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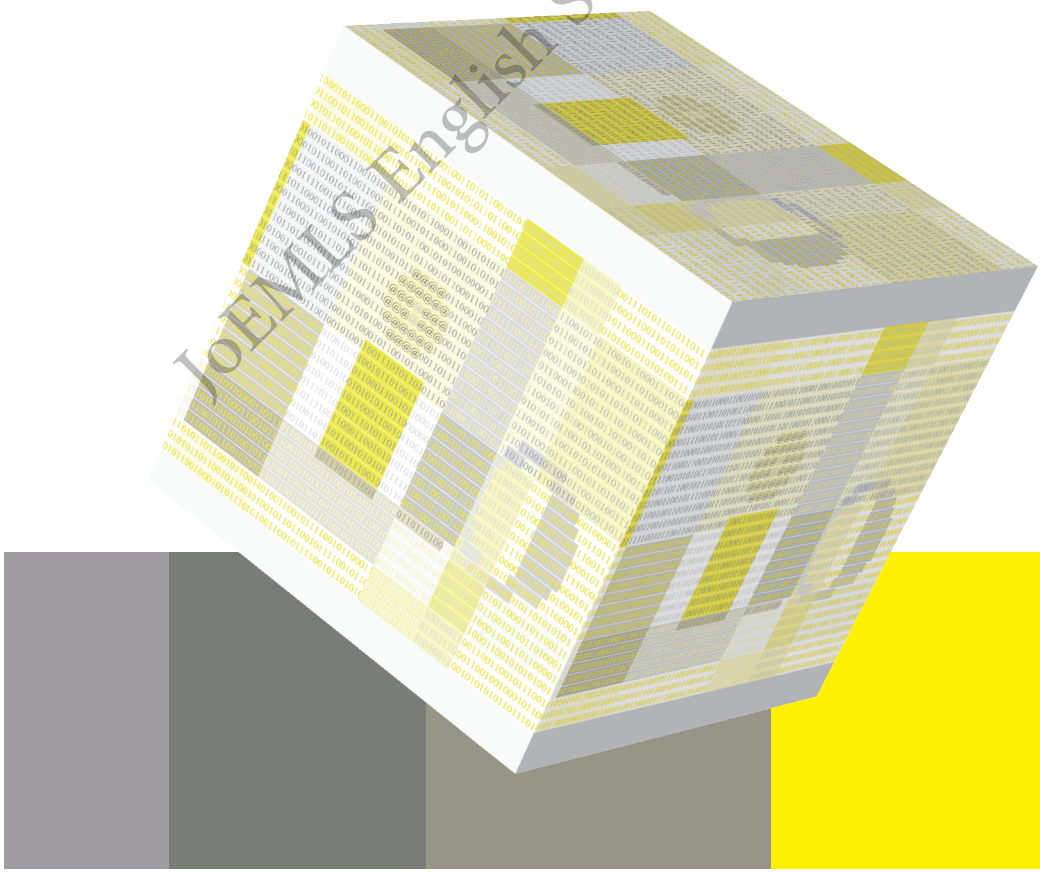

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教育資料與圖書館學，始於1970年3月創刊之教育資料科學月刊，其間於1980年9月更名為教育資料科學，並改以季刊發行。自1982年9月起易今名。另自2016年11月起，改以一年出版三期（3月、7月、11月）。現由淡江大學出版中心出版，淡江大學資訊與圖書館學系和覺生紀念圖書館合作策劃編輯。本刊為國際學術期刊，2008年獲國科會學術期刊評比為第一級，2015年獲科技部人文社會科學研究中心評定為教育學門專業類一級期刊。並廣為海內外知名資料庫所收錄(如下英文所列)。

The JOURNAL OF EDUCATIONAL MEDIA & LIBRARY SCIENCES *(JoEMLS)*, published by the Tamkang University Press and co-published with the Department of Information & Library Science (DILS) and Chueh Sheng Memorial Library, was formerly the ***Bulletin of Educational Media Science*** (March 1970 – June 1980) and the ***Journal of Educational Media Science*** (September 1980 – June 1982). In 2015, The *JoEMLS* is acknowledged as the first class scholarly journal in Taiwan by Ministry of Science and Technology (MOST). Since November 2016, the *JoEMLS* has been changed from quarterly to a tri-annual journal, published in March, July, and November.

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The cover design of ***JoEMLS*** signifies:
L (Librarianship); **I** (Information Technology); **B** (Bibliophile and the Book trade)

教育資料與圖書館學
JOURNAL OF EDUCATIONAL MEDIA & LIBRARY SCIENCES

JoEMLS 編輯政策

本刊係採開放存取（Open Access）與商業資料庫付費途徑，雙軌發行之國際學術期刊，兼具電子版與紙本之平行出版模式。本刊除秉持學術規範與同儕評閱精神外，亦積極邁向InfoLibrary寓意之學域整合與資訊數位化理念，以反映當代圖書資訊學研究趨勢、圖書館典藏內容與應用服務為本；且以探討國內外相關學術領域之理論與實務發展，包括圖書館學、資訊科學與科技、書業與出版研究等，並旁及符合圖書資訊應用發展之教學科技與資訊傳播論述。

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Contents

Journal of Educational Media & Library Sciences 63 : 1 (2026) : 1-9
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Editorial

Innovative Applications of Transparency Regulations for Disclosing the Roles of Contributors in Scholarly Journals and the Utilization of AI Tools

Following the release of the first version of the *Guidelines on Self-Disclosure and Integrity in the Use of Generative AI* at the end of 2025, the *Journal of Educational Media & Library Sciences* (*JoEMLS*) has proactively invited authors of pending manuscripts to participate in the journal's recommended AI disclosure items on a voluntary basis. This initiative aims to bridge the gap between the submission time of current manuscripts and the announcement of the initial "Integrity Principles".

Beginning with the second issue of Volume 63 of this journal (July 2026), we will invite authors of accepted but unpublished manuscripts to participate in a trial for a more detailed disclosure of individual authors in accordance with the revised (second) edition of the "Self-Disclosure and Transparency Regulations for the Use of Generative AI" (hereinafter referred to as the "New Regulation"). For new submitting authors, adherence to these new specifications will be explicitly required to ensure the comprehensive implementation of the New Regulation starting with the first issue of Volume 64 (2027).

This New Regulation combines the internationally established CRediT (Contributor Role Taxonomy) for contributor roles with existing AI-related guidelines in academic publishing (such as AI referencing styles recommendations in APA, Chicago/Turabian styles). It further incorporates three distinct facets in its design. *JoEMLS* calls this the AIxCRediT model, which includes:

- Contributor Role (CRediT facet): Disclose each author's specific human contributions during the research and writing process (14 defined roles).
- AI Disclosure/Assistance Taxonomy (AIDAT facet): Disclose each author's use of AI tools during the research and writing process (9 categories).[1]
- AI–Author Engagement Level: Disclose the depth of the author's interactive engagement when completing each task under the AIDAT

[1] The *JoEMLS* AI Disclosure/Assistance Taxonomy is divided into 9 items: A1 Conceptualization & Design; A2 Literature Retrieval, Data Management & Analysis; A3 Literature Review and Synthesis (incl. literature translation and excerpts); A4 Statistical Analysis & Visualization; A5 Drafting & Structure, A6 Readability, Proofreading, Paraphrasing, and translation; A7 Citation & Reference Management; A8 Review Communication, Ethics & Compliance Check; A9 Dissemination and Outreach, Figure & Multimedia Generation.

categories using AI tools; conversely, this can be seen as the level of assistance provided by the AI to the author (5 levels). Thus, it serves as a disclosure of the degree of human–machine interaction involved.

The CRediT taxonomy currently used by international journals lists 14 roles.[2] It provides author teams with descriptions of different contribution types to the work, thereby clarifying the precise attribution of responsibilities among co-authors and enhancing transparency in academic ethics. For example, Elsevier notes that CRediT further clarifies: (1) the corresponding author is responsible for ensuring that descriptions (of contributions) are accurate and agreed upon by all authors; (2) contributions should be responsibly expressed according to the CRediT roles; (3) authors may contribute to multiple roles; and (4) CRediT does not attempt to change or intervene in how authors qualify one another.[3] In practice, CRediT typically requires authors to explicitly declare and list their contributions upon manuscript submission. Unfortunately, CRediT's strengths still have limitations, especially in today's AI-driven context: it has not defined the correspondence between AI usage and scholarly output, nor has it imposed any ethical constraints on how the 14 roles relate to author order, relying instead on the decisions of the author group. In other words, self-discipline and self-respect remain the indispensable guiding principles.

Considering these circumstances, our journal's proposed AIxCRediT system has been conceived. This AIxCRediT model constitutes a "dual-aspect, three-dimensional" framework intended to clarify the attribution of responsibilities under human–AI co-creation, rather than arbitrarily restricting cases of reasonable, prudent, and responsible AI tool usage. Overall, the AIxCRediT model has the following features:

1. Detailed transparency: Provides more granular disclosure than simply stating "AI was used," so that co-authors are aware of their individual responsibilities and division of labor, and readers clearly understand the specific parts of the research process in which AI was involved.
2. Accountability: Reinforces that human authors bear ultimate responsibility for every research step, even if that step was assisted by AI.
3. Standardization: Provides journal editors and reviewers with a standardized framework to assess whether AI use is appropriate, and helps in formulating more precise academic ethics guidelines and related supporting

[2] see Mohammad Hosseini, et al., "CRediT Roles and Example Research Tasks That Could be Attributed to Them," https://zenodo.org/records/18421449.

