Institute-wide Task Force on the Future of Libraries

Preliminary Report

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Massachusetts Institute of Technology

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INTRODUCTION

In October 2015, MIT Provost Martin A. Schmidt asked Chris Bourg, Director of Libraries, to convene and lead an Ad Hoc Task Force on the Future of Libraries. The Task Force was charged with seeking broad input from the MIT community and from domain experts on how the MIT Libraries ought to evolve to best advance the creation, dissemination, and preservation of knowledge, and to serve as a leader in the reinvention of research libraries (Appendix 1).

Our Task Force, 30 members strong, included faculty, graduate and undergraduate students, and staff (Appendix 2). We ranged from scholars who rarely enter the physical libraries but rely on library access to journal literature daily to faculty whose research and teaching is centered in print materials. We were united in our belief that access to information is essential to research and teaching, and that the role of the Libraries in providing that access must continue to evolve in support of the Institute's mission of advancing knowledge, educating students, and serving the world.

As MIT embarks on a Campaign for a Better World, we are reminded of the importance of ensuring that the fruits of research and teaching—at MIT and beyond—are radically more available to all those who might benefit from and contribute to them. A world in which anyone might consume and create new ideas, knowledge, and understandings is one that will lead us to solutions to the world's great challenges.

For the MIT Libraries, the better world we seek is one in which there is abundant, equitable, meaningful access to knowledge and to the products of the full life cycle of research. Enduring global access to knowledge requires sustainable models for ensuring that past and present knowledge is available long into the future. Moreover, access to knowledge must be fluid, interactive, contextualized, participatory, programmable, and comprehensive in order to fully enable citizens and scholars to integrate across disciplines, timescales, geographies, languages, and cultures. The Task Force asserts that the MIT Libraries should be leaders in developing those models, and in advancing more radically open systems for the discovery, use, and stewardship of information and knowledge.

In this report, we describe a bold new vision for the library as an open global platform rooted in our shared values and mission; supported by innovative approaches to community and relationships, discovery and use, and stewardship and sustainability; and informed and enabled by an expanded emphasis on research and development.

A VISION FOR MIT LIBRARIES

We are on the cusp of a fundamental transformation of research libraries. Digital access has already changed the face of research, making it more efficient for individual library users. Today, instead of going to the library building to find and read books and journal articles, students and faculty access, organize, and read scholarly content on their own devices. However, more must be done to bring about the promise of a truly open and interactive digital library of knowledge. We believe that this transformation—from libraries where knowledge is accessed individually through analog and digital means into ones where creation and access to knowledge are dynamically networked—will affect all aspects of the research library. Furthermore, this will occur on such a foundational level that many of the Task Force's recommendations center around answering questions about the future of the research library and on developing the research tools and models for libraries of the future.

The Task Force organized itself into three working groups (Appendix 2) to address different, but related, sets of issues:

- Community and Relationships

- Discovery and Use

- Stewardship and Sustainability

The themes explored by each of the working groups, as well as a key fourth one—Research and Development—discovered in the course of our work, became pillars that rest on a strong foundation of shared values and mission. The figure below illustrates the vision we offer for the future, using MIT's iconic Great Dome, open to the world, to symbolize the global platform we will build.
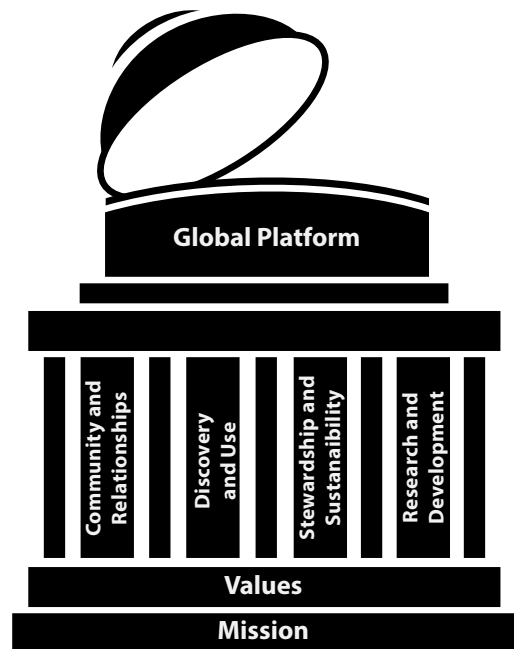
The vision and strategic recommendations that follow represent our collective proposal for a research library that reflects and leverages the unique strengths, expertise, and values of MIT, while also providing a model for more open, connected, and innovative research libraries worldwide.

The overarching theme of the Task Force's vision is that the MIT Libraries must become a global library for a global university. We conceive of the library as an open platform serving the needs of our communities. The library we imagine is built on the foundation of MIT's mission and values and those of the library profession as a whole, which emphasize the importance of the advancement of knowledge, the right of privacy in accessing information, openness, service, innovation, and support for diversity in all aspects of our work. As we work to build a library of the future, we must reimagine and reinvigorate core library functions, consider how best to use library spaces, and ensure that our new library serves the needs of all our communities.

The MIT Libraries must operate as an open, trusted, durable, interdisciplinary, interoperable content platform that provides a foundation for the entire life cycle of information for collaborative global research and education. Our vision emphasizes the need for the Libraries to embrace:

- an expansive definition of the communities they serve and the relationships and partnerships they encompass,

- a commitment to radically enhancing the discovery, access, and use of information,

- a responsibility for leadership in the long-term stewardship and sustainability of the scholarly record, and

- a new initiative to convene interdisciplinary research and development in information science and scholarly communication.

The Task Force and the community members we heard from (Appendices 3 and 4) envision the library as a networked set of global platforms replete with content, data, metadata, images, audio files, laboratory notebooks, course materials, and more. We imagine a repository of knowledge and data that can be exploited and analyzed by humans, machines, and algorithms. This transformation will accelerate the accumulation and validation of knowledge, and will enable the creation of new knowledge and of solutions to the world's great challenges. Libraries will no longer be geared primarily to direct readers but instead to content contributors, community curators, text-mining programs, machine-learning algorithms, and visualization tools. The MIT Libraries should operate as an open digital platform, available for all manner of research and development projects emanating from within and beyond MIT. While we recognize that many relevant applications and programs already exist, our platform must be flexible enough to permit those future uses of our data that we cannot yet imagine. The Task Force expects the MIT Libraries to act as both application developer and as a supporting hub for developers across the globe.

When the library operates as an open global platform, scholars can easily elect to share any part of their research process—selectively with colleagues and collaborators, or widely with the world. The open platform we envision would allow sharing of the full range of objects and outputs associated with the process of research (e.g., formal publications, data, methodologies and protocols, software that encapsulates methods and analysis, and even results of "failed" experiments). Such sharing would benefit global scholarship, accelerate discovery and accumulation of new knowledge, and provide unprecedented worldwide access to research.

We imagine a system of sharing that enables, for example, researchers working in a lab in Brazil to access not only the published work coming out of MIT but also the complete experimental protocols and results from labs at MIT (perhaps in real time). Many faculty are eager for a system that would encourage a culture of openness, inviting others to reproduce and reinterpret research, improving trust throughout the whole enterprise, and accelerating progress toward the development of revolutionary new materials, new theories, new solutions to grand problems, and new understandings of our world.

Our future library is crowned by the global open platform we will work to build and that will serve MIT's global audience of knowledge creators, seekers, and curators and will allow other libraries and scholars to build new tools atop the work we've produced.

Our choice of the Great Dome, home to Barker Engineering Library, to illustrate the components of our vision for the MIT Libraries is meaningful: it occupies a central place in the history and culture of the Institute, in no small part because it has been the site of some of the most creative and ingenious MIT hacks. In the best spirit of MIT, the Task Force hopes our platform inspires clever, creative, and productive "hacks," in the form of innovative uses, tools, and programs that extend and amplify our work. In his charge to graduates at MIT's 2016 Commencement, MIT President L. Rafael Reif encouraged graduates to "hack the world"; with this report and the vision we articulate, we encourage MIT and the world to "*hack the library*."

