The democratization of information allows citizens to enjoy the full-fledged freedom of information by retrieving and obtaining all kinds of information, including contents that otherwise would have been censored by the media, pursuant to its predefined or biased standards such as the policy of “giving views weight equal to their popularity.”\textsuperscript{21}

\textsection{14} The era of digital information or digital commons has seen the mass production and rapid dissemination of myriad information. The surge of digital information poses two major controversial issues: how to effectively guarantee free and fair use of information and how to enhance the credibility and trustworthiness of information. The second issue in particular boils down to the recognition and conceptualization of fabricated information, which certainly includes disinformation but not necessarily misinformation. Vast amounts of information today go viral without first being duly vetted or confirmed.\textsuperscript{22} This section investigates the perils of unscreened false information and its far-reaching influence on law librarianship amid the growing challenge of the post-truth phenomenon. Thus, it is a discourse on the question of how the post-truth phenomenon shapes information-seeking behavior in the era of the digital commons. Recognizing that the wide-ranging spectrum of a post-truth phenomenon may not be amenable to easy analysis, this section provides insight into the post-truth controversy and its implication for reshaping the role of law librarians.

\textsection{15} As noted in the introduction, misinformation and disinformation are not always uniformly defined, making the line between these two concepts sometimes

\begin{itemize}
\item \textsuperscript{17} Id.
\item \textsuperscript{18} Id. at 145–46.
\item \textsuperscript{19} Id. at 146–47.
\item \textsuperscript{21} Id. at 101 (noting that the policy of “giving views weight equal to their popularity seems to counter democratization with the tyranny of the majority”).
\item \textsuperscript{22} Cooke, supra note 3, at 211.
\end{itemize}
blurry. Both misinformation and disinformation may fortify the post-truth phenomenon by “prohibit[ing] collective knowledge and understanding” and “prioritizing and promoting biased, misleading, or false agendas and opinions.”23 In addition, the post-truth effect often does more than only produce confusion. Even fact-checking, when predicated upon misinformation/disinformation, tends to overshadow the credibility of information based on genuine facts or evidence that is emotionally less tempting or not compelling enough to alter the existing personal belief bias. This, in turn, quickly and erroneously stigmatizes such objective information as another form of fake news.24

¶ 16 The negative effect of misinformation and disinformation on citizens’ information behavior is enhanced in that each can disrupt the personal information retrieval and analysis process by creating either type I errors or type II errors. A type I error, also known as a “false positive” finding, refers to the rejection of a true null hypothesis. A type II error, a “false negative” finding, denotes the rejection of a true alternative hypothesis. In other words, a type I error involves falsely inferring the existence or reality of something that is not real or does not exist. By contrast, a type II error involves falsely inferring the absence or nonexistence of something that is real or does exist. Misleading information or authority induces both types of errors, particularly due to human’s inherent vulnerability to cognitive bias and propaganda. These two concepts link contextually and normatively to the post-truth phenomenon. A thorough consideration of such complementing concepts serves to elaborate and clarify the meaning of the post-truth challenge and, more important, to answer the question as to why it occurs.25

¶ 17 In the quest to link the post-truth phenomenon, cognitive bias, and propaganda, it should be first noted that the post-truth concept is of a normative nature. Thus, the post-truth phenomenon is not just about uttering a falsehood or claiming that truth does not exist. It represents misinformed or ill-advised resistance to deferring to scientific truth, evidential standards, and rational thinking. It is human nature to eschew and streamline sophisticated knowledge and information organization processes when making decisions although people might still experience, to a greater or lesser degree, a decision-making disorder in everyday lives, for example by vacillating between disparate ideas or opinions. This “psychological inflexibility tendency” makes people more vulnerable to cognitive bias when engaging in information behavior. The history of human evolution marks cognitive bias connoting a psychological state wherein one reacts against “unexpected or uncomfortable truths.”26 Humans’ preference to avoid complexity and seek simplicity often leads them to reach erroneous conclusions, which are not simply mindless mistakes explained by lack of information or scientific literacy.27

23. Id. at 214.
24. Id. at 212.
25. McIntyre, supra note 1, at 13.
26. Id. at 35.
¶18 Personal experience and a bevy of information sources also shape information behavior.28 Thus, “as the number of information items increase—or as the amount of available time decreases—people resort to simpler and less reliable rules for making choices to shorten their search time.”29 Furthermore, human nature leads people to opt for selective information seeking, namely selective exposure to information.30 Selective exposure refers to humans’ propensity to “seek information that is congruent with their prior knowledge, beliefs, and opinions, and to avoid exposure to information that conflicts with those internal states.”31

¶19 Most contemporary theories on cognitive bias have built mainly on J.C. Wason’s concept of confirmation bias: that is, the mechanism whereby people interpret information as credible and trustworthy when “it confirms their preexisting beliefs.”32 Two of the most important cognitive biases are the backfire effect and the Dunning-Kruger effect. The backfire effect refers to the “psychological phenomenon where the presentation of true information that conflicts with someone’s mistaken beliefs causes them to hold those beliefs even more strongly.”33 By comparison, the Dunning-Kruger effect is the “psychological phenomenon where our lack of ability causes us to vastly overestimate our actual skill.”34 Those biases together elucidate how our post-truth political beliefs entice us to eschew fact or evidence-based rationality.35 Additionally, the conceptual contours of cognitive bias are specifically articulated by the so-called availability heuristic, denoting a mental shortcut that allows people to assess the likelihood of risks, evaluate and solve problems, and make judgments promptly and efficiently based on immediate examples that come to their minds.36 Altogether, it seems evident that cognitive bias serves as the precursor for the post-truth phenomenon from an interconceptual perspective.