[3] Elsevier, "CRediT Author Statement," https://www.elsevier.com/researcher/author/policies-and-guidelines/credit-author-statement.

documentation (e.g., "AIxCRediT Internal Management Guidelines for Editors," "AIxCRediT Review Guidelines for AI Use in Journals," etc.).

4. Data collection: Facilitates the collection of data on actual AI usage across different research stages within the scholarly community, thereby supporting follow-up research or informing future policy development.

For practical implementation, the *JoEMLS* has also refined certain practices to make the New Regulation more effective. In executing the AIxCRediT model, we have adopted a "form-based declaration document" format, which offers the following four benefits:

1. Integrates AI usage disclosure with the research workflow: The New Regulation maps AI usage scenarios to specific research activities (such as study design, literature review, statistical analysis, and writing). This approach more clearly presents the points at which AI intervenes in the research process, enhancing transparency of the workflow.
2. Defines research activities with AI participation levels and CRediT concepts: By grading AI usage, it distinguishes different levels of AI involvement in research and emphasizes clarifying research responsibilities and benefits. It avoids simply noting "AI used or not" or providing only a descriptive paragraph, making AI usage more concrete and comparable, and helps establish a more structured disclosure method.
3. Enhances traceability of AI usage information: By disclosing the research activities, usage levels, and tool information related to AI use, one can more clearly track AI's role in the research process, which helps strengthen academic accountability and transparency. A summary paragraph outlines the usage scenario, and DOI hyperlinks guide readers to download related files from the official website and review the form.
4. Practical feasibility: The form is highly structured, so in the future both submission system providers and other journals can directly adopt or adapt this framework. If integration with publishing standards such as JATS (Journal Article Tag Suite) is needed, they only need to add the relevant fields into the existing structure to enable structured tagging, providing good system extensibility.

In summary, the extent to which an author engages in interactive dialogue with generative AI tools is closely related to academic ethics. In the research and writing process, if an author repeatedly and uncritically relies on suggestions or answers obtained from AI without verifying their credibility and accuracy, the integrity of the work can be compromised. Such a design has a dual significance:

it represents active participation and contribution in human–machine interaction; at the same time, it serves to remind and urge authors to engage in further reflection during the research publication process, thereby improving the quality of the final scholarly output.

Generative AI tools are evolving extremely rapidly, and people's acceptance is likewise accelerating, making the requirements for disclosure and transparency systems proposed by journals all the more urgent. In facing shifts in usage habits and application environments, might the regulations and requirements again evolve from complex to simpler? Confronted with such a complex and changing situation, although our journal has highlighted this highly significant academic ethics issue, we must all proceed with vigilance and caution.

How can accusations of plagiarism regarding AI-generated content be transformed into recognition of the author's creative expression? The answer lies in recognizing that whether AI usage constitutes plagiarism depends on the author's full interactive engagement with the AI and the creative effort invested, and all of this must conform to academic ethical norms. At the same time, this helps journal editors and authors deeply recognize that the originality of articles originates entirely from human authors, with AI serving solely as a supplementary tool. From the perspective of the journal's editor-in-chief, I am highly committed to supporting authors in critically evaluating the suitability of co-authorship, reinforcing accountability mechanisms, ensuring the ethical and appropriate use of AI tools, and exploring the evolving experiences of academic research and writing in this new era by implementing this approach of self-disclosure and transparency. This humanistic concern far outweighs purely technical measures; it should serve as an aspect of sound ethics education and is necessary for lifelong learning.

The *JoEMLS* was founded in March 1970, and this March we held a symposium to celebrate the 55th anniversary, which inspired us to continue forging ahead into a fresh start of AI academic ethics. In this issue (Volume 63, Issue 1), a total of 10 articles were processed, with four accepted and six rejected, resulting in a rejection rate of 60%. The four accepted articles are: "Predictive Power of Artificial Intelligence Dependence and Digital Competence on Filipino Academic Librarians' Research Capability" by Jolo Van Clyde S. Abatayo; "Exploration of Senior Services in Taiwan's Public Libraries in an Aged Society: A Case Study and Practical Analysis" by Shan-Ju Lin Chang; "Exploring Research Trends in Chinese Indonesians: A Bibliometric Study Utilizing the Scopus Database" by Anju Nofarof Hasudungan and Linda Sunarti; and "Exploring

Related Researchers in Institutional Repositories Based on Machine Learning: A Case Study of Fu Jen Catholic University" by Meng-Hsuan Tsai, Shun-Der Chen, and Hai-Lun Tu. We extend our sincere gratitude to all authors and scholars who partake in the submission and review processes. As *JoEMLS* enters its 56th year, we thank the authors of these four major contributions for their participation and contributions, and for joining our journal in witnessing this era of AI prominence.

Jeong-Yeou Chiu
JoEMLS Chief Editor

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Research Article

Predictive Power of Artificial Intelligence Dependence and Digital Competence on Filipino Academic Librarians' Research Capability

Jolo Van Clyde S. Abatayo

ABSTRACT

In the evolving landscape of academic librarianship, integrating artificial intelligence (AI) and digital technologies has significantly reshaped professional practices and research engagement. This study investigates the predictive relationship between AI dependence and digital competence on the research capability of academic librarians in the Philippines. Grounded in the Unified Theory of Acceptance and Use of Technology 2, supported by Self-Efficacy Theory and the Diffusion of Innovations Theory, the study employed a descriptive-correlational and predictive quantitative research design. A structured questionnaire was administered to 1,000 librarians across Luzon, Visayas, and Mindanao, assessing levels of AI dependence, digital competence, and research capability. Results revealed a high level of AI dependence (M = 4.01) and a very high level of digital competence (M = 4.24), while research capability was only at a moderate level (M = 2.97). Pearson correlation showed significant positive relationships between the independent variables and research capability, with digital competence showing a stronger association (r = 0.328) than AI dependence (r = 0.194). Multiple regression analysis confirmed that both predictors significantly influence research capability, with digital competence emerging as the dominant predictor. Based on these results, the Artificial Intelligence and Digital Competence–Research Capability Model (AIDC–RC Model) was developed to illustrate the validated causal pathways. The model provides a strategic framework for designing interventions. It is recommended that academic institutions strengthen professional development focused on ethical AI use, digital fluency, and sustained research training to bridge the gap between technological proficiency and scholarly productivity.

Keywords: *Academic librarianship, Artificial intelligence, Artificial intelligence dependence, Digital competence, Library and information science, Research capability*

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Please visit *JoEMLS* website to read the Peer Review Report (Open Point) and Article Summary (InSight Point) of the article.
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Introduction

In the rapidly evolving digital landscape of academic libraries, librarians are increasingly expected to integrate emerging technologies, particularly artificial intelligence (AI), into their professional practices while maintaining high levels of digital competence. The adoption of AI tools, ranging from automated cataloging/metadata support to AI-assisted reference and content services, has reshaped library workflows and professional roles, requiring academic librarians to adapt to rapid technological change (Ayinde et al., 2025; Kim, 2025; Yang et al., 2024).

Despite these transformative possibilities, librarians in the Philippine context continue to face persistent challenges. Uneven access to professional development, limited digital infrastructure, and uncertainties surrounding the ethical use of AI hinder their ability to engage in research meaningfully. Although librarians often demonstrate positive attitudes toward research, many struggle with research design, statistical analysis, and digital tool integration due to insufficient institutional support (Austria & Cabonero, 2020; Sison, 2019). Overreliance on AI, especially in areas requiring ethical reasoning and professional judgment, further compounds these difficulties. Scholars caution that dependence on AI tools may erode critical thinking, ethical discernment, and cognitive autonomy when users accept AI outputs without sufficient evaluation (Cox, 2024; Lo, 2024; Rafiq, 2024; Zhai et al., 2024).

Amid these challenges, scholarship highlights the importance of digital competence and structured capacity-building. Institutional support programs and experiential learning initiatives have been shown to strengthen librarians' research confidence and technical abilities (Anderson et al., 2022). The DigComp 2.1 framework, for example, identifies essential competencies in digital communication, security, and content creation, all of which are increasingly critical to academic librarianship (Borbély, 2022; Mejías-Acosta et al., 2024). Yet, in many developing regions, librarians continue to rely heavily on self-directed learning due to the absence of formal training structures (Xwayi, 2025). Complementary initiatives that promote AI literacy and critical digital thinking have also demonstrated potential to strengthen librarians' research roles while mitigating the risks associated with automation (Cox, 2024; Tripathi, 2024).

