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Influence of AI on marketing strategies for university libraries

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ABSTRACT

This study investigates the impact of Artificial Intelligence (AI) applications, Personalized Recommendations, Predictive Analytics, Chatbots and Virtual Assistants, Natural Language Processing (NLP), and Image Recognition, on supporting marketing strategies in university libraries. Using a quantitative approach, primary data were collected through a self-administered questionnaire completed by 121 directors and department heads from governmental, private, special law, regional universities, and university colleges. The data were analyzed using SPSS. Findings support the hypothesis that AI enhances marketing strategies for digital libraries, with Image Recognition showing the highest influence among the studied variables. All AI applications contributed to improving user engagement and service delivery, demonstrating the transformative potential of advanced technologies in library operations. Specifically, Image Recognition facilitates content search through visual identification and categorization, leading to increased user interest and satisfaction. The study recommends further integration of AI features, such as voice recognition, sentiment analysis, and predictive analytics in chatbots, to provide more personalized and proactive support. These insights highlight the critical role of AI in optimizing marketing strategies and advancing digital library services.

1. Introduction

Marketing approaches are vital in determining the position and role of university libraries in the current higher learning institutions. Priya and Ramya (2024) confirmed that these strategies are crucial in promoting awareness, use, and patronage of library resources and services by students, faculty, researchers, and the larger university and academic community. From the perspective of Baayel (2024), the efficient use of marketing principles contributes to the understanding of the existence of various types of materials and services provided by the university libraries. Through its promotional campaigns and outreach programs, libraries can effectively inform users of the wide variety of resources that can adequately meet their research, learning, and teaching requirements. Enhanced perception can promote the use of library facilities, which will enhance the benefits obtained from the library systems.

Bilovodska et al. (2024) stated that educational institutions using Artificial Intelligence (AI) technology experience substantial improvement in their educational marketing return on investment (ROI) through data-based decision making that enhances productivity and decreases expenses. Analytics tools with AI capabilities analyze huge data volumes to reveal the most effective marketing pathways and content that drive maximum student engagement and conversion success. Educational institutions utilize this capability to manage their marketing budgets by investing in successful campaigns while terminating non-productive ones. Dhand et al. (2024) agreed on adding that AI conducts automatic workflow operations, including email campaigns as well as social media scheduling and advertisement precision, and eliminates time consumption plus human labor to preserve continuous outreach techniques. AI optimizes marketing efficiency by refining campaigns; thus, the institutions reach their spending goals through enhanced impact.

AI enables marketers to achieve superior personalization approaches in their strategies that result in increased student interaction, coupled with better conversion statistics. Institutions can utilize machine learning technologies to divide their prospective student groups based on personal

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behavior traits and demographic characteristics so they can deliver customized content (Almusaed et al. 2023). The highly customized approach enhances communication relevance, thus prospective students become more likely to show positive engagement and take desired actions. AI-powered chatbots, together with virtual assistants, provide immediate support to users, which enhances their experience and raises their chances of applying and enrolling. The combined strength of AI-powered improvements enhances the marketing pipeline, which results in increased educational enrollment numbers along with stronger return on investment for educational organizations (Yadav and Shrawankar, 2025).

Thus, according to Khan et al. (2024), it can be concluded that the use of marketing strategies is crucial for the development of university libraries exposed to the intensification of competition in the information sphere. Therefore, through publicizing their resources, services, and events, the libraries can promote visibility, importance, and contribution to the academic community and, thus, achieve their mission of supporting teaching, learning, and research activities.

Asim et al. (2023) argued that the adoption of AI technologies in university libraries has increased steadily, but academic research lacks specific studies about how these systems aid marketing strategies. The wider effects of AI in educational institutions have been studied extensively, but minimal research exists about AI-driven tools that focus on individual preferences and how these optimize library marketing strategies. User data enables personalized recommendations to find content that matches students' educational requirements, along with their specific intellectual preferences, which strengthens their library interaction. Library predictive analytics tools help establish user patterns, which let institutions create optimal marketing plans. The current scarcity of focused research prevents us from discovering the full strategic worth of AI applications designed for individual user needs when it comes to promoting library offerings. As was noted by Barsha and Munshi (2023), university libraries require additional research about the marketing applications of chatbots alongside virtual assistants and natural language processing (NLP), and image recognition technologies. The capability of these AI applications to improve user service and interaction shows promise, but researchers have not delved deeply into their marketing capability. The ability of chatbots and virtual assistants to offer immediate customer support and information enables service navigation alongside event promotion, but their influence on user engagement needs better documentation. The application of NLP to analyze user feedback helps develop better communication strategies, though the exact impact of NLP on targeted marketing strategies remains unclear (Hartmann and Netzer, 2023).

Through this data, marketers can develop new campaigns that are relatable to the audience and hence increase their sales since the audience will be more inclined to engage with the product or service being marketed (Halburagi and Mukarambi, 2023). Mallikarjuna (2024) added that AI allows marketers to provide custom experiences at scale. Using machine learning algorithms, AI can identify customer data and behavior to develop personalized recommendations, content, and offers. Such an extent of personalization not only increases the level of satisfaction from the consumption of the product but also helps to build long-term relationships with the consumers.

The application of AI in the enhancement of marketing in university digital libraries offers the university a great chance to revolutionize how end users interact with the information, as well as improve access to digital information in academic circles. When integrated in recommending content, intelligent data analysis, and generating forecasts, the services of university libraries can also be optimized to match today's students, faculty, and research requirements. By making use of such approaches as AI in its marketing strategies, the library can enhance efficiency in its use of resources, enhance the quality of services offered to its users, and promote the culture of innovation in information delivery. The integration of AI in marketing, for the purpose of this study on university digital libraries, not only enhances the reach and efficacy of library resources but also the centrality of the library in the processes of knowledge dissemination in the digital environment.

