Perceptions on adopting artificial intelligence and related technologies in libraries: public and academic librarians in North America

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Abstract

Purpose – This study aims to understand how artificial Intelligence (AI) and related technologies are currently being utilized in public and academic libraries and how librarians perceive the adoption of new technologies in their relative libraries.

Design/methodology/approach – Using an online survey questionnaire, the authors collected survey responses from both public and academic librarians that were subscribed to information science-centered listservs in North America. The quantitative survey responses ($N = 242$) were measured through use of multiple chi-square tests and crosstab analyses.

Findings – The current use and awareness of AI and related technologies were more reported from academic librarians; however, public librarians' reported perceptions on such technologies were generally more positive. In all, 67% of them responded that AI and related technologies will transform the library's functions, and 68% of librarians reported that they are interested in training. This study discussed the significance of training for preparing librarians for AI and related technologies and the further examination on the role of librarians in the new era.

Originality/value – This study examined public and academic librarians' perceptions toward the adoption of six emerging technologies which often appear in the LIS literature as well as addressed as the Fourth Industrial Revolution technologies.

Keywords Robots, Internet of things, Cloud computing, Artificial intelligence, Big data, AR/VR

Paper type Research paper

Introduction

Artificial Intelligence (AI) and other emerging technologies provide new approaches and tools that can drive radical changes in industrial and public sectors. The American Library Association (ALA) Center for the Future of Libraries identified multiple technological trends that could have a potential impact on library services and operations, such as new approaches to the accessibility of library resources, enhancements to delivery of services and enhancements to serving users (Bolt, 2014). Though still nascent, the Center for the Future of Libraries provides a list of trending technologies that are relevant to libraries and librarianship, including AI, blockchains, connected toys, data everywhere, drones, facial recognition, haptic technology, Internet of things (IoT), Robots, self-driving cars, unplugged, virtual reality and voice control [1]. These technologies are included in what is referred to as

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the Fourth Industrial Revolution in business and industry. Although these trending technologies can be defined differently depending on the context, AI and machine learning, IoT, big data, blockchains, cloud and Edge computing, robots and cbots are often included in discussions regarding the Fourth Industrial Revolution (Marr, 2020). In the field of library science, Park *et al.* (2018) identified AI, IoT, cloud computing, big data, robots and mobile as technologies for libraries in this new era. Tella (2020) has also suggested that AI, robots, IoT, AR/VR and 3D printers are revolutionary technologies for information services in libraries. If the identified emerging technologies help create smart libraries capable of providing new and advanced information services, they may also be able to help change the current role of libraries within the digital society.

For this study, we selected six emerging technologies commonly considered part of the Fourth Industrial Revolution era. Our goal was to examine perceptions concerning the adoption of "AI and related technologies" by public and academic librarians. While there may be different conceptions of the scope and definitions of such technologies in different contexts, we purposely chose these six as they are common in many discussions of emergent technologies in LIS literature [2]. We also understand that the term "AI and related technologies" is not necessarily a fully accurate umbrella term encompassing these six technologies, and so could be open for debate. However, since there is currently no agreed-upon, overarching term for these trending technologies included in the Fourth Industrial Revolution, for the purposes of this article we will use "AI and related technologies" as a phrase to refer to the technologies of interest to our research project, as further defined below (Andrews *et al.*, 2021):

(1) Artificial intelligence (AI) refers to the ability to create machines that act and "think" like humans through deep learning, machine learning and natural language processing (American Library Association, 2019). At its core, AI is an accumulation of technologies that allow machines to develop functions and capabilities that align with basic human intelligence. "The major components of the Artificial Intelligence bucket are machine learning, big data, natural language processing, decision logic, data visualization, and data analytics" (Gujral *et al.*, 2019). Ideally, these machines can carry out tasks, make decisions based on past experiences and make predictions by collecting and processing large amounts of data. For library functions and services, AI can be an invaluable tool for organizing and improving accessibility to information (American Library Association, 2019). Examples of AI technologies that are already integrated in library functions are online reference assistance (ORA) (Vijayakumar and Sheshadri, 2019), PLEXUS reference referral tool (Mogali, 2014) and online chatbots (Gujral *et al.*, 2019).

(2) Internet of things (IoT) is the interconnectivity of devices and everyday objects via the Internet. These devices collect and transmit data, which can then be shared across different machines and platforms (Marr, 2020). IoT can generate new services for library users, and despite privacy concerns, the data collected help identify emerging trends and patterns (American Library Association, 2014a). Examples of IoT technologies that could be integrated into library functions are RFID tags, virtual library cards, collection management and QR codes (Fernandez, 2015; Liang, 2018).

(3) Big data practices are supported by other emerging technologies because as technology progresses, the amount of data produced also expands and becomes more readily available (Marr, 2020). This presents new challenges in collection methods, storage, analysis and usage. Big data has been defined in different ways, but Garoufallou and Gaitanou (2021) provided a general definition that is useful here, stating that it is ". . . data being generated constantly, automatically, and rapidly and

is a much more complex issue than just massive amounts of data." (p. 411). Big data technologies may be integrated into library functions that help identify selection materials for collection development and management (Crawford and Syme, 2018). In addition, analyzing big data can support the evaluation of current library services and can help library staff understand user needs so that libraries can provide users with higher-quality, targeted services (Garoufallou and Gaitanou, 2021).

(4) Robots are best described as machines that respond to environmental triggers and perform automatic and routine tasks in place of a human (Marr, 2020; American Library Association, 2014b). Robots are (and will be more actively) used to improve the effectiveness of librarians' works by reducing simple routine tasks. Robots can be deployed in both internal operations and public services (Tella, 2020). Examples of robotics used in libraries include automated storage and retrieval of materials, inventory management, shelf reading, RFID scanning, shelving and locating materials and answering repetitive and directional reference questions (Kim, 2019; Smith, 2020; Tella, 2020).

(5) Cloud computing refers to the computing services involved in the storage and processing of data on different devices (Marr, 2020). These devices can include servers, software, databases and networks that deliver data on-demand over the Internet. As libraries have accumulated more digital resources, data, larger data storage spaces and more powerful hardware and software are needed. Cloud computing can help libraries reduce data management complexity for maintaining such hardware and software (Lai *et al.*, 2020). Examples of cloud computing already used in libraries can be seen in "Software as a Service" or (Saas) which integrates common cloud computing services like Google Docs, OneDrive, Dropbox, Evernote and Box to support existing services within libraries and help facilitate better collaboration on projects within the library (Tritt and Kendrick, 2014). In addition to these common uses, Lai *et al.* (2020) adopted cloud technology to make a cloud bookcase system through which users can read e-books using mobile devices.

(6) Augmented reality/Virtual reality is a digitally generated set of stimuli (whether visual, auditory, sensational or a blend) presented through specialized electronic equipment that allows users to experience a new environment (Marr, 2020; American Library Association, 2017). These virtual and augmented realities are experienced as an overlay of the real world or an entirely generated world. The American Library Association (2017) explained the potential evolving adoption of AR/VR in library services. AR/VR can be a tool for immersive and creative storytelling and collection and space services in libraries. For example, library users can access digitized collections and cultural events in virtual or augmented reality. Other examples of augmented and virtual reality functions that are integrated into library systems are shelf arrangement tools (such as ShelfAR) (Huang *et al.*, 2016) and directional reference and resource discovery (Meredith, 2015).

To prepare librarians who can evaluate and adopt AI and related technologies in this new era, we first need to examine the current adoption status and perceptions of AI and related technologies by libraries and librarians. Across both popular media and scholarly literature, topics of AI and related technologies are being widely discussed, yet coverage of these technologies in any meaningful way has been far less prevalent across the professional library field (Wood and Evans, 2018). In their survey of academic librarians' perceptions of the impact of AI, Wood and Evans (2018) noted that the results pointed to librarians' "overwhelming sense of complacency" regarding the effect of AI on the field of librarianship.