To provide a stronger theoretical foundation, this study integrates three established frameworks: the Unified Theory of Acceptance and Use of Technology (UTAUT), Self-Efficacy Theory, and the Diffusion of Innovations Theory. UTAUT explains technology adoption in organizational settings through four core determinants: performance expectancy, effort expectancy, social influence, and facilitating conditions. These will go along together with moderating variables

such as age, gender, experience, and voluntariness of use (Venkatesh et al., 2003). In academic and digital library contexts, UTAUT has been widely applied to explain the adoption of AI and related information technologies by librarians and users (Ali & Warraich, 2024; Andrews et al., 2021; Fang et al., 2025). Applied to librarianship, it highlights how expectations about AI's usefulness and ease of use, social norms within professional networks, and available institutional support can shape librarians' levels of AI dependence and digital competence. Self-Efficacy Theory (Bandura, 1997) introduces a psychological dimension by emphasizing librarians' beliefs in their ability to perform research-related tasks effectively. Those with higher self-efficacy are more likely to undertake complex activities, such as research design, data interpretation, and publication. The Diffusion of Innovations Theory (Rogers, 2003) explains how technologies spread across adopters, from early innovators to late adopters, and underscores the influence of institutional culture, peer networks, and perceived innovation value. Taken together, these frameworks provide a comprehensive perspective on how external technological factors (UTAUT), internal psychological readiness (Self-Efficacy), and organizational or social contexts (Diffusion of Innovations) interact to shape librarians' research capability.

This research underscores both the promise and the risks of emphasizing AI literacy and digital competence in librarianship. While such competencies can enhance librarians' engagement in research and scholarly productivity, excessive reliance on automation may weaken critical thinking, ethical discernment, and professional judgment. In the Philippine context, studies remain limited, and none have examined these dynamics within a unified predictive framework. Specifically, there is a lack of research that integrates behavioral (UTAUT), psychological (Self-Efficacy), and technological diffusion (Diffusion of Innovations) perspectives to explain how AI dependence and digital competence jointly influence librarians' research capability.

By focusing on librarians from Luzon, Visayas, and Mindanao, this study seeks to provide empirical insights into how AI reliance and digital skills intersect to affect scholarly productivity. The predictive-causal model developed here offers academic institutions a strategic framework for designing professional development programs that align technological integration with research empowerment. Ultimately, this work contributes to the advancement of librarians as digitally skilled, ethically aware, and research-capable professionals in an era of accelerating technological change.

Furthermore, this study's emphasis on librarians' digital competence and responsible AI use aligns with broader educational and innovation priorities. Strengthening librarians' research capability directly supports SDG 4: Quality

Education, as librarians play a pivotal role in advancing inclusive access to knowledge and lifelong learning within higher education. At the same time, enhancing digital skills and promoting ethical AI integration contribute to SDG 9: Industry, Innovation, and Infrastructure, by reinforcing the digital research infrastructure needed for resilient academic institutions. Rather than invoking these SDGs as abstract ideals, this study situates them within the concrete context of librarianship: cultivating research-ready, digitally fluent, and ethically grounded professionals who can sustain innovation in higher education.

Finally, this study developed and tested a predictive framework linking artificial intelligence (AI) dependence and digital competence to the self-reported research capability of academic librarians in the Philippines. Conceptually informed by the Unified Theory of Acceptance and Use of Technology (UTAUT), Self-Efficacy Theory, and the Diffusion of Innovations, the study's contributions are threefold: 1. AI dependence and digital competence were operationalized with instruments adapted to academic librarianship; 2. their associations with research capability were estimated through multiple regression while reporting model fit and assumptions; and 3. digital competence was identified as a key lever for professional development. Given the cross-sectional, non-probability design, the findings are associative rather than causal, and generalizations are limited to populations similar to the sample frame. These boundaries align the study's claims with the available evidence and guide targeted institutional action. While not a full validation of the three theoretical models, this framework represents an important step toward integrating behavioral, psychological, and technological perspectives into the study of librarians' research capability.

Research Objectives and Questions

In light of the opportunities and risks associated with AI literacy and digital competence, this study pursued the following objectives:

1. To determine the levels of artificial intelligence (AI) dependence, digital competence, and research capability among academic librarians in the Philippines.
2. To examine the relationships between AI dependence, digital competence, and research capability.
3. To assess the predictive power of AI dependence and digital competence on librarians' research capability.

From these objectives, the study was guided by the following research questions:

1. What are the levels of AI dependence, digital competence, and research capability of academic librarians?
2. Is there a significant relationship between AI dependence, digital competence, and research capability?

3. To what extent do AI dependence and digital competence predict the research capability of academic librarians?

Related Works

This section synthesizes prior scholarship on five key areas: 1. AI adoption and risks in academic libraries, 2. technology-adoption theories applied in LIS, 3. measurement of AI dependence and cognitive offloading, 4. digital competence frameworks relevant to librarianship, and 5. librarians' research capability and scholarly roles. Taken together, these strands motivate the development of a unified predictive (associational) model for the Philippine context.

Research on technology adoption in librarianship has frequently drawn on behavioral models such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) to explain patterns of digital tool use (Ali & Warraich, 2024; Dwivedi et al., 2019; Venkatesh et al., 2003). Psychological constructs, particularly self-efficacy, have also been explored in relation to librarians' confidence in performing digital tasks and engaging in research activities (Anderson et al., 2022; Bandura, 1997). From a technological perspective, diffusion and innovation frameworks have been employed to account for how new systems and services are introduced into library practice (Rogers, 2003).

Although these studies provide valuable insights, few have sought to integrate these three perspectives into a single explanatory framework. The present study addresses this gap by combining behavioral, psychological, and technological dimensions to develop a holistic model that explains how AI dependence and digital competence jointly influence the research capability of academic librarians in the Philippines. This integrative approach distinguishes the study from earlier works while building on their theoretical and methodological foundations.

AI in Academic Libraries: Adoption, Roles, and Risks

Conceptual and empirical scholarship shows that AI is reshaping academic library functions, spanning strategy, collection management, reference services, discovery systems, and analytics, while simultaneously introducing ethical and organizational challenges. Cox (2024) examines possible trajectories for AI in academic libraries and maps their implications for staff competencies. Similarly, Manjunatha (2023) highlights how AI integration can enhance library services and indirectly strengthen librarians' research activities.

Professional bodies have also issued guidance for responsible adoption. The Association of Research Libraries (2024) has articulated Guiding Principles for Artificial Intelligence, while the International Federation of Library Associations

and Institutions has published strategy briefs emphasizing transparency, privacy, equity, and human oversight as core values (Cox, 2023). Likewise, IFLA's Statement on Libraries and Artificial Intelligence underscores librarians' responsibility to ensure ethical, equitable, and transparent deployment of AI technologies (IFLA FAIFE [Committee on Freedom of Access to Information and Freedom of Expression], 2020).

At the same time, researchers caution that overdependence on AI may weaken critical judgment and ethical responsibility. At the same time, researchers caution that overreliance on AI systems may weaken critical judgment and ethical responsibility, as users may default to automated outputs instead of deliberate evaluation and professional discernment (Rafiq, 2024; Zhai et al., 2024). These global policy and scholarly perspectives collectively highlight a central tension: while AI offers significant opportunities for innovation in library services, its adoption must be critically balanced with librarians' enduring professional values.

Technology-Adoption Theory in LIS (UTAUT and Diffusion)

The Unified Theory of Acceptance and Use of Technology (UTAUT) provides a widely used framework for explaining librarians' adoption of emerging technologies. UTAUT posits four core determinants of technology use: performance expectancy, effort expectancy, social influence, and facilitating conditions. These will work together with key moderating variables such as age, gender, experience, and voluntariness of use (Venkatesh et al., 2003). Meta-analytic work confirms the robustness of these constructs across diverse settings (Dwivedi et al., 2019), and a recent meta-analysis focused specifically on academic and digital libraries shows that UTAUT/UTAUT2 constructs (performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, and habit) have significant, large-effect relationships with behavioral intention to use technology in library contexts (Ali & Warraich, 2024).

Within library and information science, UTAUT has been successfully applied to model librarians' intention to adopt AI and related technologies (Andrews et al., 2021; Fang et al., 2025), researchers' use of bibliographic management tools (Rempel & Mellinger, 2015), staff preparedness for mobile library services (Saravani & Haddow, 2011), and students' use of digital reference services (Al-Hatmi & Nor, 2022). These studies collectively support the suitability of UTAUT's four core constructs for understanding technology-related behaviors in academic libraries. UTAUT2, a later extension designed for consumer contexts, adds hedonic motivation, price value, and habit to the model (Venkatesh et al., 2012), but these consumer-oriented constructs are less salient where technology use is embedded in institutional work systems and direct monetary cost and

entertainment value are not primary drivers. Accordingly, the present study draws on the original UTAUT model and focuses on its four core determinants in interpreting AI dependence and digital competence.

In this study, UTAUT is combined with Self-Efficacy Theory (Bandura, 1997) and the Diffusion of Innovations framework (Lund et al., 2020; Rogers, 2003) to provide a more comprehensive account of librarians' digital behaviors. This integrated approach captures behavioral drivers of technology use (performance and effort expectations, social norms, and facilitating conditions), the psychological dimension of confidence and self-belief, and the organizational and social processes that shape innovation adoption.

AI Dependence and Cognitive Offloading

AI dependence in this study is conceptualized using the Scale for Dependence on Artificial Intelligence (DIA/DAI), a validated unidimensional measure that demonstrates strong reliability and gender invariance (Morales-García et al., 2024).

Related research in cognitive science shows that easy access to externalized knowledge reshapes memory and information processing. Sparrow et al. (2011) identified the "Google effect," in which individuals tend to remember where information can be retrieved rather than retaining its content. Similarly, Ward et al. (2017) demonstrated that even the mere presence of smartphones can diminish cognitive capacity.

These cognitive offloading mechanisms highlight potential risks for librarians' professional practice: while AI tools may enhance efficiency, excessive reliance on them could undermine critical thinking, reflective judgment, and the exercise of professional expertise.