Based on the above gap, this current research sought to examine the influence of AI in terms of (Personalized Recommendations, Predictive Analytics, Chatbots and Virtual Assistants, NLP and Image Recognition) in supporting marketing strategies for university libraries.

2. Literature review

2.1. Marketing strategies

Tabuena et al. (2022) argued that marketing strategies are important tools that organizations develop for the purpose of advertising their products or services, and for reaching out to their target markets with the aim of achieving the organizational goals. Marketing communication strategy refers to the identification of the objectives, target public, specific communication, which is to be unleashed, the communication tools to be used, and the time when these are to be employed. These are strategic plans, and most of them are long-term, hence need to be reviewed frequently due to the fast-changing environment in the business world (Ishrat et al., 2023).

Barsha and Munshi (2023) argued that university libraries need to fulfill multiple essential requirements before implementing AI for their marketing strategies. Complete data collection along with effective management stands as the essential basis for implementing AI. University libraries must

obtain detailed user information about borrowing activities and individual interests, and resource usage behaviors. Well-functioning data management systems need to be implemented for achieving precise and secure data maintenance while complying with the General Data Protection Regulation (GDPR) and other privacy regulations. The collected data requires proper organization because meaningful analysis depends on such processing. The acquisition of advanced analytical systems to extract useful findings from this data will be key for developing customized marketing strategies that address various types of library users (Ali et al., 2024).

Gupta (2025), on the other hand, stated that marketing strategies that use AI technologies need both modern technological systems and qualified employees for their successful implementation. Libraries need to modernize their current information technology framework to run AI applications by acquiring cloud services and Natural Language Processing, and Machine Learning software platforms. Organizations need to train and employ staff with the essential technical abilities for implementing and handling, and optimizing AI tools. By implementing this system, libraries gain the ability to create custom recommendation systems and promotional strategies, as well as continuous monitoring of their performance. Library resources promotion, along with user engagement enhancement, depends on the combined work of technologists with librarians and marketing specialists. University libraries that implement the necessary steps for AI implementation will use these tools to enhance their marketing activities, which will result in better user satisfaction and resource utilization.

In addition, an effective marketing plan not only focuses on having a strong online marketing presence but also employs other marketing communication tools that are more conventional (Huang, 2024; Hamad et al., 2024). With social media marketing and content creation, digital media and its various forms, such as e-mail marketing, search engine optimization, and even partnership with key influencers, the digital world is a treasure chest of opportunities through which an organization could engage with its target audience. Using data analytics and performance metrics, marketers can determine the effectiveness of their campaigns, fine-tune their strategies, and achieve improved results.

Besides, marketing strategies encompass issues such as narrative and branding to make a heartfelt appeal and reel in the customers. Therefore, through a coherent message strategy and the consistent implementation of brand management and visual identity, organizations can communicate a clear identity and thus stand out from the competition (Bar-Zeev et al., 2024). Concisely, marketing strategies provide a framework for the strategic management of organizations by defining how organizations can compete effectively for customers' patronage in the marketplace. This means that businesses need to focus their strategies on consumer needs, embrace the digital space, and tell great brand stories, and this is the best way to achieve growth in the current complex market environment (Hashem, 2024).

2.2. Involving AI in educational marketing strategies

Wu and Monfort (2023) stated that marketing automation with AI has significantly changed the way companies approach customer segmentation, communication, and conversion. The penetration of AI in analyzing and processing large chunks of data, in predicting future trends, in developing customized solutions, and in automating marketing processes opened the range of new opportunities for marketers to boost their sales and to increase ROI (Potwora et al., 2024). Kamalov et al. (2023) argued that the enforcement of AI within educational marketing methods has introduced a revolutionary method for institutions to boost their relationship with evolving students and their enrollment performance. Universal data analysis through AI tools enables educational institutions to study student demographic profiles and interests and behaviors so they can develop individualized marketing solutions. Static analytics provides information about forthcoming students' enrollment behavior, which lets organizations direct their marketing funds effectively. AI-powered chatbots and virtual assistants offer immediate 24-hour assistance to students in their application journey by providing answers and application guidance and enhancing enrollment probabilities through time-sensitive, relevant interactions.

Shaik (2023) noted that AI skills of predictive analysis, therefore, help marketers to envision future trends and customer demands that the firm could adopt proactive rather than reactive approaches. This way, a business will be able to predict possible opportunities as well as risks in the marketplace, thus increasing the efficiency of resource utilization and improving the efficiency of marketing communications. Singh and Kaunert (2024) argued that AI helps in hyper-personalization as it means that marketers can take specific customized experiences to the individual customer level. Using recommendation engines, chatbots, and dynamic content generation, organizations get to intervene in their customers' experiences in real time and build long-term bonds and customer loyalty.

As for Guendouz (2023), continuous marketing strategy optimization occurs through AI because automated systems use learning algorithms that modify their operations based on marketing program results. Through NLP and machine learning methods, educational institutions create personalized content that speaks to their diverse audience presence across social media channels, together with email platforms and institution-based websites. Through customized interactions, educational institutions achieve better user

engagement while establishing themselves as an institution that delivers consistent, relevant student-focused communication. The global student enrollment competition leads institutions to implement AI strategically in their educational marketing for specialized differentiation and development of better student-alumni bonds, which results in more durable enrollment and retention success.

2.3. Marketing within university libraries

Fraser-Arnott (2023) argued that university libraries maintain an essential position within academia, while their service marketing serves as the key to elevating student and faculty awareness and involvement. University libraries need purpose-built marketing approaches that demonstrate their specialized resources as well as their advantages beyond basic book collection services. The marketing strategy includes displaying specialized collections and giving access to academic databases while providing research support and creating collaborative study areas. Through social media, alongside newsletters, workshops, and events, libraries will reach their users effectively to demonstrate how they help students reach their academic targets. A feedback integration system enables libraries to customize their services by fulfilling user requirements, which generates a service environment that better responds to their patrons (Hamad et al. 2023).