¶20 Inherent cognitive biases make us susceptible to manipulation and exploitation by governments or organizations for the propagandistic use of information, “especially when they can discredit all other sources of information.”37 For example, the media at the forefront of a political agenda may employ our inherent cognitive biases to propagandize falsehoods or falsify objective facts, which then lead us to abandon evidential standards and internalize post-truth beliefs. Thus, “the media can sometimes be a culprit in fostering scientific misunderstandings and myths.”38 But it is ironic that one ostensible defense of the media in response to criticism may be predicated on cognitive

30. Id. at 115.
31. Id.
32. McIntyre, supra note 1, at 44–45.
33. Id. at 173.
34. Id.
35. Id. at 48.
36. Gorman & Gorman, supra note 27, at 185.
37. McIntyre, supra note 1, at 62.
38. Gorman & Gorman, supra note 27, at 176.
biases. The media may argue that they simply present what people are interested in learning or having their beliefs confirmed by.\(^{39}\) This justification, however, may be far from coherent and merely forms a farfetched and outrageous argument as far as fake news is concerned. Fake news is not merely misleading or false news; it is disinformation that is deliberately created with an ideological or other purposeful motive.\(^{40}\) In this light, it can be said that fake news has a conceptual analogy to propaganda. Indeed, propaganda does not purport to convince someone of something untrue, but it aims to “build allegiance” and “assert political dominance.”\(^{41}\) Propaganda has served as “a means to exploit and strengthen a flawed ideology,” which is perceived as the post-truth phenomenon.\(^{42}\) Likewise, the social media generating fake news facilitates the post-truth encroachment or predominance by diverting our attention to unscientific, non-objective, and distorted information, thereby thwarting our rational approach when engaging in information behavior. In sum, both fake news and propaganda serve as tools to infuse our minds with flawed ideologies and reinforce our post-truth beliefs. Furthermore, it is cognitive bias that drives and effectuates fake news and propaganda. Human nature is inherently vulnerable to an external stimulus like yellow journalism as generally understood as characterized as being provocative, sensational, incendiary, appealing to one’s sentiment, or triggering empathy. Hence, in human nature, people are susceptible to an unconscious but steady ideological manipulation or contamination, and prone to easily and readily bear repugnance to less asserted and lucid but objective facts and information, which will lead us to circumvent the complex process of scientific, rational thinking in our daily lives.

**A Proposed Behavioral Reform: Reshaping the Role of Academic Law Libraries as Information Activists**

\(^{21}\) By mobilizing cognitive biases and generating alternative unconfirmed facts or information, the post-truth effect obfuscates and suppresses information that citizens of a democracy should know and prioritize.\(^{43}\) Arguably, then, the post-truth phenomenon creates a new paradigm to shape the roles and virtues of law librarians at the forefront of robust initiatives to enhance public information literacy and safeguard freedom of information.\(^{44}\) Thus, law librarians serving as information consumers, providers, and interpreters must make competent, intelligent, persistent, and proactive efforts to effectively safeguard the public and the local community from being led astray

\(^{39}\) Id. at 176–77.
\(^{40}\) McIntyre, supra note 1, at 112.
\(^{41}\) Id. at 113, 116.
\(^{42}\) Id. at 113.
\(^{43}\) Cooke, supra note 3, at 212.
\(^{44}\) Jamie J. Baker, 2018: A Legal Research Odyssey: Artificial Intelligence as Disruptor, 110 LAW LIBR. J. 5, 30, 2018 LAW LIBR. J. 1, ¶ 87 (arguing “law librarians are on the front lines of teaching legal research tools [and] as . . . law librarians consider the fate of law libraries in the Information Age and beyond, it is imperative that [they] continue to assess and instruct on information quality”). Id. at 30, ¶¶ 87, 89.
by inaccurate, misleading, or erroneous information. The best-qualified librarians in the age of post-truth prevalence, then, are those who think and evaluate through a critical lens. Critical thinking or reasoning defies blind acceptance of information or servile conformity and obedience to conventional ideas and alternative facts, without reasonable doubts as to trustworthiness and credibility of such information or ideas. In the process of critical thinking, law librarians are called upon to consistently impugn the authenticity and credibility of information presented before themselves, consume and evaluate information with a skeptical eye, and remain on high alert to misinformation or disinformation.