Other researchers have mentioned that although new technologies have reshaped and redefined librarians' roles, the new technologies were adopted in libraries without strategic training (Carson and Little, 2014; Cherinet, 2018; Dowdy, 2020; Ratledge and Sproles, 2017; Tritt and Kendrick, 2014).

As a step toward preparing librarians to adopt AI and related technologies, our research aims to understand current practices and perceptions concerning AI and related technologies within libraries among public and academic librarians in North America. We hope that the findings can serve as evidence of preparing librarians. The following two research questions guided this study:

RQ1. How are AI and related technologies currently utilized in academic and public libraries in North America?

RQ2. How do academic and public librarians in North America perceive adopting AI and related technologies in libraries?

Literature review

As mentioned in the Introduction section, this study is interested in six AI and related technologies (AI, IoT, big data, robots, cloud computing and AR/VR), which are often addressed in the LIS literature related to Fourth Industrial Revolution. To adapt to the evolving needs of information consumers, libraries have had to incorporate new technologies into old practices. Although many of the new technological developments are in the research and nascent stages, there are a few cases where AI and related technologies are already being implemented in library systems and can be observed. This section will review how the six AI and related technologies have been implemented in library systems. The areas that the six AI and related technologies were implemented are categorized into collection management, user service and user education, and library facilities.

For the past 35 years, libraries have fully embraced computerization (Wood and Evans, 2018) and web-based content and collections (Gul and Bano, 2019). With many collections being fully online, collection management applications and big data analytics allow librarians to make more efficient collection management and marketing decisions (Crawford and Syme, 2018). "Collection management is driven by transformed data that support decision-making, promote marketing, budgeting, webometrics (citations of publications) and usage of information resources" (Makori, 2017, p. 659). When data patterns emerge in common library services such as the number of downloads, holds and query frequencies, they expose the potential for change selections to collection development.

AI and related technologies have developed to the point of being a reliable substitute for some human services and are aiding in user services. For instance, robots that can perform perceptual-motor tasks under direct supervision or through pre-programmed tasks (Mogali, 2014) can be a cost-efficient way to expand library service hours and provide services to more users (Yao *et al.*, 2015). AI can also help to deliver information services more quickly and effectively by taking on stressful and complex work and executing tasks quicker and with fewer errors than if the same task was completed by a human (Omehia and Mmejim, 2020). When looking at research in law library settings, chat and location-based services are taking some of the burdens off librarians' already busy schedules, helping to facilitate better search engine optimization for students' learning outcomes (Becker *et al.*, 2017). AR/VR technology is also integrated with guiding shelves (Huang *et al.*, 2016) and reference and resource discovery services (Meredith, 2015). Pushes for user education, programming initiatives for technology and development of makerspaces are increasingly in demand. Librarians are helping create opportunities for users to explore new technologies (Finley, 2019), while also offering educational opportunities for these technologies (Lessick and Kraft, 2017).

To lessen the impact and real estate of space in library facilities, the IoT contains wirelessly connected devices that can interact to personalize information to an individual, provide library services or acquire data analytics (Liang, 2018). This connectivity allows for the access and sharing of information without physical interaction. "These days in consumer electronic items and hence giving intelligence and sensing capabilities to their products, with which they can sense, learn from, and interact with their environment" (Bansal *et al.*, 2018). In libraries, IoT can be applied to assist with inventory control, theft management, book returns, user identification via face recognition, fire detection and prevention, mobile access to library resources and book availability tracking (Bansal *et al.*, 2018). IoT has already pushed informational organizations out of the age of pre-connected systems toward more modern knowledge and communication portals (Makori, 2017). If libraries were to implement this tool, it could make it easier for patrons to access the building, see what materials a patron has checked out and if any books are overdue. However, with more widespread use of IoT, personal privacy concerns, user data consent, targeted marketing, hacking and connection issues will inevitably become a topic of discussion (Cox *et al.*, 2019; Fernandez, 2015).

Cloud computing may be used for reducing management complexity caused by maintaining hardware and software. Utilizing large storage spaces from cloud computing services is beneficial to both user services (Lai *et al.*, 2020) and internal operations (Tritt and Kendrick, 2014; Sosa-Sosa and Hernandez-Ramirez, 2012).

As these technologies continue to progress, the impact they will have on the information profession will become more apparent. The question of whether new technologies create or remove jobs is playing out on a large scale in libraries and is creating a crossroads in the field. People are naturally resistant to change, but libraries are constantly growing and evolving and have been adapting to technological changes for decades (Nakhoda and Tajik, 2017). Hervieux and Wheatley (2021) found that only a small percentage of librarians were aware of having used AI as part of their jobs, and an even smaller percent believe that AI is actively used in their libraries. As technologies advance and more automations are integrated into long-standing library practices, librarians can either adopt and implement new technologies or see them as disruptions and fight against them (Massis, 2018). Typically, technologies are integrated into organization structures incrementally, allowing time for new processes to be adopted and adapted to by a profession. Libraries where management staff are more accepting of changes and challenges will experience less employee cynicism and mold its organizations around these new technologies (Cervone, 2011), while those more resistant to changes by maintaining more traditional systems may face greater challenges as time goes on (Weiner, 2003). "As machines begin to assume a larger share of human 'thinking' work, it will be important for libraries to prepare their staff, and to become centers of continuing education for their communities" (Arlitsch and Newell, 2017, p. 795).

Research design

This study conducted an online questionnaire survey with academic and public librarians across North America. A pilot study of the survey instrument was conducted to test the readability, design and overall structure of the instrument to be delivered via Qualtrics online survey tool. For the pilot study, the survey questionnaire was sent to several LIS students and librarians for feedback. Their comments were incorporated into the survey instrument, and then the second pilot study was conducted with two experienced academic and public librarians. Again, comments were incorporated into the final version of the survey instrument. Table 1 presents the composition of survey questions.

After receiving IRB exemption approval, invitation emails for online surveys were sent out through various professional listservs of library associations for recruiting academic and public librarians, including The American Library Association (ALA)'s Machine and Deep

Factors	Measures
Demographic and background information	• Age, gender, ethnicity, experience, position, MLS/MLIS degree, current use of AI and related technologies, how to keep professional trends • Questions only for academic librarians: library type, primary job responsibility • Questions only for public librarians: community type, primary job responsibility
Awareness of and Interests in AI and related tech. (Appendix 1)	• Awareness of AI and related tech • Interests in AI and related tech
Perceived impact of AI and related tech. (Appendix 2)	• Current adoption of the AI and related tech ○ in your library type ○ in your library • Possibility of AI and related tech. being used in the library within the upcoming years ○ within 2 years ○ within 10 years ○ within 30 years • Impact of AI and related tech. on the library professionals in the near future ○ positive impact ○ negative impact ○ eventually replace many functions • AI and related technologies . . . ○ will transform the library functions ○ will expand the role of the library ○ may cause dangers, such as fake news, privacy, access and censorship ○ will improve lives of people
Perceived utilization of AI and related tech. (Appendix 3)	Regarding eleven identified services • Heard about the service utilizing AI and related tech. • The service is currently utilized in your library • The service utilizing AI and related tech. will be useful for your users Regarding nine identified departments • How well-suited is the department in the library for AI and related tech. implementation?
Perceptions on training and training methods (Appendix 4)	• Able to attain sufficient knowledge for adopting and utilizing AI and related technologies in your library • Interested in training on AI and related technologies • Preferred training methods

Table 1.
Summary of survey questionnaire

Learning Research Interest Group, Library and Information Technology Association (LITA) List, Association of College and Research Libraries (ACRL), Science and Technology Section Discussion List, Advocacy for Libraries, LITA Instructional Technologies Interest Group Email List, Center for Research Libraries (CRL), Systematic Reviews and Related Methods Interest Group, Community and Junior College Libraries Section (CJCLS) Section, Association for Library Collections and Technical Services (ALCTS), Catalog Form and Function, ACRL New Members Forum, ACRL First-Year Experience Discussion Group and, finally, the Public Library Association (PLA)'s main discussion board. Data were collected from November 16, 2020, until January 6, 2021. A total of 340 responses were obtained, and 20 responses were eliminated because they either were not academic or public librarians and/or not able to move forward with the questionnaire. Also, we excluded 78 responses, of which completion rates were lower than 97% from the final analysis. This brought our total number of participants to 242. Among 242 participants, six were from Canada and 236 were from the United States. Also, 117 were academic librarians (48.35%) and 125 were public librarians (51.65%).