An essential element of marketing library services as according to Sahli et al. (2024), involves building partnerships between different university departments and organizations. Libraries that partner with academic departments and research centers, and student organizations, can alter their services to match user requirements, thus establishing their value according to users. The organization of workshops focused on subjects and information literacy training, and bringing academic speakers into libraries enhances both visibility and usage of library resources. Library teams should apply data analytics techniques for user behavior analysis to deliver precise marketing strategies that match each audience segment. The strategic marketing of library services helps support both library mission goals and university-wide education objectives by creating a research-based educational environment (Miltenoff, 2024).

According to Allil (2024), academic libraries now use AI systems to revolutionize their marketing methods, which better enables them to serve various types of users. The combination of data analytics and predictive modeling through AI enables library personnel to customize their outreach and work better with customers by using behavioral data and individual choice information. Huh et al. (2023) noted that through AI-powered assistance, libraries can deliver automatic support and material suggestions that best serve their users while guiding people through digital systems to create superior service interactions. The combination of machine learning algorithms with borrowing history analysis and search patterns, and demographic data enables precise trend identification and future information needs forecasting for targeted outreach campaigns.

As for Hannan and Liu (2023), it was argued that the strategic power of AI allows academic libraries to link their marketing approach with institutional objectives regarding student involvement and research output enhancement, along with information skills development. The addition of AI to customer relationship management (CRM) systems allows libraries to accomplish better audience segmentation while delivering personalized content through various contact tools, which include mobile applications and social media platforms, and email blasts. Gulati et al. (2024) agreed on the same idea, noting that the improved communication efficiency, together with service visibility for the academic community, represents the benefits of this approach. AI stands as a pivotal digital tool for academic libraries that lets them redefine marketing value along with improving audience engagement while demonstrating their impact within the competitive educational field.

2.4. AI in an academic setting

Huang (2024) examined the variety of AI applications utilized in academic libraries and important factors and challenges regarding the integration of AI. The author used a quantitative non-experimental data collection technique in the form of a questionnaire with both closed and open-ended questions. Among the questionnaires distributed, 472 were filled out by the academic librarians and were deemed to be valid. The author wanted to ask questions of the librarians who were using AI applications and those who were not using them. The questions asked were about the type of AI applications implemented, concerning factors and barriers to promoting AI. It was found out that there were some disparities between the extent of support towards AI applications and the impact of the challenges listed above. In addition, the greater the number of knowledge activities that were conducted and executed by the librarians and libraries acquired, the more positive the attitude towards the use of AI in the libraries. Nonetheless, librarians admitted that the use of AI is already unstoppable, but the problems of implementation hinder its use of AI.

Hussain's (2023) sought to discuss the application of the use of AI in various activities of the library by analyzing the benefits and drawbacks of the use of AI in the delivery of library services. AI and libraries are closely related as we see; however, the adoption and understanding of AI in providing library services are still raising question marks discussed in this paper. This work is therefore based on a qualitative research approach, which will adopt a content analysis procedure. Research was conducted on the existing literature on the topic, and

this formed the basis of this study. The results of this study reveal that AI is an active technology that can be adopted in library services, but some challenges, such as sufficient finances, the attitude of librarians, and technical proficiency, are some of the barriers to AI in library functioning. The study also shows that incorporating AI in the running of libraries will set libraries on the right trajectory.

Mallikarjuna (2024) presented a literature review of incorporating AI in academic libraries with a view to demonstrating the changes that the application of AI in library practices will bring to library management, usage of resources, and the general research process. As for the opportunities, the application of AI systems brings great solutions in terms of improving the efficiency and effectiveness of the delivery of services and tasks, for which some of the challenges and concerns of the review are as follows: ethical and privacy issues, staff development, user-oriented approach.

To achieve the successful implementation of AI, libraries need to engage with AI practitioners, scholars, and policymakers, and need to have a continuing education process regarding AI. Resistance to change, communicating efforts, and engaging staff are critical factors that must be managed if libraries are to harness the benefits that could be offered by AI and improve their services /operations.

Khan et al. (2024) examined how the future development of AI may influence specific services provided by academic libraries. The study employed three Generative AI systems: ChatGPT, Perplexity, and iAsk.Ai. The purpose was to identify the potential effects of AI implementation on library services and to provide recommendations for how libraries can adapt to meet users' needs. ChatGPT is a conversational AI designed to provide quick responses to patrons' questions. Perplexity is a language model that can assist with tasks such as cataloguing and content categorization. iAsk.Ai is an NLP tool that can support research and reference services.

By assessing these three AI systems, the study aims to evaluate their feasibility for academic library services and to outline possible future directions for service delivery. Insights from previous research (Priya and Ramya, 2024; Khan et al., 2024; Halburagi and Mukarambi, 2023; Mallikarjuna, 2024) informed the conceptual framework shown in Fig. 1, from which the study hypotheses were developed.

