

Leaders, practitioners and scientists' awareness of artificial intelligence in libraries: a pilot study

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Leaders, practitioners and scientists' awareness of artificial intelligence in libraries: a pilot study

The benefits of
AI in libraries

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Abstract

Purpose – This study investigates the level of artificial intelligence (AI) awareness among library leaders, practitioners and scientists of Indonesian academic libraries to elucidate the benefits of AI implementation and its necessary infrastructure and challenges.

Design/methodology/approach – The study adopted a purposive sampling technique to select the 38 participants and thematic analysis to analyze the data, identifying eight themes: understanding of AI, AI adoption, benefits of AI, competencies needed to support AI, facilities to support AI, factors supporting AI adoption, AI-inhibiting factors and expectations of AI.

Findings – Different viewpoints provided full readiness among library stakeholders and sufficient information to begin AI initiatives in Indonesian libraries as leaders, practitioners and scientists had a favorable, open and encouraging outlook on AI.

Research limitations/implications – The study does not investigate variations in perspectives between the participants, but it examines their understanding of AI and elaborates the results into the concept of an intelligent library. Moreover, this study only uses samples from academic libraries.

Practical implications – Libraries can take these results into consideration before implementing AI, especially in technology and facilities, librarian competency with regard to AI and leadership roles in AI projects.

Social implications – Library boards and library associations can use this research as a source to create guidelines about AI implementation in academic libraries.

Originality/value – The study addresses the gap in the research on university libraries' readiness and awareness to implement AI, especially in developing countries.

Keywords Artificial intelligence, AI awareness, Developing countries, Academic library, Leaders' perception, Librarian perception

Paper type Research paper

Introduction

An intelligent library project using artificial intelligence (AI) is a large-scale undertaking that requires substantial funding, support infrastructure and human resources. Currently, AI is widely used by large-scale companies; however, large libraries, such as academic libraries, are also considering AI to support their services. The work of a library includes technical services (backstage), such as information organization processes (classification, cataloging and subject determination), collection, selection, shelving and loan circulation, and routine

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activities that librarians perform daily. In many cases, librarians spend their time performing repetitive tasks, leaving little time for professional development or the development of library innovations and technologies. The same is true for the managerial level, which requires significant assistance in the library for data analysis and data presentation for decision making and policy formulation.

Many libraries now utilize information technology (IT) not only for library automation processes, such as online public access catalog (OPAC) and information retrieval, but also for gate systems, circulation and cataloging. The IT routinely used in libraries relies on human intervention and interaction. For example, classification and cataloging, where the classification number and metadata of a collection are determined manually, and circulation, which is not entirely performed by machines, require librarians to spend significant time on these routine activities.

Several AI-based technologies are available in libraries to assist with routine or complex tasks; however, only a few libraries have fully embraced AI, either partially or completely. Libraries must consider some specific issues when deciding whether to implement AI, including those relating to leadership policies, budgets, human resources and facilities.

Therefore, the researcher intends to investigate the level of AI awareness in Indonesian academic libraries from the various perspectives of library leaders, practitioners and scientists. It is hoped that the findings will elucidate these perspectives on the benefits of AI for libraries and the infrastructure required for AI implementation as well as its challenges.

Literature review

Several studies have been conducted on AI in libraries, including empirical research, conceptual papers and literature review papers. Papers were collected from the Scopus database, Web of Science and Google Scholar in 2020 using the keywords “artificial intelligence AND library.” The filters included “English language” and a 2016–2020 time range, and a manual screening of the documents was performed to obtain articles related to AI implementation in libraries. Several conceptual papers on AI in libraries have been published, including the impact of AI in libraries (Fernandez, 2016), using AI to solve difficult library tasks (Shrivastava, 2018), and the possibility of implementing AI in libraries (Massis, 2018; Herron, 2017). The literature reviews discuss the potential of AI implementation in libraries and how it can be used to solve library problems.

Some studies have also been conducted on the application of AI in university libraries, including AI in Iran, a taxonomy study (Asemi and Asemi, 2018), human rights protection and AI (Miao, 2019), AI emergence (Omehia and Mmejim, 2020), robots in libraries (Guth and Vander Meer, 2017; Tella, 2020; Yao *et al.*, 2015; Yueh *et al.*, 2020), AI for cataloging (Schreur, 2020), AI to recommend books to users (Xiao and Gao, 2020), AI for service (Chen and Shen, 2019), library chatbots (Allison, 2012), AI for shelving and inventory processes (Zurek *et al.*, 2013), AI in reference services (Honghai, 2020) and AI for classification (Phillips and Chen, 2017). Some of these included case studies of libraries’ AI project initiatives. However, literature that assesses and evaluates the effect of AI on effectiveness and efficiency, decision-making and the ability to stimulate innovation is scarce. This is because libraries are still unsure about the existence of AI, and some believe that it is difficult to achieve and implement.

