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From hype to strategy: navigating the reality of experimental strategic adoption of AI technologies in libraries

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Abstract

Purpose – The article highlights the value of adopting an experimental strategy for artificial intelligence (AI) adoption in libraries, with a specific focus on the University of Toronto (UofT) libraries as a case study. The experimental approach entails carrying out small-scale, effective, quick, and reversible experiments to increase awareness, reduce risks with adoption of incorrect, ineffective, or full-scale adoption; increase flexibility in adopting new technologies in the rapidly evolving AI industry; and increase open-mindedness to consider diverse perspectives even though they go against one's held perceptions, and develop dynamic capabilities to innovate. To fully realize the revolutionary potential of AI technologies in libraries, it is crucial to adopt new technologies strategically, driven by experimentation, collaboration, and knowledge sharing.

Design/methodology/approach – Mixed-model research involving case study of UofT libraries and the author's professional experiences in digitally transforming libraries is used to answer the research question. AI is an emerging area and hence its applications in libraries. Leveraging the author's professional and research expertise, the findings from the case study are enriched, offering broader perspectives and more nuanced implications.

Findings – Libraries can recognize emerging opportunities, adapt to the shifting AI landscape, and effectively exploit AI technologies because of the development of dynamic capabilities and a focus on innovation. The UofT instance sheds light on the experimental strategy and acts as a lens to comprehend how to strategically think about the complete AI spectrum rather than keeping an eye on a few technologies that otherwise might just be overhyped in media outlets. A mix of centralization and decentralization of AI technology adoption experimentation is evident at UOT, where any librarian is free to test out a new tool and share their findings with their peers in the expectation that other libraries will embrace it as well. The reverse scenario is also conceivable (top management to individual libraries). UofT's culture fosters collaboration and knowledge-sharing among librarians, promoting experimentation and innovation. Cocreation with patrons, including student entrepreneurs, enhances dynamic capabilities and informs rational adoption decisions. Looking at the results, some future research directions emerge that could strengthen the library's focus on AI. The future research directions indicate the need for further investigation into experiment design, particularly focusing on experimentation policies, monitoring and evaluation of experimentation activities, and fostering greater collaboration with patrons. Additionally, exploring AI adoption factors at both organizational and individual levels is essential to create a supportive environment for these experiments. Conducting continuous AI experiments enables librarians to critically assess AI technologies by leveraging their experiences with various applications, allowing them to distinguish practical solutions from market hype and concentrate on options that truly enhance their library operations.

Practical implications – The article contributes to the knowledge of strategic AI technology adoption and the role of experimentation in libraries' adoption of AI technologies. This paper offers practical guidance for libraries of all sizes and resource levels seeking to experiment with AI technologies. It encourages the creation of a collaborative environment where patrons and peers can come together to experiment and share knowledge.

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Additionally, it encourages libraries to explore various research directions—such as defining experimentation policies, integrating monitoring and evaluation (M&E) to assess the effectiveness of experiments, fostering collaboration, and leveraging AI adoption factors—to cultivate a culture of experimentation. This approach aims to increase the number of experiments and, consequently, the adoption of valuable AI technologies.

Originality/value – AI in libraries is rapidly evolving, but current literature remains underdeveloped and lacks comprehensive adoption frameworks. Investigating individual libraries' AI practices and sharing these insights will enable collaborative learning, helping them improve overall adoption process, fostering further innovation with emerging technologies, and helping in development of a theoretical foundation or maturity of AI domain. The research outcomes hold significant value for a wide range of libraries, from those hesitant to adopt AI due to ethical concerns to those actively experimenting with AI technologies. The article uniquely recommends further research at the intersection of library AI-driven digital transformations, cocreation, monitoring and evaluation (M&E), adoption models, and AI experimentation policies that ethically balances library innovation focus and data privacies.

Keywords Libraries, Dynamic capabilities, Artificial intelligence, Innovation, Experimentation, Strategic technology adoption, Entrepreneurship, Cocreation, Monitoring and evaluation, AI experimentation policy

Paper type Case study

1. Introduction

Artificial intelligence (AI) has revolutionized various sectors, including knowledge sector, with profound implications for libraries. Emerging technologies like robotics, chatbots and generative AI hold immense potential to redefine library operations and enhance user experiences. For instance, Generative AI, such as ChatGPT, offers significant potential for both academic and public libraries by generating unique content based on the extensive datasets used to train large language models (LLMs). This technology can tailor student reading lists, aid in metadata tagging, and summarize research papers, enhancing information accessibility and knowledge discovery, thereby benefiting patrons, including the entrepreneurs seeking business support from the libraries. Previous studies have highlighted AI as an opportunity to enhance library services (Echedom and Okuonghae, 2021; Winkler and Kiszl, 2022; Ajani *et al.*, 2022). However, these technologies, for instance ChatGPT also presents several limitations, including inaccurate responses to queries or generation of harmful or violent contents, concerns around data protection, potential misuse, privacy and security risks, accessibility challenges, limited understanding of complex technologies, potential biases, inability to comprehend the context, Over-reliance, Digital-divide, Blackbox problem, and other ethical considerations (Fui-Hoon Nah *et al.*, 2023; Panda *et al.*, 2024; Nehra and Bansode, 2024).