The participants, who submitted their email addresses for compensation, were paid a $10 Amazon gift certificate upon survey completion.

Results

Table 2 presents the breakdown of responses concerning antecedents for both academic and public librarians, including demographics and select professional factors such as possession MLIS degree, current use of AI or related technologies and information gathering in regard to current trends in the profession. Demographics concerning age and ethnicity are consistent with what is reflected in both academic and public librarianship. More academic librarians possess an MLIS than public librarians, but experience in terms of years in the profession and the variety of information sources for professional development seem evenly distributed across both groups. A total of 21% of librarians responding reported that they are currently using AI and related technologies, with academic librarians (25%) reporting higher usage than public librarians (17%).

To determine whether there is a significant relationship between academic and public librarians based on the above measures, a chi-square test was performed. Gender $X^2(3, N = 242)$ 7.95, $p < 0.05$; professional position, $X^2(3, N = 242)$ 16.05, $p < 0.01$; and whether respondents possess an MLIS $X^2(2, N = 242)$ 23.87, $p < 0.01$ were each shown to be significant.

Table 3 further shows the different responsibilities of the respondents and the types of libraries where they work.

In the figure we see some minor differences between academic (represented by the bars) and public librarians (represented by the orange lines [3]) in both their awareness of and interests in various AI and related technologies. Most technologies seem to have similar levels of interest and awareness between academic and public librarians, yet there are a couple of technologies where there appear to be differences. For instance, robotics is an area that public librarians seem to have both more awareness and more interest in (awareness $X^2(4, N = 240)$ 10.998, $p < 0.05$; interests, $X^2(4, N = 237)$ 12.789, $p < 0.05$). Conversely, academic librarians appear more likely to have an awareness of big data ($X^2(4, N = 240)$ 15.244, $p < 0.01$), and public librarians are more interested in AR/VR ($X^2(4, N = 238)$ 12.714, $p < 0.05$). Among six AI and related technologies, cloud computing has the highest level of awareness from both academic and public librarians, and AI and big data are the technologies showing the widest gaps between awareness and interests.

The data represented in Figure 2 reflect the degree of agreement across all the respondents, with both academic and public represented separately (academic by the bars, public by the line). Across each of the variables examined, there is a general consistency between academic and public librarians. In terms of adoption nationally and within each respondent's library, public librarians were closer across the two than academic, which suggests that AI and related technologies have been adopted by more libraries nationally (see Figure 2a). The responses for both groups on the perception of AI and related technologies being adopted in the future are very similar, increasing as time gets further away (see Figure 2b). There seems to be the perception that the impact of AI and related technologies on the profession will be positive going forward; however, more academic librarians responded that there would be negative impacts (see Figure 2c).

More differences seem to occur in the kinds of effects that AI and related technologies might have on the libraries and librarianship, with public librarians responding more frequently that AI and related technologies will transform library functions, expand its role ($X^2(4, N = 235)$ 17.705, $p < 0.05$) and improve lives ($X^2(4, N = 234)$ 13.859, $p < 0.01$, but less frequently that it may cause dangers ($X^2(4, N = 235)$ 13.291, $p < 0.05$) (see Figure 2d).

Figures 3–5 display the results of how both academic and public librarians perceive various groups' (based on areas of responsibility) seeming readiness for the adoption of AI and related technologies.

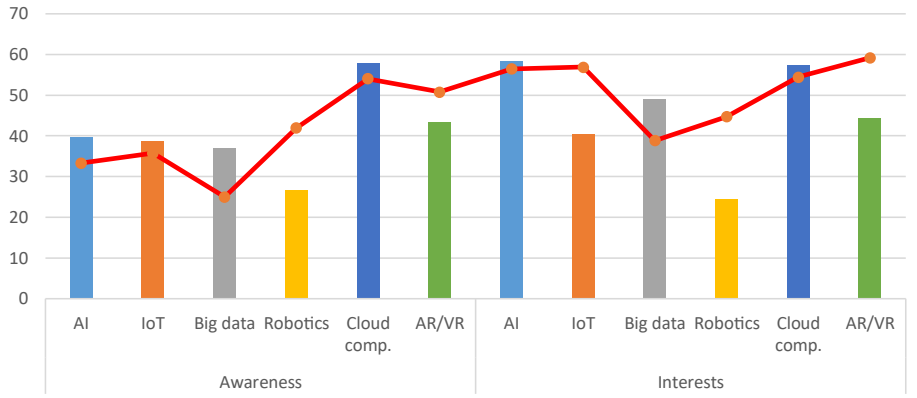
	Academic		Public		
	Freq	%	Freq	%	X^2
Age					7.236
24 or under	1	0.85	2	1.60	
25–34	24	20.51	30	24.00	
35–44	36	30.77	33	26.40	
45–54	24	20.51	29	23.20	
55–64	18	15.38	26	20.80	
65 or over	10	8.55	3	2.40	
I Prefer not to respond	4	3.42	2	1.60	
Gender					
Male	29	24.79	17	13.60	7.948*
Female	80	68.38	104	83.20	
Other	4	3.42	1	0.80	
Prefer not to response	4	3.42	3	2.40	
Ethnicity					11.682
Asian	6	5.13	1	0.80	
Black or African American	4	3.42	2	1.60	
Caucasian	89	76.07	108	86.40	
Hispanic/Latino	5	4.27	2	1.60	
Native American	0	0.00	1	0.80	
Pacific Islander	0	0.00	0	0.00	
Mixed race	3	2.56	5	4.00	
Prefer not to respond	7	5.98	6	4.80	
Other	3	2.56	0	0.00	
Experience as a librarian					4.147
Less than 5 years	19	16.24	21	16.80	
5 to less than 10 years	33	28.21	34	27.20	
10 to less than 15 years	23	19.66	28	22.40	
15 to less than 20 years	13	11.11	19	15.20	
20 to less than 25 years	10	8.55	9	7.20	
25 to less than 30 years	9	7.69	10	8.00	
More than 30 years	10	8.55	4	3.20	
Position					16.047**
Librarian	113	96.58	100	79.37	
Other professional staff	3	2.56	15	11.90	
Para-professional	1	0.85	7	5.56	
Other	0	0.00	4	3.17	
MLS/MLIS					23.874**
Yes	114	97.44	95	76.00	
Currently pursuing an MLS/MLIS degree	0	0.00	7	5.60	
No	3	2.56	23	18.40	
Current use of AI and related technologies					2.232
Yes	28	25.00	21	17.07	
No	84	75.00	102	82.93	
How do you keep professional trends (check all)					
Journal/Magazine articles	106	20.70	109	19.89	
Social media	61	11.91	88	16.06	
Listservs	111	21.68	110	20.07	
Attend professional conferences	109	21.29	110	20.07	
Webinar	112	21.88	117	21.35	
Other	13	2.54	14	2.55	