Several researchers conducted interviews with librarians and other related parties to determine whether libraries were ready for AI (Lund *et al.*, 2020), including leaders’ perceptions of AI and their perspectives (Cox *et al.*, 2019). Prior research has concentrated on libraries’ type of adopter and their leadership’s perspectives on the impact of AI implementation.

Research on AI in libraries has mainly focused on the concept and initiative project of AI, the possibility of AI implementation in libraries and the type of library services that would benefit from AI. However, limited research exists on the readiness and awareness of libraries

to implement AI, particularly in developing countries. Thus, this study aims to close this research gap and make scientific and practical contributions to the readiness of AI implementation in developing countries based on the opinions of library leaders, librarians and scientists.

The benefits of AI in libraries

Methodology

This study adopts a descriptive approach. A total of 38 participants were included in this study. As this study did not aim to make generalizations, the number of participants was considered adequate with respect to Sugiyono's (2015) minimum sample size of 30. The participants were divided into three groups: (leaders) heads of libraries, who accounted for 11 people, (scientists) researchers and library observers, who accounted for 14 people, and (practitioners) librarians, who accounted for 13 people. To select participants, a purposive sampling technique was used, with criteria that included heads of academic libraries who use IT in libraries extensively, such as digital libraries and library automation; researchers and observers in the field of library technology and librarians who work with IT. In July 2021, 11 open-ended questions were distributed to 70 selected participants via Google Forms (Table 1); however, only 38 participants responded.

The questionnaires were followed up and probed through a WhatsApp chat session. Thematic analysis was used to analyze the data, and it identified eight themes: (1) understanding of AI, (2) AI adoption in libraries, (3) benefits of AI for libraries, (4) competencies needed to support AI in libraries, (5) facilities to support AI, (6) factors supporting AI adoption, (7) AI-inhibiting factors and (8) expectations of AI in libraries. The open questionnaire results were then analyzed and coded, and the coding was categorized based on the themes that had been previously developed. In addition, the analysis was conducted by contrasting the findings of previous studies with the concepts of AI.

Findings

The following are the data findings from the questionnaire results, which were grouped and analyzed in accordance with the themes established from the outset of the study.

Understanding of AI as a robot

The results were derived from the responses of participants regarding their understanding of AI as an intelligent machine or robot. Intelligent robots are, according to some, machines that have been given AI. The participants also made connections between robotics and futuristic films, such as *Doraemon*, which tells the story of a smart cat robot; *Avengers*, which features several characters such as robots; and *Star Trek*, among others. Robots were described as

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1. What do you know about artificial intelligence?
 2. Can artificial intelligence be adopted in libraries?
 3. If yes, in what form? And if not, why?
 4. Is artificial intelligence useful for libraries?
 5. How useful is artificial intelligence in libraries? And in what areas?
 6. What librarian competencies can support artificial intelligence?
 7. In your opinion, what facilities should be prepared to support artificial intelligence in the library?
 6. What convenience do you expect when using artificial intelligence in a library?
 9. In your opinion, what are the factors that support the application of artificial intelligence in a library?
 10. In your opinion, what are the factors that hinder the application of artificial intelligence in libraries?
 11. What is your expectation if the library implements artificial intelligence?
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Table 1.
Survey questions

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intelligent machines capable of thinking and acting in the same way as humans. The participants' responses to this question regarding AI are provided as follows:

AI is like an intelligent robot. (Librarian)

(AI is) A computer program that is made so that it can make decisions and not just process them, similar to a robot. (Librarian)

Understanding of AI as a human intelligence-mimicking machine

Additionally, the participants stated that AI is a machine capable of imitating or performing human-like behaviors, and it has the potential to replace repetitive human tasks and make human work more convenient:

A machine that resembles human intelligence and does something (action/response) automatically. (Librarian)

(A) machine/algorithm program designed to be able to think and act like a human so that AI that has a certain capacity can become an agent like humans and be held accountable (accountability). (Researcher)

The participants' responses cited hardware and software that were specifically programmed to resemble human intelligence. AI, as a machine, is more than hardware; rather, it is a technology that has been programmed with specific algorithms and given access to a variety of data to take action, make predictions and perform tasks that are both routine (predict/follow patterns) and time-sensitive (provide solutions quickly).