The adoption of AI technologies in academic libraries is on the rise and expected to continue growing (Winkler and Kiszl, 2022). Hervieux and Wheatley (2021) found that 43% of surveyed academic librarians in Canada and the USA are optimistic about AI's positive impact on libraries, indicating a growing awareness and potential. This aligns with the findings reported by Yoon *et al.* (2022), based on a survey of public and academic libraries in North America, which showed that while perceptions of AI technologies are generally positive, there is a strong interest in receiving additional training. This is also in line with the findings of Lo (2024a), which indicate that while library employees have a modest understanding of AI concepts and recognize the potential benefits of AI, their readiness for implementation remains low due to the need for training and the establishment of ethical guidelines. Similarly, Kaushal and Yadav (2022) found that stakeholders are generally supportive of AI tools, such as chatbots, but remain cautious due to concerns about privacy and the ability of AI to handle complex tasks. These practical issues appear to have affected the implementation of AI technologies in libraries, aligning with Huang (2024) findings that while librarians recognize the inevitability of AI applications in the future, they also highlight that practical challenges serve as a barrier to fully embracing these technologies.

The technology adoption decisions should be grounded in the strategic planning enabling libraries to align their priorities with external trends, fostering the adoption of AI technologies

for enhanced services (Saunders, 2015). The lack of technology adoption decisions in strategic plans is associated with lower adoption rates (Okunlaya *et al*., 2022), compounded by concerns regarding the inherent limitations of technology, particularly ethical issues, and the need for comprehensive training (Lo, 2024a; Kaushal and Yadav, 2022; Huang, 2024). Integrating AI adoption strategies into strategic planning is essential for cultivating a culture of continuous experimentation with emerging technologies, where learning from failures is embraced, sharing both successes and setbacks is the norm, and trying new initiatives—even on a small scale—is encouraged without hesitation.

As the AI field continues to evolve and advanced applications consistently emerge in the market, adoption rates are expected to rise, significantly influencing libraries' future work and presenting both opportunities and challenges that must be addressed. However, careful exploration of these technologies is essential to identify potential use cases while addressing their inherent limitations driven by continuous, small-scale experiments. Experimentations help librarians to make strategic technology adoption decisions grounded on their hands-on experimentation, and cumulative experiences with the technology. Lo (2024b) reported that the successful AI reskilling involves cultivating a culture of continuous learning, adaptability, and collaborative exploration, underpinned by a practical, hands-on approach, helping librarians navigating continuously evolving AI landscape. Practical experiences and collaborative exploration of technology enable librarians to develop essential technology-related competencies, including dynamic capabilities, which triggers continually experimentations with emerging technologies while mitigating the impact of market hype. Liu *et al*. (2024) reported on the relationship between AI adoption, existing dynamic capabilities, and AI adaptation. Their findings indicate that established dynamic capabilities are essential for sensing AI, seizing AI, and transforming to effectively leverage AI for various business activities, such as business model innovation. Conducting continuous AI experiments enhances a librarian's dynamic capabilities, strengthening their ability to sense opportunities, seize them, and reconfigure resources, ultimately positioning them to undertake further AI experiments in the library.

The field of AI is continuously evolving, and new applications for libraries are emerging at a rapid pace. While existing literature addresses various AI-related aspects within the library sector, it remains underdeveloped and lacks maturity at this stage. The swift advancements in AI technologies, particularly in areas like Generative AI, reveal substantial gaps in the literature, posing challenges for libraries attempting to adapt existing solutions (where they exist) to meet their specific needs aligned with their unique working context (Gupta, 2024a). Additionally, the literature lacks comprehensive approaches to AI technology adoption tailored to libraries. Such adoption approaches are essential for helping libraries navigate the complexities of an ever-evolving AI landscape. There is an urgent need for exploratory research into how individual libraries are adopting AI.

To bridge this gap, this article reports the result of the conducted case study with University of Toronto (UofT) libraries. The results will help to contribute to the theory of the AI adoption process of libraries grounded on UofT practices helping the library community to become aware of such practices, add to these practices their experiences, and contribute to the best practices to navigate the complexities of integrating AI-evolving technologies effectively. This will ultimately be contributing to a more robust theoretical foundation for AI in the library sector.

The findings are supplemented by the practical experiences of the researcher illustrating the impact of an AI adoption experimental culture on entrepreneurial services of the library community especially driven by cocreation with patrons (not only student entrepreneurs). The future research directions are then provided that indicate the need for further investigation into collaborative experiment design, particularly focusing on experimentation policies, and monitoring and evaluation (M&E) of experimentation activities. Additionally, exploring AI adoption factors at both organizational and individual levels is essential to create a supportive environment for these experiments. This research tries to answer the following research

question *"How are libraries adopting AI technologies strategically, with a specific focus on UofT libraries, and how can they further innovate adoption processes"?*

2. University of Toronto (UofT) library: a case study

2.1 Research methodology

The adoption of AI in university libraries plays a significant role in enhancing their support for businesses. By embracing AI adoption, libraries can effectively assist buddy entrepreneurs to develop their entrepreneurship skills by gaining access to the valuable resources, generating insights, and fostering innovation, thereby facilitating their future journey in domestic and international markets. The discussion about the support provided by libraries to businesses, the resources owned by them, and how libraries are advancing digitally requires a special focus on AI technology adoption at the libraries. This was uncovered during interview sessions with librarians of UofT (discussed in following paragraphs). AI adoption directly impacts library services and plays a defining role in shaping the portfolio of services offered to businesses. By exploring the intersection of AI adoption and library support to entrepreneurs, the research sheds light on how libraries can enhance their support and cater to the evolving needs of businesses in today's technological landscape.