Note(s): *$p < 0.05$, **$p < 0.01$

Table 2.
Demographic and background information

Academic librarians only	#	%	Public librarians only	#	%
Library type			*Community type*		
Research university	58	58.00	Rural	37	29.84
Teaching university	24	24.00	Suburban	65	52.42
Liberal arts college	11	11.00	Urban	22	17.74
Community college	23	23.00			
Special focus	0	0.00			
Primary job responsibilities			*Primary job responsibilities*		
Reference; public services	69	58.97	Reference; public services	76	60.80
Instruction; learning support	69	58.97	Instruction; learning support	36	28.80
Metadata and cataloging	18	15.38	Metadata and cataloging	29	23.20
Special collection; subj. dev	4	3.42	Special collection	12	9.60
Administration; budgeting	19	16.24	Administration; budgeting	56	44.80
Acquisitions; collection dev	33	28.21	Acquisitions; collection dev	59	47.20
Outreach and marketing	28	23.93	Outreach and marketing	48	38.40
Open access, APC management	7	5.98	ILL; circulation	25	20.00
ILL; Circulation	8	6.84	Technology	41	32.80
Technology	32	27.35	Children/Youth services	46	36.80
Subject librarian – health sci	14	11.97	Adult services	55	44.00
Subject librarian – business	9	7.69	Bookmobile	0	0.00
Subject librarian – arts/humanities	19	16.24	Others	10	8.00
Subject librarian – social sci	17	14.53			
Subject librarian – sci/tech./engineering	30	25.64			
Other	15	12.82			

Table 3.
Types of libraries and primary responsibilities



Note(s): * Academic librarians (bars); Public librarians (line)

** % of positive responses were calculated by combining 4 and 5 from the 5-point Likert scale (Appendix 1)

Figure 1.
Awareness of and interests in the AI and related technologies (% of positive responses)

Figure 3 displays the results of academic librarians' perceived usefulness, current utilization and prior knowledge of the service. Of the technologies mentioned, data-driven collection development, library analysis, self-check-out/return, reference and OPAC lead as the most well-suited according to the reported perceptions of academic librarians. The least well-suited technologies according to academic librarians are services related to beacon technology and smart cart. Library functions that currently utilize more AI and related technologies tend to have higher perceptions of the usefulness of adopting AI and related technologies.

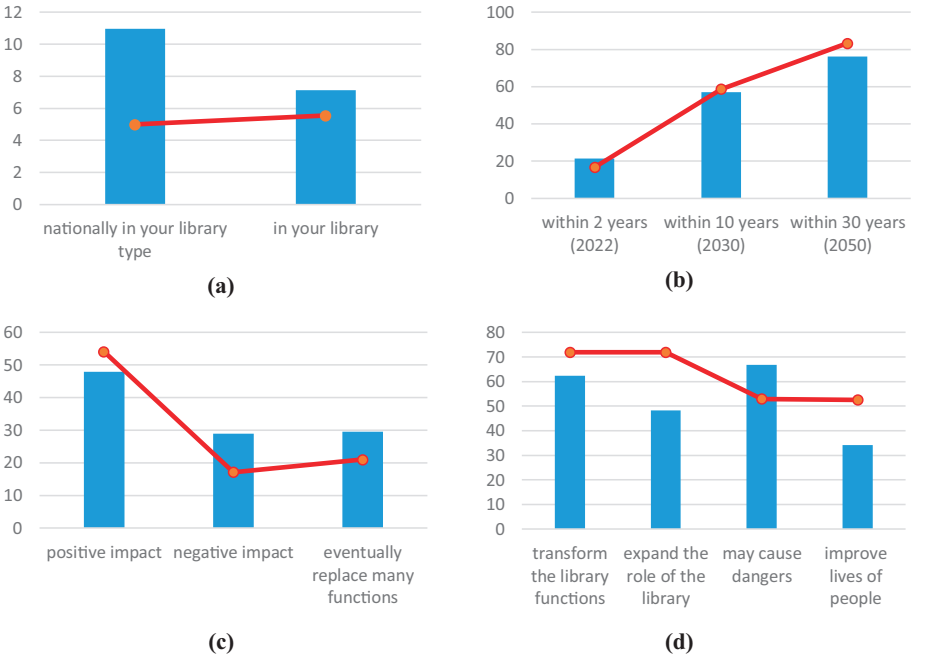


Figure 2.
Perceptions of AI and related technologies (% of positive responses). (a) Current adoption of the AI and related technologies. (b) Probability of AI and related technologies being used in the library within the upcoming years. (c) Impact of the AI and related technologies on the library profession in the near future. (d) Agreement with the following statements: AI and related technologies will . . .

Note(s): * Academic librarians (bars); Public librarians (line)
** % of positive responses were calculated by combining 4 and 5 from the 5-point Likert scale (Appendix 2)
*** Questions for Figure 2 were adopted from Wood and Evans (2018) and revised

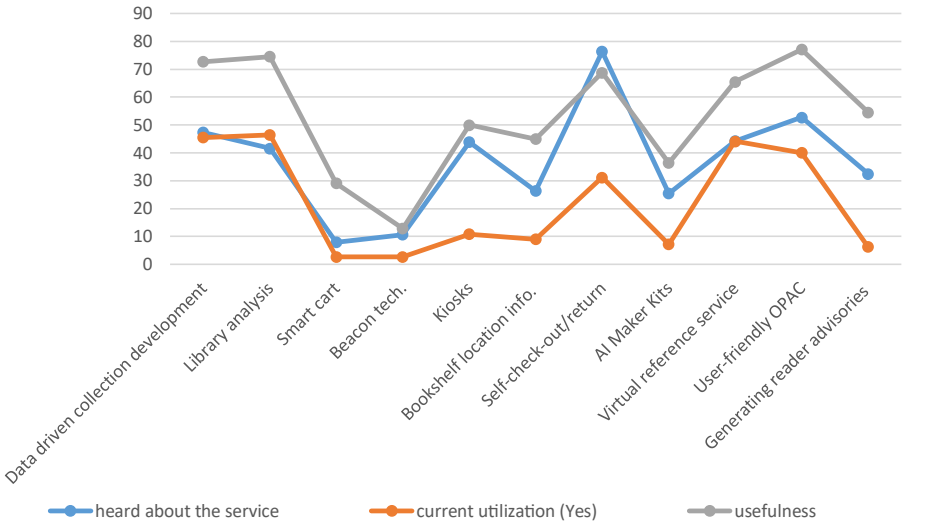
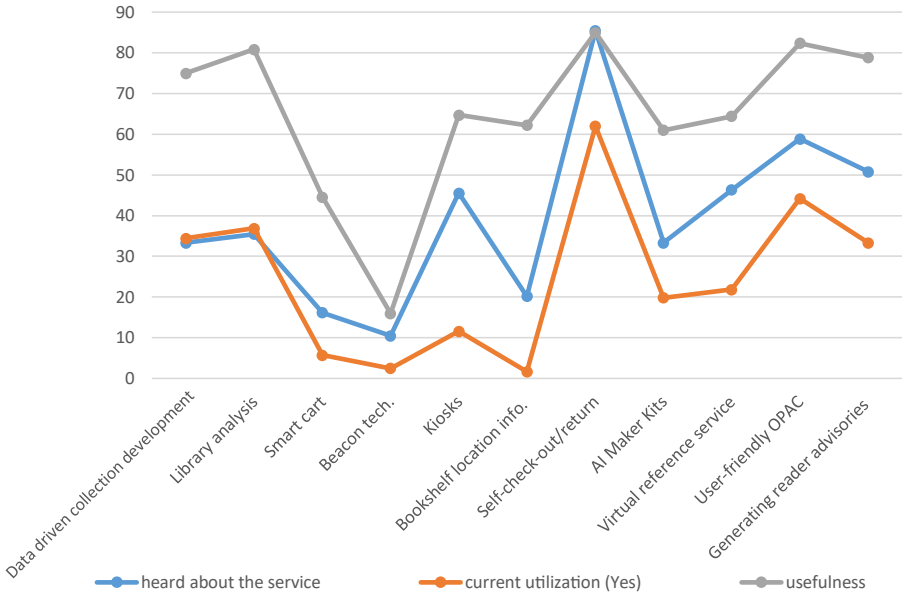