COMMUNITY AND RELATIONSHIPS

Recommendation 1: The Task Force asserts that the MIT Libraries must be a global library serving a global university and its audiences. The MIT Libraries should conceive of the communities they serve as concentric circles, from the closely affiliated circle of current students, faculty, and staff to increasingly larger circles of cooperating scholars, MIT alumni, participants in MITx classes, the local Cambridge and Boston community, and the broader global community of scholars.

In the course of our work (Appendix 3), the Task Force discovered that the MIT Libraries' user base has grown significantly, not just in numbers but in geographic reach. The Libraries provide critical services not only to MIT students, staff, and faculty but to scholars with whom we collaborate, MIT alumni, students in our online courses, the Cambridge and Boston community, and the broader global community of citizens and scholars. Moreover, MIT students, staff, and faculty increasingly spend significant time engaged in research and educational activities away from campus. We began rethinking the mission and function of the Libraries around the idea of a global audience, including not only current users but future ones as well: a library that serves not only today's students but the 10-year-old girl in Nigeria who is exploring her interest in robotics.

In thinking about concentric circles of users, we should seek to ensure that access to our resources extends as far to the outer edges as possible so that the experiences of users in the outer circles are as similar to those in the inner circles as possible. We will likely need to restructure agreements that give us access to digital resources by negotiating with content providers who are willing to consider access models based, for example, on simultaneous usage (seats) rather than total possible users (population). The Task Force encourages the Libraries to explore pilot agreements with willing publishers, including our own MIT Press.

More importantly, it will require the library staff to align their work toward serving a global audience, not just the individuals they encounter in person. This shift is critical at a time when library usage is becoming more virtual and when the challenges MIT engages with are global in scale. A library focused on serving a global community benefits MIT's local communities in many ways. Faculty will be able to share articles, data, and other resources with collaborators throughout the world more easily. Students will benefit from a more inclusive learning environment that allows them to more easily access relevant and interesting readings, data, and other materials from across the globe. Alumni will find it easier to keep abreast with MIT research.

The library we envision is more than a building or a set of resources. It is an open platform for global research and learning. While the Task Force believes that MIT must be a leader in building tools for a new global library, we also realize the power of distributed effort. In building a library that can serve users around the globe, we recommend that the MIT Libraries build platforms that can be used by MIT faculty and students— and by innovators anywhere—to build novel research tools and discovery methods. A key priority for the "library as a platform" will be to make open standardized metadata for library collections accessible via public application programming interfaces (APIs). We recommend that the MIT Libraries play two roles: (1) as a core developer of new tools for computer-assisted research methods and novel forms of information discovery, and (2) as a key support for and convener of developers around the world who are working on new ways to interrogate scholarly resources, discover resources in our collections and elsewhere, and help scholars linked by common interests discover one another.

While we believe the twin ideas of a "global library for a global university" and "library as a platform" outline an ambitious and exciting future for the MIT Libraries, the Task Force believes that the Libraries' core values and functions remain as important as they ever were. The Libraries must continue their exemplary service to local communities of learners, scholars, and information seekers both on and off campus. While MIT Libraries build—and enable others to build—new tools for scholarship and discovery, we must maintain welcoming and inclusive spaces for discovery and scholarship within our physical footprint. The MIT Libraries must operate as a global digital platform while also operating as a space—virtual and physical—where

communities of students, scholars, local citizens, and global learners can gather to interact with one another and with scholarly objects and tools.

In our conversations with the MIT community, the Task Force heard significant excitement about, and some impatience for, the kinds of bold new directions, models, and services the MIT Libraries ought to pursue. We also heard considerable appreciation of and continued need for the Libraries' core functions and values. Faculty, staff, students, and alumni all spoke of the importance of the library as a physical space, and of librarians as partners in the academic life of the institute.

The Libraries and their staff occupy an essential role in the intellectual and community life of the Institute, perhaps especially for students. The Libraries are a place of research and learning, and the library staff are subject-matter and methodological experts who are committed to supporting student success. One important characteristic of library staff that distinguishes them from faculty is the lack of any authoritative or evaluative role over students. This makes the Libraries places where students might be especially free and comfortable asking questions, seeking help, experimenting with nascent ideas and thoughts, and making mistakes. In addition, the Libraries and library staff might be especially well positioned to partner with groups at MIT that seek to promote and support student and community wellness (e.g., the MindHandHeart Initiative). The Libraries' staff serve as partners with whom our community can engage in judgment-free inquiry and exchange, and the Task Force urges the Institute and the Libraries to strengthen and promote that aspect of the Libraries' role on campus and in student life.

Certain of the MIT Libraries' core values are even more important as they embrace a more expansive role. A commitment to privacy and integrity of information is critical as the MIT Libraries expand their reach to potential users in societies with varying degrees of openness. The MIT Libraries' work and leadership in areas of inclusion, diversity, equity, social justice, and openness are even more essential as their audience becomes more global. The Task Force recommends that the Libraries recommit to leveraging their spaces, collections, policies, services, tools, resources, and internal culture and practices to promote these core values in ways that support and amplify them across MIT.

Recommendation 2: *The Task Force recommends that the Institute create a new planning group to make specific recommendations regarding the redesign of the MIT Libraries' physical spaces, reflecting the vision and themes of this report.*

Many of the Libraries' physical spaces are ripe for renovation and redesign. Hayden Library in Building 14, for example, has significant renovation needs and ranks high on the Accelerated Capital Renewal initiative priority list. With the new vision for the Libraries outlined in this report, it is time to renew planning and fundraising for library space renovations and redesigns.

Library spaces serve a unique and valued function across campus, providing physical spaces for a full range of activities, including quiet contemplative study, noisy collaborative work, departmental and community events, and informal, unplanned conversations with colleagues. Further, conversations across the community suggested an emerging role for library spaces to support new modes of instruction and collaboration.

The process of developing new ideas and recommendations for library spaces must be inclusive and transparent. Because most of MIT's libraries are located in buildings that also house other departments, labs, or centers, it is especially important that library renovation planning be done in close collaboration with neighboring units and co-occupants. A library space planning group led by and composed of faculty, students, and staff ensures that redesigned library spaces reflect the intent of this Task Force and the needs and desires of the scholarly communities we serve.

The Task Force also recommends that the new library space planning group take advantage of the considerable expertise of the MIT community. We can imagine, for example, the redesign of Hayden Library as a case study in an architectural design course or the optimization of library spaces as the focus of a student hackathon. The library space planning group will work closely with and under the guidance of the MIT Building Committee, the Office of Campus Planning, the Associate Provost responsible for space, and the Department of Facilities.

Guided by the following principles, we aim for a library redesign planning process that excites and inspires the MIT community around new, experimental ways of thinking about library spaces while also meeting enduring needs and functions:

- Reflecting and embodying the Institute's values, the MIT Libraries should remain as open as possible to the public, and should be inclusive, welcoming, and safe.

- In recognition of the Libraries' role as public spaces that serve as "extensions of home, work, and recreational spaces" for community members (especially students), the MIT Libraries' spaces should support a full range of scholarly and community functions.

Recommendation 3: *In supporting the research and teaching mission of MIT, the Libraries will provide educational opportunities to equip MIT community members with essential skills and habits for critically and effectively using information. It also will teach them the skills required to responsibly generate new knowledge and to create the platforms, systems, and networks to disseminate it, guided by the values held dear by MIT and by the library profession.*

Faculty and students alike noted that increased access to information brings with it the need for new skills for evaluating, producing, and using information and scholarly resources responsibly. As trusted institutions associated with and committed to the values of democracy, diversity, inclusion, intellectual freedom, and social responsibility, libraries are well suited to help advance the social goals of their communities and parent institutions. Libraries are places where community members can encounter and explore credible sources representing a full range of topics, ideas, viewpoints, and voices. The Task Force recognizes the important role the Libraries play in exposing MIT students to the full range of human experience. The Libraries' spaces, educational offerings, and other services should not only reflect MIT's values but should also inspire and equip community members to promote them through their work, research, teaching, and learning.