In March and April 2023, the researcher spent two weeks conducting research at the UofT libraries in Canada. It was an incredible experience to meet with librarians, library managers, and experts from incubators, accelerators, and the Centre for Entrepreneurship. The goal was to research the entrepreneurial initiatives enabled by UOT's robust innovation ecosystem. Interviews with these professionals, observations, and document analysis were the data collection instruments as the part of the research case study of UofT. The reasons for visiting the UofT libraries (and its entrepreneurship ecosystem) includes the following:

(1) The UofT library system is the largest research library system in Canada and the second largest in North America, providing unparalleled resources and support for their patrons (University of Toronto, n.d.a). This presented a valuable opportunity to explore the intersection of libraries and their role in fostering entrepreneurship. The resources offered by the libraries cater not only to traditional patrons but also to student entrepreneurs.

(2) There is a growing emphasis on supporting entrepreneurs through an extensive entrepreneurship ecosystem, where libraries play a crucial role as support actors. This includes over 12 accelerators, Centre for Entrepreneurship, libraries across three campuses, and a specially designated Entrepreneurship Librarian role (University of Toronto, n.d.b).

(3) The University of Toronto (UofT) has successfully established 650 companies, leading all Canadian universities in this regard and attracting over $3bn (CAD) in investments in the last ten years. In 2022, UBI Global acknowledged UofT's entrepreneurial efforts by placing it among the top 10 university-managed incubators worldwide (University of Toronto, n.d.c).

The incorporation of AI technology in UofT libraries is one intriguing area investigated during two-week research visit, undertaken as a rigorous case study. This investigation involved rigorous data collection methods, including interviews and email correspondence, to gather insights from participants, ensuring that their perspectives were accurately captured and integrated into the analysis. This helped to document the practices and strategies employed by UofT libraries in integrating AI technologies into their services.

The findings from this case study not only provide insights into UofT's practices focused on experimenting with AI technologies but also serve as a foundation for identifying future research directions. By examining how AI is currently utilized, this research highlights

potential areas that require further attention to strengthen AI adoptions, ensuring that the ongoing discourse surrounding AI in libraries remains relevant and impactful.

The case study involved conducting an interview with the Director of Strategic Initiatives and Associate Chief Librarian for Science Research and Information, UofT. They were informed of the intent to investigate the current topic and the plans for publication, ensuring that the results could be shared with a broader audience. This approach aims to help others learn from ongoing UofT efforts, adapt best practices, and disseminate key lessons within the community. Data collected during the interview with Director of Strategic Initiatives was meticulously recorded and subsequently analyzed utilizing NVIVO software. The data was collected from the Associate Chief Librarian for Science Research and Information through an email exchange, during which pertinent information regarding AI adoption was shared. Subsequently, the researcher's analysis pertaining to latter was shared with the Associate Chief Librarian, who provided feedback. Minor edits were made to the analyzed results based on this feedback loop to ensure that the researcher interpretation of the email information was correct.

In the current research investigation focusing on the role of AI in UofT libraries, this study is part of a broader examination of how UofT libraries support entrepreneurs. In summary, only the Director of Strategic Initiatives and the Associate Chief Librarian for Science Research and Information were involved in data collection, providing valuable insights on the topic under investigation. Furthermore, the Associate Chief Librarian offered feedback on the researcher's interpretation of the insights she shared, primarily making minor edits to improve clarity and accuracy. The research was approved by the Institutional Review Board of Gisma University of Applied Sciences, Potsdam, Germany under protocol number 02/2023.

2.2 Result analysis

The UofT Libraries' focus on AI was brought up during the discussion with the director of strategic initiatives. The University of Toronto (UOT) libraries demonstrated a strong emphasis on the adoption of AI technologies, albeit with a focus on an experimental approach. This commitment to exploring and integrating AI was evident in their initiatives and activities. Weekly meetings of the UofT library executive council include discussions on AI, apart from other topics as well. Additionally, there is a Retreat that is held once a year and focuses on in-depth conversations concerning a variety of subjects, including AI. This shows that libraries are aware of the potential of AI technology and seek to adopt them rationally. Researcher opinion is that it is a prudent strategy to implement AI technologies incrementally. This avoids the situation where they are devoting all resources in a "one-go" fashion without fully knowing their potential and the areas in which they could create significant value.

The UofT libraries' weekly newsletter, "In the Loop," was a noteworthy means of communication with all library staff. The purpose of this newsletter was to inform everyone of events and updates taking place at the UofT libraries. A special section, named "Special Series: Artificial Intelligence", was created as a 9 weeks series to highlight different AI tools for people to test out and play with. In other words, this special section was specifically intended to inform library staff about various AI technologies to make them aware of new technologies, motivating them to test them out and then share their experiences with their peers for possible adoption of valuable tools. One example, which ran in the March 29, 2023 edition, introduced Scholarcy, an AI tool that summarizes articles and creates and transforms lengthy articles into summaries in the form of interactive flashcards. The deep learning technology employed by Scholarcy enables it to extract meaningful insights from complex scholarly texts, breaking down these texts into smaller, easily digestible sections, for instance, key findings, creating links to open access versions of cited sources, and comparisons with earlier studies. This special section helps raise awareness of simple-to-use AI technology, and hopefully inspires library staff to experiment with them and identify uses for them in library operations. One significant benefit would be that it keeps library staff informed about and interested in the developments in AI technology at UofT libraries. Peer libraries can learn from the experiences

that librarians have had with the AI tools. Additionally, the UofT library executive council can be informed of this for potential discussion during their executive sessions.