Understanding of AI as a technology that helps humans work

The participants stated that AI is a computer program beneficial for assisting and answering human questions via the Internet:

Artificial intelligence from a computer program that is useful for helping or answering various human questions through Internet networks. (Researcher)

In addition to being able to answer questions, this technology-based system can perform daily tasks for various professions and repetitive jobs:

A technology-based system that can help humans carry out daily tasks for various professions. (Librarian)

Artificial intelligence to relieve repetitive work. (Researcher)

However, AI is not only limited to performing routine tasks; it can also be defined as a system capable of performing tasks that require the ability to think or the use of human intelligence to complete the task at hand. Some participants stated that AI is

A system that can help us to carry out tasks that require high enough thinking skills including problem-solving. (Chief Librarian)

13 A simulation of the intelligence possessed by humans which are modeled in machines and programmed to think like humans. In other words, AI is a computer system that can perform jobs that generally require human power or human intelligence to complete the job. (Researcher) 4

The participants' understanding of AI varied. Among the three groups, leaders and practitioners perceived AI as a smart machine/robot dominated by librarians, while scientists perceived it as a technology that assists humans in their work, both routine and nonroutine. While the research group perceived AI as a technology that assists humans in their work.

In other words, researchers are more concerned with AI as a technology that benefits humans, while heads of librarians and librarians with a smart machine/robot that can perform tasks. Knowledge of AI is essential as a starting point in the process of preparing libraries for its implementation; consequently, all parties involved were asked to share their thoughts on AI. The data analysis revealed no statistically significant difference in how they viewed AI, indicating that they already had general knowledge of AI and its functions and technology.

The benefits of AI in libraries

AI adoption in libraries

All participants agreed that AI has the potential to be implemented in libraries and provide numerous benefits and conveniences to librarians. Additionally, they stated that AI can assist librarians with routine tasks and technical issues as well as data analysis. With AI, library tasks can be simplified, work productivity will increase and work will be completed faster.

For users, a 24-h service is expected, along with fast access, ease of finding sources of information, accuracy of information, data security, ease of use, quick answers to user questions, user-friendliness and semantic facilities, such as notification of similar sources of information to user accounts and the ability to read and analyze user information needs. AI is also considered useful in supporting library users' research, information services in the form of chatbots, information search and library management.

In terms of management, using AI in the library reduces the need for several human resources and lengthy bureaucracy, facilitates data analysis and aids decision-making. Some of the advantages of AI in libraries are as follows.

Routine task

The participants argued that the presence of AI in libraries could assist librarians in their daily tasks or simplify these. AI also enables librarians to spend less time on routine tasks, allowing them to focus more on their personal development. Moreover, their work will be more effective and efficient as stated by the participants:

Reducing human resource in carrying out routine tasks. To be more focused on self-development. (Librarian)

Very useful for the effectiveness and efficiency of library work. (Chief Librarian)

For libraries, AI is extremely useful, especially for routine and repetitive tasks, such as circulation, shelving and indexing services.

(AI) Can help a librarian a lot, especially in technical matters. such as circulation services and processing library materials. (Chief Librarian)

AI is also required to assist librarians in the processing of information sources, such as classification, cataloging and indexing.

(AI is) Very useful, for example, librarians no longer need to spend a lot of time cataloging/classifying because they have been helped by the AI. (Librarian)

Circulation is the process of borrowing and returning library collections, and with AI, users will no longer be required to interact with librarians when wishing to borrow items from the library. Similarly, shelving activities take up a significant time; however, with the help of a shelving robot, the time spent on this task by the librarian can be significantly reduced.

AI helps librarians do simple work but takes a lot of time, for example in member registration processes, services, (and) shelving. (Researcher)

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Routine work is considered simple, but it consumes librarians' valuable and productive time, limiting their ability to innovate and improve the quality of their library services. Both librarians and chief librarians agree that AI tools, such as shelving robots, misplaced book detectors, classification and cataloging applications and automated borrowing and returning machines, help librarians perform their jobs more efficiently and effectively. Thus far, librarians have been performing all these tasks manually.

Apart from supporting AI technical services, data analytics is particularly useful for jobs that require analysis, such as reference services, natural language searches, user needs analysis and data analytics. Librarians believe that by using AI, they can offer more library services and services that were previously unavailable, such as providing personalized information services for users, where they receive information tailored to their interests and hobbies through AI; performing user information behavior analysis quickly and providing big data services:

As in providing services according to the information needs of each user, AI can play a role in determining the choices of documents that can be ranked based on the user's hobbies, knowledge, and habits. (Researcher)

AI can help analyze user information behavior so that it can provide service relevance and provide solutions for librarians. Services can be included in the library's big data unit, online services section, circulation services section, etc. (Librarian)

Research support

The participants also believed that AI can be beneficial by providing researchers with various tools. The university library serves as the hub of research support for the academic community, and librarians want to make the most of the various tools available to support research and provide the best possible research services:

Several AI-based tools can be used for research and publication. Librarians can pass this on to researchers. (Librarian)

Further, participants stated that AI research support services utilizing machine learning technology can assist researchers in tracing information according to research topics in an appropriate manner as well as provide recommendations on research topics that still need to be researched and developed.