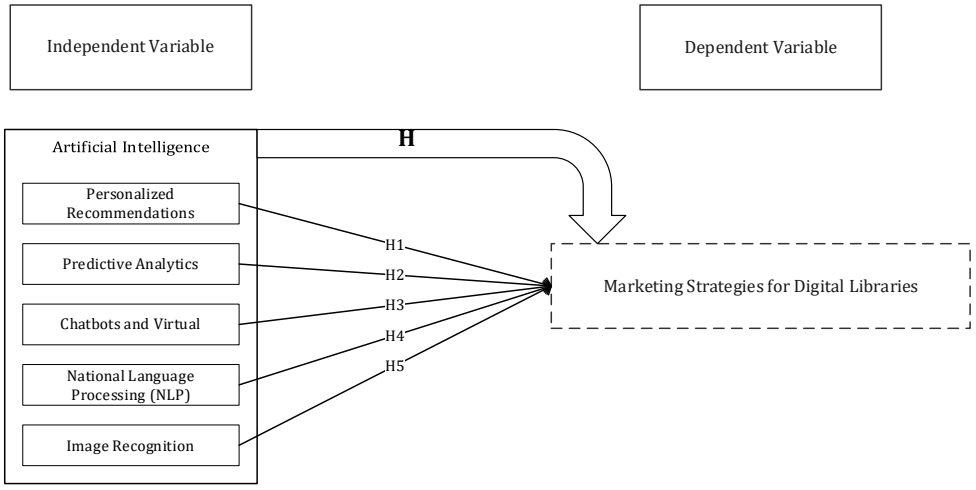

Fig. 1: Study model

From the model in Fig. 1, the following set of hypotheses was reached:

2.5. Main hypothesis

H: AI can support marketing strategies for digital libraries.

2.6. Sub-hypotheses

H1: Personalized recommendations can support marketing strategies for digital libraries.
H2: Predictive analytics can support marketing strategies for digital libraries.
H3: Chatbots and Virtual Assistants can support marketing strategies for digital libraries.
H4: NLP can support marketing strategies for digital libraries.
H5: Image Recognition can support marketing strategies for digital libraries.

3. Methods and materials

3.1. Methodological approach

Answering the main question of the current study and realizing its aim was done utilizing quantitative methodology. This methodology seemed to be more suitable for collecting data from a larger sample size. This way, results can be generalized more thoroughly.

3.2. Tools of study

The primary data collection instrument in this study was a questionnaire, which consisted of two

sections. The first section collected demographic information about the participants, including gender, age, qualifications, and work experience. The second section contained statements related to the study's sub-variables: Personalized Recommendations, Predictive Analytics, Chatbots and Virtual Assistants, NLP, and Image Recognition.

The questionnaire used a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Its validity was established through expert review, where a panel of specialized academics in the field examined the instrument. Based on their feedback, some statements were revised while others were removed. The final version of the questionnaire consisted of 32 statements.

3.3. Population and sampling

The population of the study consisted of directors of university libraries and heads of departments within governmental, private, university colleges, universities with a special law, and regional universities, as shown in Table 1.

Table 1: Population of study

Source	Number of entities
Governmental universities	10
Private universities	18
University colleges	9
Universities with a special law	2
Regional universities	1
Total	40

A convenient sample of 160 individuals was chosen to represent the population from 4 universities in each section. After the application process, the researcher was able to retrieve 121 properly filled questionnaires. This indicated a response rate of 75.6%, as statistically accepted.

3.4. Statistical processing

The Statistical Package for the Social Sciences (SPSS) version 23 was used to analyze the collected primary data. Reliability and internal consistency of the research instrument were assessed using Cronbach's alpha (α). As shown in Table 2, all variables achieved alpha values above 0.70, indicating satisfactory reliability. Additional statistical analyses included descriptive statistics (mean, standard deviation, frequency, and percentage) as well as multiple and linear regression analyses.

4. Results and discussion

Mean (μ) and standard deviation (σ) were used to analyze the questionnaire of the study. Table 3 indicates that along with the average and standard deviation for each. Based on the consistently high scores of 3.00 or above on every survey topic, it is evident that all participants had a positive outlook. The statistics clearly demonstrate that the emotions were positive. The individuals surveyed displayed a favorable outlook towards the variables under investigation. Surprisingly, all the variables examined in this study had scores that exceeded the average value of 3.00.

Table 2: Demographics

Category	n	%
Gender		
Male	55	45.5
Female	66	54.5
Education		
Bachelor's degree	84	69.4
Postgraduate degree	37	30.6
Experience		
2-5 years	6	5.0
6-9 years	22	18.2
10-13 years	30	24.8
14+ years	63	52.1
Total	121	100.0

The reliability of the study was assessed using Cronbach's alpha. The variables can be considered acceptable, as their alpha values are higher than the minimum allowable percentage of 0.70. The outcomes are displayed in Table 4.

Utilizing multiple regression, it has been demonstrated in Table 5 that AI was able to support marketing strategies for digital libraries. This finding was backed by a robust F-value of 12.483, considered significant at the 0.05 level. Furthermore, it was important to highlight that the independent variables account for 35.2% of the variability observed in the dependent variable. In addition, the correlation coefficient of r = 0.593 signifies a medium relationship between the variables.

Regarding sub-hypotheses, linear regression was able to reach the following results (Table 6):

- Personalized recommendations were able to support marketing strategies for digital libraries. This finding was backed by a robust F-value of 33.166, considered significant at the 0.05 level. Furthermore, it was important to highlight that the independent variables accounted for 21.8% of the variability observed in the dependent variable. The correlation coefficient of r = 0.467 signifies a medium relationship between the variables.
- Predictive analytics was able to support marketing strategies for digital libraries. With an F-value of 46.901, it is considered significant at the 0.05 level. The independent variables account for 28.3% of the variability observed in the dependent variable. The correlation coefficient of r = 0.532 signifies a medium relationship between the variables.
- Chatbots and Virtual Assistants were able to support marketing strategies for digital libraries. With an F-value of 18.163, it is considered significant at the 0.05 level. The independent variables account for 13.2% of the variability observed in the dependent variable. Furthermore, the correlation coefficient of r = 0.364 signifies a medium relationship between the variables.
- NLP was able to support marketing strategies for digital libraries. With an F-value of 35.597 considered significant at the 0.05 level, it was

important to highlight that the independent variables accounted for 21.5% of the variability observed in the dependent variable. Furthermore, the correlation coefficient of r = 0.464 signifies a medium relationship between the variables.