¶22 Law librarians should reframe their role as inclusive of promoting critical information literacy, which facilitates users’ abilities to purposefully seek, locate, and use appropriate information and to engage in more thoughtful dialogues and learning processes. Critical information literacy provides “an overarching, self-referential, and comprehensive framework” for robust interaction with individuals, ideas, and information in participatory and collaborative digital environments. Thus, critical information literacy asks information users to “consider the underlying power structures that shape information.” It is quite telling that the new mission for law librarians lies in “developing a critical practice of librarianship—a theoretically informed praxis.” This philosophical evolution calls on law librarians to anticipate and respond vigilantly to changes in the information environment to more proactively and benevolently intervene in user information-seeking behavior. Such an approach resists complacency in law librarianship practices by expanding librarians’ role beyond value-neutral information providers.

¶23 It is worth reiterating that the age of massive digitization is marked by the ubiquity of, and unrestricted access to, an abundance of information. As expectations for digital access today in a wide range of private and public sectors have already reached “the point where only digital information will satisfy the vast majority of user needs,” law libraries are called on to “digitize extensively and to a level of quality that supports a wide variety of actual and potential uses” and strenuously preserve digital information.

¶24 This digital information environment asks people to interact more vigorously with others than ever before on broader contact points throughout the robust information-seeking process. The consequences of such interactions are arguably in no wise

46. Cooke, supra note 3, at 216.
47. Id. at 217–18. See generally Elmborg, supra note 45.
49. Cooke, supra note 3, at 218.
50. Elmborg, supra note 45, at 198.
51. Id.
desirable or positive in every case but rather seem oftentimes problematic. In the past, cognitive biases were ameliorated by zealous efforts to exchange information that helped correct false information, refine weak ideology, and reinforce ungrounded information. However, in today’s media deluge, information exchange itself may not be enough to counter information manipulation or inaccuracy concerns and stimulate the dissemination of unvarnished, undistorted, and genuine facts. The free flow of information exposes citizens to the growing risk of misinformation or disinformation that results from flawed or biased ideologies, thoughts, or viewpoints delivered by individuals, governments, social media platforms, and the like. The accumulation of information risks beyond the ordinary level of information literacy and discernment may hamper the reasonably informed decision-making process that could drive sound social change and foster well-functioning democracy. Such risks could be eliminated, or at least mitigated, by the fair and free media when it duly performs the agenda-building function to exert positive influences on society and the public policymaking process. In the agenda-building perspective countenances ordered but widespread social change or innovation, departing from the existing situation if necessary. In the agenda-building framework, information, even the information reflective of prevailing social rules or public order and customs, is not taken at face value, but the validity and legitimacy of the source of information is subject to continuous evaluation and verification against evolving standards or new relevant information available in society. Consequently, social innovation on the continuum of information development may facilitate “to break society’s logjams, to prevent ossification in the political system, [and] to prompt and justify major innovations in social policy and economic organization.” Inasmuch as media bias may to a greater or lesser degree exist in the real world, it is imperative that society has the efficacious regulatory mechanism to properly detect and address the intrusive impact of post-truth. It should be noted that post-truth may create normative concerns when it “amounts to a form of ideological supremacy, whereby its practitioners are trying to compel someone to believe in something whether there is good evidence for it or not.”

All in all, it seems axiomatic that a close look at the contextual, normative link between cognitive bias, propaganda, and the post-truth phenomenon warrants the imposition of comprehensive accountability on individuals, governments, and organizations, including social media, for their neglect in playing a proactive role to address the ever exacerbating post-truth phenomenon. Thus, the new paradigm of redressing the post-truth concern envisions the so-called umbrella liability framework. In addition to taking any necessary individual and mutual responsibility for the malaise of post-truth phenomenon, each of three entities is required to maintain a fair and balanced

53. McIntyre, supra note 1, at 58.
55. Id. at 913.
57. McIntyre, supra note 1, at 13.
approach in engaging in a wide range of information practices. This tripartite collaboration may effectively solve this normative post-truth puzzle. Notably, this sociocultural mandate for cooperation among these sectors particularly highlights the more proactive role of law librarians in combating misinformation and disinformation, which prevents a variety of user groups from fulfilling their respective information needs. Indeed, the importance of the vigorous engagement of law librarians in countering the predominating post-truth phenomenon cannot be emphasized enough, since they perform their outreach role at the forefront, interacting directly with people by assisting them in satisfying their intellectual curiosity. Like individuals, states, and organizations that are involved in the dynamic play of the post-truth effect, law librarians fight misinformation and disinformation on the integrated battlefield. With the recognition of the danger of a premature conclusion, it can be said that should law librarians strive to align the values of critical literacy with their more mundane work, one may anticipate a sound sociocultural climate disallowing the encroachment of misinformation or disinformation on the ordinary course of people's intellectual processes, although the post-truth evils may not be able to be fully eradicated forthwith.