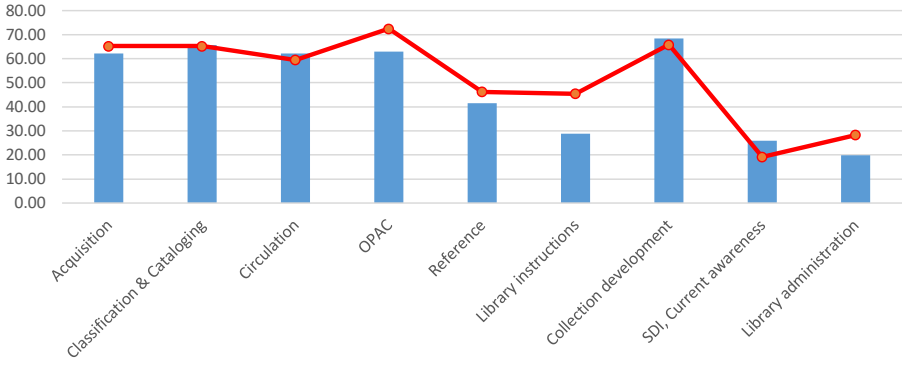
Figure 3.
Academic librarians' use and perceptions of adopted AI and related technologies in library services (% of positive responses)

Note(s): * % of positive responses were calculated by combining 4 and 5 from the 5-point Likert scale (Appendix 3)



Note(s): * % of positive responses were calculated by combining 4 and 5 from the 5-point Likert scale (Appendix 3)

Figure 4.
Public librarians' use and perceptions of adopted AI and related technologies in library services (% of positive responses)



Note(s): * Academic librarians (bars); Public librarians (line)

** % of positive responses were calculated by combining 4 and 5 from the 5-point Likert scale (Appendix 3)

Figure 5.
Suitability of library departments for AI and related technology implementation (% of positive responses)

Figure 4 displays the results of public librarians' perception across areas of responsibility in terms of being well-suited for the adoption of AI and related technologies, with a few departments showing dips and/or spikes for certain areas. Similar to academic librarians' perceptions of the technologies mentioned, public librarians perceived data-driven collection development, library analysis, self-check-out/return, OPAC and generating reader advisories as the most well-suited technologies. The least well-suited technologies according to public librarians are services related to beacon technology. As observed from Figure 3, library

functions that currently utilize a greater degree of AI and related technologies tend to have higher perceptions of the usefulness of adopting AI and related and technologies. However, bigger gaps were noticed between data-driven collection development and library analysis.

Figure 5 displays the results of how both academic and public librarians perceive departmental suitability for AI and related technology implementation. Results suggest both academic public librarians perceive library instructions and library administration and SDI/awareness as being less well-suited, whereas OPAC and collection development were rated by both academic and public librarians as being most well-suited. Overall, public librarians, as compared to academic librarians, reported similar or higher suitability for most library departments except current awareness service.

Figures 6a and b reveal similar responses from both academic and public librarians on issues regarding training for AI and related technologies. Both groups indicate high levels of interest in learning about such technologies, and many feel they can attain new knowledge in this space. They also appear similar regarding the delivery of training for new AI and related technologies. This could be very helpful in designing, delivering and ensuring high uptake of new training in AI and related technologies for both academic and public librarians.

Discussion

The findings from our limited survey of academic and public librarians provide some updated information on the utilization and perceptions of AI and related technologies that can inform future work.

Regarding the first research question guiding this study, *How are AI and related technologies currently utilized in academic and public libraries?*, we found 21% of all surveyed librarians reported that they are currently using AI and related technologies, with academic librarians (25%) reporting higher usage than public librarians (17%). Differences between academic and public librarians were also observed in areas where AI and related technologies might be adopted: five service areas (data-driven collection development, library analysis, kiosks, self-check-out/return user-friendly OPAC) were reported by over 40% of academic librarians and two services (self-check-out/return, user-friendly OPAC) by over 40% of public librarians. Whereas self-check-out/return and user-friendly OPAC were commonly reported

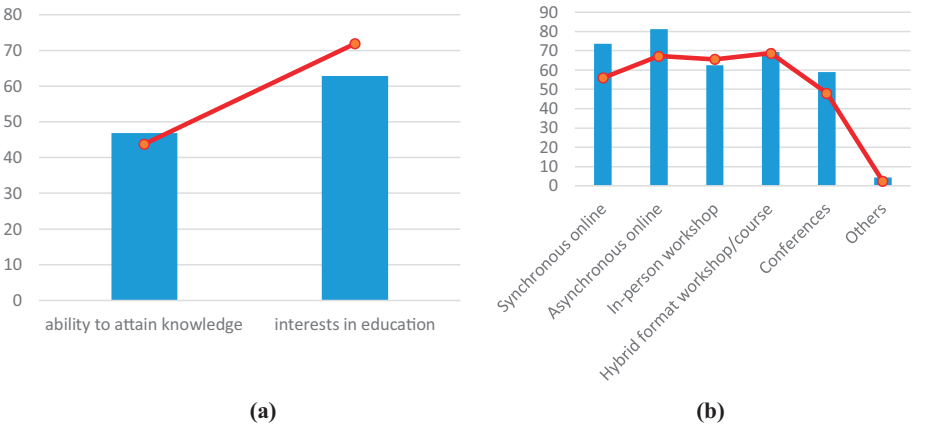


Figure 6.
Perceptions on training and training methods. (a) Perceptions on training on AI and related technologies (% of positive responses). (b) Training method preference for AI and related technologies (%)

Note(s): * Academic librarians (bars); Public librarians (line)

** % of positive responses were calculated by combining 4 and 5 from the 5-point Likert scale (Appendix 4)

by both academic and public librarians, data analysis technologies for collection development and library analysis were adopted more frequently in academic libraries. Kiosks seem to be popularly adopted by academic libraries for checking in and out laptops for students.

It is difficult to speculate as to why these apparent differences in AI and related technology use exist between academic and public libraries. There may be a larger audience in academic settings working on research or related activities involving AI and related technologies, and so academic libraries may feel compelled to explore and adopt new technologies as part of its range of services. Still, considering that AI and related technologies are already embedded throughout our everyday lives – according to Northeastern University and Gallup (Reinhart, 2018), 85% of Americans are already using products that embed AI (Finley, 2019) – adoption of AI and related technologies in libraries seems inconsistent. Weatley and Hervieux (2019) noted the surprising finding that only a small number of academic libraries have programs involving AI, and no academic library involves AI in their strategic planning. This is likely to change over time if the levels of interest reflected in our study continue to grow and perceptions change. Libraries have traditionally included in their missions the goal of disseminating new technologies to the public; in the rapidly evolving era of AI, libraries should be taking an active role in the "democratization" of emerging technologies (Finley, 2019, p. 8).