- Image Recognition was able to support marketing strategies for digital libraries. With an F-value of 47.491 considered significant at the 0.05 level, it was important to highlight that the independent variables accounted for 28.5% of the variability observed in the dependent variable. Furthermore, the correlation coefficient of r = 0.534 signifies a medium relationship between the variables.

Table 3: Questionnaire analysis

Theme	Statement	μ	σ
Personalization and user experience	AI tools analyze users' behavior and preferences.	3.711	1.036
	Examining interactions with library resources supports personalized recommendations.	3.620	1.090
	AI recommends materials based on user preferences.	3.653	0.937
	Users' interests and preferences are stored for future use.	3.463	1.065
	AI improves user experience and engagement.	3.471	1.162
	Personalized recommendations are provided through AI.	3.583	0.900
	AI enables a more user-focused marketing approach.	3.165	1.150
Predictive analytics	Predictive tools can effectively use fuzzy data.	3.107	1.237
	AI anticipates and predicts user behavior.	3.612	1.028
	AI runs targeted marketing campaigns effectively.	3.678	1.112
	AI designs marketing campaigns using promotional strategies to attract and retain users.	4.066	0.920
	Libraries use AI to analyze data and predict user needs for marketing.	3.537	1.049
	Predictive analytics supports marketing in libraries.	3.600	0.886
Virtual assistants and chatbots	Virtual assistants provide immediate support to users.	3.430	0.911
	Chatbots answer questions from users in different locations.	3.388	1.020
	Chatbots and virtual help make resource allocation easier.	3.529	0.958
	Chatbots increase user engagement, strengthening marketing campaigns.	3.727	0.983
	Virtual assistants and chatbots offer 24/7 assistance.	3.760	1.140
	Chatbots and virtual assistants enhance library services.	3.567	0.782
NLP	NLP predicts textual data for marketing purposes.	3.893	0.956
	NLP helps libraries gather feedback from surveys and social media.	4.000	1.072
	NLP uses algorithms to understand users' sentiments.	3.992	0.962
	NLP-based marketing identifies emerging trends.	3.727	1.008
	NLP creates tailored marketing messages for target audiences.	3.397	1.136
	NLP supports effective library marketing.	3.802	0.865
Image recognition	AI-powered image recognition improves visual search.	3.702	0.963
	Image recognition supports marketing strategies with needed catalogs and resources.	3.727	0.983
	AI-generated images are more attractive than text-based content.	3.686	1.000
	Image recognition technology improves search experiences.	3.446	1.016
	AI-driven image recognition improves resource discovery and supports visual content preferences.	3.405	1.053
	Image recognition benefits library marketing.	3.593	0.868
General marketing strategies	AI-supported marketing enhances content optimization.	3.364	1.190
	AI uses social media platforms for digital library marketing.	3.058	1.105
	AI is an effective tool for email marketing campaigns.	3.132	1.238
	AI facilitates collaborations and partnerships.	3.463	1.155
	AI-driven decision-making helps develop better marketing strategies for libraries.	3.438	1.139
	AI provides continuous promotion and awareness-building for digital libraries.	3.446	1.154
	AI marketing strategies for digital libraries are effective.	3.295	0.880

Table 4: Reliability test

Variable	α
Personalized recommendations	0.903
Predictive analytics	0.882
Chatbots and Virtual Assistants	0.837
NLP	0.896
Image recognition	0.916
Marketing strategies for digital libraries	0.876

5. Discussion

This study examined the impact of AI in the areas of personalized recommendations, predictive analytics, chatbots and virtual assistants, natural language processing, and image recognition in supporting marketing strategies for university libraries. A quantitative approach was applied, with primary data collected through a self-administered questionnaire completed by 121 participants. Primary data were analyzed using SPSS. The findings showed that AI is poised to transform marketing strategies in university libraries by offering a range of opportunities and functions that can increase user engagement, enhance resource usage, and tailor services to the needs of the academic community. By applying data analytics supported by AI, university libraries can better understand user behavior, needs, and trends, enabling them to design and implement marketing strategies that align with their target audience. The use of AI to deliver tailored content recommendations and targeted messages can help libraries maximize promotional efforts and draw the attention of students, faculty, and researchers to their resources and services.

The study further revealed that AI can streamline marketing automation in university libraries and enable effective communication with users. AI-based chatbots and virtual assistants offer additional advantages by guiding and assisting users, thereby improving the overall user experience and facilitating easy access to library resources. The integration of predictive analytics with AI allows libraries to anticipate user expectations, optimize resource utilization, and identify emerging trends, ensuring that services remain aligned with the

evolving needs of the academic community. When applied in marketing, AI can help universities, particularly university libraries, strengthen relationships with users, enhance visibility, and establish the library as a key center of knowledge and innovation.

Table 5: Main hypothesis

Coefficients								
Model		Unstandardized coefficients		Standardized coefficients	t	Sig.	R	R-squared
		b	Standard error	Beta				
1	(Constant)	1.029	.336		3.060	.003	.593	.352
	Personalized recommendations	.022	.119	.022	.184	.854		
	Predictive analytics	.317	.118	.320	2.687	.008		
	Chatbots and virtual assistants	-.170	.135	-.151	-1.262	.210		
	NLP	.157	.132	.154	1.189	.237		
	Image recognition	.294	.127	.290	2.309	.023		