(AI) can even study and suggest the relation of a research topic that is still rarely researched or deserves to be developed. (Librarian)

AI also aids researchers in locating relevant and quick sources of information, such as search systems that can determine what a user wants to look for:

[...] when he searches according to keywords, the system can learn what the user is looking for and can direct to specific sources for the information needed. (Librarian)

Information services

Information services in libraries benefit from AI because they assist librarians in answering common questions that are frequently asked by users. Additionally, AI can assist with reference questions and question and answer (Q&A) services in addition to answering general inquiries.

The benefits are mainly in providing general information services to users. The field can be in reference services, information retrieval, Q&A services, etc. (Researcher)

Library management

In the field of management, AI is also useful for managing human resource data that can be used for career development, building management and library facilities, among other things. According to librarians and researchers, AI can improve library management.

Management, HR career development, information retrieval, services, arrangement of books on shelves by robots, stock-taking. (Chief Librarian)

[. . .] with other technologies, (AI) can manage library facilities: library rooms, building management, etc. (Researcher)

Information retrieval

Information retrieval is one of the most important aspects of library services and is currently accomplished online through the OPAC. AI can improve information retrieval by, for example, automatically surfacing search terms that are commonly used, finding documents quickly and precisely and making search engines more interactive with voice or text inputs. Many researchers expressed their views on the application of AI to information retrieval as follows:

AI can provide the information we normally need. For example, in library search engines, we can install AI, (and) the terms we usually search for will appear in our search engine account without us having to search. (Researcher)

Views on the advantages of AI vary, with librarians and library directors mainly highlighting the advantages of AI for routine work and researchers primarily identifying the benefits of AI in assisting with research services. However, library management and researchers have differing views on the advantages of AI in library administration and information retrieval, and researchers and librarians believe that data analytics are beneficial.

Benefits of AI for libraries

A common understanding among participants is that AI will provide numerous benefits to libraries, such as the ability to assist librarians with routine tasks and to process data and information more quickly. Some librarians spend an excessive amount of time performing routine tasks, and owing to the reduction in technical tasks due to AI, they can devote their time to higher-value activities, such as self-improvement and the development of new services. Librarians believe that with AI, they can perform their tasks more efficiently and effectively, while saving time. Users will also benefit from AI: by increasing service innovation, users will receive excellent services, rapid response times and rapid data and information processing times, among other benefits. In conclusion, library management can make decisions more quickly and accurately as well as manage human resources and library facilities more easily.

Competencies needed to support AI in libraries

AI is supported by two types of competencies: professional and soft. Professional skill competencies include the ability to demonstrate mastery of **knowledge and skills in the field of IT and** librarianship. Soft skills include mastering analytical and critical thinking, creativity, innovation and adaptability.

Professional skills

Information technology. The implementation of AI in libraries will necessitate librarians to nurture their professional skills, including learning general IT skills. Databases, content management systems and programming are examples of IT capabilities.

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Artificial intelligence. Knowledge of AI and its development, as well as an understanding of the tools and applications built from it, are all essential for librarians. Although librarians do not play the role of developers, they must be familiar with AI to work with developers or suppliers. Machine learning, data analytics and information retrieval are examples of areas in which librarians can pursue training or degrees in AI. Training requirements are aimed at enhancing librarians' ability to work alongside technological advancements.

Data analytics. In addition to the above skills, data analysis and statistics using various applications are required and conducted with assistance to be completed quickly and precisely in accordance with the requirements. Librarians can handle a wide range of transaction data, including services, collection, management and other areas.

User behavior. AI is used to analyze customer data, through which the library can examine how users interact with it. Therefore, it is necessary to compensate for library users' behavior while also utilizing data analytics. Through an understanding of this behavior, libraries can provide services tailored to meet the needs of their users and their communities.

System design. In terms of AI, librarians do not need to be familiar with programming languages or technical system development because these require specialized skills that librarians do not typically acquire through education. However, similar to an AI-based information system planner, the librarian acts as a link between system developers and end users.