In line with the hypothesized framework, prior research suggests that AI dependence may influence librarians' research capability in both supportive and constraining ways. AI applications can streamline literature searching, reference management, and writing-related tasks, potentially improving efficiency and research engagement (Rafiq, 2024). At the same time, evidence suggests that over-reliance on AI dialogue systems can negatively affect critical cognitive skills (Zhai et al., 2024). However, excessive reliance on automation risks diminishing critical judgment and ethical discernment, which are essential to research integrity (Cox, 2024; Lo, 2024). Similarly, evidence points to digital competence as a strong enabler of research capability. Frameworks such as DigComp 2.1 emphasize digital communication, security, and content creation as foundations for scholarly productivity (Borbély, 2022; Mejías-Acosta et al., 2024). Empirical studies confirm that librarians with stronger digital skills demonstrate greater confidence and participation in research activities (Anderson et al., 2022; Sison,

2019). These findings provide empirical support for the hypothesized links in the AIDC-RC model, where both AI dependence and digital competence are expected to predict librarians' research capability.

Digital Competence Frameworks for Librarianship

The European Commission's DigComp 2.1 framework outlines key competence areas for digital proficiency (Carretero et al., 2017). It has been widely applied across education and librarianship to benchmark and guide professional skills development (Borbély, 2022).

Empirical studies affirm the value of digital competence for librarians' scholarly and professional roles. Wolski et al. (2020) and Joel and Ibrahim (2021) demonstrated that digital competence supports research data management, collaboration, and knowledge dissemination. Evidence from the Philippines echoes these findings: Yazon et al. (2019) reported significant positive associations between librarians' digital competence and their research productivity, although Friday et al. (2024) observed a positive but statistically non-significant effect.

Taken together, these studies suggest that digital competence is an enabling factor for research capability, though its impact may vary across contexts and methodological approaches.

Librarians' Research Capability and Scholarly Roles

Surveys consistently show that librarians express enthusiasm for research, yet face persistent skills and support gaps. In the Philippine context, Austria and Cabonero (2020) found that librarians are generally proficient in literature review but struggle with methodology and data analysis, a pattern echoed by Sison (2019) and Eclevia and Cordova (2022). International perspectives mirror these challenges, with studies reporting similar gaps in research competencies (Anderson et al., 2022).

Recent scholarship points to both opportunities and limitations in strengthening librarians' scholarly roles. Bolasco (2023) confirmed that digital competencies facilitate technology use in educational settings, while Dube et al. (2024) and Xwayi (2025) emphasized that digital literacy underpins librarians' ability to both support and conduct research. However, Lo (2024) and Edam-Agbor et al. (2025) caution that without ethical AI literacy, librarians' research contributions remain constrained.

Together, these findings highlight a dual challenge: librarians increasingly recognize the importance of digital and AI competencies for research, yet structural and ethical barriers continue to limit their full participation as scholarly contributors.

Synthesis and Gap

Existing research establishes several important foundations: 1. the rapid integration of AI accompanied by explicit ethical guardrails, 2. theoretically grounded models of technology adoption, 3. validated measures of AI dependence and well-documented cognitive offloading mechanisms, 4. mature digital-competence frameworks, and 5. evidence of librarians' uneven yet vital engagement in research.

What remains underexplored, particularly in the Philippine academic-library context, is a unified predictive model that connects AI dependence and digital competence to self-reported research capability. Such a model must integrate behavioral, psychological, and technological dimensions within a single framework. This study seeks to fill that gap.

Methodology

This section outlines the research design, participants, instrumentation, and statistical procedures employed to investigate the predictive relationship between artificial intelligence (AI) dependence, digital competence, and research capability among Filipino academic librarians.

Research Design

The study employed a quantitative, non-experimental, correlational–predictive design to examine the relationships among AI dependence, digital competence, and librarians' research capability. This design is well-suited to the study's objectives, as it enables the identification of patterns and predictive relationships within naturally occurring data without manipulating variables. As Creswell (2014) emphasized, quantitative research is particularly valuable for analyzing trends, establishing associations, and testing theoretical frameworks in large-scale data settings. In the present study, such a design allowed the quantification of librarians' AI dependence, digital competence, and research capability, while also testing a predictive framework grounded in established theories. The approach goes beyond descriptive work by modeling associations and predictive relationships, thereby providing a structured foundation for evidence-based strategies and institutional policies that support AI literacy, digital fluency, and scholarly productivity among academic librarians. At the same time, because the design is cross-sectional and non-experimental, regression coefficients are interpreted as associations rather than causal effects, and causal language is deliberately avoided.

The study was conceptually guided by three theoretical perspectives: the Unified Theory of Acceptance and Use of Technology (UTAUT), Self-Efficacy Theory, and the Diffusion of Innovations Theory. These frameworks informed

the selection of constructs and the interpretation of results, particularly in linking technology use, confidence in research processes, and adoption behaviors. In line with the academic-library context of this research, we draw specifically on UTAUT's four core determinants: performance expectancy, effort expectancy, social influence, and facilitating conditions. It was rather used than the consumer-oriented extensions introduced in UTAUT2 (Venkatesh et al., 2003, 2012).

In practice, these theoretical perspectives provided conceptual guidance for selecting and adapting validated instruments rather than functioning as direct sources of questionnaire items. AI Dependence was measured using the Morales-García et al. (2024) scale, which we interpret as aligning with the effort and performance expectancy dimensions described in UTAUT. Digital Competence was structured using Mejías-Acosta et al. (2024), aligning with innovation-adoption processes and facilitating conditions from both the Diffusion of Innovations framework and UTAUT. Research Capability was adapted from Sison (2019), reflecting Self-Efficacy Theory through measures of confidence and engagement in research processes. In this way, the theories informed the predictive framework by shaping construct selection and interpretation of findings, while ensuring the use of previously validated, context-appropriate measurement tools.

This design further enhances internal validity through its structured approach to measurement and statistical analysis and ensures external relevance by incorporating a geographically diverse sample from Luzon, Visayas, and Mindanao. While the non-experimental nature limits causal inference, predictive modeling provides a robust foundation for developing evidence-based strategies and institutional policies that support AI literacy, digital fluency, and scholarly productivity among academic librarians. Because the design is cross-sectional and non-experimental, regression coefficients are interpreted as associations rather than causal effects. Therefore, causal language was deliberately avoided, and the model is framed as predictive and explanatory within the observed data structure.

Population and Sampling Procedure

The target population of this study comprised academic librarians from higher education institutions across the three major island groups in the Philippines: Luzon, Visayas, and Mindanao. To ensure proportional geographic representation, the study employed a quota sampling technique with regional stratification. Fixed quotas were established per region: 400 librarians from Luzon, 300 from Visayas, and 300 from Mindanao, for a total of 1,000 respondents. Within each regional quota, participants were selected using

non-probability convenience sampling based on accessibility, availability, and institutional cooperation. Quota sampling, which involves dividing the population into mutually exclusive subgroups and then selecting participants non-randomly within each subgroup to meet predetermined quotas (Battaglia, 2008), enhances representativeness by ensuring that specific characteristics of the population, in this case, regional location, are proportionally reflected in the sample. Although it does not allow for statistical generalization in the same way probability methods do, quota sampling is widely recognized as an appropriate approach in contexts where randomization is not feasible (Daniel, 2012; Etikan et al., 2016). Furthermore, the total sample size of 1,000 exceeds the recommended minimum for multiple regression analysis, ensuring adequate statistical power to detect predictive relationships (Hair et al., 2014).

A total of 1,000 valid responses were obtained, meeting the predetermined regional quotas (Luzon = 400, Visayas = 300, Mindanao = 300) and yielding a 100% response rate. Inclusion criteria were: 1. currently employed academic librarians in higher education institutions (HEIs) and 2. at least one year of professional tenure. Exclusion criteria were: 1. non-librarian staff and 2. incomplete survey responses. While quota–convenience sampling ensured proportional geographic representation, the absence of random selection restricts statistical generalizability. For this reason, the findings are best interpreted as analytically generalizable to comparable contexts rather than universally applicable.

It is also important to note that while this study ensured geographic representation from Luzon, Visayas, and Mindanao, it did not explicitly control for institutional-level variations such as funding support, organizational culture, or digital infrastructure. These contextual differences may influence how academic librarians experience and develop digital competence, AI dependence, and research capability. Future research may incorporate stratification by institutional characteristics to capture these nuanced influences.

Another limitation is that the study did not collect detailed demographic information such as age, academic qualifications, or years of professional experience. Such factors could shape librarians' digital competence, AI use, and research capability in meaningful ways. Future research could incorporate these variables to identify subgroup differences and tailor professional development programs more effectively.

Research Instrument

Data were collected using a researcher-modified structured questionnaire divided into three major sections: Artificial Intelligence Dependence, Digital Competence, and Research Capability. Each section of the instrument was

adapted from previously validated tools and revised to fit the research context of academic librarianship in the Philippines. The Artificial Intelligence Dependence section was based on the Dependence on Artificial Intelligence (DIA) Scale developed by Morales-García et al. (2024) and was adapted to reflect professional AI usage in academic settings. The Digital Competence section was derived from the framework of Mejías-Acosta et al. (2024) and was organized into six subdimensions: Access to Digital Content Management, Digital Empathy, Use of Digital Media, Digital Security, Communication of Digital Content, and Creation of Digital Content. The Research Capability section was developed by integrating and adapting indicators from Sison (2019), structured into two subdimensions: Research Process Skills and Research Involvement. Research Process Skills (Items 1-10) refer to librarians' technical ability to perform the core stages of the research process, such as identifying a topic, reviewing literature, formulating questions, designing methods, collecting and analyzing data, and disseminating findings. Research Involvement (Items 11-17) refers to the extent of librarians' participation in research activities, including seminars, forums, conferences, and publications. For transparency, the complete set of items is presented in Appendix, organized according to these subdimensions. All items were rated on a five-point Likert scale, with anchors tailored to each dimension.