H: AI can support marketing strategies for digital libraries

Table 6: Sub-hypotheses

Hypothesis	Constant				R	R-squared	Variable				
	b	Standard error	t	Sig.			b	Standard error	beta	t	Sig.
H1	1.66	0.293	5.675	0.0	0.467	0.218	0.456	0.079	0.467	5.759	0.0
H2	1.394	0.286	4.88	0.0	0.532	0.283	0.528	0.077	0.532	6.848	0.0
H3	1.835	0.351	5.234	0.0	0.364	0.132	0.409	0.096	0.364	4.262	0.0
H4	1.503	0.322	4.668	0.0	0.464	0.215	0.472	0.083	0.464	5.709	0.0
H5	1.351	0.29	4.656	0.0	0.534	0.285	0.541	0.079	0.534	6.891	0.0

Analysis of the sub-hypotheses indicated that all selected sub-variables, personalized recommendations, predictive analytics, chatbots and virtual assistants, natural language processing, and image recognition, had a medium-strength relationship with the independent variable, AI. Among these, image recognition showed the highest impact, with a variance of 28.5%. The use of image recognition in university libraries supports visual characterization of resources to improve accessibility. It can also enhance resource organization, diversify library interfaces, and introduce new search options based on images and other content types. Image recognition increases user interaction by offering visually engaging interfaces, enabling quick identification of resources, and providing efficient browsing methods. These findings are consistent with Mallikarjuna (2024) and Khan et al. (2024), who emphasized that AI promotes the display of visual materials and enhances access to a wide range of library resources.

Predictive analytics ranked second, with a variance of 28.3%. Through marketing automation, university libraries can anticipate user needs and behaviors, enabling them to promote their services in ways that align with user preferences. This capability allows libraries to forecast trends and patterns, identify optimal methods for fulfilling their objectives, provide appropriate resources, and effectively reach their target audiences. Hussain (2023) supported this view, noting that such technology helps libraries remain informed and efficient while striving to deliver improved services. The ability to analyze previously unseen trends is a key feature of predictive analytics, aiding in the development of marketing strategies that are both relevant and engaging, thereby enhancing the overall user experience. Personalized recommendations scored a variance of 21.8**%** and came in the 3rd rank of influence. Recommendations are one of the most critical components that determine the marketing strategies of university libraries since they help to deliver content based on users' interactions. Recommendations use information about users' actions and previous data to improve, engage, and recommend the right resources, which make users happy. This approach enhances the users' experience, leads to user loyalty, and provides a feeling of individuality, thus making the users keep on using the library services. Such results agreed with Guendouz (2023) and Huang (2024), who argued that this makes it easier for libraries to display the resources in the best manner possible to the users, hence improving the usage rates and satisfaction levels.

Natural language processing ranked fourth, with a variance of 21.5%. This technology enables university libraries to process text data, interpret user queries expressed in natural language, and enhance search capabilities. It facilitates the categorization of content, supports effective information retrieval, and provides recommendations based on language patterns. NLP also refines the search process, delivering more accurate and relevant results. Shaik (2023) confirmed these benefits, noting that NLP contributes to the design of more intuitive interfaces, increases access to library materials, and optimizes the overall user experience within the library environment.

The least influential variable was Chatbots and Virtual Assistants, with a variance of 13.2%. Chatbots and virtual assistants bring significant changes in customer service in university libraries by responding to customers' questions, informing them about resources, and helping customers in real-time, 24/7. They improve the level of interaction with users, facilitate and accelerate the process of communication, and offer help at the right time as agreed on by Wu and Monfort (2023).

6. Conclusion and recommendations

In conclusion, the introduction of AI is an opportunity to enhance the marketing techniques for digital libraries and transform the role of these knowledge depositories in enriching the academic communities. With the help of AI tools like data analysis and content recommendation, as well as automation, digital libraries can adapt their marketing strategies to meet the students, faculty, and researchers. Because of the real-time analysis capability of AI, libraries can benefit in terms of understanding their users' behaviors and preferences, allowing for the creation of meaningful campaigns that strike a chord with the audience. AI enables digital libraries to improve the ways in which to deliver relevant and targeted content, promote efficient use of resources, and sustain innovation, all to improve the end users' experiences.

In addition, AI solutions in the field of marketing positively affect not only the interactions with users but also the organizational processes, which increase the efficiency of the library's interaction with its users. In using AI technologies for the recognition of the user's needs, libraries can be more responsive and meet such needs by offering the appropriate services and products. With the best digital libraries being developed under the maturing digital environment and with AI being systematically promoted for inclusion in marketing strategies, their roles are set to improve visibility, access, and relevance for these institutions as innovative knowledge centers in the academic environment. As has been discussed in previous sections, AI's interaction with marketing strategies enhances the user experience and contributes to the capability of digital libraries to compete for users' attention in the escalating global information space.

Launching from the study results and conclusion, the following recommendations were presented:

1. Introduce conversational agents such as chatbots and virtual assistants that can offer users more relevant and specific answers based on users' profiles, library system usage history, and other variables.
2. Include options whereby users can provide their preferences or profiles in the chatbots to enable them to get appropriate service or recommendations.
3. Use big data and machine learning techniques to make chatbots more effective at personalizing the user experience and to find out the best way to model users' needs and/or interactions.
4. Improve the implementation of chatbots and virtual assistants in multiple library interfaces – library website, catalog, databases, and others, that will create a coherent interface.
5. Make sure that chatbots help to navigate users between different services and resources available in the context of the library environment as smoothly as possible.
6. Integrate the use of cross-platform interactions to create a system whereby users can engage with the chatbots from various devices and channels to have a continuous conversation.
7. Improve the functionality of chatbots and virtual assistants to have more than question/answer functionality, for example, acting as a personal assistant and offering recommendations, helping users navigate databases and research, or engaging in knowledge acquisition.
8. Develop AI functionalities such as NLP to enhance the ability of the chatbots to engage users in a personalized and natural language so that the chatbots are more effective in answering the users' questions.
9. Identify additional features that can be integrated into chatbots, such as voice recognition, a sentiment analysis tool, or even predictive analytics to increase the users' satisfaction and provide them with proactive and personalized support.