An alternate approach that was also implemented was for UofT's individual libraries (there are 40) to experiment with new technologies, putting these technologies to use at smaller scale, and if these technologies are really valuable then sharing findings with other libraries. As a result, the peers learn about this useful technology, get access to adoption experiences, and acquire the skills necessary to test these technologies in their own libraries to evaluate whether they might be useful for their library operations. The peers eventually form a behavioral intention to use these technologies as a consequence of this process. This method of trying new things (experimentation), exchanging knowledge, and working together within the library community enhances the first library's operations as well as giving other libraries the opportunity to investigate and use cutting-edge technologies. This cooperative strategy helps libraries to keep up with new trends and solutions and develops a culture of continual improvement. One successful case of technology adoption based on this experimentation, collaboration and knowledge sharing approach at UofT libraries is shared by Associate Chief Librarian for Science Research and Information, "*One example was around a library collection app (this was a few years ago) that one library had used to help with collection maintenance. This was shared at an internal conference and several libraries were intrigued and also began using the same technology in their spaces*". Also, UofT libraries has included AI play in the workplan documentation for all libraries; motivating library staff to interact with each other and with various AI tools. According to the Associate Chief Librarian for Science Research and Information UofT Libraries, "*I have recently formed 4 small AI working groups of short duration to get people discussing and playing with different AI concepts, which will then be shared back to the system writ large*". These groups will foster exploration, learning, and collaboration around AI technologies within the library community.

In researcher opinion, the UofT case signifies that librarians are very much aware of the AI world and are motivated to enhance their current services or add new ones to better serve their patrons based on evidence-driven experimentation with AI technology. All librarians are free to adopt and evaluate AI technologies and then discuss their technology experiences with their peers and top management. Knowledge sharing, both positive and bad experiences is valuable in future experimentations which are conducted in a continuous manner. This strategy appears to have the major advantage of making librarians aware of AI technology even if it is overhyped, but adoption of that technology will proceed rationally and only be made if it offers value.

3. Potential impacts on entrepreneurship support activities

UofT libraries offer diverse services to support entrepreneurial growth, including workshops, training, research tools, and networking opportunities. While the emphasis is on developing entrepreneurial skills rather than directly facilitating business establishment, the goal is to equip entrepreneurs with knowledge and resources to nurture their abilities for future career endeavors. While not directly discussed in interview sessions, the experimental culture for AI adoption is likely to influence entrepreneurial services at UofT libraries. As integral parts of the UofT ecosystem, these libraries cater to the diverse needs of students, instructors, researchers, and staff. Their emphasis on experimentation aligns with a commitment to fostering innovation, a cornerstone of entrepreneurial success.

The experimentation culture significantly impacts the involvement of students and student entrepreneurs in ongoing initiatives. Educating them about the value of experimentation fosters their engagement with AI technology, allowing them to explore, test concepts, and refine entrepreneurial assignments using library-provided AI platforms. Their feedback is valuable for librarians experimenting with technology, aiding in further innovation of the adoption process. Additionally, their enthusiasm for experimenting with new technologies and expertise can enhance library efforts in the AI sector through social influence of the peers and

the patrons. Sharing experiences and providing support in experimentation cultivates a robust AI community involving students, librarians, and other patrons.

Libraries' experimentation culture enhances services, benefiting entrepreneurs and patrons with tailored and efficient support. Embracing an experimental mindset, libraries continuously evaluate new technology opportunities to meet evolving user demands, resulting in individualized assistance. With increased awareness and experience with AI technologies, libraries can offer customized resources, workshops, and guidelines, such as ChatGPT fair usage policy documents, tailored to patrons' and university entrepreneurial community's needs. Through this experimental culture, libraries aid entrepreneurs in acquiring essential skills by providing cutting-edge resources, networking opportunities, and insightful advice.

The emphasis on AI adoption and the experimental culture in libraries will enrich UofT's innovation ecosystem. Through shared experimentation, libraries collaborate with incubators, accelerators, and the Centre of Entrepreneurship, facilitating knowledge exchange and idea cross-pollination. This integration positions libraries as integral components of the broader innovation ecosystem. As AI technologies are increasingly utilized and the experimentation culture matures, the full impact will become evident over time.

Through active engagement and shared decision-making, stakeholders cocreate value in a collaborative process known as cocreation. For instance, it entails including patrons and librarians in the planning and creation of library services. Cocreation is one of the tools that could help managers to enhance their innovation capabilities (Frow *et al.*, 2015), reduce the innovation uncertainties especially related to customer needs and the technologies (Piller *et al.*, 2011), and make a response to the uncertain times through innovations.

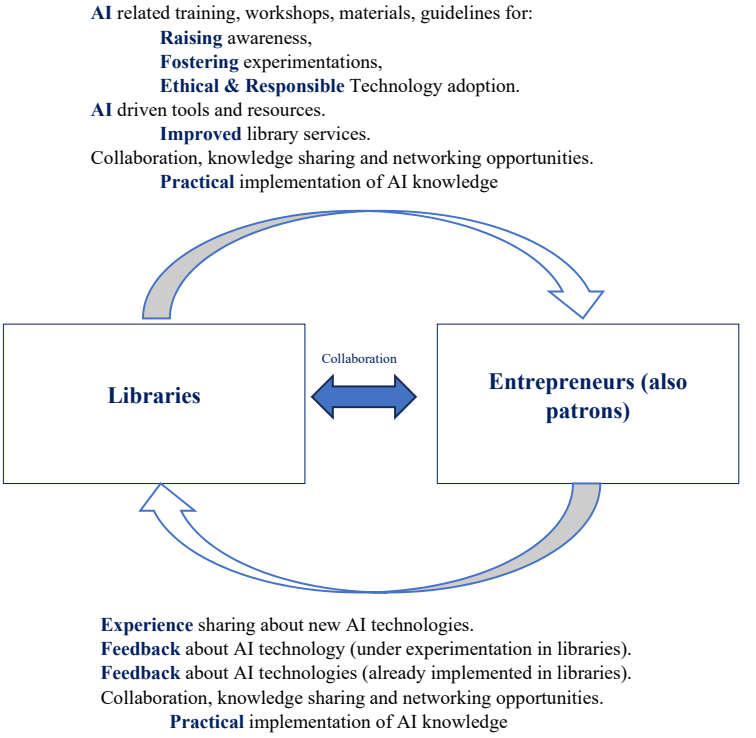
In cocreation, library users no longer solely determine final outcomes but contribute knowledge and insights, fostering creative solutions. This collaborative approach strengthens relationships, encourages innovation, and yields solutions that align with everyone's needs and preferences. Collaboration between librarians and users creates value for both parties, driving innovation in experimentation practices, dynamic capabilities, and services. Patrons, through practical AI implementation, offer valuable insights that inform library innovation efforts.