As experts who are deeply embedded in the social, commercial, legal/regulatory, and ethical ecosystems through which knowledge is produced, disseminated, and validated, librarians have an important role to play in teaching the skills needed to navigate, contribute to, and influence the evolving information landscape. MIT students are more than just information consumers—they are individual creators of knowledge who need to understand patents, standards, copyright, trademarks, regulations, and all the rules of engagement in the global landscape where commerce, academia, and research take place. In addition to creating new knowledge, students are also actively developing applications, algorithms, platforms, and tools that enable the dissemination, sharing, and consumption of information by others. It is essential that MIT students critically understand the impact and social consequences of technical choices and design decisions. Faculty and library staff must collaboratively incorporate into the curriculum teaching modules that address global information access in a digitally networked landscape.

The Libraries' instructional program should have a worldwide reach, building on the success of MIT OpenCourseWare and MITx. In designing and delivering learning opportunities, the Libraries should also collaborate broadly in order to incorporate educational materials from around the world. The Task Force imagines library-run educational opportunities might include course-based instruction, drop-in workshops, Independent Activities Period courses, online courses and modules, and more. In today's rapidly evolving

and expanding information environment, the Libraries can make a unique contribution by providing instruction in topics such as privacy, copyright, digital publishing, open access publishing, and data management. Students with this kind of critical knowledge will be better problem solvers and, as a key benefit of this recommendation, will increase those capacities in our communities.

DISCOVERY AND USE

Recommendation 4: In support of the MIT mission and values of openness and service, the MIT Libraries should be a trusted vehicle for disseminating MIT research to the world.

While the Libraries are a trusted resource for sharing MIT research to the world, they must expand their efforts, to more comprehensively collect, innovatively describe, and openly disseminate information about MIT scholars and scholarship. A consistent theme in our discussions was the challenge faced by scholars to stay abreast of research in their fields and related topics. Many MIT faculty noted particular frustration at the lack of tools or systems for keeping up with the research activities of other scholars, at MIT and elsewhere. The Task Force recommends that the Libraries work with departments, labs, and centers on campus to explore the development of a central, comprehensive, well-maintained index of MIT's scholarly output.

While the web systems and services used to discover MIT's research will continue to evolve, the Task Force determined that the Libraries must take responsibility for openly providing rich, comprehensive, well-described, and well-structured data that will populate an ever-evolving scholarly ecosystem. In some cases these resources may enable local reuse, facilitate the discovery of potential collaborators for MIT researchers, or automate the assembly of sets of resources to be shared selectively on MIT domains. Shared, structured data might also fuel knowledge discovery systems outside of MIT. All audiences would benefit from an information resource that provides a more complete catalog of research and teaching activities at MIT, fosters discovery of potential collaborators, provides consistent and frequently updated information on faculty output, removes barriers to efficient information discovery, and showcases MIT's impact in addressing the world's great challenges.

There is also a clear need to continue to comprehensively collect and make openly available the resources described and linked to from such an index, and to make those resources available in formats that support the broadest range of methodologies for scholarly inquiry. In some disciplines, data and other materials are already being made openly available in trusted disciplinary or government repositories, for example. Priorities for collecting and preserving MIT content locally must be set based on ongoing analyses of disciplinary practices, policies, and existing repository infrastructures. In some cases, ensuring interoperability and automated data sharing and content harvesting between MIT's platform and existing, trusted disciplinary platforms will be more productive than duplicate deposit and/or collection efforts.

The Task Force recognizes the importance of having a repository of information about MIT's research efforts, with carefully curated links to its resources, authors, contributing organizations, and topical areas. However, the ultimate goal of this system is an information hub that is networked among similar systems within the academy, thus facilitating interconnection with the broader scholarly network.

Recommendation 5: The MIT Libraries will provide comprehensive digital access to content in our collections and/or content needed by MIT's global community by expanding our capacity to acquire and make available born-digital content, and by embarking on an ambitious project to digitize much of our analog collections.

The promise of comprehensively accessible digital collections within a network of interconnected information resources is not simply a collecting and engineering challenge. While the MIT Libraries' current collecting strategy is a predominantly digital one, with nearly 90% of the collections budget dedicated to

online journals and ebooks, the overwhelming majority of the resources in the MIT Libraries and Institute Archives & Special Collections are still only available to our community as physical resources, not electronic ones. For example, only 38% of MIT theses are available in digital format; the majority of scholarly journal titles, technical reports, and working papers in our collections are not yet available electronically; and only an estimated 8% of the 1.3 million monograph/book titles in our collections are available for reading online. In the Institute Archives and Special Collections, less than 1% of our collection of manuscripts, faculty archives, rare books, and other items are available in accessible digital formats.

The troubling reality is that content available in physical form only, in our current environment of online discovery and access, will largely fade from the global knowledge base that the web has become and from the scholarly conversation that it supports. Such a large gap in the scholarly record is so detrimental to current and future research that we recommend investing in a large-scale digitization program to surface these treasures. Such an effort, when completed, will facilitate the provision of quality digital surrogates for scholars who require them. It also will allow us to showcase the MIT community's impact on addressing the world's great challenges and its contribution to the advancement of knowledge through the open digital dissemination of research materials.

In its efforts to provide digital access to the fullest possible range of resources, the Libraries should seek to provide access to MIT content in formats suitable both for direct human consumption and machine interrogation, and in a manner that recognizes and begins to address the reality of digital inequity for much of our global community. The Task Force recognizes that there are real challenges for our researchers in accessing much of the scholarly record, primarily due to paywalls, lack of digital surrogates, constraints on acquiring and making available born-digital content, and a discovery environment consisting of information silos that often have idiosyncratic and frustrating user interfaces. However, we possess a privilege that much of the global community does not: ubiquitous, high-speed internet access and the tools to leverage it. In order to make our MIT-created content (including content published by the MIT Press) openly and comprehensively available, we must first recognize that the content we make openly available in digital form (such as the MIT Open Access Articles collection) may still not be discoverable or readable in parts of the world where internet access is not reliable, is too expensive for large file consumption, or where the formats we produce are incompatible with the devices readily available. If we are to be a global library for a global community, it is imperative that we recognize the challenges that much of that world faces in gaining access to the fruits of our research. Radically more open mutual exchanges of knowledge and ideas among those who currently have limited access might lead to the most innovative solutions to some of our most pressing global challenges, but our aims here should not be paternalistic. Instead, we should recognize that a commitment to knowledge creation and problem solving requires us to make our work accessible and to provide the tools that will support communication and collaboration within and beyond the MIT community, broadly defined. Our community clearly benefits from the global networks it has cultivated. The Task Force realizes that a diverse set of perspectives is required to support MIT's global mission for research and education and it sees a central role for the MIT Libraries in facilitating this wider conversation.

By saying that our digital collections should be "comprehensively accessible," we mean that they should support a variety of uses as well as diverse reading and learning styles. This means, for example, that digital content should be accessible on a variety of digital devices and should be printable. It also means that our digital collections should be made available in ways that facilitate new and emerging methods of direct digital inquiry, such as text and data mining, that facilitate knowledge extraction, document clustering, topic bursting, and machine learning at scales impossible with traditional linear, human consumption. Similarly, our non-textual resources, such as maps, photographs, audio and visual materials, data, and metadata, must be electronically accessible and support a broader range of digital use.

Our vision is one in which all content is available in universally accessible digital formats, even while some content is also available in appropriate and meaningful analog formats. The Task Force recommends that the MIT Libraries conduct a detailed time and budget analysis of the large-scale digitization program

proposed here. In consultation with the MIT community and with libraries and library consortia around the world, the MIT Libraries should develop a prioritized list of digitization projects based on community needs, uniqueness of the materials, potential global impact, and other appropriate criteria. Urgent consideration must be given to the degree of preservation risk in the physical materials, as digitization can be an effective strategy for capturing and preserving content from physical media at risk of decay and loss.