Prior to full implementation, the instrument underwent expert review and pilot testing to establish validity and reliability. Three experts in educational research and library and information science evaluated the draft instrument for content validity, clarity, and cultural appropriateness. Their feedback prompted revisions to ambiguous wording, such as simplifying technical terms in the Digital Competence scale and clarifying phrasing in the Research Capability items. The revised questionnaire was then pilot tested with 30 academic librarians who were not included in the main study sample. Pilot data were analyzed to assess reliability and construct validity. Results confirmed high internal consistency (Cronbach's α = .926 overall; AI Dependence = .891; Digital Competence = .933; Research Capability = .904). Exploratory factor analysis further supported dimensionality (KMO = .902, Bartlett's χ^2 = 1254.37, p < .001), with items retained if factor loadings were ≥ .40 and cross-loadings < .30. No items were removed, but minor adjustments were made to improve clarity based on pilot feedback. These procedures ensured that the final instrument was psychometrically sound and appropriate for full-scale deployment.

Data Collection Procedure

Following instrument validation, data were collected using a combination of online and paper-based survey dissemination to ensure accessibility across the three major island groups of the Philippines: Luzon, Visayas, and Mindanao. This

dual-mode strategy was designed to address disparities in internet connectivity and institutional infrastructure, particularly in remote or underserved regions. Prior to participation, respondents were provided with an informed consent statement that outlined the objectives of the study, the voluntary nature of participation, and assurances of confidentiality. Surveys were distributed through institutional channels, professional library associations, and researcher networks to maximize outreach and participation.

The data collection phase lasted six weeks, during which follow-up reminders were issued to help achieve the predetermined regional quotas. All completed surveys were carefully screened for accuracy and completeness before inclusion in the final dataset. To uphold ethical compliance, no personally identifiable information was collected, responses were anonymized, and participation was entirely voluntary and uncompensated.

Statistical Treatment of Data

The statistical analysis of the data collected in this study was conducted using the Statistical Package for the Social Sciences (SPSS), a widely accepted software for quantitative research. The analysis followed a three-phase process aligned with the research objectives: descriptive analysis, correlation analysis, and predictive modeling.

In the first phase, descriptive statistics were computed to determine the levels of artificial intelligence (AI) dependence, digital competence, and research capability among academic librarians. Measures of central tendency, specifically mean scores, were calculated for each variable and its subdimensions. These values were interpreted using a predefined Likert scale rubric that categorized responses as Very Low, Low, Moderate, High, or Very High, thereby ensuring consistent and meaningful interpretation.

In the second phase, Pearson's product-moment correlation coefficient (*r*) was employed to assess the strength and significance of the linear relationships between the independent variables (AI dependence and digital competence) and the dependent variable (research capability). This method was selected for its suitability in analyzing continuous variables and its capacity to detect both positive and negative associations. Statistical significance was determined using a *p*-value threshold of .05.

In the third phase, multiple linear regression analysis was carried out to evaluate the predictive power of AI dependence and digital competence on librarians' research capability. This procedure generated standardized beta coefficients (*β*) to indicate the relative contribution of each predictor to the outcome variable, alongside unstandardized coefficients (B), standard errors, and *t*-values to provide a comprehensive account of the model's explanatory capacity.

The regression results were synthesized into the proposed AIDC–RC Model, which conceptually visualizes the validated predictive relationships.

This multi-layered statistical approach ensured analytical rigor, supported hypothesis testing, and maintained alignment with the study's theoretical framework and objectives.

Results and Discussion

This section presents the analyzed data and interprets the findings in relation to the study's objectives and theoretical framework. Key trends, correlations, and predictive insights are discussed to explain the interplay among the examined variables.

As shown in Table 1, the findings reveal that librarians in the Philippines exhibit a high level of artificial intelligence (AI) dependence, with an overall mean of 4.01, verbally interpreted as Agree and descriptively categorized as High. All five indicators registered mean scores ranging from 4.0 to 4.1, indicating strong agreement among respondents regarding their reliance on AI for various professional tasks. These results suggest that AI tools have become integral to librarians' workflows, particularly in routine functions such as data processing, content generation, and digital service facilitation.

This outcome aligns with recent literature describing increased AI uptake in academic library services, particularly for automating routine tasks and improving service efficiency (Ayinde et al., 2025; Kim, 2025). Similarly, Edam-Agbor et al. (2025) confirmed high levels of AI awareness and acceptance among librarians, though they cautioned that actual application varied according to demographic factors and institutional readiness.

Table 1 Level of AI Dependence among Librarians

Item	Mean	Verbal Description	Verbal Interpretation
1. I feel unprotected when I don't have access to artificial intelligence.	4.1	Agree	High
2. I worry about delaying my tasks or projects if I don't use artificial intelligence.	4.0	Agree	High
3. I do my best to stay current in artificial intelligence to remain relevant.	4.0	Agree	High
4. I constantly need validation or feedback from artificial intelligence systems to feel confident in my decisions.	4.01	Agree	High
5. I don't fear that artificial intelligence will replace my current skills or capabilities.	4.02	Agree	High
Overall	4.01	Agree	High

Note: Legend: Very High = 4.20 – 5.00; High = 3.40 – 4.19; Moderate = 2.60 – 3.39; Low = 1.80 – 2.59; Very Low = 1.00 – 1.79.

The data further resonate with Morales-García et al. (2024), who conceptualized AI dependence as a compulsive reliance on automated systems

for decision-making. Respondents' agreement with items such as the need for validation from AI and fears of skill obsolescence underscores a psychological attachment to AI tools, signaling a shift from simple adoption to dependence. This finding is supported by qualitative evidence that subject librarians' use of AI-generated content is shaped by perceived performance benefits and practical work demands, alongside concerns about accuracy, ethics, and professional responsibility (Yang et al., 2024).

However, this dependence carries potential drawbacks. Research indicates that over-reliance on AI dialogue systems can reduce critical thinking and analytical judgment when users accept AI-generated recommendations without adequate scrutiny (Rafiq, 2024; Zhai et al., 2024). Cox (2024) likewise emphasizes that while AI can enhance efficiency, it lacks the nuanced understanding and empathetic capacity inherent to librarianship. Thus, while the high mean scores indicate widespread AI integration, they also highlight the importance of cultivating a critical and ethically grounded stance toward AI use.

The findings further point to the need for institutional policies that define responsible AI use. Without clear guidelines, librarians may apply AI inconsistently, risking compromises in data integrity or academic rigor. Overreliance also raises concerns about cognitive offloading, where essential professional skills such as critical analysis or manual cataloging may deteriorate due to automation. To mitigate these risks, institutions must promote a balanced approach, one that safeguards librarians as active knowledge practitioners rather than passive consumers of AI. Embedding AI ethics and critical thinking modules in continuing professional development programs is particularly vital to sustain professional standards in the face of accelerating automation.

The results also affirm the explanatory relevance of the Unified Theory of Acceptance and Use of Technology (UTAUT), which highlights performance expectancy, effort expectancy, social influence, and facilitating conditions as key determinants of technology use (Venkatesh et al., 2003). Librarians' perceptions of AI's utility and the normative pressure to adopt it appear to reinforce their dependence, while the Diffusion of Innovations Theory (Rogers, 2003) helps contextualize how innovations like AI become normalized within professional practice.

Overall, the high level of AI dependence reflects not only the success of technological integration but also the need for balanced engagement strategies and institutional frameworks that safeguard professional autonomy, critical reasoning, and ethical decision-making in academic librarianship.

Table 2 presents the overall mean score for digital competence among librarians, which stands at 4.24. This corresponds to a Strongly Agree rating and

is descriptively interpreted as Very High. Among the six subdimensions, "Creation of Digital Content" registered the highest mean (4.26), followed closely by "Access to Digital Content Management" (4.25), and with the remaining dimensions clustered between 4.23 and 4.24. These results reflect a consistently high level of proficiency across digital domains, underscoring librarians' adaptability to the digitized landscape of academic libraries and their readiness to integrate digital tools into professional practice.

Table 2 Level of Digital Competence among Librarians

Item	Mean	Verbal Description	Verbal Interpretation
1. Access to Digital Media	4.25	Strongly Agree	Very High
2. Digital Empathy	4.24	Strongly Agree	Very High
3. Use of Digital Media	4.23	Strongly Agree	Very High
4. Digital Security	4.24	Strongly Agree	Very High
5. Communication of Digital Content	4.24	Strongly Agree	Very High
6. Creation of Digital Content	4.26	Strongly Agree	Very High
Overall	4.24	Strongly Agree	Very High

Note: Legend: Very High = 4.20 – 5.00; High = 3.40 – 4.19; Moderate = 2.60 – 3.39; Low = 1.80 – 2.59; Very Low = 1.00 – 1.79.