Soft skills

In addition, librarians are well versed in soft skills, such as flexibility and adaptability to new situations and technologies, as well as creative, innovative, critical thinking, collaboration and communication. Many changes in libraries because of applying AI necessitate adaptable, creative and innovative human resources; therefore, these soft skills are necessary. They also require critical thinkers; as technology exposure in libraries cannot be avoided, librarians must have open and adaptable perspectives in the presence of IT. Librarians must also be creative thinkers who can create new information products.

Facilities to support AI

Hardware, software, brainware and management aspects are all components that must be prepared to support AI in libraries. IT infrastructure, electricity, laptops/PCs/gadgets, Internet, servers, networks, IT laboratories, library collection databases and bandwidth are all examples of hardware.

Software is required to support semantic web features, augmented reality, virtual reality, camera facilities for library behavioral mapping analysis, AI applications, Internet of Things, user interfaces, interactive websites, inference engines and development engines.

Brainware is required in several areas, including librarian competency and officers' adaptive attitudes, AI development team, programmer and maintenance team.

The availability of funds, support from the head of the library and the parent institution, clarity of the concept of AI-based services and preparation of a sustainable system are all important management factors to be considered.

Factors supporting AI adoption

Participants are confident that AI adoption will be successful if leaders and institutions show support and commitment, and IT development policies are clearly defined. In the following stages of the process, human resources should be qualified in both professional and soft skills areas. The availability of infrastructure and financial support will aid in AI adoption.

Factors inhibiting AI adoption

The participants' responses revealed several factors that prevented AI adoption, including those related to management, human resources and facilities. There are management barriers to implementing library development policies, including budgets, leadership vision related to IT, institutions' unwillingness to adopt new technology and an unsupportive organizational culture. Furthermore, HR barriers can be classified as human resource incompetence or incompetence in AI technology. HR is also apathetic to changes in technological developments in libraries; thus, librarians are unprepared and afraid of being replaced, which causes them to be unconfident in their jobs. Other challenges include inadequate infrastructure, an unstable Internet network, high electricity consumption and the inability to keep up with the ever-changing nature of IT.

Expectation on AI

The participants were enthusiastic about the adoption of AI in libraries and had high expectations regarding how AI can assist them in improving their performance. It is expected that AI will improve librarians' capacity and performance through tools that assist them in performing their tasks in a more timely and accurate manner. Incorporating AI into library operations will improve the image of the library and users' experience when visiting it. When users are satisfied with the services provided by the library, their image of the library is positive. Finally, AI has the potential to promote creativity and innovation.

Discussion

This section discusses the findings of the thematic data analysis, which demonstrate the importance of AI adoption in libraries for leaders, practitioners and scientists. The first theme was AI understanding, which is the foundational knowledge required before moving on to other AI topics. The participants were also asked about the possibility of AI adoption in libraries; the advantages of AI for librarians, users and management; the competencies required for AI adoption; the facilities that support AI and the factors that support and hinder AI adoption. Finally, participants were asked about their expectations regarding AI adoption in the library environment. Table 2 provides an overview of these themes.

AI is defined as follows in the Encyclopedia of Life Support Systems: "An area of study in the field of computer science. Artificial intelligence is concerned with the development of computers able to engage in human-like thought processes such as learning, reasoning, and self-correction." In a more limited sense, AI is the study of ways to make computers work more efficiently by improving programming approaches. It can thus be concluded that library leaders, librarians, IT observers and researchers already have a basic understanding of AI, which they define as a machine/robot/computer application that mimics or adopts human intelligence to assist or facilitate human work. They divide AI into four groups: (1) systems that think like humans, (2) systems that act like humans, (3) systems that reason logically and (4) systems that behave logically. The participants also gained an understanding of AI as a smart machine/robot through numerous science fiction films, and their comprehension of AI can be classified into two categories based on their AI literacy, namely those who can recognize AI and those who comprehend the intelligence qualities found in it (Long and Magerko, 2020), and they may explain AI based on the characteristics that they have identified and understand its role. According to a previous study conducted in Pakistan, chief librarians are aware of AI technologies such as Google Assistant, Google Translate, voice searching, text data mining, big data and cloud computing but not of robotic AI and chatbots (Ali et al., 2020). According to prior research conducted in Canada, librarians define AI in terms of how it works and its role in comparison to AI products/technology and