A Proposed Structural Reform: Designing Blockchain–Platform Integrated Library Systems

¶26 In today’s data-driven economy, disruptive innovations of the information organization system and process constantly challenge functional and structural aspects of traditional information retrieval frameworks established long ago in the library context. Almost inevitably, these innovations will also reshape the existing intermediary role of librarians as information providers and distributors. The rapid technological advance propels libraries to reassess the hackneyed system and process to respond quickly and effectively to the new needs of the fast-evolving digital ecology. Amid all this change, what structural reforms might law libraries make to correct imperfections of conventional library information retrieval systems? As discussed in preceding sections, the burgeoning post-truth phenomenon accentuates these system imperfections by increasing information seekers’ vulnerability to cognitive biases resulting from unwarranted and ill-founded internal consensus or external factors such as information manipulation by media and individual providers. This section discusses the far-reaching functional clout of blockchain technology. It illustrates how blockchain technology offers one solution for libraries seeking structural reform.

¶27 Blockchain is a decentralized and distributed record—or “ledger”—of data or transactions stored in a highly secure, verifiable, and permanent way using various cryptographic techniques. An array of parties in a blockchain can read and write transactions to the database. Transactions that pass get hashed—in other words, assigned a digital fingerprint that identifies the transactions. Those validated

58. Baker, supra note 44, at 13, ¶ 31 (emphasizing the increasing significant impact of the digital revolution on legal practice).
transactions then get grouped into a block, which is assigned its own hash. That hash becomes the first hash of the next block of transactions, linking them in a chain. Thus, blockchain has a built-in consensus mechanism in which multiple parties interact with one another in a trusted network.59

¶28 Emerging blockchain technology is likely to facilitate a paradigm shift in the role and functions of academic libraries by enabling direct and transparent sharing of information among individual users in the same block, without third-party intervention, thus ensuring a certain confidence level in the information circulated. In the midst of the technological evolution impacting the pattern of institutional information organization, blockchain will dramatically reshape the functional and spatiotemporal status of libraries.

¶29 With this recognition, this section provides a pioneer suggestion of a new conceptual and procedural modality for the implementation of improved information retrieval and sharing systems. Streamlining and decentralizing the mechanism of information retrieval and sharing will serve to achieve genuine freedom of information. This section avers that a blockchain-based knowledge-sharing platform will be able to effectively rectify human cognitive biases resulting from the functional failure of traditional library systems to eliminate misinformation and disinformation, and further resuscitate information democratization. It then highlights that the blockchain system will effect the reshaping of the role of an academic library, beyond information provider and distributor, to include system designer, coordinator, and manager.

Blockchain Mechanism in Detail

¶30 As briefly noted above, blockchain is a decentralized and distributed record—or ledger—of data or transactions that are stored in a highly secure, verifiable, and permanent way using various cryptographic techniques. A blockchain is a continuously growing list of records, combined in “blocks” and then “chained” to each other using cryptography.

¶31 In blockchain, data entered onto the blockchain are “hashed,” getting a unique digital signature. Data is shared, verified, and validated on a peer-to-peer basis. Validated data gets grouped into a string of data, the block, and gets a unique signature. This signature becomes part of the data of the next block. As illustrated in figure 1,60 the data in block A is linked to block B by adding the signature of block A to the data of block B. The signature of block B is now partially based on the signature of block A because it is included in the string of data in block B.


60. This graphic is based on Jimi S., *How Does Blockchain Work in 7 Steps—A Clear and Simple Explanation*, GOOD AUDIENCE (May 6, 2018), https://blog.goodaudience.com/blockchain-for-beginners-what-is-blockchain-519db8c6677a [https://perma.cc/72HC-DBMQ]. The graphic was *mutatis mutandis* reformulated to streamline illustrating the blockchain mechanism.
¶32 What happens when data is altered? As shown in figure 2, the new signature of block 1 (S1a) does not match the signature previously added to block 2 (S1). Block 1 and block 2 are now not considered chained to each other.

¶33 How could data alteration be successful? As shown in figure 3, the new signature S2a of block 2 still does not match the signature S2 in block 3. Altering a single block requires a new signature for every block that comes after it. A single bad actor will never succeed unless he has more computational power than the rest of the network.

¶34 As such, a blockchain is a decentralized, distributed, and secured architecture of trust. Four key natures of blockchain are as follows:

61. Id.
62. Id.
Blockchain is decentralized. No single entity controls the network; it is maintained by multiple parties.

Blockchain is distributed. Digital records are shared with and updated by all participants at any time based on a built-in, proof-of-work consensus mechanism.

Blockchain is secured. It is driven by a blend of proven cryptographic technology, making it hard to tamper with the records.

Blockchain is immutable. Information, once added to a blockchain, is time-stamped and cannot easily be modified.

For these peculiar characteristics, blockchain is often called a trust machine. It is highly resilient and resistant to external threats or malicious attacks, such as unauthorized information manipulation.63

Blockchain Types and the Degree of Decentralization

Generally, blockchains are categorized according to multiple criteria. Blockchains are divided into permissionless or permissioned blockchain by platform accessibility. Permissionless blockchain is open to everyone without any restriction in accessibility. By contrast, permissioned blockchain imposes restrictions on who can read, write, or validate data/transactions on the platform.64 Thus, the permissioned blockchain restricts access depending on the specificity of the platform.