Recommendation 6: *Through interdisciplinary institutional and external partnerships, the Libraries should generate open, interoperable content platforms that explore new ways of producing, using, sharing, and preserving knowledge and that promote revolutionary new methodologies for the discovery and organization of information, people, ideas, and networks.*

The Task Force's recommendations for comprehensive, accessible, digital content that facilitates reuse across any number of envisioned use cases, and that facilitates interoperability with other available resources on the web, acknowledges that the promise of an open digital library of knowledge has yet to be sufficiently realized. Current discovery portals are cumbersome to use; opaque in their holdings, structure, and search algorithms; and limited in their functionality. The Task Force conceives of a bold redesign that will allow the Libraries to operate as an open, trusted, durable, interdisciplinary, interoperable content platform that provides a foundation for the entire life cycle of information for collaborative global research and education. Such a platform will help realize the opportunity for the web to be a transformative tool for the discovery and organization of information, people, ideas, and networks. Through partnerships, experiments, and collaboration, MIT and the Libraries should lead in the development and deployment of tools, systems, and services that will support emerging methods of scholarly inquiry that leverage the knowledge, creativity, and connections of the MIT community to build new capabilities. Those tools, systems, and services should support the ability to discover, combine, manipulate, visualize, and create new knowledge; share results with the global community; and ensure that these new knowledge artifacts will persist long into the future.

Recent exemplars of the broader notion of discovery we seek to emulate are services like Netflix, Last.fm, and Spotify. These services offer the ability to discover content of interest by mining and analyzing their content across a number of parameters, analyzing the playlists and consumption patterns of an individual user, matching those patterns across the network of all users, and algorithmically recommending new content of potential interest. In general, the more information that can be derived from the system's users, the better trained the algorithms can become.

While the notion of "tracking" any individual's consumption patterns for research and educational materials is anathema to the core values of libraries, and while privacy is an important value in MIT culture, the opportunity to leverage emerging technologies and new methodologies for discovery should not be discounted. There may well be opportunities to facilitate this much broader notion of data-driven discovery in ways that maintain the requestor's anonymity and that would remain optional to use. We also imagine opportunities for more immersive discovery environments, along the lines of Muriel Cooper's prescient Information Landscapes concept.

Another emerging use case for discovery is the use of text- and data-mining applications to interrogate corpora of resources directly. Through these applications, users are able to discover new patterns that exist across the literature, perform their own ranking of relevance against particular parameters, and find new pathways for discovery more efficiently than could be enabled through existing information portals. The resources of many content aggregators can now be accessed in this way (generally through APIs) but many impediments to frictionless use persist.

The Task Force recognizes the potential for these types of non-consumptive uses and recommends that the MIT Libraries work with content owners/aggregators to free their content from these gated systems so that new methods of knowledge discovery can be invented, restricted only by the speed of our community's creativity. The Task Force envisions the creation of a robust platform that would allow for

the local aggregation of collections of resources for direct use. Moreover, the platform envisioned should support a repository of tools acquired or built directly by our community to leverage reuse by others. The platform should also support a broader range of users than just those with programming skills—essentially democratizing access to advanced computational methodologies for knowledge discovery.

While many of the challenges to discovery and use addressed by the Task Force and the forums were based on textual resources, similar deficiencies were noted for other resource types, such as images, audio, video, 3D models, and complex research data. Repository solutions offered by the Libraries currently act as a persistent digital shelf. While these collecting and access functions are critical, they do not support the advanced and emerging methods of scholarly use that our researchers need, and that libraries want to and should support. In some cases, working with non-textual media is made even more challenging by complicated copyright and reuse issues. As an illustration, libraries have been unable to deploy effective platforms to support the way many scholars want to work with digital image collections. Scholars want the ability to create unique sets of images for their own research and teaching, enhance or otherwise manipulate those images, annotate them locally or share them with colleagues performing similar research elsewhere, and link them to other resources held locally or as part of a broader scholarly network. Effective platforms for working with images in this way are not yet available. Similar lacunae exist across all media types.

Another exciting potential benefit of library-maintained and developed open content platforms is improved systems for facilitating scholarly connection and communication, inside and beyond MIT. Many scholars who seek to form cross-disciplinary teams told us how difficult it is to identify colleagues at MIT with particular interests. Current library-provided environments are passive, read-only systems that don't support the social connections, open commenting/annotation, or other forms of open scholarly conversations that many users desire. Some Task Force and community members noted with reluctance the need to use third-party systems that share neither the values nor mission of the academy and that are inherently fragile players in the scholarly ecosystem. Others expressed a desire for MIT and the MIT Libraries especially to work more closely with external players (both nonprofit and for-profit entities) who do share our values and who are doing innovative work to develop platforms and tools that our scholars find useful. The Task Force recognizes that this as an area where research and development, in collaboration with a broad set of stakeholders within MIT, with our scholarly peers, and with other parties, would be required. It also notes that MIT is especially well positioned to provide leadership in this area due to its broad commitment to open scholarship and its interdisciplinary strengths in engineering, computer science, innovation, entrepreneurship, and design.

The Task Force recommends that the MIT Libraries engage in research and development with communities at MIT already deeply invested in building new discovery pathways and working with media in creative ways in order to leverage their existing knowledge, energy, and networks. The Task Force further recommends that these new capabilities be integrated into an open, interoperable platform that is designed from the outset with these advanced types of applications in mind. Finally, the Task Force recommends that the Libraries consider the cross-training, community building, research, teaching, and creative hacking opportunities that such a platform could enable. Providing a physical Information Maker Space(s) where MIT community members can learn from one another, share tools and methodologies, hold hackathons to build new capabilities into the platform, and use the platform to create new scholarship is an opportunity worth considering in the spirit of MIT's *mens et manus* culture and emphasis on "learning by doing."

Recommendation 7: *The Task Force recommends that the Institute convene a new Ad Hoc Task Force on Open Access to review the current MIT Faculty Open Access Policy and its implementation with an eye toward revising and expanding current policies and practices, where appropriate, to further the Institute's mission of disseminating the fruits of its research and scholarship as widely as possible.*

Both within the Task Force and in the open forums we conducted, community members expressed strong support for the Libraries' efforts to implement the MIT Faculty Open Access Policy. Many hope that these efforts continue and, possibly, expand to include non-faculty authors at MIT. Many also hope that the

Libraries will continue to press scholarly publishers and societies to support, if not embrace, open access to research, to continue to push for equitable relationships within the scholarly ecosystem, and to aggressively pursue new avenues for open scholarly publishing.

At the same time, some members of the Task Force raised important questions about the compatibility of some open access models with publishing in fields where strong intellectual property protections apply or where core journals in a discipline have not embraced open access models for publishing. Others expressed a need for assistance with the mechanics of publishing and disseminating finished works and the raw materials that precede them, and to ensure that the process does not unduly burden researchers.

The Task Force recommends that the Libraries continue to collect comprehensively peer-reviewed research articles, conference proceedings, and other scholarly output under the MIT Faculty Open Access Policy. To date, the MIT Libraries have collected and openly disseminated 44% of the faculty's peer-reviewed scholarly articles published since the policy was adopted in 2009. Contributions made to the collection include a mix of author-deposited articles, direct publisher deposits, and content harvested from the MIT domain and other open environments. Readers around the world have downloaded articles from the MIT Open Access Articles collection in DSpace@MIT more than six million times. Among academic research libraries, both the percentage of contributed articles and their usage represent high-water marks, and the Libraries are often consulted to aid other institutions in implementing their open access policies and workflows. In recent years, increasing numbers of universities have adopted open access policies, and many government and private funding agencies are requiring that data and publications related to funded research be made openly available. Most publishers of scholarly literature have converted at least some of their publications to open access models. MIT should remain a leader in this movement, for its own good, and for the good of the world.