Table 2.
Themes overview

Theme description	Theme	Sub-theme	Example of data from participants
Participants develop their understanding of AI	Understanding of AI	1. Understanding of AI as a robot	"Machine, robot, application" (Librarian)
		2. Understanding of AI as a human intelligence-mimicking machine actions" (Librarian)	"A machine programmed to be able to imitate human thinking and human actions" (Librarian)
		3. Understanding of AI as a technology that helps humans work problems" (Chief Librarian)	"Programs that can be modified and developed to assist humans in solving problems" (Chief Librarian)
Participants identify the possibility of AI adoption in the library.	AI adoption in library	1. Routine tasks, such as circulation, shelving, indexing, classification and cataloging, and user registration	"Automatic book borrowing and returning machines, shelving robots, misplaced book detection machines, etc." (Librarian) "Helping librarians in doing work that seems simple but takes a lot of time, for example in the field of member registration administration, services, shelving" (Scientist) "Research services and research assistant" (Librarian)
		2. Research support, i.e. uses research tools and fast information retrieval for research	"Reference services help answer the questions of users who are looking for a specific topic or subject" (Scientist)
		3. Information services, reference inquiries, Q&A and general library questions	"Management, human resource career development, information retrieval, services, arrangement of books on shelves by robots, stock-taking" (Chief Librarian)
		4. Library management, career development, building management and library facility management	"AI can provide the information that we need. For example, in library search engines, we can install AI, the terms we usually search for will appear in our search engine account without us having to do a search" (Scientist)
		5. Information retrieval and AI for library search engine	"Basically, helping librarians in doing work that seems simple but takes a lot of time, for example in the field of member registration administration, services, shelving" (Scientist) "Very useful because it will help library users to get the information they need without having to make more effort. With AI, all collections needed by users can be according to what they want" (Chief Librarian) "Ease of decision making" (Scientist)
Participants explore the potential benefits of using AI for library	Benefits of AI for library	1. Librarian: help routine tasks, data processing much faster and easier, work effectivity and efficiency, self-development opportunity and time savings	"ICT literacy or ICT development in general, it would be better if you know a little bit about coding" (Librarian) "Creative, innovative, easy to adapt to the times, have critical thinking" (Chief Librarian)
		2. Library users: increase users service, data accuracy and fast response	
		3. Management: decision-making, service excellence and problem-solving	
Participants describe the librarian competency to support AI	Competencies needed to support AI in library	1. Professional skills, IT skills, artificial intelligence skills and knowledge, data analytics, users' behavior and systems design	
		2. Soft skills, adaptive, creative, innovative and critical thinking	

(continued)

Theme description	Theme	Sub-theme	Example of data from participants
Participants identify the facilities that support AI	Facilities that support AI	<ol style="list-style-type: none"> 1. Hardware, IT infrastructure, electricity, PC/gadget, Internet and IT lab 2. Software, augmented reality, virtual reality, interactive website, IoT, inference engine and develop the engine 3. Brainware, management element, fund, head library support, clarity of the concept and preparing sustainable systems 	<p>"In addition to human resources that must be prepared is the completeness of ICT support, hardware/software, Laptop/PC/gadget/wearable gadgets, adequate Internet connection, good cabling management, servers, etc." (Librarian)</p> <p>"Technology-based facilities 4.0 (IoT, semantic web, augmented reality, virtual reality, etc.)" (Scientist)</p> <p>"Technology literate human resources, funds, leadership support, adequate technology equipment" (Chief Librarian)</p>
Participants identify some factors that drive AI adoption	Factors supporting AI adoption	<ol style="list-style-type: none"> 1. Institutional/leader support 2. Qualified human resource 3. Adequate fund 4. Sufficient IT infrastructure 5. Institutional readiness 	<p>"Internal factors related to the highest management support in infrastructure and HR policy support. In addition, the librarian itself must be ready to adapt" (Scientist)</p> <p>"Quality of human resources, the support of shady institutions, the vision of the leadership, and sufficient financial support" (Librarian)</p> <p>"Leadership commitment and budget availability" (Scientist)</p> <p>"Availability of adequate infrastructure and quality human resources" (Librarian)</p> <p>"The readiness of the parent institution to the need to facilitate the application of AI in the library, the head of the library who is vision in the application of AI in the library and qualified library staff in utilizing existing IT and the enthusiasm to continue learning" (Chief Librarian)</p>
Participants identify some obstacles of AI adoption in the library from various aspects	Factor inhibiting AI adoption	<ol style="list-style-type: none"> 1. Management, insufficient library development policies, limited fund, lack of leadership visions related to IT, institution reluctant to implement IT, lack of supporting or organizational culture and lack of fund 2. Human resources, incompetence human resource, apathy, librarian unprepared, librarian afraid to be replaced and not confidence 3. Facility, inadequate infrastructure, unstable network and inability to maintain IT infrastructure 	<p>"The lack of knowledge of policymakers in the institutions that oversee the library and the competence of the application of librarian IT" (Scientist)</p> <p>"Low competence of human resources" (Chief Librarian)</p> <p>"Institutional policies, inadequate budget and infrastructure" (Chief Librarian)</p>
Participants explore their expectations on AI implementation in the library	Expectation on AI	<ol style="list-style-type: none"> 1. Improving librarian capacity and performance 2. Enhance library image and services 3. Increase user engagement and experience 4. Boost creativity and innovation 	<p>"Improving services and competence of human resources even better" (Librarian)</p> <p>"Library services will be more optimal in realizing an informed and knowledgeable society as well as making information and knowledge sources the most basic primary needs" (Scientist)</p> <p>"Data-driven library and user interaction" (Chief Librarian)</p> <p>"Library services are increasingly used by users and produce a variety of new knowledge and innovations produced by users and library staff in the library" (Chief Librarian)</p>