Blockchains can also be classified by platform management and user authentication, in other words, by the level of anonymity of the participants.65 Public blockchain is the most decentralized type of blockchain. Public blockchain does not allow a single entity to manage the platform or to be given special privilege on any transactional

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64. Id. at 8.
65. Id. at 8–9.
decision. Public blockchain is a completely trustless platform and relies on consensus, not any trusted party, in validating the transaction. Therefore, public blockchain is vulnerable to a “51 percent attack,” which occurs when an individual entity or a group of like-minded entities holding more than half of the computational power maliciously attempts to take control of the blockchain and thereby exert influence on the decision-making process to the detriment of network integrity.\(^66\) Most public blockchains are permissionless. Ethereum is typical of a permissioned public blockchain.\(^67\) On the contrary, private blockchains are operated on platforms controlled by a single entity, which is highly trusted by others.\(^68\) The verification process is carried out by a very small number of authorized nodes, such as computers or servers.\(^69\) Thus, the private blockchain is the least decentralized form of blockchain. As validators are already known to one another in the private blockchain, any faulty nodes are relatively easy to fix, and the risk of a 51 percent attack that may arise from minor collusion among a group of entities in the same blockchain network does not exist.\(^70\) The consortium (federated) blockchain occupies the middle ground. It is “a type of private blockchain that operates under the leadership of a group rather than a single entity and in which participants are identified.”\(^71\) The consortium blockchain is a “partially decentralized platform” and generally a permissioned blockchain.\(^72\) Therefore, a few selected and predetermined nodes control the consensus process, and access to the platform is limited to participants with permission.\(^73\)

Blockchain Application Controversy Over Functional Reliability and Validity

\(^{38}\) Notwithstanding the mushrooming potential of blockchain technology in a wide range of areas, general views remain divided regarding its reliability and functional validity when applied to the library information process. One may argue that decentralized blockchain mechanisms deviate from third-party authority and make it lengthy and costly to implement and maintain as standard information platforms in academic law libraries.\(^74\) Skeptical perspectives point to the notion that blockchain is neither the only nor best means to achieving data integrity, security, transparency, and durable preservation even in the data-driven era.\(^75\)

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\(^{67}\) Ganne, *supra* note 63, at 10 (noting that in permissioned public blockchain, transactions are validated based on the participants’ stake, that is, "how many coins he/she has and for how long").

\(^{68}\) *Id.*

\(^{69}\) *Id.*

\(^{70}\) *Id.*

\(^{71}\) *Id* at 11.

\(^{72}\) *Id.*

\(^{73}\) *Id.*

\(^{74}\) Smith, *supra* note 59, at 31.

\(^{75}\) *Id.*
§39 Besides, the potential pitfall of a 51 percent attack underlying the blockchain consensus mechanism may continue to make viable cases for skepticism. In blockchain, a single entity, or a group of multiple entities with a common interest, that gains control over more than half of the verifying parties can rewrite the blockchain and rig transactions.76 This systemic drawback may undermine the guaranteed security and offset the efficiency of information processing that blockchain can bring positively into the library. The 51 percent attack is also problematic in that it compromises the principle of majority rule by buttressing biases toward distorted information. Theoretically, an individual entity can move forward to maneuver information-processing mechanisms by enticing other participants in the same blockchain network to engage in a concerted practice favoring particular information. Such an ambitious entity can lead a majority of other participants astray by creating ex ante cognitive bias anew or infusing ex post cognitive bias into their conceptual mentality. It follows that interrupting biases to that effect may have an adverse effect on an entity’s conceptual mechanism; this effect may culminate in dismantling the existing collective conceptual frameworks. Thus, the interrupting biases can facilitate a group’s conceptual deviation from warranted information and concerted reliance on unverified information. Such being the case, the structural shortcomings of a 51 percent attack may undermine blockchain utility and functionality inspiring the innovative information-processing platform design and make blockchain vulnerable to internal cognitive bias challenges by a particular entity intending to manipulate blockchain consensus mechanisms in order to give particular salience to, or impugn and demur at, the validity and accuracy of particular information. A perceived corollary to arbitrary manipulation is allegedly a significant impediment to freedom of information selection. The 51 percent attack flaw appears to create the same concerns as Habermas’s consensus theory of truth. According to this theory, a warrantedly assertible statement is deemed true because its validity is supported by the best argument in the current scientific debate.77 This view of truth by consensus involves a too objectivistic decision-making process and excludes further consideration of a context of theoretical discourse.78 Thus, truth by consensus should be complemented by the notion of authenticity, which is “a willingness to stand by one’s theoretical views not only in the face of an adverse common opinion but also in the face of one’s contingent inability to articulate them as the best argument.”79 The statement authentically asserted may or may not be subsequently accepted as more valid than the former best argument.80 That said, everything claimed to be authenticated might not necessarily turn out to be true.

§40 The potential perils of blockchain flaws may counterintuitively boil down to another argument that blockchain technology, though integrated into the library

76. Id. at 32.
78. Id.
79. Id.
80. Id.
context to a greater or lesser degree, would not transform the traditional role of academic libraries. Indeed, libraries work at the intersection of information and people. A sequence of professional judgment in practice defines what librarians perform and how libraries operate. This may be more so these days because, as well articulated in the emerging discipline of digital humanities, information literacy could result in a high degree of achievement with the proper use of digital resources, as well as constant reflection on their application.