Although the Open Access Policy and its implementation by the MIT Libraries are widely seen as a successful model for openly disseminating scholarly research, the fact remains that most of MIT's scholarship remains unavailable for open dissemination. Most faculty research is not yet available in our Open Access collection, including 56% of recent faculty journal articles, a much higher percentage of journal articles published prior to 2009, the overwhelmingly majority of MIT-authored monographs, and much more. Moreover, the considerable scholarship produced by MIT's research scientists, postdoctoral scholars, staff, students, and other affiliated scholars is not covered by the current policy and is therefore generally not available for open dissemination. The gap in coverage not only represents a loss in access for MIT's global community of stakeholders, it also ensures that MIT's full contribution to the scholarly record cannot be comprehensively assessed or computationally analyzed. The Task Force recommends that the Institute assemble a Task Force on Open Access to assess the program and make recommendations to further the Institute's mission.

STEWARDSHIP AND SUSTAINABILITY

Recommendation 8: Through its archival programs and practices, the MIT Libraries will serve as a durable, trusted repository for research objects produced at MIT and the metadata associated with MIT scholars and scholarship, as a continuation of their mission to serve as the "Institute's memory" and record of research and learning.

The role the Libraries play in facilitating the discovery and use of information is closely related to and dependent on their responsibility for the long-term stewardship of resources and for ensuring the sustainability of the technical, social, and economic models supporting the discovery, use, and preservation of knowledge. The stewardship responsibility is an especially important and urgent one. While much of MIT's recently published peer-reviewed research has been collected and made openly available through the Libraries implementation of the MIT Faculty Open Access Policy, a great deal of MIT's research remains outside of the Libraries' current efforts of systematic collection, stewardship, and open dissemination. Collecting and archiving the official history of the Institute, as well as the artifacts of the people associated

with creating that history, are even more important and challenging now that official records and faculty archives consist of both print and digital media.

A tremendous amount of the content produced here, from scholarly publications to records and reports of the Institute, is directly published to the web—on MIT websites and/or in external subject-based repositories. Unfortunately, much of this content has already fallen inaccessible due to link rot. When this occurs, valuable research that was once openly available is lost. Third-party repositories are not always an adequate solution. Increasingly, third-party systems and services are being consolidated in the hands of a few large commercial actors. For example, Elsevier, already the largest journal publisher in the world, recently acquired Mendeley, SSRN, and Hivebench. John Wiley & Sons, Inc., a large global provider of research, educational, and professional content and products recently purchased Atypon, one of two leading providers of journal publishing software/platforms used by a large number of academic publishers. In 2015, EBSCO purchased YBP, and ProQuest acquired Ex Libris. Increased market control by a few large companies has introduced concerns about the openness, flexibility, and sustainability of external archiving solutions.

The MIT Libraries and Institute Archives serve as MIT's memory and, as such, the Task Force recommends that they lead an effort to organize, provide access to, and expose relevant metadata about MIT-based technical papers, working papers, research notes, and other public but underserved distributions, and in so doing develop models that might be useful to other institutions and the larger community.

Recommendation 9: *The MIT Libraries should continue to actively engage with and, in many cases, provide leadership to collaborative global efforts to develop viable models and systems for the long-term stewardship and preservation of digital research.*

A major problem in scholarly communication is the relatively limited ability to meaningfully and usefully access research information, data, models, and software many years after their creation. As formats, media, operating systems, and intermediary software packages evolve, much of the research output of the past continues to "go dark," and can no longer be compared to new results or incorporated in new studies. Research that was intended to be replicable ceases to be so. Examples include models that can no longer be run on modern computers because they use outdated and obsolete versions of computer languages; data and equations that can no longer be rendered because they rely on font specifications that are no longer available or are inadequately identified; and images that can no longer be viewed because they are encoded in currently unsupported formats.

As stewards of MIT's scholarship, we need to ensure that our resources are preserved and maintained in formats so that they may always be accessed, studied, and referred to as desired, but without undue burden on MIT researchers. In some fields, the preservation need is already adequately met through disciplinary initiatives, such as the National Institutes of Health Open Access initiative. However, across the disciplines and range of material produced by MIT scholars, coverage is uneven, formats can be uneven and inflexible, versioning may be nonexistent, and migration of old material to new formats may not happen reliably. For example, while journals and open access sites may be excellent at archiving and providing access to research articles, they are less effective with websites and data associated with that research, which may be fundamental to future studies. Moreover, few of these sites have verified, durable, long-term preservation plans or infrastructures.

Sustainable digital preservation is an important problem shared by the entire scholarly community, and MIT should continue to build partnerships and provide leadership to help solve the inherent technical, social, and economic issues in this area. Digital stewardship is a collaborative, inclusive effort that includes creators, users, champions, content managers, and preservers. With this recommendation, the Task Force hopes to highlight, expand, and accelerate the MIT Libraries' leadership in addressing the challenges of digital stewardship. Any sustainable vision for the future of research libraries must include a commitment to the long-term stewardship of the scholarly record.

RESEARCH AND DEVELOPMENT

Recommendation 10: *The Task Force recommends that MIT establish an Initiative for Research in Information Science and Scholarly Communication, based in the MIT Libraries, to enable bold experimentation and to serve as a hub for best-in-class research on the great challenges in information science and scholarly communication.*

MIT is a place where basic research is applied to solving big problems. Research libraries and scholarly publishers face complex challenges in developing new, sustainable models for producing, using, managing, sharing, preserving, and discovering scholarly information in a digital age. Libraries and publishers across the globe are experimenting with new ways of disseminating scholarship and are increasingly seeking rigorous interdisciplinary research to inform the development and deployment of these new models, services, and tools.

Although research and development was not originally an area of focus for the Task Force, it became clear through the course of our work that progress toward our vision of the Libraries as an open global platform requires significant investment in research, development, and experimentation.

An Initiative for Research in Information Science and Scholarly Communication would accelerate progress on a number of key issues of importance to scholars and practitioners at MIT and around the world. The landscape of information science, information policy, and information management is rapidly evolving, with much excellent work coming out of library and information science programs and research centers here and abroad. Establishing a center at MIT focused on research and development in information science and scholarly communication would build on the global trend in expanding library and library science research to include information science and scholarly communication. It would also allow faculty, students, and researchers across MIT to engage more systematically with existing efforts to bring research to bear on the key challenges in this space. This initiative will require adequate funding, and the Task Force recommends a combination of core sustaining Institute support and aggressive fundraising by MIT and the Libraries.

An initiative of this kind would leverage several of MIT's and the Libraries' strengths to achieve significant progress in interdisciplinary applied research and experimentation in information science and scholarly communication. MIT Libraries have a uniquely close relationship with the MIT Press, an existing research program in information science, a donor-funded Digital Sustainability Lab working on solutions to digital content management challenges, and access to scholars and students doing groundbreaking work in relevant fields at MIT.

The MIT Press, an early and effective innovator in digital publishing and open access, falls under the oversight of the Director of MIT Libraries and will be a natural and valuable partner in this initiative. Through the MIT Press and other like-minded publishers, an Initiative for Innovation in Information Science and Scholarly Communication would provide the foundation for MIT to become a leader in experimenting with innovative models of scholarly publishing and research communication. The initiative would also build on and significantly accelerate and amplify the work of the MIT Libraries' existing Program on Information Science.

The problems of global access, long-term preservation, information discovery, and sustainable funding for open scholarly publishing require solutions informed by interdisciplinary thinking from architecture, arts, business, engineering, humanities, planning, science, and social sciences. The Task Force imagines research projects that draw on internal and external expertise in, for example, brain and cognitive sciences, media arts and design, computer science, and business modeling. We recommend that this new research initiative be formed in close collaboration and partnership with faculty from across the departments, labs, and centers at MIT. Some particularly compelling possibilities for such an initiative might be the establishment of joint/shared appointments for faculty with relevant research interests and funded research opportunities for

graduate and undergraduate students. The success of a new research initiative such as this will depend on close collaborations and partnerships with MIT faculty.

One possible model for an Initiative for Research in Information Science and Scholarly Communication at MIT is the Berkman Klein Center for Internet and Society at Harvard University, an interdisciplinary research center that supports international cohorts of research fellows who conduct original interdisciplinary research, build tools and platforms, and develop active global networks to advance solutions. We expect this new research center will support MIT scholars (faculty, research scientists, staff, postdoctoral fellows, graduate students, and undergraduate students), and attracts external expert from across the globe.