Figure 1 shows how libraries and buddy entrepreneurs collaborate or support ongoing AI adoption experiments in libraries.

4. Discussion and future research directions

UofT libraries foster an experimental culture promoting methodical, self-directed adoption of AI technologies through knowledge-sharing and data-driven practices. Librarians benefit from conducting small, incremental experiments to assess AI's benefits and drawbacks, aiding informed decisions on its adoption and integration into specific library activities.

The decision to adopt AI technology or switch to the alternative solutions (switching intentions) is done by going through multiple stages iteratively. Progressing through stages helps them to gradually assessing technology's usefulness, ease of use, and emotional responses before making a final decision (Gupta and Yang, 2024; Gupta, 2024b). Generative AI adoption model proposed by Gupta and Yang (2024) from perspective of the entrepreneurs and evaluated by Gupta (2024b), outlines three stages through which entrepreneurs adopt the technology. In the Preperception and Perception Phase, entrepreneurs familiarize themselves with generative AI through iterative hands-on experiments, influenced by factors such as social environment, technology experience, system quality, domain experience, support and training, interaction convenience, and anthropomorphism. As experimentation progresses, utilitarian value gains prominence over hedonic values. Moving to the Assessment Stage, entrepreneurs delve deeper into using the technology for complex tasks, evaluating perceived usefulness, ease of use, and generating perceptions of enjoyment. Utilitarian value becomes more significant, influencing emotions and intentions to switch to generative AI (outcome stage). The adoption factors foster the user's continuous experimentations with the technology grounded on self-learning, peers support, and previous experiences. For instance, there is



Source(s): Author's own work.

Figure 1. Cocreation with library patrons

higher adoption of technologies in personal lives of librarians (Hervieux and Wheatley, 2021). Enhanced adoption in personal lives, human type interactions with these technologies, and other factors limit the need for explicit instruction or formal training to understand and adopt the technology. This is consistent with research published in (Chu and Du, 2012; Semode *et al.*, 2017), which reported that librarians pick up on the training intuitively through self-practice, conferences, and seminars, and asking friends and colleagues for assistance. An increased understanding of the adoption factors will enable library managers to develop strategies that leverage these elements, fostering an open innovation environment that nurtures a culture of experimentation and promotes data-driven adoption decisions based on practical, hands-on experiences with these technologies. A better understanding of these factors also helps library managers select emerging AI applications from a wide array of options, focusing on those that appear feasible and easy to experiment with, based on alignment with the organization's resources and capabilities. For instance, a library may choose to experiment with a customized Generative AI chatbot prototype designed specifically for the library context and business support services, due to three favorable adoption factors: social factors, reflecting the positive community attitude toward AI, especially since chatbots have been used in libraries before; anthropomorphism, which enhances user comfort through relatable, human-like interactions, as current applications often feature text and voice capabilities; and librarian domain experience, meaning librarians possess valuable experience in supporting businesses and can effectively evaluate the quality of current technology while supplementing the chatbot's output with additional data sources. This facilitates experimentation by providing a supportive environment where librarians can confidently explore AI technologies, leveraging their

existing knowledge and user familiarity. As a result, they can more effectively assess the chatbot's performance, gather meaningful feedback, and make data-driven improvements, ultimately enhancing the library's services and user experience. This helps the library target applications that can be easily experimented with using existing resources. The experience gained from these initial experiments raises the competency levels necessary for tackling more complex applications in the future. This also enables libraries to adopt technologies based on their own experiences rather than relying solely on news buzz.

The experimentation culture fosters librarians' enthusiasm for exploring new technologies and sharing insights with peers, thus mitigating hesitations toward adoption. Despite awareness of AI adoption in academic libraries, librarians often harbor mixed feelings (Ajani *et al.*, 2022), and concerns regarding the inherent limitations of technology, particularly ethical issues, and the need for comprehensive training (Lo, 2024a; Kaushal and Yadav, 2022; Huang, 2024). Practical experiences gained through experimentation alleviate these doubts, promoting adoption based on real-world encounters rather than instinct. This culture enables libraries to continually experiment with emerging AI technologies with tangible business value.

It can be argued that organizational flexibility is demonstrated by the fact that any librarian inside an organization has the freedom to research and test AI technology leading to sharing their findings and recommendations with their peers and superiors. Knowledge and experience are transformed into a strategic resource by the capacity to undertake experiments and use experimental learning, thereby strengthening need-based experimentations and curiosity-based experimentations (Gupta and Gupta, 2023). This also strengthen their dynamic capabilities that further fosters experimentations-driven AI adoptions.