These findings support the results of Borbély (2022), who affirmed that librarians with higher educational attainment demonstrate advanced digital skills necessary for research facilitation and content management. Similarly, Atchrimi and Ogunbodede (2024) reported that South-South Nigerian librarians performed effectively in digital environments, often acquiring skills through informal means such as peer collaboration and self-study, an experience that parallels the pathways followed by many Filipino librarians.

The elevated mean scores also resonate with the DigComp 2.1 Framework emphasized by Mejías-Acosta et al. (2024), which outlines key digital competence areas, including communication, safety, and content creation. The presence of these skills among the respondents suggests that librarians are achieving a breadth of digital proficiency despite infrastructural barriers and unequal training opportunities noted by Hamad et al. (2020) and Osinulu (2021). This adaptability highlights librarians' resilience in bridging gaps through self-directed learning and professional collaboration.

The theoretical framing further strengthens this interpretation. In line with UTAUT (Venkatesh et al., 2003), the high digital competence levels may be driven by performance expectancy and effort expectancy, indicating that librarians view digital proficiency as both beneficial and manageable. Likewise, Self-Efficacy Theory (Bandura, 1997) explains how strong confidence in digital abilities enhances engagement and productivity in digitally mediated tasks. Together,

these perspectives underscore the motivational and psychological factors that sustain high levels of digital competence.

In summary, the very high digital competence of librarians represents a critical asset for advancing digital transformation and supporting research productivity in academic libraries. However, the findings also reveal a missed opportunity to formally recognize these competencies. Although most librarians acquire their skills through informal channels, the absence of structured credentials may restrict their capacity to lead institutional digital initiatives or to engage in cross-departmental collaborations. To address this, academic institutions and library associations should consider establishing certification or microcredential programs to validate librarians' expertise. Moreover, librarians with advanced digital proficiency can be strategically positioned as institutional leaders in digital innovation, ensuring that their skills not only enhance library services but also contribute to broader organizational transformation. transformation, guiding faculty and students in navigating complex digital environments.

Table 3 indicates that the overall mean score for research capability is 2.97, verbally interpreted as Neutral and descriptively categorized as Moderate. This moderate rating is consistent across both subdimensions, Research Process Skills and Research Involvement, reflecting a balanced yet cautious level of confidence and participation in research-related activities. The results suggest that, despite strong digital competence, librarians' engagement in research remains modest, highlighting a persistent gap between digital readiness and actual scholarly productivity.

The result corroborates the findings of Sison (2019), who noted that while librarians in the Philippines generally display a positive research attitude, many struggle with the technical aspects of research, particularly instrument design and statistical analysis. Similarly, Austria and Cabonero (2020) reported that librarians tend to demonstrate proficiency in reviewing literature but often lack competence in methodology and data analysis. These earlier studies align with the present findings, reinforcing the conclusion that research capability among Filipino librarians remains moderate despite their strong information-handling skills.

Table 3 Level of Research Capability among Librarians

Item	Mean	Verbal Description	Verbal Interpretation
Research Process Skills	2.97	Neutral	Moderate
Research Involvement	2.97	Neutral	Moderate
Overall	2.97	Neutral	Moderate

Note: Legend: Very High = 4.20 – 5.00; High = 3.40 – 4.19;
Moderate = 2.60 – 3.39; Low = 1.80 – 2.59;
Very Low = 1.00 – 1.79.

This moderate capability can also be explained through Self-Efficacy Theory, which posits that individuals with limited prior success or inadequate institutional support are likely to develop lower self-efficacy, thereby reducing their willingness to engage in more demanding research activities. Eclevia and Cordova (2021) support this interpretation, identifying gaps in self-confidence among Filipino librarians when faced with complex research tasks. Such psychological barriers compound the technical challenges, creating obstacles to deeper research engagement.

The findings underscore the need for institutional investment in mentorship programs, targeted training, and expanded opportunities for publication and conference participation to strengthen librarians' research identities and scholarly presence. At the same time, the moderate level of research capability suggests that librarians remain an underutilized scholarly workforce within higher education. Many already possess transferable expertise in evidence synthesis, digital data management, and methodological support, yet institutional cultures and role definitions often preclude them from research-oriented projects.

Future strategies should prioritize collaborative research roles for librarians, supported by structured mentorship and inclusion in research funding mechanisms. It may also be valuable to disaggregate research capability by demographic variables such as age, employment rank, or regional affiliation, as certain groups may face unique barriers that aggregate statistics obscure. Such nuanced analysis will ensure that the high levels of digital competence observed among librarians are effectively translated into sustained research involvement and meaningful scholarly productivity.

Table 4 shows that both AI Dependence (r = 0.194, p <.001) and Digital Competence (r = 0.328, p < .001) have significant positive correlations with research capability. Although both predictors demonstrate statistical significance, digital competence exhibits the stronger association, indicating that proficiency in digital skills contributes more substantially to research capability than reliance on AI tools.

These results align with the findings of Dube et al. (2024) and Borbély (2022), who emphasized the pivotal role of digital competence in enhancing librarians' capacity to support and conduct research. By contrast, the more modest relationship between AI dependence and research capability may indicate that while AI tools can support task completion, greater dependence can reduce critical engagement and reflective judgment (Zhai et al., 2024).

Table 4 Correlation Analysis between Independent Variables and Research Capability

Variables	*r*	*p*-value	Interpretation
AI Dependence & Research Capability	0.194	.000	Significant
Digital Competence & Research Capability	0.328	.000	Significant

Note: Legend: r = correlation coefficient; $p < .05$ = Significant.

The broader literature further contextualizes these findings. Manjunatha (2023) reported that AI applications improve library services such as information retrieval and data management, which can indirectly support research activities. Meanwhile, Yazon et al. (2019) demonstrated a significant positive correlation between digital competence and research productivity among educators, underscoring the transferability of digital skills to scholarly outcomes. Conversely, Friday et al. (2024) found that while digital literacy influenced librarians' research productivity in South-South Nigerian universities, the relationship was not statistically significant, suggesting that other institutional or contextual factors may moderate this effect.

The observed correlation is also interpreted within the framework of Diffusion of Innovations Theory (Rogers, 2003). Early adopters of AI and digital tools are better positioned to integrate them into scholarly practice, thereby gaining a comparative advantage in research capability. However, the findings also call for a critical stance: technology should supplement rather than overshadow core competencies in research design, methodology, and analysis.

Furthermore, these correlation patterns suggest that improvements in AI use or digital competence must be accompanied by supportive organizational interventions. The moderately strong relationship, particularly for digital competence, indicates that while the requisite skills are present, librarians may still lack the motivation, time, or institutional resources needed to translate them into tangible research outputs. Integrated professional development programs that combine digital fluency, research methodology, and AI literacy within a unified curriculum may prove more effective than isolated training initiatives. At the same time, correlation strength can serve as a diagnostic indicator, signaling the need to examine structural or motivational constraints that inhibit full participation in research despite high competence levels.

Table 5 shows that both AI Dependence ($\beta = 0.194$, $p < .001$) and Digital Competence ($\beta = 0.328$, $p < .001$) significantly predict research capability. Among the two predictors, digital competence emerges as the stronger determinant, as evidenced by its higher beta coefficient and t-score, underscoring its greater influence on the dependent variable. These results highlight the centrality of digital competence in shaping scholarly productivity. Wolski et al. (2020) and

Joel and Ibrahim (2021) similarly emphasized that librarians' digital capabilities directly enhance their ability to manage research data, collaborate in digital environments, and support research dissemination. By contrast, while AI dependence is significant, its effect must be carefully balanced with human expertise, as overreliance on automation may dilute critical engagement (Rafiq, 2024; Zhai et al., 2024).

Table 5 Multiple Regression Analysis on Predictors of Research Capability

Predictor	B	SE B	β (Beta)	t	p-value
Constant	0.117	0.164	—	0.713	.476
AI Dependence	0.157	0.020	0.194	7.850	.000
Digital Competence	0.319	0.026	0.328	12.269	.000

Note: Legend: B = Unstandardized Coefficient, SE B = Standard Error, β = Standardized Coefficient, $p < .05$ = Significant.

These regression findings also carry important implications for institutional policy and decision-making. Given the stronger predictive power of digital competence, universities should prioritize digital skill-building when allocating professional development resources. Budget planning should strategically emphasize initiatives that enhance digital content creation, data literacy, and secure information handling. Although AI dependence contributes meaningfully, its relatively lower beta value indicates that reliance on automation alone is insufficient for driving scholarly productivity. To optimize research capability, professional development must therefore cultivate both foundational digital skills and critical, reflective AI use grounded in ethical and disciplinary standards.

The results further align with prior scholarship. Bolasco (2023) demonstrated that digital competencies significantly influence the adoption of emerging educational technologies, thereby enhancing research activity. Likewise, Friday et al. (2024) reported a positive, though not statistically significant, influence of digital literacy on librarians' research productivity, suggesting that contextual or institutional factors may moderate this effect. Complementing these perspectives, Manjunatha (2023) highlighted the role of AI in improving library services, where integration into information retrieval and data management indirectly supports librarians' research activities.