Examples of research and development projects that an Initiative for Research in Information Science and Scholarly Communication might explore include:

- Establishing technical, business, and economic models for publishing interactive, multimedia forms of scholarly work, and making them available to the world

- Developing models, techniques, tools, and standards for the secure management, preservation, and use of data of all kinds, sizes, and formats

- Creating methodologies, algorithms, and technologies that enable researchers to browse massive libraries of physical and digital materials in productive and exciting new ways

- Developing a deeper and more complex understanding of the unique learning and research affordances of both tangible and digital media, to improve information discovery, and use so that we might make better-informed decisions about collections building, space usage, and reading and research platforms

- Developing methods to more fully integrate the research and publication processes, perhaps by developing tools for selective sharing and linking of continuously maintained and updated "laboratory notebooks" and associated data within the repository context described earlier in this report

- Piloting and evaluating new ways of configuring physical library spaces to maximize productive research and learning and to enhance community building

- Developing technical, social, and business models for the long-term collaborative preservation of digital objects, including investigating and experimenting with methods of ensuring that aging formats remain accessible

The Task Force suggests that the MIT Libraries might collaborate with interested faculty from other departments, labs, and centers to convene and host a working summit on grand challenges in information science and scholarly communication, bringing together a global community of experts to describe and define the central questions in this space and develop an aggressive research agenda to find answers and drive innovation.

As the MIT Libraries actively develop tools and convene developers, those efforts must be grounded in research and subject to rigorous assessment and evaluation. Experimentation with new products and tools, developed at MIT and elsewhere, should become regular practice within the Libraries, and an expected, welcome, and supported service within the communities we serve. Examples of innovative new products the Libraries might promote and support could include open publishing platforms developed by MIT students, visual and semantic discovery tools launched by technology startups, or suites of content recommendation services developed in global open source communities. While the Libraries clearly must continue to provide reliable core services, the Task Force hopes that the Libraries and the MIT community will embrace a practice of trying and evaluating experimental tools and services—even, maybe especially, those products that may still be in a beta mode.

TENSIONS AND CONCERNS

A number of important and productive tensions became evident in the course of the Task Force's work that will require careful consideration and new research as the future unfolds in order to arrive at an appropriate resolution to each:

- The future of libraries is more complicated and interesting than a simple transition from a predominantly print world to a digital one. The relative merits of physical versus digital collections was a frequent topic of conversation and some disagreement. All of the community members we talked to used and benefitted from online access to digital resources. In Recommendation 5, we urge the MIT Libraries to accelerate these benefits by providing comprehensive digital access to its collections.

- At the same time, it is important to note that many undergraduate students, faculty, and staff expressed the desire to use some materials in physical formats. While undergraduates increasingly expect easy online discovery and access for scholarly materials, many prefer to work with tangible materials for some types of study and research tasks. While MIT should strive to make all resources available digitally, many resources must also be available in physical formats. Pursuing collaborative research and development projects aimed at more fully understanding and maximizing the unique affordances of all manner of analog and digital formats as part of the Initiative for Research in Information Science and Scholarly Communication (Recommendation 10) should be a high priority.

- While there is a sense that improved search and recommendation engines will more precisely target discovery, we were reminded frequently of the nonlinear path of academic discovery, in which serendipity plays a crucial role. Toolmakers should make use of this observation and consider ways to enhance browsing and serendipity in a digital environment.

- Privacy and freedom from tracking are important values for the MIT community, yet we recognize that effective methods of discovery and use, as well as research into discovery and use, will benefit from some level of sharing of use patterns. A combination of safeguards, including anonymization and opt-in/opt-out provisions, should be considered in discussion with appropriate stakeholders.

- Some of the solutions we envision can be implemented by an individual university, while others could be more effective at a consortium or even global level. Likewise, some solutions are best provided by academia or by open source projects, while others might be more appropriate for governments, funding agencies, or for-profit companies to implement. In the past, important developments were pioneered by academia and evolved into commercial products. MIT should consider these different possibilities and develop partnerships and licensing agreements as appropriate.

SUMMARY AND CONCLUSIONS

At their core, libraries have always been about sharing information with their communities, advancing knowledge, and facilitating connection. The means by which researchers and scholars collect, access, and disseminate data, information, and research results will continue to transform rapidly. There are tremendous opportunities to improve the ability of scholars and the public alike to interact with each other and with information through new models of publishing; new mechanisms of collecting, storing, cataloging, and disseminating information; and new modes of discovery and use. MIT must take a leading role in the development of models that are open, equitable, and effective to ensure the most productive environment and tools for education, research, and discovery to tackle the world's most challenging problems. Additionally, the Institute must make certain that MIT research and educational materials are accessible to as wide a public as possible, and that the MIT community, broadly defined, has access to the best tools and resources for education and research.

To arrive at the best possible version of the future that we imagine, there are crucial roles for MIT. As a developer of new standards, tools, and models, the solutions we adopt will serve as models for others. As a convener and supporter of developers and stakeholders around the world, MIT will form partnerships and consortia to catalyze the adoption of the best solutions and approaches for access, integration, and preservation of the products of world research and scholarship. As a research center, the MIT Libraries will study and develop new models and best practices for preservation, access, discovery, publication, and use. As an educational center, the MIT Libraries will collect and license the best tools and content, making them readily available and usable by the MIT community, and will offer training in their use to students, staff, and faculty. The MIT Libraries will serve as an open, authoritative, long-term repository for MIT-created content and its associated metadata.

As described throughout this report, the Task Force's overarching vision is that the MIT Libraries embrace and accelerate their transformation from a local portal to a global platform. This vision of the Libraries as an open global platform will be realized through a set of recommendations reflecting new, expanded, and/or redefined roles for the Libraries and their staff:

- The Libraries must conceive of their community as a global one, embracing openness, diversity, global social justice, and critical thinking in their relationships with those communities, in their spaces, and in their educational programming.

- The Libraries must develop and facilitate the creation of content platforms and tools that encourage the open dissemination of MIT research and that facilitate new methods of discovering and using information.

- The Libraries must be leaders in the long-term stewardship of MIT content and in the development of collaborative models for the long-term stewardship of all parts of the scholarly record.

- The Libraries must become a center for research and development, fueling bold experimentation and new answers to the grand challenges facing research libraries and scholarly communication.

Community and relationships, discovery and use, stewardship and sustainability, and research and development are the pillars that undergird the open global platform we seek to build. The openness of our platform and our commitment to a library that is interactive, responsive, and collaborative are embodied in our call for MIT and the world to hack the library. The success of our vision for the MIT Libraries will be realized through the creative ways in which scholars and global users exploit our resources, tools, services, spaces, and expertise to accelerate science and knowledge in the service of solving the world's greatest challenges.

APPENDIX 1: TASK FORCE CHARGE

In a letter to the MIT community on October 13, 2015, Provost Martin A. Schmidt announced the formation of an Institute-wide task force.

To the members of the MIT community:

I am writing to let you know that I have asked Chris Bourg, the Director of MIT Libraries, to lead an Ad Hoc Task Force on the Future of Libraries, composed of faculty, staff and students from across the Institute. Because the MIT Libraries play a pivotal role in how scholarly information is communicated among faculty, students and researchers, the future of our educational and research programs depends heavily on services that the Libraries provide.

The Task Force is charged with seeking broad input from the MIT community and from domain experts on how the MIT Libraries ought to evolve to best advance the creation, dissemination, and preservation of knowledge—and to serve as a leader in the reinvention of research libraries.

The full charge to the Task Force, along with the list of committee members, can be seen at the Task Force website.

I encourage all members of the MIT community to share any thoughts or suggestions they may have regarding the work of the Task Force via this web site. The site includes an idea bank through which any MIT community member can share thoughts about the role of the Libraries; it also includes other mechanisms for communicating directly with the Task Force members.