Perceptions of AI and related technologies across academic and public librarians were investigated via our second research question. Here, we found 19% of librarians responded that AI and related technologies will be used in two years (by 2022), and 80% of them responded they expect to use them in 30 years (by 2050). Also, 67% of librarians responded that AI and related technologies will transform the library's functions, which suggests 33% of librarians do not see a transformational impact of AI and related technologies on library functions. Wood and Evans (2018) revealed that librarians' perceptions of AI technologies substantially differed from the expectations of experts by citing the "NMC (New Media Consortium) Horizon Report" which addressed "the five-year impact of innovative practices and technologies for academic and research libraries across the globe" (Becker *et al.*, 2017, p. 2). The NMC Horizon report showed an expected 4–5 years as the time for adopting AI in libraries (or, 2021–2022). Fernandez (2015) also said, "For libraries, the question is not so much what technology will be affected, but rather what technology, if any, will remain unaffected by AI" (p. 22). As stated, we found that still one-third of librarians do not expect the impact of AI and related technologies on library functions.

Whereas the current use and awareness of AI and related technologies were more reported by academic librarians, public librarians' reported perceptions on such technologies were generally more positive. Public librarians, compared to academic librarians, had a higher interest in AI and related technologies and expect there to be a more positive impact and usefulness of utilizing these technologies for library services in the future. There were five services (data-driven collection development, library analysis, self-check-out/return, user-friendly OPAC, generating reader advisories) that over 70% of public librarians said AI and related technologies would benefit, although four services (data-driven collection development, library analysis, self-check-out/return, user-friendly OPAC) were reported by over 70% of academic librarians.

Librarians' positive perceptions of AI and related technologies could be related to the overall trends in current use and awareness. From the questions asking about interests in six AI and related technologies (AI, IoT, big data, robotics, cloud computing and AR/VR), public librarians demonstrated similar or higher interests in these technologies in comparison to academic librarians, except big data technology. We assume that academic librarians have more experience with big data technology for collection development, research support, data management and library analysis, experiences that might lead to more positive perceptions. The positive relations among awareness, use and perceptions were more clearly presented through the library services adopting AI and related technologies (Figures 4 and 5). These

findings suggest that when technology is being utilized in a library, people are more likely to think it is useful. People are generally resistant to change, so there might be a fear of the unknown and its expected repercussions; however, once changes are implemented, people may fall back on cognitive dissonance and be more willing to accept, and even grow to like, the change.

The finding of awareness, as related to positive perceptions, suggests there could be a growing need for training or education for librarians on AI and related technologies (Arlitsch and Newell, 2017). Only 45% of librarians answered that they can attain sufficient knowledge for adopting AI and related technologies, and 68% of librarians reported that they are interested in training. These are higher percentages than Wood and Evans (2018) study, where 47% of librarians were interested in training for AI technologies. Anxieties about the impact of AI and related technologies have been known, such as the replacement of current roles and functions and job loss (Frey and Osborne, 2017; Tredinnick, 2017). AI and related technologies will make changes in libraries, and librarians should proactively establish professional identity and roles in the AI era (Wheatley and Hervieux, 2019). "[t]he success of librarians and professional staff is contingent on their ability to thrive in this technology-rich environment" (Arlitsch and Newell, 2017, p. 789).

The results of our study provide interesting insights into a rapidly evolving area of technology that will continue to impact libraries. However, there are noted limitations in our approach, and the results should be acknowledged. First, we sought to gather responses from librarians across North America via professional listservs. Although we did receive responses from Canada, many of these lists are from US-based organizations and may not have many members from other countries in the region. Also, the use of listservs seemed to achieve more than the number of responses we initially sought (300); however, processing the final survey responses revealed a larger number of incomplete surveys than expected, resulting in a lower N. Future studies should endeavor for broader inclusion that might come from wider advertisement and lead to more diverse audiences. Lastly, we limited our survey instrument to include several measures of the perceptions and use of AI and related technologies. We recognize that our perspective on designing the survey was one that views these technologies as potentially positive and did not include in the tool items related to the possible negative consequences of AI and related technologies in libraries and on users. We hope that future studies on adoption, implementation and evaluation will look more deeply at this side of technology in libraries, as well.

Conclusion

For decades, libraries have been helping their communities discover and utilize new technologies, while the field itself has been struggling with how to integrate them into its profession. As a greater number of new technologies emerge, the potential impact on library services and operations becomes more apparent. The field of library science is still working to integrate new technologies into practice, but not at the rate needed to keep up with new advancements. In this study, we looked to determine how AI and related technologies are currently being utilized in public and academic libraries and how librarians perceive the adoption of new technologies in their relative libraries. We found that 21% of academic and public librarians responding reported that they are currently using AI and related technologies, but 80% of them thought there is a strong probability of AI and related technologies being adopted into libraries within the next 30 years. Although both groups also reflected a high level of interest in learning about such technologies, librarians' positive perceptions on AI and related technologies could be related to the overall trends in current use and awareness. Of those surveyed, 68% of librarians reported that they are interested in training.

It is expected that AI and related technologies will "amplify the utility and reach of library services" (Becker *et al.*, 2017, p. 2). Although libraries have been adopting emerging technologies for enhancing their services (Gujral *et al.*, 2019), this study findings demonstrated inconsistencies in utilization and perceptions on adopting AI and related technologies. We support Arlitsch and Newell's (2017) assertion that "[h]ow we choose to react to the AI wave is entirely up to us. We can recognize and accept the changes that are coming and we can educate ourselves to the best of our abilities, and be open to the opportunities that broadened view will bring" (p. 796). Cox *et al.* (2019)'s study, which interviewed 33 library directors and educators, revealed concerns that librarians might not take leading roles in adopting AI and related technologies in libraries. Future studies could be conducted that address what should be taught in order to prepare librarians for use of AI and related technologies and examining the role of librarians in the new era.

Notes

1. http://www.ala.org/tools/future/trends
2. Among the number of articles that explored the six technologies, the below articles provide (systematic) reviews on each of technologies in library contexts: AI and robots: Asemi *et al.* (2021), IoT: Liang (2018), big data: Garoufallou and Gaitanou (2021), cloud computing: Swain (2014), AR/VR: Massis (2015).
3. Although line graphs are mostly used for trends or changes, for more visually clear comparison between academic and public libraries, we combined line and bar graphs rather than using double bar or stacked bar graphs.

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Appendix 1

Table A1.
Awareness of and interests in the AI and related technologies

		5		4		3		2		1			
		#	%	#	%	#	%	#	%	#	%	*M*	STD
*Are you aware of the following technologies?**													
AI	A	12	10.34	34	29.31	49	42.24	16	13.79	5	4.31	2.72	0.974
	P	14	11.38	27	21.95	55	44.72	25	20.33	2	1.63	2.79	0.952
IoT	A	9	7.76	36	31.03	42	36.21	23	19.83	6	5.17	2.84	1.004
	P	19	15.45	25	20.33	43	34.96	23	18.70	13	10.57	2.89	1.196
Big data analysis	A	13	11.21	30	25.86	46	39.66	19	16.38	8	6.90	2.82	1.06
	P	13	10.48	18	14.52	36	29.03	35	28.23	22	17.74	3.28	1.22
Robotics	A	4	3.45	27	23.28	45	38.79	29	25.00	11	9.48	3.14	0.995
	P	16	12.90	36	29.03	43	34.68	24	19.35	5	4.03	2.73	1.046
Cloud computing	A	25	21.55	42	36.21	34	29.31	12	10.34	3	2.59	2.36	1.016
	P	26	20.97	41	33.06	35	28.23	17	13.71	5	4.03	2.47	1.093
AR/VR	A	13	11.30	37	32.17	38	33.04	24	20.87	3	2.61	2.71	1.007
	P	21	16.94	42	33.87	41	33.06	18	14.52	2	1.61	2.5	0.992
*Are you interested in the following technologies?***													
AI	A	29	25.22	38	33.04	25	21.74	16	13.91	7	6.09	2.43	1.185
	P	26	20.97	44	35.48	32	25.81	14	11.29	8	6.45	2.47	1.137
IoT	A	14	12.28	32	28.07	39	34.21	23	20.18	6	5.26	2.78	1.071
	P	27	21.95	43	34.96	29	23.58	16	13.01	8	6.50	2.47	1.162
Big data analysis	A	23	20.18	33	28.95	39	34.21	12	10.53	7	6.14	2.54	1.115
	P	19	15.70	28	23.14	36	29.75	17	14.05	21	17.36	2.94	1.306
Robotics	A	7	6.14	21	18.42	32	28.07	39	34.21	15	13.16	3.3	1.105
	P	14	11.38	41	33.33	33	26.83	27	21.95	8	6.50	2.79	1.111
Cloud computing	A	23	20.00	43	37.39	30	26.09	16	13.91	3	2.61	2.4	1.043
	P	20	16.26	47	38.21	33	26.83	15	12.20	8	6.50	2.54	1.103
AR/VR	A	20	17.39	31	26.96	35	30.43	25	21.74	4	3.48	2.67	1.106
	P	29	23.20	45	36.00	30	24.00	10	8.00	9	7.20	2.39	1.15