¶41 Notwithstanding the foregoing plausible arguments, blockchain is being touted as the new panacea to effectively maintain data security and transparency. It should be noted that blockchain technology can be directly applied to the peer-review process, to a wide variety of information retrieval and sharing settings, and for chain of custody for digital repositories.

Artificial Intelligence Application in ILS Design and Blockchain Complementarity

¶42 A variety of industries have embraced artificial intelligence (AI) applications for the data-processing efficiency, which are likely to carry more weight with information retrieval and sharing matters when implemented in blockchain-based further secured platforms. In a nutshell, the utility and practicability of blockchain technology become more evident across targeted industries such as banking and insurance (regarding payment service), supply chain management (provenance tracking), healthcare (health records management), and energy management (decentralized generation and usage). Blockchain, among other things, may significantly alter the landscape of library and information science (LIS), which has been already transformed, disrupted, revolutionized, and remade by AI over recent years. For example, enhanced information retrieval and document review have been made increasingly possible by virtue of AI legal research tools at law firms. AI legal systems in general are built by identifying, collecting, digitizing, indexing, and cataloging source materials in the public domain. In their administrative role, law librarians can ensure that AI systems constantly feed into current and relevant information. In addition, AI has been widely employed in a broader LIS context. Agent technology, a subfield of AI, has been used in a variety of settings. Agent technology includes intelligent agents “that can make decisions about how they act based on experience and are free to choose between different actions.”

81. Smith, supra note 59, at 33.
82. Id. at 31.
84. Id.
85. Id.
86. Id. at 18.
88. Id.
AI-based intelligent agent systems currently used in the LIS context have limited functions by turning only to “automated reasoning or logical searching, to assist library patrons.” Nevertheless, those agents have fulfilled the needs of diverse users by helping “achieve the best outcome or, when there is uncertainty, the best expected outcome.”

It is noteworthy that AI systems are based on cognitive computing: that is, machine learning analyzing repeated searches and refining them to meet the user’s demands more closely. Law librarians can play a role in helping AI applications retrieve optimal results by identifying systemic defects, filling the loopholes, and fine-tuning the process. Furthermore, full-fledged librarians with a current awareness of AI mechanisms may contribute to rectifying a “false sense of accuracy” created by users lacking a proper technical understanding required for database searching. Nonetheless, there remain perceived limitations as to the implementation of AI-driven legal automation, given that AI employs machine-learning algorithms coterminous with human learning, analytical reasoning, and decision-making processes and, therefore, is not completely free from cognitive biases. Hence, the imperfections of AI systems boil down to the fact that even those benefits that can be reaped from an optimal AI application may or may not counterbalance the implied pitfalls resulting from the complexity of AI technology as well as its opacity and uncertainty.

Blockchain technology can effectively counterbalance the underlying imperfections of AI systems. Blockchain’s decentralized consensus mechanism may offer a glimpse into the inner workings of AI by having all the information undergo verification by network participants, which allows them to evaluate and correct possible mistakes created by AI systems by means of consensus making. Thus, participants autonomously verify information and determine its validity, accuracy, authenticity, and authority. This verification process is regulated by the institution charged with the system oversight. Theoretically, blockchain can serve as a well-defined “information architecture,” that is, “the process of designing, implementing and evaluating information spaces that are humanly and socially acceptable to their intended stakeholders.”

Another version of the definition sets out more elaborate and multidimensional aspects:

- The structural design of shared information environments
- The synthesis of organization, labeling, search, and navigation systems within digital, physical, and cross-channel ecosystems

89. Id. at 388, ¶ 8.
90. Id. at 387, ¶ 7.
91. Chen & Neary, supra note 83, at 18–19.
92. Id. at 19 (noting that law librarians who train/instruct law students/new practitioners can be an integral part of the AI system construction, implementation, and evaluation team).
93. Id. at 20.
94. Id.
95. Id. (noting that “[t]echnology, especially AI technology, can be deceptive because its inner workings are invisible to the naked eye”).
The art and science of shaping information products and experiences to support usability, findability, and understanding

An emerging discipline and community of practice focused on bringing principles of design and architecture to the digital landscape.  

Given these definitions, blockchain can be a better alternative to contemporary ILS platforms as information retrieval and sharing tools, which are “essential as basic building blocks for a system that will organize as much of . . . recorded information as possible.” Thus, its unique decentralized design can serve to effectively revamp the present flawed system that might be easily compromised by potential information biases that could occur as a consequence of human system operation tasks. Blockchain may streamline the sophisticated information-processing system by facilitating direct and diversified participation from parties in the process.

Four Takeaways for Optimum ILS Design by Means of Blockchain Application

Underlining its functional excellence and practical usability, blockchain serves to open a new frontier of information retrieval and sharing processes in the LIS context. It will bring an innovative ILS platform as a structural and functional upheaval into the information-processing arena. The foregoing discourse on blockchain application in the LIS context suggests the following four takeaways.