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Table 2.

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what is meant by AI (Ajibade and Mutula, 2020; Hervieux and Wheatley, 2021). In this study, the participants explained AI as a computer that mimics human behavior, gave examples of AI technologies, such as intelligent robots and machines, and addressed the function of AI, which is to assist humans in their work, particularly in data processing.

The participants concluded that AI was beneficial for libraries; they were extremely enthusiastic and expressed the hope that AI could assist librarians, particularly with regular duties, such as circulation services, shelving, processing and the registration of new members, among others, allowing them to undertake more productive work for library development. This is consistent with the numerous research initiatives into the application of AI technologies for classification and catalogs to make the classification of library collections more efficient (Chaoying, 2021) by using machine learning to generate classification numbers using the Dewey decimal system, particularly for names of people found on the web (Golub *et al.*, 2020; Murakami *et al.*, 2013; Omehia and Mmejim, 2020). According to the findings of previous research (Fernandez, 2016; Lund *et al.*, 2020; Morris, 2020; Schreur, 2020), AI can aid in the cataloging process as well as in shelving collections through robotics or automation systems capable of self-shelving (Yang *et al.*, 2017). In addition to aiding librarians, robotic power offers a technologically enriched experience to users.

The participants also considered AI useful for data analytics, such as processing library activity data to be used for decision-making, including loan data, access to e-resources, service usage data and other user activity data. Thus, with the help of AI, the intention is to process user behavior and analyze trends in user needs. Library data processing uses data processing technology in the big data era (Chen *et al.*, 2016) and adopting AI-driven technology for data analytics can accelerate the data analysis process (Lin *et al.*, 2019). The participants stated that several data in the library were not analyzed due to limited time, tools and energy and could not be used for service development and decision-making; this underlies the need for librarians and heads of libraries to utilize AI in their data processing.

Furthermore, AI is valuable for research support by providing knowledge on study topics and assisting in the rapid and precise discovery of relevant material. This is consistent with the findings of prior studies into AI-supported research services (Fernandez, 2016; Iantovics *et al.*, 2016). The benefits of AI can also be felt in the field of information services, as evidenced by previous studies that found smart-talking robots for reference services to be a viable option (Yao *et al.*, 2015).

Overall, AI has numerous benefits in libraries, and previous studies have found that it can be applied to cataloging, classification, indexing, reference and acquisition processes (Mogali, 2015), search engines in digital libraries (Wu *et al.*, 2015), information literacy (Honghai, 2020; Yueh *et al.*, 2020), library marketing (Omehia and Mmejim, 2020), public relations (Guth and Vander Meer, 2017) and content creation (Hilt, 2017). According to this study, using AI applications has advantages, specifically for library management and for structuring human resources and career development as well as physical facilities, such as buildings, rooms and equipment. AI can be used in decision support systems that are relevant to this managerial function (Herron, 2017).

Libraries have the potential to use AI, but this cannot be done without the librarians' expertise, which includes both professional abilities and soft skills. Librarians must be knowledgeable about IT and its applications and development in libraries. They must also be literate in AI, which includes knowledge of AI, AI tools and technology, data analytics competence, library management, user behavior and system design. As AI originates in the domains of computers and mathematics, it is difficult to communicate AI to those who are not in IT, programming or computer science; however, with proper training, anyone with or without such a background can use AI in their work (Long and Magerko, 2020).