Note(s): *5 (extremely aware) . . . 1(not aware at all)
**5 (very interested) . . . 1(not interested at all)

Appendix 2

		5		4		3		2		1			
		#	%	#	%	#	%	#	%	#	%	*M*	STD
*Current adoption of the AI and related technologies**													
Nationally in your	A	0	0.00	8	10.96	27	36.99	29	39.73	9	12.33	3.53	0.851
library type	P	0	0.00	4	5.00	25	31.25	29	36.25	22	27.50	3.86	0.882
In your library	A	0	0.00	7	7.14	19	19.39	24	24.49	48	48.98	4.15	0.978
	P	0	0.00	6	5.56	14	12.96	17	15.74	71	65.74	4.42	0.918
*Impact of the AI and related technologies on the library profession in the near future***													
Positive impact	A	11	9.57	44	38.26	37	32.17	18	15.65	5	4.35	2.67	0.998
	P	16	12.90	51	41.13	47	37.90	8	6.45	2	1.61	2.43	0.857
Negative impact	A	4	3.51	29	25.44	43	37.72	35	30.70	4	3.51	3.06	0.915
	P	2	1.63	19	15.45	50	40.65	44	35.77	8	6.50	3.3	0.868
replace many	A	7	6.09	27	23.48	33	28.70	40	34.78	8	6.96	3.13	1.047
functions	P	5	4.03	21	16.94	34	27.42	53	42.74	11	8.87	3.35	0.998
*What is the probability of AI and related technologies being used in the library within the upcoming years?****													
Within 2 years	A	6	5.36	18	16.07	31	27.68	32	28.57	25	22.32	3.46	1.162
(2022)	P	8	6.67	12	10.00	43	35.83	40	33.33	17	14.17	3.38	1.063
Within 10 years	A	24	21.43	40	35.71	38	33.93	7	6.25	3	2.68	2.33	0.972
(2030)	P	24	19.83	47	38.84	40	33.06	6	4.96	4	3.31	2.33	0.961
Within 30 years	A	60	53.10	26	23.01	23	20.35	2	1.77	2	1.77	1.76	0.957
(2050)	P	67	55.83	33	27.50	17	14.17	2	1.67	1	0.83	1.64	0.848
*How do you agree/disagree with the following statements? AI and related technologies will . . . *****													
Transform the	A	20	17.54	51	44.74	35	30.70	8	7.02	0	0.00	2.27	0.834
library functions	P	25	20.66	62	51.24	28	23.14	6	4.96	0	0.00	2.12	0.791
Expand the role of	A	8	7.02	47	41.23	37	32.46	21	18.42	1	0.88	2.65	0.892
the library	P	24	19.83	63	52.07	24	19.83	9	7.44	1	0.83	2.17	0.863
May cause dangers	A	14	12.28	62	54.39	22	19.30	16	14.04	0	0.00	2.35	0.872
	P	22	18.18	42	34.71	41	33.88	14	11.57	2	1.65	2.44	0.974
Improve lives of	A	5	4.39	34	29.82	60	52.63	10	8.77	5	4.39	2.79	0.836
people	P	9	7.50	54	45.00	54	45.00	2	1.67	1	0.83	2.43	0.695

Note(s): *5 (excellent) . . . 1 (I do not know)
**5 (strongly agree) . . . 1 (strongly disagree)
***5 (almost certain) . . . 1 (rare)
****5 (strongly agree) . . . 1 (strongly disagree)

Table A2.
Perceived impact of AI and related technologies

Appendix 3

Table A3. Perceived utilization of AI and related technologies

		5		4		3		2		1			
		#	%	#	%	#	%	#	%	#	%	*M*	Std
*Have you heard about the following services utilizing AI and related technologies?**													
Data-driven collection development	A	17	15.18	36	32.14	39	34.82	15	13.39	5	4.46	2.6	1.04
	P	17	13.82	24	19.51	52	42.28	15	12.20	15	12.20	2.89	1.17
Library analysis (e.g. assessing use, assisting with collection management, assisting with evaluation of services)	A	17	15.04	30	26.55	36	31.86	22	19.47	8	7.08	2.77	1.14
	P	13	10.48	31	25.00	43	34.68	19	15.32	18	14.52	2.98	1.17
Smart cart (for efficient acquisition and shelving)	A	1	0.88	8	7.02	25	21.93	40	35.09	40	35.09	3.96	0.97
	P	6	4.84	14	11.29	28	22.58	38	30.65	38	30.65	3.71	1.16
Beacon tech	A	2	1.77	10	8.85	20	17.70	20	17.70	61	53.98	4.13	1.11
	P	4	3.23	9	7.26	19	15.32	22	17.74	70	56.45	4.17	1.13
Lib. service info. devices (kiosks)	A	9	7.89	41	35.96	39	34.21	17	14.91	8	7.02	2.77	1.03
	P	14	11.38	42	34.15	37	30.08	17	13.82	13	10.57	2.78	1.15
Bookshelf location info. (e.g. smart bookshelf)	A	9	7.89	21	18.42	28	24.56	33	28.95	23	20.18	3.35	1.22
	P	7	5.65	18	14.52	34	27.42	32	25.81	33	26.61	3.53	1.19
Self-service (check-out/return)	A	40	35.09	47	41.23	13	11.40	10	8.77	4	3.51	2.04	1.07
	P	68	54.84	38	30.65	8	6.45	6	4.84	4	3.23	1.71	1.01
AI maker kits (user education/program	A	9	7.89	20	17.54	23	20.18	38	33.33	24	21.05	3.42	1.23
	P	20	16.26	21	17.07	40	32.52	24	19.51	18	14.63	2.99	1.27
Interactive/Virtual reference service	A	21	18.58	29	25.66	29	25.66	22	19.47	12	10.62	2.78	1.26
	P	14	11.38	43	34.96	27	21.95	22	17.89	17	13.82	2.88	1.24
User-friendly OPAC	A	21	18.75	38	33.93	28	25.00	18	16.07	7	6.25	2.55	1.17
	P	27	21.77	46	37.10	23	18.55	15	12.10	13	10.48	2.52	1.25
Generating reader advisories or similar lists, helping suggest other material to users	A	9	7.89	28	24.56	31	27.19	32	28.07	14	12.28	3.12	1.15
	P	26	20.97	37	29.84	25	20.16	25	20.16	11	8.87	2.66	1.26

Are any of the following services currently utilized in your library?