6.1. Theoretical and practical implications

The current study results may help in presenting implications on two main levels. From a theoretical perspective, analyzing the impact of AI in the provision of marketing approaches for university libraries contributes to the practical evidence of how technological advancement sustains consumers' interaction and resources' acquisition in academic institutions. Due to the analysis of the relationship between AI, marketing strategies, and library services, this research contributes to understanding the changes in the application of AI in improving information delivery in educational organizations. The study implications are discussed in the context of theoretical contributions on technology adoption in library contexts and marketing strategies in academic settings, as well as suggestions for harnessing AI to improve library service delivery and support academic community needs.

From a practical standpoint, the findings of this study highlight the potential for university libraries to apply AI technologies to strengthen marketing communication and stimulate user interest. AI applications, such as content recommendations, data analysis, and the automation of library services, can enable libraries to design offerings that meet the needs of students, faculty, and researchers. The insights generated from this study can assist library managers and marketing professionals in enhancing the visibility, accessibility, and effectiveness of library resources by leveraging AI to promote a culture of innovation and knowledge sharing within the academic community.

6.2. Future studies

Further research could be directed towards exploring the effects of integrating AI in the long run, concerning the users' behaviors, the engagement indices, and the consumption of resources in

university libraries. Comparing and evaluating the long-term possibilities of AI-supported marketing initiatives may also be helpful to understand the continuous efficiency and problems connected to AI implementation in library contexts. Moreover, looking at the ethical perspectives and consequences of AI usage for library marketing in addition to identifying the possibilities of AI application for providing support to cooperative research activities and knowledge exchange between academia can open new opportunities for further developments in this field.

6.3. Limitations of the study

It is possible to identify several limitations in this line of research that it is worth mentioning. Firstly, the generalization of the research findings may be a challenge due to the nature and type of university libraries used in the study. However, the study is limited to the use of AI in marketing strategies; hence, it may ignore other factors that may affect the level of users' engagement and the use of resources in the libraries. Other threats to internal validity include methodological limitations, which include restricted sample size, data collection biases, and other factors that may influence the study's validity and reliability. In addition, they may present the possibility of obsolescence of the AI technologies and/or marketing trends under consideration during the time it takes to complete a study.

Compliance with ethical standards

Ethical considerations

This study was conducted in accordance with the ethical standards for research involving human participants. Participation was entirely voluntary, informed consent was obtained from all respondents, and their responses were kept anonymous and confidential. Data collection, analysis, and reporting were carried out with a commitment to honesty and transparency, avoiding any fabrication, falsification, or plagiarism. The welfare of participants was paramount, with efforts made to ensure minimal harm and adherence to established welfare guidelines. The researchers also considered the potential societal impacts of their work, ensuring that the findings would not be misused to harm individuals or create new inequalities.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

Ali MY, Naeem SB, Bhatti R, and Richardson J (2024). Artificial intelligence application in university libraries of Pakistan: SWOT analysis and implications. Global Knowledge, Memory and Communication, 73(1-2): 219-234. https://doi.org/10.1108/GKMC-12-2021-0203

Allil K (2024). Integrating AI-driven marketing analytics techniques into the classroom: Pedagogical strategies for enhancing student engagement and future business success. Journal of Marketing Analytics, 12(2): 142-168. https://doi.org/10.1057/s41270-023-00281-z

Almusaed A, Almssad A, Yitmen I, and Homod RZ (2023). Enhancing student engagement: Harnessing "AIED"'s power in hybrid education—A review analysis. Education Sciences, 13(7): 632. https://doi.org/10.3390/educsci13070632

Asim M, Arif M, Rafiq M, and Ahmad R (2023). Investigating applications of artificial intelligence in university libraries of Pakistan: An empirical study. The Journal of Academic Librarianship, 49(6): 102803. https://doi.org/10.1016/j.acalib.2023.102803

Baayel P (2024). Contemporary strategies for marketing electronic library resources to students: A study of technical universities in Ghana. https://doi.org/10.21203/rs.3.rs-5354193/v1

Barsha S and Munshi SA (2023). Implementing artificial intelligence in library services: A review of current prospects and challenges of developing countries. Library Hi Tech News, 41(1): 7-10. https://doi.org/10.1108/LHTN-07-2023-0126

Bar-Zeev Y, Berg CJ, Khayat A, Romm KF, Wysota CN, Abroms LC, Elbaz D, and Levine H (2023). IQOS marketing strategies at point-of-sales: A cross-sectional survey with retailers. Tobacco Control, 32(e2): e198-e204. https://doi.org/10.1136/tobaccocontrol-2021-057083 **PMid:35140170 PMCid:PMC9360187**

Bilovodska O, Kravchuk T, Ponomarenko I, Bliumska-Danko K, and Kononenko A (2024). Artificial intelligence for marketing product strategy in the online education market. Economics of Development, 23(3): 18-31. https://doi.org/10.57111/econ/3.2024.18

Dhand S, Singh SK, and Le TM (2024). Automating routine tasks to improve. In: Tunio MN (Ed.), Improving entrepreneurial processes through advanced AI. IGI Global, Hershey, USA. https://doi.org/10.4018/979-8-3693-1495-1.ch005

Fraser-Arnott M (2023). Academic library marketing in the post-COVID world. The Journal of Academic Librarianship, 49(4): 102744. https://doi.org/10.1016/j.acalib.2023.102744

Guendouz T (2023). Artificial intelligence-powered customer experience management (moving from mass to hyper-personalization in light of relationship marketing). International Journal for Scientific and Research, 3(6): 247-306. https://doi.org/10.59992/IJSR.2024.v3n6p9

Gulati A, Saini H, Singh S, and Kumar V (2024). Enhancing learning potential: Investigating marketing students' behavioral intentions to adopt ChatGPT. Marketing Education Review, 34(3): 201-234. https://doi.org/10.1080/10528008.2023.2300139