Compulsory Proof of Work Ensuring Enhanced Procedural Transparency and Efficiency, and Guaranteeing Information Validity and Authenticity

In the blockchain ILS, only information that properly undergoes the internal verification process can survive as qualified information for retrieval and sharing among parties in the networks. This system enables ILS users to autonomously and collectively ensure the procedural transparency and efficiency of the verification process by requiring an individual entity proposing new information to file proof of work that shows how he or she has already assessed and evaluated that information. Every proof submitted is circulated among all parties and archived for future reference. Information whose objectivity, validity, and authenticity are not predicated upon supporting evidence will not be able to retain complete verification and will eventually be disqualified.

97. Id. at 41 (quoting what is defined by Rosenfeld, Morville, and Arango who argue that it is not possible to provide “a few words that succinctly capture the essence and expanse of the field of information architecture”).
98. Id. at 98.
99. Id. at 151–52 (arguing that “[a]s the tools became automated, though, the task of design was taken on by people who understood computers but often had little or no knowledge of the contents of the records that would make up the system”).
Constructing an ILS Platform Based on Blockchain Technology

48 Depending on the degree of security and accessibility, blockchains are generally divided into two categories: public blockchain and private blockchain. In a public (generally permissionless) blockchain, anyone in the public domain can access all the data or blocks contained in the blockchain. By contrast, in the case of private (generally permissioned) blockchain, transactions or blocks are only made accessible to members of the blockchain or to parties who are granted full or partial access. Academic libraries may opt to build in-house ILS platforms in the form of either public or private blockchain, or both. The institutions can establish public blockchain-embedded ILS platforms to make all the information publicly accessible. Or they can alternatively invent ILS platforms partaking of private blockchain for information qualified for restricted access and distribution due to copyright and other security concerns. In addition to designing a private or public blockchain ILS model for an individual institution, multiple institutions can further innovate the ILS design by establishing partnerships under a consortium blockchain model. Figure 4 shows how institutional collaboration works on the blockchain platform.

Figure 4
Comparison Between Traditional and Blockchain ILS Models

49 In designing the interinstitutional ILS platform, an important issue may arise as to how to address technical interoperability issues. The following four scenarios can be considered.

50 In the first scenario, partnered institutions interact with each other on the same blockchain. As shown in figure 5, this case obviates the need to consider interoperability issues. Institutions can directly exchange data on the platform pursuant to its governing rules relative to transactions, for example, the policy, process, and rules of an interlibrary loan system.100

51 In the second scenario, institutions interact with each other on two different platforms built on the same blockchain technology. As figure 6 shows, institutions are

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100. Ganne, supra note 63, at 36.
required to ensure technical interoperability because they still operate on different platforms, though not on different blockchains. Platforms need to prove compatible with each other without any technical restriction when interacting on the same blockchain.101

¶52 In the third scenario, institutions interact with each other on different platforms, with each being based on different blockchain technologies. As figure 7 demonstrates, institutions need to verify the interoperability between two different platforms. Given the potential discrepancy in connectivity and compatibility between different blockchain technologies, it is inter-ledger interoperability, not intra-ledger interoperability, that need be verified and ensured.102

¶53 In the fourth scenario, institutions remain off-chain and interact only on the blockchain-based interface platform. This platform allows information to be exchanged

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101. Id. at 37.
102. Id. at 38.
or transferred from one system to another.\textsuperscript{103} As figure 8 shows, when users request specific information, their institution can extract a pool of relevant information from the platform and then users can retrieve specific authorized information from that pool.\textsuperscript{104}

\textsuperscript{54} As such, a blockchain-based integrated system can advance technical interactions between institutions. Blockchain can even facilitate cross-border partnerships by integrating a variety of national-level platforms into a comprehensive platform at the global level. How to surmount technical barriers in terms of interoperability would still remain a critical issue in designing and formulating the overarching blockchain platform.

\begin{itemize}
\item \textsuperscript{103} Id.
\item \textsuperscript{104} Id.
\end{itemize}
The Utility of a Blockchain-Based ILS Model

¶55 Blockchain confers a number of benefits on institutions and users. Blockchain can facilitate the inter- or intra-institution flow of information. It can innovate traditional information retrieval and sharing processes by mobilizing digitized and automated systems. Blockchain can also enhance institutional collaboration and streamline and improve a series of processes for the benefit of end information users. Intellectual property–related issues can be solved efficiently and transparently in the blockchain platform, where information is required to be verified and authenticated. Furthermore, with such a transparent and automated system employed, blockchain can significantly reduce a variety of direct and overhead costs, including “verification, assessment, networking, processing, coordination, transportation and logistics as well as financial intermediation and exchange rate costs.”

A New Perspective on Reconceptualizing a Library’s Role as a System Designer, Coordinator, and Manager

¶56 Applying blockchain for ILS implementation will reshape the role of academic libraries. In the mainstream LIS landscape, libraries work mainly as information providers and distributors. A functional shift due to the introduction of an innovative ILS platform connotes that libraries may be required to engage in information processing as designers, coordinators, and managers of blockchain systems.