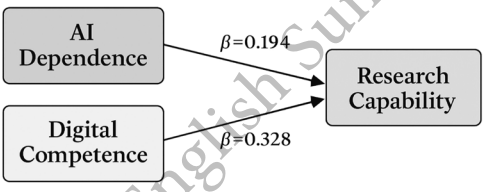
Taken together, these findings are well explained by the integration of UTAUT, Self-Efficacy Theory, and Diffusion of Innovations Theory. Digital competence aligns with constructs such as performance expectancy and self-efficacy, reflecting the extent to which librarians feel capable of achieving valued outcomes through digital skills. Meanwhile, AI dependence resonates with technology adoption and usage behaviors, situated within broader innovation ecosystems. This theoretical grounding underscores that while digital

competence remains the stronger predictor of research capability, both variables interact within individual, organizational, and technological contexts to shape scholarly engagement.

Proposed Predictive Framework of Librarians' Research Capability

The Artificial Intelligence and Digital Competence–Research Capability (AIDC–RC) framework, presented in Figure 1, integrates the regression findings into a conceptual model for understanding and strengthening librarians' scholarly engagement. The framework highlights that while both AI Dependence and Digital Competence contribute to research capability, Digital Competence exerts the stronger influence. This suggests that professional development strategies should prioritize enhancing digital skills, such as secure information handling, digital content creation, and data literacy, while also encouraging librarians to adopt AI tools in a critical and reflective manner.

Figure 1 Artificial Intelligence and Digital Competence–Research Capability Model



The framework aligns with UTAUT and Self-Efficacy Theory in underscoring the importance of performance expectancy and self-belief in digital tasks, while the Diffusion of Innovations perspective explains how digital practices and AI adoption diffuse across professional communities. By synthesizing these perspectives, the model illustrates not only the statistical associations but also the behavioral and organizational mechanisms that shape research capability.

Rather than serving as a definitive theoretical validation, the framework offers a practical roadmap: institutions can use it to identify leverage points for professional development, policy formulation, and curricular design in library and information science education. Future studies may refine this model through longitudinal designs or structural equation modeling, enabling a deeper validation of its theoretical underpinnings.

Limitations and Future Directions

While the present study provides valuable insights into the predictive relationships among AI dependence, digital competence, and research capability, the findings are based exclusively on self-reported survey data. As such, the interpretations should be understood as indicative associations rather than definitive explanations of librarians' behaviors or institutional dynamics. To more

deeply contextualize these quantitative results, future research should integrate qualitative methods such as interviews or focus groups. Such approaches would allow for richer exploration of the lived experiences of librarians, uncovering the nuances behind their survey responses and further validating the patterns observed in this study.

Beyond geographic coverage, it must also be recognized that the study did not examine institutional contexts in detail. Differences in funding support, organizational culture, and technological infrastructure across universities may shape how librarians build digital competence, adopt AI tools, and engage in research. These contextual influences were not captured in the present design, but they represent important factors for future inquiry, particularly in explaining variation across academic settings.

Finally, the absence of detailed demographic information such as age, educational qualifications, or professional experience limits the interpretation of subgroup differences. It is plausible, for instance, that early-career librarians may approach AI tools with greater ease, while senior colleagues may draw more on professional judgment or institutional authority in their research engagement. Without these variables, the findings remain aggregated and cannot capture such nuances. Future research that incorporates demographic profiles could provide a richer understanding of how professional background shapes the interplay of digital competence, AI reliance, and research capability.

Conclusion

This study is among the first to examine how artificial intelligence (AI) dependence and digital competence jointly predict the research capability of academic librarians in the Philippines. While findings revealed high levels of AI dependence and very high digital competence, self-reported research capability remained only moderate. Correlation and regression analyses confirmed both variables as significant predictors, with digital competence emerging as the stronger contributor.

These results underscore the dual role of digital transformation in librarianship: while AI and digital tools expand efficiency, productivity, and information access, translating these affordances into meaningful research output requires deeper engagement, critical digital literacy, and sustained professional development. The widespread use of intelligent systems illustrates the opportunities of automation but also raises concerns about overreliance, echoing earlier scholarship. In contrast, multidimensional digital competence, including content creation, security, communication, and media literacy, demonstrated a more direct and substantial impact on librarians' engagement with research.

By integrating perspectives from the Unified Theory of Acceptance and Use of Technology (UTAUT), Self-Efficacy Theory, and the Diffusion of Innovations Theory, the study advances an original predictive framework (AIDC–RC) that goes beyond description to offer a conceptual roadmap for research capacity-building. This framework highlights that technological readiness alone is insufficient without psychological confidence and institutional support. The originality of this contribution lies in linking behavioral, technological, and cultural dimensions into a testable model specific to the Philippine academic library context.

The study also introduces practical innovation by aligning with the United Nations Sustainable Development Goals (SDGs), particularly SDG 4: Quality Education and SDG 9: Industry, Innovation, and Infrastructure. The AIDC–RC framework provides institutions with actionable insights for designing policies, professional development programs, and ethical AI integration strategies that directly strengthen librarians' role as both facilitators of information and contributors to scholarly inquiry.

In conclusion, librarians' research capability in the digital age is shaped by both technological and psychological readiness. Cultivating a balanced ecosystem, one that encourages ethical, critical, and strategic use of AI while embedding digital competence training and research mentorship, ensures librarians remain active drivers of educational innovation. The proposed AIDC–RC framework represents not only an empirical contribution but also an innovative foundation for future research. Subsequent studies may apply longitudinal and mixed-method designs, expand to diverse institutional contexts, and refine the framework to enhance its robustness and generalizability.

Acknowledgment and Declaration

The author used ChatGPT (GPT-5.1) only for language/statement construction (grammar, clarity). No AI was used to generate or analyze data, results, or references. The author reviewed/edited all AI-assisted text and take full responsibility.

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Appendix: Survey Instrument

Section I: AI Dependence (adapted from Morales-García et al., 2024)

Instructions: The following statements assess your reliance on artificial intelligence for tasks, decision-making, and professional growth. Please indicate the extent to which you agree or disagree with each statement by selecting the appropriate response:

Strongly Agree (5)

Agree (4)

Slightly Agree (3)

Disagree (2)

Strongly Disagree (1)

Choose the response that best reflects your perception of AI dependence.

Item	Strongly Agree (5)	Agree (4)	Slightly Agree (3)	Disagree (2)	Strongly Disagree (1)
1. I feel unprotected when I don't have access to artificial intelligence.					
2. I worry about delaying my tasks or projects if I don't use artificial intelligence.					
3. I do my best to stay current in artificial intelligence to remain relevant.					
4. I constantly need validation or feedback from artificial intelligence systems to feel confident in my decisions.					
5. I don't fear that artificial intelligence will replace my current skills or capabilities.					

Section II: Digital Competence (adapted from Mejías-Acosta et al., 2024)

Instructions: This section evaluates your digital competence in various aspects, including access to digital content, digital empathy, digital security, and the use of digital media for communication and creation. Please indicate the extent to which you agree or disagree with each statement using the following scale:

5 – Strongly Agree (I consistently demonstrate this ability)

4 – Agree (I frequently demonstrate this ability)

3 – Slightly Agree (I moderately demonstrate this ability)

2 – Disagree (I rarely demonstrate this ability)

1 – Strongly Disagree (I do not demonstrate this ability)

Answer each item truthfully based on your skills and experience.

Item	Strongly Agree (5)	Agree (4)	Slightly Agree (3)	Disagree (2)	Strongly Disagree (1)
a. Access to Digital Media					
1. I have applications that keep me updated with the recent happenings.					
2. I can search for and access information in digital environments.					
3. I can use different media to store and manage information.					
4. I can search for the information I need on the internet.					
5. I can understand the information I obtain from the Internet.					
b. Digital Empathy					
6. I respect other people in digital environments.					
7. I take into account the opinions of others in digital environments.					
8. I can put myself in others' shoes in digital environments.					
9. I am willing to help other people in digital environments.					
10. I inform myself before commenting on a topic.					
c. Use of Digital Media					
11. I can complete digital content related to my tasks.					
12. I can use digital media to detect content plagiarism.					
13. I use digital media to solve tasks.					
14. I can create and edit digital content required in my tasks.					
15. I skilfully use digital software to complete tasks.					
d. Digital Security					
16. I avoid inappropriate behavior on social networks.					
17. I am careful with my personal information and that of others.					
18. I can identify harmful behaviors that can affect me.					
19. Before carrying out a digital activity, I evaluate the consequences.					
20. When sharing digital information, I consider my privacy and security.					
e. Communication of Digital Content					
21. I know how to communicate through different digital media.					
22. I can communicate with other people in digital environments.					
23. I know how to communicate with others differently (images, texts, videos, etc.).					

Item	Strongly Agree (5)	Agree (4)	Slightly Agree (3)	Disagree (2)	Strongly Disagree (1)
24.I share information and content through digital tools.					
f. Creation of Digital Content					
25.I know different ways to create and edit digital content.					
26.I can transform information and organize it in different formats.					
27.I can present what I want to convey in digital environments.					

Section III: Research Capability (adapted from Sison, 2019)

Instructions: This section assesses your research capability, including your ability to conduct research, analyze data, and disseminate research findings. Your responses will help determine your proficiency in various research aspects. Please indicate the extent to which you agree or disagree with each statement using the following scale:

5 – Strongly Agree (I am highly capable in this research area)

4 – Agree (I am frequently capable in this research area)

3 – Slightly Agree (I am moderately capable in this research area)

2 – Disagree (I am rarely capable in this research area)

1 – Strongly Disagree (I am not capable in this research area)

Answer each question based on your actual research knowledge and experience.