An open issue remains regarding how librarians can foster AI experimentations when sensitive data must be shared with AI applications. Establishing effective protocols and strategies for securely managing sensitive information, while still enabling innovation, is a critical challenge that needs to be addressed. This involves balancing the need for experimentation with strict adherence to data privacy norms, ensuring that AI technologies can be tested and utilized in ways that are both innovative and compliant. Despite librarians' awareness of AI's potential, their ability or motivation to implement and experiment with it remains low due to concerns, particularly regarding ethical issues such as privacy (Lo, 2024b; Kaushal and Yadav, 2022). These concerns may limit their willingness to explore and adopt new technologies. Further research is required about how libraries can formulate an AI experimentation policy that allows librarians to conduct experiments with flexibility when no sensitive data is involved and under controlled conditions when sensitive data is at stake. Additionally, exploring how institutionalization can support the AI experimentation policy—by fostering collaboration between different actors with different authorities to enforce controlling. This will be crucial for ensuring that AI technologies are integrated effectively and ethically in library settings.

Another issue is integrating M&E activities with AI experimentation to evaluate both individual experiments and the effectiveness of all the experimentations conducted and ongoing in the library. This will help librarians to measure impact of their experimentations and take further actions based on the analysis of the evaluations. Formative and summative evaluations will be crucial in determining whether these experimentations, as interventions within the library's innovation program, are successful in achieving the intended objectives, and hence achieving planned outputs and outcomes. The literature outlines various methods for conducting library impact and performance evaluations, as noted by Urquhart (2018) and Yim *et al.* (2020). Poll and Payne (2006) recommend employing outcome-based evaluations in libraries to effectively demonstrate the impact and value of their services. The M&E processes will need to be institutionalized. Institutionalization is important because it establishes clear roles and responsibilities for conducting M&E, ensures coordination among stakeholders, defines who will receive evaluation reports, and outlines decision-making authority based on the findings. Additionally, decisions must be made regarding whether the M&E process will be

conducted by librarians, a dedicated library department with expertise in M&E, or an external M&E agency. A collaborative approach is also possible where librarians collaborate with third party evaluators to establish M&E framework and then librarians conduct its activities, for instance survey with patrons. This approach was used in Libraries Build Business (LBB) initiative of American Library Association (ALA) supported by Google.org, where libraries and Cicero Group, an impact consulting firm, collaborated to develop a M&E framework and helped libraries in implementing M&E activities (American Library Association, 2023).

The crucial research questions that warrant further investigation pertain to designing, planning, and executing experiments as well as evaluating their success, cocreating with patrons, and AI technology adoption models. Libraries must ensure that experiments and carefully designed and their results accurately measured to drive further experiments. If experimentation is assumed as an intervention, then frameworks such as the theory of change (Weiss, 1995) can be employed to explain the experiment activities and how they lead to the desired change. Additionally, the factors influencing patrons' decision to participate in cocreation experiments need to be investigated further. The patron's participation in technology adoption experiments could influence their peers to participate as well and adopt the technology (called social influence) needs to be empirically investigated. Libraries have the challenge of providing an environment that fosters experiments and knowledge transfer across business-driven and curiosity-driven experiments. Finally, AI technology adoption factors at individual and organizational levels need to be empirically investigated to identify adoption factors. As noted earlier, understanding these factors helps library managers create an environment that leverages them, strategically selecting and embracing technologies that align with their specific resources, capabilities, and community needs, rather than being driven by media hype. The experience gained boosts their dynamic capabilities, empowering them to make informed adoption decisions in the future. The future research directions/agenda is given in Table 1.

5. Research contributions

This research has made the following theoretical and practical contributions.

(1) *Theoretical contributions:* This article adds to the theory of AI applications in libraries and illustrates the importance of experimentation-driven technology adoptions, aligning with concepts of organizational learning and dynamic capabilities. By advocating for small-scale, reversible experiments, the article suggests a method for libraries to adapt to the rapidly changing AI landscape while minimizing risks associated with full-scale adoption. Additionally, the importance of cocreation with library patrons is highlighted which will help libraries to innovate their library services making adoption a learning process for both parties.

(2) *Practical contributions:* On a practical level, the paper provides insightful guidance for libraries looking to incorporate AI technologies into their business operations. The article offers practical examples of how libraries can use experimentation, collaboration, and cocreation with patrons to spur innovation and successfully utilize AI technologies, using the UofT library as a case study. Libraries with limited resources and uncertainty about AI applications can benefit from the approach that emphasizes small-scale experimentation and flexibility in adoption processes. The research outcomes have greater value for a broad spectrum of libraries—those that are hesitant to adopt AI due to ethical issues, those focusing on AI by organizing third-party training sessions, workshops for patrons, and involvements in small-scale experiments at individual levels, and those actively experimenting with AI. Additionally, the managers will have to create an environment where business-driven and curiosity-driven experimentations are fostered, and knowledge is transferred across each type of experimentation. Conducting continuous AI

Table 1. Future research agenda

Topic	Research agenda discussion	Future research questions
Experimentation	Designing and conducting meaningful experiments	1. How can libraries design effective experiments? 2. What factors result in curiosity-driven experiments? 3. Does participation in both business-driven experiments and curiosity-driven experiments impact technology adoption? 4. How the outputs, outcomes, and impacts of the experimentations can be evaluated 5. How M&E can be institutionalized to support AI experimentation policy that supports M&E? 6. How the AI technology adoption experiments can be planned and evaluated? 7. How can libraries develop a robust AI experimentation policy that allows continuous experimentations in a way that balances innovation with data privacy?
Cocreation	Making experimentations more participatory, especially by involving patrons	1. What are the factors that will motivate patrons to participate in experiments? 2. Does patron participation impact the technology adoption? 3. Does patron participation impact the motivation levels of peers to adopt the technology?
AI adoption process	Identifying the factors influencing the decision to adopt various AI technologies	1. What are the factors that motivate librarians to adopt AI technology, for instance, Generative AI technology (individual level)? 2. What are the factors that motivate libraries to adopt AI technology, for instance, Generative AI technology (organization level)?