¶57 System design is inevitable for the retrieval of organized information because it determines how information is acquired, compiled, evaluated, and displayed. The contours of system design are articulated based on robust interaction between technical functionality and users’ information behavior. Therefore, what makes or mars the system would be the degree to which it can effectively protect procedural transparency and information credibility and accuracy from the potential threat of biases. Remarkably, blockchain may solve this systemic puzzle. Implementing machine-learning ILS will be a groundbreaking paradigm shift to eliminate cognitive or computational biases. Decentralized consensus mechanisms embed information retrieval and sharing processes into secured networks of relationships that mediate hierarchical information categories as well as procedural systems that encapsulate conceptual engineering.

The evolving role of academic libraries boils down to designing, coordinating, and regulating the blockchain ILS to ensure its optimal functionality and architecture. In their highlighted role, libraries will be directed to address the potential pitfall of consensus mechanisms marked by the 51 percent attack. Thus, they will need to prevent those mechanisms from being abusively operated in ways to mislead or frustrate information retrieval and sharing processes by creating more biases and uncertainty.

105. Id. at xi.
106. Joudbrey & Taylor, supra note 96, at 152.
A Way Forward

¶58 The normative moments that define the function of ILS have already arrived when it comes to initial interaction with technological advances.108 The demands of the times call for academic libraries to embrace cutting-edge technologies that make patrons and users better off in their information-seeking endeavors.

¶59 The significant overtone of innovative blockchain application may materialize in progressive initiatives to embrace disruptive technologies to proactively accommodate the diverse needs of information seekers in the fast-paced LIS digital ecology. The most fundamental step to renovating the contemporary ILS in the academic setting is to facilitate competitive intelligence in streamlined information retrieval and sharing processes and information management systems.109 A well-ordered, blockchain-integrated ILS will improve information retrieval and sharing processes through autonomous and compelling verification that captures potential cognitive biases and effectively evaluates and disseminates qualifying information. It will lead to enhanced information literacy by increasing the productivity and efficiency of users’ information behavior.

Concluding Thoughts: Exploring a New Frontier for Academic Law Libraries

¶60 The first step in expanding the functional horizon of law libraries to accommodate the fast-evolving LIS environment in the digital era may be to clarify the concept of democratization of information. Next is to make certain that the core values democratization of information manifestly or implicitly represents are treated with paramount gravity and respect in our cultural understanding of library information systems. The democratization of information is not an elusive goal and should not be construed as existing in a vacuum. The normative significance of information democratization can be elicited, and its conceptual clarity can be secured, to an appreciable degree in that it defines freedom of information by shaping the normative landscape where freedom of information can remain firmly entrenched and guaranteed in the course of human information-seeking behavior. Nonetheless, the emerging post-truth challenge has threatened to put the democratization of information at risk. The insidious and wide-ranging post-truth effects implicate cognitive biases as a significant impediment to democratization of information. While cognitive bias, in and of itself, is not amenable to easy analysis or discussion, by all accounts its far-reaching importance in the LIS context, particularly in the profession of academic law librarianship, seems evident. With this recognition, this article offers the trenchant practical suggestion for prospective initiatives to rectify the growing peril of cognitive bias and resuscitate a genuine degree of democratization of information. In essence, law libraries are called

108. Baker, supra note 44, at 19, ¶ 50 (stressing the necessity of considering “the notion of premature disruption, whereby technologies replace human workers before the technology is truly ready to perform at the level of the replaced humans”).
on to move forward seeking vigorous recourse to behavioral and structural remedies as
effective corrective measures to gratify the demands of the digital times.

¶61 Law libraries need to reshape their role as information activists in their endeavors to afford prompt, adequate, and effective protection to information-seeking users from a surge of misinformation/disinformation threats and cognitive bias attenuating information analysis and logical reasoning ability. Thus, law librarians need to engage in in-depth critical thinking and make multidimensional value judgments on the validity, objectivity, authenticity, and accuracy of information. A new call for behavioral reform as such should not be interpreted as requiring librarians either to promote or facilitate rigorous censorship over information, for instance by withholding or restricting certain unfavorable or undesirable information, or to derogate from core values of neutrality and impartiality in their role. Instead, librarians must proactively unveil the disguised color of information and thereby properly guide users not to take at face value information before them.

¶62 On another note, it is imperative that law libraries take progressive actions to structurally revamp ILS platforms with a view to optimizing information retrieval and sharing processes. Blockchain technology mediates systemic evolution based on its unique decentralized consensus mechanisms. In essence, this mechanism is driven by voluntary verification of information in place by each party in the network. The procedural transparency and validity of consensus mechanisms are warranted by autonomous and continued proof-of-work processes, which lead to enhanced information accuracy, objectivity, and credibility as disqualified information is timely screened out after being carefully vetted. While the blockchain-platform ILS is as highly innovative as an algorithm-driven system and is vested with autonomous regulatory authority, its functional integrity does not always remain intact and secured. The unilateral arbitrary maneuver of the decision-making process of taking control of a majority of verifying parties would remain a potential challenge unless there is assurance that the operation of the ILS platform goes duly under the surveillance and oversight of libraries. This fact creates an intuitive implication that the blockchain application for ameliorated ILS calls for the evolving role of libraries as system designers, coordinators, and managers.