I have asked the Task Force to issue a report and set of recommendations by the end of the 2015–16 academic year. Again, I encourage you to take advantage of these opportunities to engage with, and contribute your thoughts to, the Task Force over the course of the year. I very much look forward to working with the Task Force, and to eventually sharing the results of its efforts with the MIT community.

Sincerely,

Martin A. Schmidt

Charge to the Ad Hoc Task Force on the Future of Libraries

The mission of great research libraries has always been to advance research and learning by ensuring immediate and enduring access to the scholarly record and to the tools and expertise necessary to discover, use, and create knowledge. At MIT, our libraries are interdisciplinary spaces, virtual and physical, where students, faculty, and other community members can find the resources, technologies and expertise they need to advance knowledge and to serve the world.

Transformative changes in culture, technology, publishing, research, and pedagogy require equally transformative changes in research libraries; both in response to a changing scholarly landscape and as a catalyst for new ways of producing, using, and preserving knowledge. As MIT takes the lead in helping to reinvent the future of education, so too must we take the lead on reinventing the future of research libraries.

I have asked the Director of Libraries, Chris Bourg, to convene and lead an Ad Hoc Task Force on the Future of Libraries, composed of faculty, staff, and students from across the Institute. The Task Force is charged with seeking broad input from the MIT community and from domain experts, on how the MIT Libraries ought to evolve to best advance the creation, dissemination, and preservation of knowledge; and to serve as a leader in the reinvention of research libraries.

I am asking the Task Force to think broadly about the role of the MIT Libraries at the Institute and in the world, and to work with the Director and her staff to develop a bold new vision for a library system that embodies MIT's emphasis on excellence, innovation, and service.

The Task Force should complete its work during the 2015–2016 Academic Year, with the goal of submitting a report and set of recommendations to me before the end of the Spring Semester.

The Task Force should gather input from key constituents and subject matter experts in considering a wide range of topics related to libraries, information access, and scholarly communication, including:

- The role the MIT Libraries might play in developing innovative tools, platforms, services, and techniques for the acquisition, organization, discovery, use, production, and preservation of digital and analog information

- How the libraries ought to serve the local and global community of scholars in advancing MIT's mission of sharing the Institute's outputs with the world; and in promoting policies, ideas, and initiatives that advance MIT's values

- How the Institute might best leverage library expertise in areas such as information and media literacy, data management, digital preservation, metadata creation and management, digital humanities, geospatial information and analysis, information science, content management, open access publishing, and much more

- The optimal role and design of the physical library spaces at MIT, to include spaces for quiet and collaborative study and research, for teaching and learning with technology, for consulting with library experts, and for encountering and working with tangible collections

- The role of tangible collections, including archival and special collections, in the intellectual life of the Institute; and how the libraries might best be organized, resourced, staffed, and designed to enhance productive uses of tangible collections within the community

- The role of the library in equipping students across disciplines with the skills and habits needed to thrive in and potentially influence a complex and evolving information landscape

- The role of the library as an interdisciplinary gathering space where community members have access to a broad and inclusive range of information, expertise, and perspectives; and where the free and informed exchange of ideas is both encouraged and cultivated; and where the environment inspires new forms of scholarly inquiry and collaboration

- The kinds of collaborations and partnerships—within the Institute, with the global library community, and with external non-profit and commercial players—the Libraries ought to pursue to advance library values and missions and MIT's priorities

- How the Libraries services, expertise and facilities should evolve to aid MIT's competitive advantage in recruiting new faculty and researchers and to enhance the residential experience for its prospective students

This Task Force represents a unique opportunity for the MIT community to consider the ways in which the MIT Libraries might make unique and transformative contributions to defining new models for a modern, innovative research library. As such, I encourage all of us to take advantage of opportunities to engage with the Task Force throughout the year on these issues and other topics related to information, scholarly communication, and the role of research libraries.

APPENDIX 2: TASK FORCE MEMBERS

The Task Force included 30 members of the MIT community, including faculty and researchers from all five schools; graduate and undergraduate students; and staff from the MIT Libraries, the Office of Digital Learning, and Information Systems and Technology.

The Task Force established working groups to organize and frame our discussions and investigations in the following areas:

- **Community and Relationships:** The responsibility for long-term preservation and sustainability of the scholarly record and the structures (tools, systems, policies, infrastructure, and business models) associated with the production and dissemination of scholarship.

- **Discovery and Use:** The people, technology, policies, systems, and tools that promote the discovery and use of scholarly resources.

- **Stewardship and Sustainability:** The role of research libraries as a public good—locally, nationally, and globally—and the relationships of libraries with other players in the scholarly communications system, such as publishers, government agencies, industry, and other libraries, museums, and archives.

There was considerable overlap in the topics considered by each of the groups, which resulted in a set of recommendations that we feel represent multiple perspectives on the challenges we identified.

Task Force Members

Leadership

Chris Bourg (Chair), *Director of Libraries*

Bruce Tidor (Co-chair), *Department of Biological Engineering and Department of Electrical Engineering and Computer Science*

Community and Relationships Working Group

Faculty

Ethan Zuckerman (Chair), *Program in Media Arts and Sciences*

Isaac Chuang, *Department of Electrical Engineering and Computer Science*

Timothy Grove, *Department of Earth, Atmospheric and Planetary Sciences*

Erica James, *Anthropology Program*

Amy Keating, *Department of Biology*

Leigh Royden, *Department of Earth, Atmospheric and Planetary Sciences*

Meejin Yoon, *Department of Architecture*

Staff

Lareese Hall, *Architecture and Art Librarian, MIT Libraries*

Sean Thomas, *Program Manager, Scholarly Repository Services, MIT Libraries*

Students

Erhardt Graeff, *Graduate Student, Program in Media Arts and Sciences*

Jetson Leder-Luis, *Graduate Student, Department of Economics*

Discovery and Use Working Group

Faculty

Chris Bourg (Chair), *Director of Libraries*
Mary Fuller, *Literature Section*
Cesar Hidalgo, *Program in Media Arts and Sciences*
Rafael Jaramillo, *Department of Materials Science and Engineering*
Jeffrey Ravel, *History Section*
Brent Ryan, *Department of Urban Studies and Planning*

Staff

Lareese Hall, *Architecture and Art Librarian, MIT Libraries*
Gita Manaktala, *Editorial Director, MIT Press*
Sean Thomas, *Program Manager, Scholarly Repository Services, MIT Libraries*

Students

Benjamin Tidor, *Undergraduate Student, Department of Electrical Engineering and Computer Science*

Stewardship and Sustainability Working Group

Faculty

Bruce Tidor (Chair), *Department of Biological Engineering and Department of Electrical Engineering and Computer Science*
Adam Albright, *Department of Linguistics and Philosophy*
Tonio Buonassisi, *Department of Mechanical Engineering*
Stephen Graves, *Sloan School of Management*
Stuart Madnick, *Sloan School of Management*
Christine Ortiz, *Dean for Graduate Education, 2010–2016*
Emily Pollock, *Music and Theater Arts Section*

Staff

Oliver Thomas, *Technology Consultant, Information Systems and Technology*
Sean Thomas, *Program Manager, Scholarly Repository Services, MIT Libraries*

Students

Nicholas Hoffman, *Undergraduate Student, Department of Earth, Atmospheric and Planetary Sciences*
Sophie Mori, *Undergraduate Student, Department of Electrical Engineering and Computer Science, and Department of Linguistics and Philosophy*

Staff to the Task Force

Douglas Pfeiffer (Staff), *Assistant Provost for Administration*

APPENDIX 3: TASK FORCE ACTIVITIES

The Task Force began its work in fall 2015 and gathered input through a variety of formal and informal mechanisms, including several open forums designed to elicit ideas from MIT faculty, students, and staff on their visions for the future of research libraries. The Task Force website also included an Idea Bank, where members of the MIT community could submit their ideas about the future of libraries and comment on the ideas of others.

The Task Force's activities included the following:

- Chris Bourg provided an update on the Task Force charge and membership to the Deans' Group on September 29, 2015.