Source(s): Author's own work

experiments enables librarians to critically assess AI technologies by leveraging their experiences with various applications, allowing them to distinguish practical solutions from market hype and concentrate on options that truly enhance their library operations. Overall, the paper offers libraries valuable insights from the UofT library to help them navigate the challenges of AI adoption by addressing resistance to technology experimentation, enabling them to leverage AI's functionality to create value for library users and stakeholders.

6. Concluding remarks

The article emphasizes the importance of strategic technology adoption driven by experimentation, collaboration, and knowledge sharing to harness the transformative potential of AI technologies in libraries. UofT library serves as a valuable case, showcasing an experimental approach to AI adoption that fosters continuous learning, sharing of learning with peers, and possible adoptions. An experimental culture and a strategic mindset are necessary for successful AI adoption. Librarians are encouraged by experimental cultures to undertake small-scale, reversible experiments, learn from their mistakes, and make informed decisions. Through these experiments, librarians will have improved experimentation skills, and dynamic capabilities to leverage across constantly evolving AI landscape.

Dynamic capabilities as acquired through continuous experimentations help libraries to sense emerging AI opportunities, seize them proactively, and transform their operations to leverage the potential of AI technologies. The development of dynamic capabilities, the promotion of experimental culture, and an emphasis on innovation are necessary for libraries to successfully incorporate AI technologies, and cocreation with the patrons can positively contribute to it. Libraries can navigate the shifting AI world, continuously enhance their offerings, and cater to the changing demands of their patrons. This encourages libraries to maintain a broader focus on a diverse array of AI applications, rather than limiting their attention to just a few headline-grabbing technologies. NBE and CBE frameworks provide a holistic framework to provide librarians with effective strategies to experiment with AI technology. By leveraging both frameworks, libraries can experiment with new AI technologies to innovate library services to serve their patrons in a better way.

Finally, a thorough investigation into experiment design, execution, and evaluation, alongside understanding patrons' cocreation participation and AI adoption factors, is crucial. Employing frameworks such as the Theory of Change can assist librarians in effectively planning their experiments and measuring the impact of ongoing AI initiatives, ensuring that they systematically assess the effectiveness and outcomes of their efforts while aligning with their strategic objectives.

Implementing AI experimentation policies is crucial for libraries to strike a balance between fostering innovation and addressing ethical issues associated with AI. These policies should outline clear guidelines for conducting experiments, ensuring that ethical considerations—such as data privacy, bias, and transparency—are prioritized. This will promote responsible experimentation by providing librarians with essential guidelines for conducting controlled experiments, helping them overcome resistance to trying new technologies. It encourages exploration of innovative AI applications while adhering to existing rules and regulations.

References

Ajani, Y.A., Tella, A., Salawu, K.Y.Y. and Abdullahi, F. (2022), "Perspectives of librarians on awareness and readiness of academic libraries to integrate artificial intelligence for library operations and services in Nigeria", *Internet Reference Services Quarterly*, Vol. 26 No. 4, pp. 213-230, doi: 10.1080/10875301.2022.2086196.

American Library Association (2023), "Libraries build business", available at: https://alair.ala.org/server/api/core/bitstreams/2e276162-edb2-4fbc-9d2b-26ba8eb43691/content (accessed 10 May 2024).

Chu, S.K.W. and Du, H.S. (2012), "Social networking tools for academic libraries", *Journal of Librarianship and Information Science*, Vol. 45 No. 1, pp. 64-75, doi: 10.1177/0961000611434361.

Echedom, A.U. and Okuonghae, O. (2021), "Transforming academic library operations in Africa with artificial intelligence: opportunities and challenges: a review paper", *New Review of Academic Librarianship*, Vol. 27 No. 2, pp. 243-255, doi: 10.1080/13614533.2021.1906715.

Frow, P., Nenonen, S., Payne, A. and Storbacka, K. (2015), "Managing co-creation design: a strategic approach to innovation", *British Journal of Management*, Vol. 26 No. 3, pp. 463-483, doi: 10.1111/1467-8551.12087.

Fui-Hoon Nah, F., Zheng, R., Cai, J., Siau, K. and Chen, L. (2023), "Generative AI and ChatGPT: applications, challenges, and AI-human collaboration", *Journal of Information Technology Case and Application Research*, Vol. 25 No. 3, pp. 277-304, doi: 10.1080/15228053.2023.2233814.

Gupta, V. and Gupta, C. (2023), "Leveraging AI technologies in libraries through experimentation-driven frameworks", *Internet Reference Services Quarterly*, Vol. 27 No. 4, pp. 211-222, doi: 10.1080/10875301.2023.2240773.

Gupta (2024a), *Libraries as Hubs for Entrepreneurship*, Springer, Germany, (In Press).

Gupta, V. (2024b), "An empirical evaluation of a generative artificial intelligence technology adoption model from entrepreneurs' perspectives", *Systems*, Vol. 12 No. 3, p. 103, doi: 10.3390/systems12030103.