In addition to competence, soft skills are also associated with AI adoption, with the goal that AI adoption in libraries will be easier if librarians master soft skills, which appear as an

adaptable attitude toward technological advancements as well as in the form of creativity and innovation, critical thinking, cooperation and communication. In the information and communication technology (ICT) era, librarians' soft skills include communication, leadership, interpersonal and presentation abilities (Machendranath *et al.*, 2018), and the AI era requires them to be flexible or able to adapt and be open to new technology rather than refuse to accept AI because they believe it will deprive them of their jobs. Despite the lack of studies on librarian competency and soft skills in the AI era, certain studies have found evidence of ICT competency (Oyedokun *et al.*, 2018), professional competence in digital libraries (Khan and Bhatti, 2017) and librarian professional abilities, such as communication skills, presentation skills, marketing skills and leadership skills (Kulkarni, 2017). Thus, the findings indicate that the competencies and skills that librarians must have for AI applications are AI literacy, knowledge of IT, ability to perform data analytics, library management, user behavior and system design as well as adaptive and creative thinking, among other things.

The participants felt that AI can bring convenience; in the survey results, this is shown in the question "can AI help make work easier?" to which they all responded positively. According to the survey findings, librarians, users and management valued the convenience of AI. The participants believed that AI applications can assist with library duties, boost workplace productivity and enable work to be completed more rapidly (efficiently). This is consistent with prior research, which found that AI technology can improve effectiveness and boost productivity in other sectors, such as banks (Mor and Gupta, 2021), manufacturing (Long *et al.*, 2020) and agriculture (Lakshmi and Corbett, 2020). Libraries would also feel the effects of AI applications through increased flexibility, efficiency and innovation (Chen *et al.*, 2016; Yu *et al.*, 2019).

Users also benefit from AI applications at the library in terms of convenience, such as receiving fast service available around the clock and accessing reliable information sources quickly and accurately. The library's quick response can improve user experience in the library community (Nguyen, 2020), while also assisting with content creation (Peltonen and Wickstorm, 2014). According to earlier studies' findings, AI does not bring many benefits to library users, particularly in terms of speed of service and ease of access; this is because few AI technologies are implemented in libraries.

AI is expected to support library management, particularly in the areas of data analysis and decision-making. Expert systems and knowledge-based systems are two types of AI that can be used for decision-making, although they are seldom used by libraries. According to research findings, AI is applied to decision-making in high schools in Ghana focused on student career development (Asabere and Amoako, 2020), in the medical field for diagnosis and treatment (Mirmozaffari, 2019) and in manufacturing planning (Leo Kumar, 2019). Libraries are still hesitant to use AI for management because the level of complexity involved in managing human resources and facilities remains low; however, if successfully implemented, AI has the potential to improve the quality of human resources in libraries in an organized manner.

According to the survey results, a library must prepare several components in order to use AI, including hardware, software, brainware and management tools. In addition to expressing optimism regarding the deployment of AI in libraries, the participants mentioned factors that could impede AI implementation, such as those relating to management, human resources and facilities. Many librarians raised concerns about management obstacles, particularly those related to budget and leadership vision related to IT development, such as the management's lack of a vision for IT development and leadership support as well as unclear policies related to AI, leadership support and funding. In addition, a major concern for librarians is the lack of finances available for the advancement of IT, particularly AI. Conversely, according to the heads of libraries, the

hurdles are related to human resources who are not innovative, not creative, incompetent or indifferent; apathetic human resources; human resources who are not yet experts in the IT area and a lack of willingness on the part of the human resources. Additionally, they mentioned the bureaucracy's complexity and the lack of readiness to change as well as the library's limited financial capability. Academics believe that the primary impediments to applying AI in libraries are the institution's unwillingness and incompetence, the legacy of the parent agency's support and the lacking human resource competency. For factors that can facilitate the application of AI in libraries, academics emphasize the critical nature of library development policies, visionary leadership, the availability of facilities and funds, the willingness of leaders and human resources and the desire to change. Brock and Wangenheim (2019) have noted that integral, teaming and agile are all important for the success of AI initiatives, and according to this study's findings, the elements that drive the development of AI include managerial, technological, operational, strategic and IT infrastructure (Alhashmi *et al.*, 2020).

Conclusion

Different viewpoints on intelligent libraries indicate a full level of awareness among library stakeholders. Analyzing AI from three different perspectives (leaders, practitioners and scientists) provides sufficient information to begin implementing AI initiatives in Indonesian libraries, as demonstrated by the participants' grasp of AI, its benefits for libraries, its convenience, the skills and expertise required by libraries when applying it, its inhibiting factors and AI facilities. A limitation of this research is that the researcher does not look for variations in perspectives among librarians, heads of libraries and researchers but rather examines their understanding of AI, extending the results to produce the concept of an intelligent library.

These results can be used by libraries that consider implementing AI in their operation. Future research might investigate users' perceptions of AI awareness in libraries as well as what services they would like to improve.

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