- Five meetings of the full Task Force, on October 9, November 13, February 5, April 1, and May 3. These included presentations by Task Force members: Mary Fuller, on tangible collections; Cesar Hidalgo, on the library as a platform; Stuart Madnick, on data output; and Meejin Yoon, on trends in the architecture and design of libraries.

- Seven meetings among the three Working Groups, on December 2, 16, and 17; April 4, 15, and 26; and May 5.

- Two open forums for MIT faculty and staff, on January 29 and February 9, with a total attendance of approximately 80 participants.

- Three open forums for MIT Libraries staff, on February 8, 18, and 24, with a total attendance of approximately 150 participants.

- Meeting on February 10 with David Adjaye, architect and MIT McDermott Award winner; Ginnie Cooper, retired head of the DC Public Library system; and Jeffrey Schnapp, professor of romance languages and literatures and of comparative literature at Harvard Graduate School of Design, founder and faculty director of metaLAB, faculty director of Harvard's Berkman Center for Internet and Society, and co-author of *Library Beyond the Book*.

- Public panel on February 11, Future of the Library, including panelists Chris Bourg, David Adjaye, Ginnie Cooper, Jeffrey Schnapp, and Nader Tehrani, dean of the Irwin S. Chanin School of Architecture at The Cooper Union of the Advancement of Science and Art and principal of NADAA.

- Two open forums for MIT students, on March 3 and 15, with a total attendance of approximately 15 participants.

- Meeting of the Task Force co-chairs with the Faculty Policy Committee on March 31.

- Meeting of the Task Force co-chairs with the undergraduate academic officers on April 4.

- Meeting of select Working Group members with the Faculty Committee on Library System on April 15.

- Presentation by Chris Bourg to the Association of MIT Alumnae on June 4.

- Presentation by Chris Bourg, Bruce Tidor, and Sean Thomas to Academic Council on June 23.

APPENDIX 4: IDEA BANK

When the Task Force was launched in October 2015, we opened up an Idea Bank online to solicit ideas from the MIT Community. The Idea Bank was open to current MIT community members and to MIT alumni. Anyone outside the MIT community who wanted to contribute ideas was encouraged to submit them through a designated email address. In total, 69 ideas were contributed via the online Idea Bank, and 10 were submitted via email.

The most common topic among the ideas submitted was that of the role of physical collections on campus. The comments we received were evenly split between those who argued for the value of keeping print collections on campus and those who suggested that the spaces currently used for physical materials could and should be repurposed for community spaces, and/or for facilities and equipment needed for digital scholarship. The range of opinions on this matter in both the Idea Bank and in our other conversations affirmed for us the urgent need for better research on the ways in which print and digital materials are discovered and used and how we might maximize the intellectual payoffs of the content we hold and the formats we have. This need is reflected in Recommendation 10, which calls for MIT to establish an Initiative for Research in Information Science and Scholarly Communication. The Task Force suggests that the questions around the values of materiality in scholarly work and learning be an early priority for this new initiative, with a goal of producing new models for determining optimal physical collections and perhaps new interfaces for physical and digital browsing and reading.

A second popular topic, closely related to comments on the physical collection, was the role and potential roles of library spaces in the community. In Recommendation 2, the Task Force recommends that the Institute convene a focused planning group to develop a vision for library spaces. All of the comments and suggestions about space will be provided to that planning group, once created.

The vast majority of the ideas submitted map to our pillars of community and relationships, discovery and use, stewardship and sustainability, and research and development, and the general sentiments of those ideas (if not the specifics) are expressed in our recommendations and vision. The themes of openness, radically enhanced discovery tools, and the role of the library as long-term steward of the scholarly record came through loud and clear in the comments. The Task Force has attempted to reflect those themes in our vision and recommendations.

There were also a number of comments of a more operational nature, ranging from questions about whether the library held a specific book to valuable suggestions about lighting in the Libraries' study spaces. The Libraries have already acted on some of the more specific comments and will evaluate, prioritize, and act (as appropriate) on the remaining ones.

APPENDIX 5: GLOSSARY

Notes: The definitions provided for the terms below are those relevant to the context of this report; other definitions are not included here. The URLs from which definitions were taken were accessed between September 28 and October 7, 2016.

Algorithm: A set of steps or rules used by a computer program to achieve a particular goal or solve a particular problem.

Digital Surrogate: Generally understood in the library and archival context to refer to any digital representation of a physical work, including thumbnails, catalog records, or digital images. Here we use the term in its broadest sense, but in the context of our goal of providing digital representations of physical works to meet the ever-evolving needs of scholars and readers around the globe.

DSpace@MIT: A service of the MIT Libraries that provides MIT faculty, researchers, and their supporting communities stable, long-term storage for their digital research and teaching output and to maximize exposure of their content to a world audience. This collection of more than 90,000 high-quality works includes conference papers, images, peer-reviewed scholarly articles, preprints, technical reports, theses, working papers, and research datasets, and is recognized as among the world's premier scholarly repositories and receives, on average, more than one million downloads per month.

Hack: *v.* To apply ingenuity to create a clever result (*tmrc.mit.edu/hackers-ref.html*). *n.* At MIT, hack usually refers to a clever, benign, and "ethical" prank or practical joke, which is both challenging for the perpetrators and amusing to the MIT community. *hacks.mit.edu*

Hackathon: An activity or event in which people come together to brainstorm solutions to a difficult problem, often in an unconventional way.

Independent Activities Period (IAP): A special four-week term at MIT that runs in January and is designed to provide all MIT community members the opportunity to organize and participate in a wide variety of for-credit and not-for-credit educational opportunities.

Information Silo: An information system that cannot be integrated into or easily accessed by other information systems.

Information Science: A discipline concerned with the theory and practice of collecting, organizing, managing, preserving, and providing access to information in all forms. See *www.asist.org/about/information-science/* for additional definitions.

Link Rot: The process by which hyperlinks on individual websites or the Internet in general point to web pages, servers or other resources that have become permanently unavailable. *en.wikipedia.org/wiki/Link_rot*

Machine Learning: A subfield of computer science that evolved from the study of pattern recognition and computational learning theory in artificial intelligence, it explores the study and construction of algorithms that can learn from and make predictions on data. *en.wikipedia.org/wiki/Machine_learning*

Metadata: Data about data, i.e., descriptive information about a particular data set, object, or resource, including how it is formatted, and when and by whom it was collected. Metadata can be about physical or electronic resources. *www.ala.org/tools/atoz/metadata/metadata*

Mens et manus: The MIT motto is "*mens et manus*," Latin for "mind and hand." The motto is manifest in the emphasis on "learning by doing" that has characterized the MIT educational experience from founder William Barton Rogers' initial vision to the present day. *web.mit.edu/mission.html*

MIT OpenCourseWare (OCW): A web-based publication of virtually all MIT course content, open and available to the world. *ocw.mit.edu/about/*

MITx: The Institute's portfolio of free, online, open-enrollment courses, offered through an online learning platform (edX) and produced by MIT departments and faculty.

Recommendation Services: Web-based services that direct users to content based on other content they have already used or expressed interest in.

Scholarly Communication: Scholarly communication is the system through which research and other scholarly writings are created, evaluated for quality, disseminated to the scholarly community, and preserved for future use. The system includes both formal means of communication, such as publication in peer-reviewed journals, and informal channels, such as electronic listservs. *www.ala.org/acrl/publications/ whitepapers/principlesstrategies*

Scholarly Record: The products surrounding scholarly works in all disciplines that are eventually disseminated, and upon which each discipline bases its discussions and measures its progress. Taken from *hangingtogether.org/?p=4803* and *www.oclc.org/content/dam/research/publications/library/2014/ oclcresearch-evolving-scholarly-record-2014.pdf*

Text-Mining Program: A means to analyze natural language in online documents using sophisticated algorithms to derive high-quality contextual information from text.

Tracking: The activity of following and, possibly collecting data on, an individual's internet use, such as web sites and pages visited as well as information relating to time, location, or other details of interest, by means of a software program.

Visualization Tool: Software or program that enables the visual representation of electronic data.