		Yes		*No*		*Not sure*	
		#	%	#	%	#	%
Data-driven collection development	A	51	45.54	40	35.71	21	18.75
	P	42	34.43	56	45.90	24	19.67

(*continued*)

		5		4		3		2		1			
		#	%	#	%	#	%	#	%	#	%	*M*	Std
Library analysis (e.g. assessing use, assisting with collection management, assisting with evaluation of services)	A	52	46.43	40	35.71	20	17.86						
	P	45	36.89	52	42.62	25	20.49						
Smart cart (for efficient acquisition and shelving)	A	3	2.68	83	74.11	26	23.21						
	P	7	5.74	100	81.97	15	12.30						
Beacon tech	A	3	2.68	75	66.96	34	30.36						
	P	3	2.46	93	76.23	26	21.31						
Lib. service info. devices (kiosks)	A	12	10.81	88	79.28	11	9.91						
	P	14	11.57	101	83.47	6	4.96						
Bookshelf location info. (e.g. smart bookshelf)	A	10	9.01	84	75.68	17	15.32						
	P	2	1.67	110	91.67	8	6.67						
Self-service (check-out/return)	A	34	31.19	71	65.14	4	3.67						
	P	75	61.98	46	38.02	0	0.00						
AI maker kits (user education/program	A	8	7.21	83	74.77	20	18.02						
	P	24	19.83	88	72.73	9	7.44						
Interactive/Virtual reference service	A	49	44.14	54	48.65	8	7.21						
	P	26	21.85	86	72.27	7	5.88						
User-friendly OPAC	A	44	40.00	44	40.00	22	20.00						
	P	53	44.17	49	40.83	18	15.00						
Generating reader advisories or similar lists, helping suggest other material to users	A	7	6.31	87	78.38	17	15.32						
	P	40	33.33	65	54.17	15	12.50						
*Do you think library services utilizing AI and related technologies are useful for your users?***													
Data-driven collection development	A	28	25.45	52	47.27	16	14.55	11	10.00	3	2.73	2.17	1.01
	P	32	26.67	58	48.33	16	13.33	11	9.17	3	2.50	2.13	0.99
Library analysis (e.g. assessing use, assisting with collection management, assisting with evaluation of services)	A	28	25.45	54	49.09	19	17.27	5	4.55	4	3.64	2.12	0.97
	P	36	30.00	61	50.83	12	10.00	8	6.67	3	2.50	2.01	0.95
Smart cart (for efficient acquisition and shelving)	A	4	3.64	28	25.45	54	49.09	7	6.36	17	15.45	3.05	1.04
	P	17	14.29	36	30.25	45	37.82	15	12.61	6	5.04	2.64	1.04
Beacon tech	A	2	1.83	12	11.01	68	62.39	8	7.34	19	17.43	3.28	0.94
	P	5	4.20	14	11.76	78	65.55	9	7.56	13	10.92	3.09	0.89
Lib. service info. devices (kiosks)	A	11	10.00	44	40.00	34	30.91	11	10.00	10	9.09	2.68	1.08
	P	21	17.65	56	47.06	21	17.65	16	13.45	5	4.20	2.39	1.06

(*continued*)

Table A3.

		5		4		3		2		1			
		#	%	#	%	#	%	#	%	#	%	*M*	Std
Bookshelf location info. (e.g. smart bookshelf)	A	19	17.43	30	27.52	44	40.37	7	6.42	9	8.26	2.61	1.11
	P	23	19.33	51	42.86	29	24.37	10	8.40	6	5.04	2.37	1.05
Self-service (check-out/return)	A	33	30.28	42	38.53	16	14.68	9	8.26	9	8.26	2.26	1.21
	P	68	56.67	34	28.33	7	5.83	7	5.83	4	3.33	1.71	1.04
AI maker kits (user education/program	A	14	12.73	26	23.64	47	42.73	10	9.09	13	11.82	2.84	1.14
	P	32	27.12	40	33.90	34	28.81	8	6.78	4	3.39	2.25	1.04
Interactive/Virtual reference service	A	27	24.55	45	40.91	25	22.73	7	6.36	6	5.45	2.27	1.07
	P	27	22.88	49	41.53	22	18.64	10	8.47	10	8.47	2.38	1.18
User-friendly OPAC	A	51	46.79	33	30.28	20	18.35	4	3.67	1	0.92	1.82	0.95
	P	62	52.10	36	30.25	14	11.76	2	1.68	5	4.20	1.76	1.02
Generating reader advisories or similar lists, helping suggest other material to users	A	18	16.36	42	38.18	28	25.45	11	10.00	11	10.00	2.59	1.18
	P	44	37.29	49	41.53	13	11.02	7	5.93	5	4.24	1.98	1.05
*How well-suited is each of the following departments/services in the library for AI and related technology implementation?***													
Acquisition	A	24	21.62	45	40.54	16	14.41	20	18.02	6	5.41	2.45	1.17
	P	25	20.66	54	44.63	22	18.18	13	10.74	7	5.79	2.36	1.10
Technical service	A	28	25.23	45	40.54	22	19.82	10	9.01	6	5.41	2.29	1.11
	P	30	24.79	49	40.50	24	19.83	9	7.44	9	7.44	2.32	1.15
Circulation	A	21	18.92	48	43.24	24	21.62	12	10.81	6	5.41	2.41	1.08
	P	25	20.66	47	38.84	28	23.14	14	11.57	7	5.79	2.43	1.12
OPAC	A	29	26.85	39	36.11	33	30.56	2	1.85	5	4.63	2.21	1.01
	P	42	35.00	45	37.50	20	16.67	8	6.67	5	4.17	2.07	1.08
Reference	A	12	10.81	34	30.63	24	21.62	25	22.52	16	14.41	2.99	1.25
	P	15	12.40	41	33.88	33	27.27	21	17.36	11	9.09	2.77	1.15
Library instructions	A	10	9.01	22	19.82	29	26.13	22	19.82	28	25.23	3.32	1.29
	P	14	11.57	41	33.88	41	33.88	14	11.57	11	9.09	2.73	1.10
Collection development	A	17	15.32	59	53.15	12	10.81	18	16.22	5	4.50	2.41	1.07
	P	24	20.00	55	45.83	24	20.00	10	8.33	7	5.83	2.34	1.07
SDI/Current awareness	A	12	11.11	16	14.81	56	51.85	11	10.19	13	12.04	2.97	1.09
	P	4	3.33	19	15.83	78	65.00	11	9.17	8	6.67	3	0.81
Library administration	A	5	4.50	17	15.32	40	36.04	22	19.82	27	24.32	3.44	1.15
	P	5	4.17	29	24.17	51	42.50	18	15.00	17	14.17	3.11	1.06

Note(s): *5 (very often) . . . 1 (never)
**5 (very useful) . . . 1 (not at all)

Table A3.

Appendix 4

Table A4. Perceptions on training and training methods for the AI and related technologies

		5		4		3		2		1			
		#	%	#	%	#	%	#	%	#	%	*M*	STD
How do you agree with the following statements?													
You are able to attain sufficient knowledge for adopting and utilizing AI and related technologies in your library	A	13	11.50	40	35.40	27	23.89	30	26.55	3	2.65	2.73	1.06
	P	13	10.74	40	33.06	42	34.71	24	19.83	2	1.65	2.69	0.97
You are interested in training on AI and related technologies	A	22	19.47	49	43.36	22	19.47	18	15.93	2	1.77	2.37	1.03
	P	26	21.49	61	50.41	20	16.53	12	9.92	2	1.65	2.2	0.95

Note(s): *5 (strongly agree) . . . 1 (strongly disagree)

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