Gupta, V. and Yang, H. (2024), "Generative artificial intelligence (AI) technology adoption model for entrepreneurs: case of ChatGPT", *Internet Reference Services Quarterly*, Vol. 28 No. 2, pp. 223-242, doi: 10.1080/10875301.2023.2300114.

Hervieux, S. and Wheatley, A. (2021), "Perceptions of artificial intelligence: a survey of academic librarians in Canada and the United States", *The Journal of Academic Librarianship*, Vol. 47 No. 1, 102270, doi: 10.1016/j.acalib.2020.102270.

Huang, Y.H. (2024), "Exploring the implementation of artificial intelligence applications among academic libraries in Taiwan", *Library Hi Tech*, Vol. 42 No. 3, pp. 885-905, doi: 10.1108/LHT-03-2022-0159.

Kaushal, V. and Yadav, R. (2022), "The role of chatbots in academic libraries: an experience-based perspective", *Journal of the Australian Library and Information Association*, Vol. 71 No. 3, pp. 215-232, doi: 10.1080/24750158.2022.2106403.

Liu, Y.D., Sun, J., Zhang, Z.J., Wu, M., Sima, H. and Ooi, Y.M. (2024), "How AI impacts companies' dynamic capabilities: lessons from six Chinese construction firms", *Research-Technology Management*, Vol. 67 No. 3, pp. 64-76, doi: 10.1080/08956308.2024.2324407.

Lo, L.S. (2024a), "Evaluating AI literacy in academic libraries: a survey study with a focus on US employees", *College and Research Libraries*, Vol. 85 No. 5, pp. 635-S668, doi: 10.5860/crl.85.5.635.

Lo, L.S. (2024b), "Transforming academic librarianship through AI reskilling: insights from the GPT-4 exploration program", *The Journal of Academic Librarianship*, Vol. 50 No. 3, 102883, doi: 10.1016/j.acalib.2024.102883.

Nehra, S.S. and Bansode, S.Y. (2024), "Exploring the prospects and perils of integrating artificial intelligence and ChatGPT in academic and research libraries (ARL): challenges and opportunity", *Journal of Web Librarianship*, pp. 1-22, doi: 10.1080/19322909.2024.2390413.

Okunlaya, R.O., Syed Abdullah, N. and Alias, R.A. (2022), "Artificial intelligence (AI) library services: innovative conceptual framework for the digital transformation of university education", *Library Hi Tech*, Vol. 40 No. 6, pp. 1869-1892, doi: 10.1108/LHT-07-2021-0242.

Panda, S.K., Bhatt, A. and Satapathy, A. (2024), "ChatGPT and its role in academic libraries: a discussion", *New Review of Academic Librarianship*, pp. 1-15, doi: 10.1080/13614533.2024.2381510.

Piller, F., Ihl, C. and Vossen, A. (2011), "Customer co-creation: open innovation with customers", in Wittke, V. and Hanekop, H. (Eds), *New Forms of Collaboration and Innovation in Internet*, Universitätsverlag Göttingen, Germany, pp. 31-63.

Poll, R. and Payne, P. (2006), "Impact measures for libraries and information services", *Library Hi Tech*, Vol. 24 No. 4, pp. 547-562, doi: 10.1108/07378830610715419.

Saunders, L. (2015), "Academic libraries' strategic plans: top trends and under-recognized areas", *The Journal of Academic Librarianship*, Vol. 41 No. 3, pp. 285-291, doi: 10.1016/j.acalib.2015.03.011.

Semode, F.D., Ejitagha, S. and Baro, E.E. (2017), *Social Networking Sites: Changing Roles, Skills and Use by Librarians in Tertiary Institutions in Nigeria*, Library Philosophy & Practice, pp. 1-25, available at: http://digitalcommons.unl.edu/libphilprac/1500

University of Toronto (n.d.a), "Quick facts about U of T", available at: https://www.utoronto.ca/about-u-of-t/quick-facts (accessed 14h May 2024).

University of Toronto (n.d.b), "U of T is the place to accelerate new tech", available at: https://entrepreneurs.utoronto.ca/(accessed 14 May 2024).

University of Toronto (n.d.c), "Entrepreneurship at U of T", available at: https://research.utoronto.ca/inventions-commercialization-entrepreneurship/entrepreneurship-u-t (accessed 14 May 2024).

Urquhart, C. (2018), "Principles and practice in impact assessment for academic libraries", *Information and Learning Sciences*, Vol. 119 No 1/2, pp. 121-134, doi: 10.1108/ILS-06-2017-0053.

Weiss, C.H. (1995), "Nothing as practical as good theory: exploring theory-based evaluation for comprehensive community initiatives for children and families", in Connell, J., Kubish, A., Schorr, L. and Weiss, C. (Eds), *New Approaches to Evaluating Community Initiatives*, Aspen Institute, Washington, DC, pp. 65-92.

Winkler, B. and Kiszl, P. (2022), "Views of academic library directors on artificial intelligence: a representative survey in Hungary", *New Review of Academic Librarianship*, Vol. 28 No. 3, pp. 256-278, doi: 10.1080/13614533.2021.1930076.

Yim, M., Fellows, M. and Coward, C. (2020), "Mixed-methods library evaluation integrating the patron, library, and external perspectives: the case of Namibia regional libraries", *Evaluation and Program Planning*, Vol. 79, 101782, doi: 10.1016/j.evalprogplan.2020.101782.

Yoon, J., Andrews, J.E. and Ward, H.L. (2022), "Perceptions on adopting artificial intelligence and related technologies in libraries: public and academic librarians in North America", *Library Hi Tech*, Vol. 40 No. 6, pp. 1893-1915, doi: 10.1108/LHT-07-2021-0229.

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