Gupta V (2025). From hype to strategy: Navigating the reality of experimental strategic adoption of AI technologies in libraries. Reference Services Review, 53(1): 1-14. https://doi.org/10.1108/RSR-08-2024-0042

Halburagi S and Mukarambi P (2023). Use of artificial intelligence (AI) technology futures in library. International Journal of Research in Library Science (IJRLS), 9(2): 14-19. https://doi.org/10.26761/ijrls.9.2.2023.1642

Hamad F, Al-Fadel M, and Fakhouri H (2023). The provision of smart service at academic libraries and associated challenges. Journal of Librarianship and Information Science, 55(4): 960-971. https://doi.org/10.1177/09610006221114173

Hamad F, Al-Fadel M, and Shehata AMK (2024). The level of digital competencies for the provision of smart information service at academic libraries in Jordan. Global Knowledge, Memory

and Communication, 73(4-5): 614-633. https://doi.org/10.1108/GKMC-06-2022-0131

Hannan E and Liu S (2023). AI: New source of competitiveness in higher education. Competitiveness Review: An International Business Journal, 33(2): 265-279. https://doi.org/10.1108/CR-03-2021-0045

Hartmann J and Netzer O (2023). Natural language processing in marketing. In: Sudhir K and Toubia O (Eds.), Artificial intelligence in marketing: 191-215. Emerald Publishing Limited, Bingley, UK. https://doi.org/10.1108/S1548-643520230000020011

Hashem T (2024). Examining marketing cyber-security in the digital age: Evidence from marketing platform. International Journal of Data and Network Science, 8(2): 1141-1150. https://doi.org/10.5267/j.ijdns.2023.11.020

Huang YH (2024). Exploring the implementation of artificial intelligence applications among academic libraries in Taiwan. Library Hi Tech, 42(3): 885-905. https://doi.org/10.1108/LHT-03-2022-0159

Huh J, Nelson MR, and Russell CA (2023). ChatGPT, AI advertising, and advertising research and education. Journal of Advertising, 52(4): 477-482. https://doi.org/10.1080/00913367.2023.2227013

Hussain A (2023). Use of artificial intelligence in the library services: Prospects and challenges. Library Hi Tech News, 40(2): 15-17. https://doi.org/10.1108/LHTN-11-2022-0125

Ishrat I, Hasan M, Farooq A, and Khan FM (2023). Modelling of consumer challenges and marketing strategies during crisis. Qualitative Market Research: An International Journal, 26(4): 285-319. https://doi.org/10.1108/QMR-12-2021-0149

Kamalov F, Santandreu Calonge D, and Gurrib I (2023). New era of artificial intelligence in education: Towards a sustainable multifaceted revolution. Sustainability, 15(16): 12451. https://doi.org/10.3390/su151612451

Khan R, Gupta N, Sinhababu A, and Chakravarty R (2024). Impact of conversational and generative AI systems on libraries: A use case large language model (LLM). Science & Technology Libraries, 43(4): 319-333. https://doi.org/10.1080/0194262X.2023.2254814

Mallikarjuna C (2024). An analysis of integrating artificial intelligence in academic libraries. DESIDOC Journal of Library and Information Technology, 44(2): 124-129. https://doi.org/10.14429/djlit.44.2.18958

Miltenoff P (2024). Initiating immersive teaching and learning service in academic libraries: Part 1: The approach to VR services and the role of the library. International Information and Library Review, 56(1): 65-85. https://doi.org/10.1080/10572317.2024.2301864

Potwora M, Vdovichena O, Semchuk D, Lipych L, and Saienko V (2024). The use of artificial intelligence in marketing strategies: Automation, personalization, and forecasting. Journal of Management World, 2: 41-49. https://doi.org/10.53935/jomw.v2024i2.275

Priya S and Ramya R (2024). Future trends and emerging technologies in AI and libraries. In: Khamis I (Ed.), Applications of artificial intelligence in libraries: 245-271. IGI Global, Hershey, USA. https://doi.org/10.4018/979-8-3693-1573-6.ch010

Sahli F, Alidousti S, and Naghshineh N (2024). Designing a branding model for academic libraries affiliated with the Ministry of Science, Research and Technology in Iran. Library Hi Tech, 42(4): 1305-1330. https://doi.org/10.1108/LHT-02-2022-0111

Shaik M (2023). Impact of artificial intelligence on marketing. East Asian Journal of Multidisciplinary Research, 2(3): 993-1004. https://doi.org/10.55927/eajmr.v2i3.3112

Singh B and Kaunert C (2024). Future of digital marketing: Hyper-personalized customer dynamic experience with AI-based predictive models. In: Khang A, Dutta PK, Gupta S, Ayedee N, and Chatterjee S (Eds.), Revolutionizing the AI-digital landscape: A guide to sustainable emerging technologies for marketing professionals: 189-203. Productivity Press, New York, USA. https://doi.org/10.4324/9781032688305-14

Tabuena AC, Necio SM, Macaspac KK, Bernardo MP, Domingo DI, and De Leon PD (2022). A literature review on digital marketing strategies and its impact on online business sellers during the COVID-19 crisis. Asian Journal of Management, Entrepreneurship and Social Science, 2(1): 141-153.

Wu CW and Monfort A (2023). Role of artificial intelligence in marketing strategies and performance. Psychology and Marketing, 40(3): 484-496. https://doi.org/10.1002/mar.21737

Yadav U and Shrawankar U (2025). Artificial intelligence across industries: A comprehensive review with a focus on education. In: Keeley KL (2025). AI applications and strategies in teacher education: 275-320. IGI Global, Hershey, USA. https://doi.org/10.4018/979-8-3693-5443-8.ch010