Item	Strongly Agree (5)	Agree (4)	Slightly Agree (3)	Disagree (2)	Strongly Disagree (1)
a. Research Process					
1. I am highly capable of making summaries, conclusions, and recommendations.					
2. I am highly capable of choosing and describing the population.					
3. I can clearly define terms and concepts to be used in the study.					
4. I am highly capable of gathering necessary data.					
5. I am highly capable of reviewing related literature and studies.					
6. I am highly capable of choosing the topic of research.					
7. I am excellent at formulating research questions.					
8. I am excellent at identifying and designing appropriate research design and instruments to gather data.					
9. I am excellent at disseminating the research output to the audience (e.g. conferences, in-house forums).					

Item	Strongly Agree (5)	Agree (4)	Slightly Agree (3)	Disagree (2)	Strongly Disagree (1)
10.I am highly capable of analyzing data (quantitatively or qualitatively).					
b. Research Involvement					
11.I actively participate in seminars/ workshops about research.					
12.I actively participate in in-house/ institutional research forum.					
13.I actively participate in local research forums/ conferences.					
14.I actively participate in regional research forums/ conferences.					
15.I actively participate in international research forums/ conferences.					
16.I actively publish my research papers in reputable local journals.					
17.I actively publish my research papers in reputable international journals.					

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Research Article

Exploration of Senior Services in Taiwan's Public Libraries in an Aged Society: A Case Study and Practical Analysis

Shan-Ju Lin Chang

Abstract

As population aging accelerates and the heterogeneity and diversity of older adults become more pronounced, library efforts to promote lifelong learning and reading for all have entered a professionalized stage characterized by age-differentiated and audience-segmented services. In response to the expanding cohort of older users, professional associations worldwide have issued guidelines for library services to older adults. Building on an inductive synthesis of these international guidelines and drawing on a series of roundtables, focus groups, and questionnaire surveys, my earlier work produced the first national set of guidelines in Taiwan addressing library and information services for older readers under the challenges of an aging society. Grounded in these prior data, the present study further analyzes service cases from domestic public libraries. It describes and critically examines operational practices and implementation experiences in selected cases, identifies practice-relevant research issues, develops instructional modules for services to older adults, and offers recommendations for both service design and research. The aim is to strengthen planning for services to older readers, enrich the substantive content of such services, and provide capacity-building training materials and practical references for library personnel across institutions.

Keywords: *Aged society, Public libraries, Senior services, Dementia friendly libraries, Guidelines for reader services*

SUMMARY

Background

Taiwan's demographic transition is both rapid and profound: the nation crossed the threshold into an "aged society" in 2018 and, by 2025, will be "super-aged," with those 65+ surpassing 20% of the population. The scale

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and speed of this shift reorder social arrangements and policy priorities across labor markets, taxation, pensions, household composition, mobility, health and care systems, and beyond. In this context, public libraries—already embedded as neighborhood hubs for information, learning, exchange, and cultural participation—face a dual imperative: to sustain inclusive access for diverse older adults while upgrading their service ecologies to support active, healthy, and dignified aging. The paper foregrounds that libraries must mobilize collections, spaces, programs, equipment, and digital technologies to become welcoming "third places" for later life learning and sociality.

Objectives

This study extends a prior national effort that synthesized international guidelines and, through roundtables, focus groups, and surveys, produced Taiwan's first set of Library & Information Services Guidelines for Older Readers (2019). Building on those data, the present work analyzes concrete service cases from Taiwan's public libraries to 1. describe and critically examine operational practices and implementation experiences; 2. identify practice-relevant research issues; 3. develop exemplar instructional modules for staff training; and 4. propose actionable recommendations that strengthen planning, program design, and evaluation. The overarching aim is to enrich the substantive content of senior services and provide capacity-building resources for practitioners.

Methodology

The paper combines a documentary analysis of international guidelines (IFLA; ALA/RUSA; CLA; ALIA; LIANZA; CILIP) with qualitative data from a 2019 national working group on older readers' services (six committee meetings, ~3.5 hours each; two focus groups, 90 and 100 minutes; 14 participants; ~23 hours of transcripts). In parallel, the team systematically gathered materials from 11 public libraries (practice documentation and activity photos), and subsequently extended the corpus through field-based professional development workshops across multiple regions and on-site evaluations of 17 branches in two municipalities in 2021. The project thus triangulates guideline synthesis, committee and focus group deliberations, workshop case sharing, and field visits as sources for case descriptions and cross-case analysis.

Conceptual Framework

A salient anchor for analysis is RUSA's 2017 Guidelines for Library Services with 60+ Audiences, which articulate eight dimensions: staff training; collections & services; programming; technology; outreach; services for the homebound & special populations; facilities; and funding/budgets. These domains reflect a

shift toward multi-generational inclusion, language and cultural diversity, and the centrality of technology in later-life information practices—together reframing what "good" older-adult services look like at the branch level.

Case Highlights

Puli Township Library (Nantou County)

Puli illustrates a hybrid of place-making, reminiscence, and digital inclusion. Nostalgia-themed talks connect older residents to local memory ("old photos, old stories"), while tablet learning ("Happy Learning with Tablets") expands digital participation. An original "pulp-chair" co-creation project, inspired by local papermaking, invites older patrons to design and fabricate chairs that later populate the senior reading zone—an act of tangible authorship that deepens belonging. Critically, Puli piloted a dementia-inclusive volunteer model ("Brain-Healthy Volunteers"), partnering with the county health bureau and a hospital-based dementia care center (2019). Participants undertake suitable in-library roles with professional support, strengthening cognitive activation, reducing isolation, and modeling stigma-reducing, community-embedded inclusion.

Tainan Public Library and Yuwun Branch

Tainan offers a pre-renovation spatial adjustment that privileged ground-floor newspaper rooms for accessibility, and later, in the new main building (2021), advanced LIS-informed space concepts: a cooking classroom to structure five-senses learning (view, listen, touch, smell, taste) alongside related book displays, and a makerspace with sewing machines and craft tools that enable intergenerational, memory-rich creative sessions. These facilities exemplify how libraries can scaffold multi-modal learning and social participation for older adults within an inclusive third-place architecture.

Kaohsiung Public Library

The "Silver Life" campaign reframed reading as non-print, mobile, and participatory: guided walks, hands-on workshops, and curated booklists aligned to health, finance, end-of-life, and local memory themes; 45 branches joined, with 50+ events and nine deep-travel routes. The program's design foregrounded five-senses engagement and contextual reading, pairing itineraries and activity formats with targeted collections. This city-wide activation demonstrates how marketing, curation, and experience design can shift perceptions and reduce participation barriers among older residents.

Miaoli County Library and Town Libraries (Sanwan, Nanzhuang)

Miaoli's senior zone integrates optical magnifiers and curated selections; its "cognitive board games" initiative, seeded through professional learning, evolved into a weekly social learning community by reader demand—an example of how

light-touch program seeding can yield durable, peer-led engagement. The county system also coordinates with adult education and senior learning centers, scaling reach through rotating book boxes and on-site co-learning that situate library programming in familiar community venues.

National Taiwan Library (NTL)

NTL's portfolio spans spatial re-location of the senior resources zone to the ground floor, partnerships with silver workforce centers, collaborations with performing arts institutions, and multi-agency dementia awareness programs (e.g., touring talks and workshops "Meeting Dementia at the Library" with 9 municipal partners). The library also builds bridges with hospitals and NGOs, offering curated booklists on aging/long-term care and hosting multi-sensory courses (music, drama, reminiscence) that embed health literacy and caregiver support into everyday library life.

Cross-Case Synthesis

Analyzed comparatively, the cases reveal coherent patterns across six design and delivery dimensions:

1. Facilities: Senior zones function best when ground-floor, proximate to restrooms and water, with appropriate furniture and lighting; emerging models add multi-purpose rooms for reminiscence therapy, nutrition education, and creative production. New main libraries since ~2018 showcase diversified, community-centered spatial repertoires.
2. Collections: Many branches now tie program-aligned displays (health, finance, end-of-life, local history) to talks and workshops to convert attention into borrowing and reading—turning events into engines for collection activation.
3. Services and Programs: The dominant trajectory is from print-centric to multi-sensory, socially embedded learning: board games for cognitive stimulation, music listening and song circles for emotional and neurological benefits, craft-based reminiscence, and digital literacy that respects older learners' pace and privacy. The Kaohsiung and Puli examples, in particular, illustrate how experience design bridges older adults into reading and information practices beyond print.
4. Staffing and Volunteers: RUSA's emphasis on staff training is reflected in practice: gerontology-informed etiquette, an eye to heterogeneity, and the strategic recruitment of older volunteers. The dementia-inclusive volunteer model demonstrates how libraries can reposition older adults not only as service recipients but as co-producers of value and social connection.
5. Partnerships and Outreach: Cross-sector ties—with hospitals and clinics, health bureaus, schools, NGOs, and senior learning centers—extend reach to

homebound patrons, enable intergenerational learning, and inject specialized expertise (e.g., dementia literacy, fall prevention, nutrition) into library programs. The strongest cases are ecosystemic, aligning space, program, collection, and partner capabilities.

6. Equipment and Assistive Technologies: Optical aids, accessible seating, clear wayfinding, and thoughtful placement of digital devices matter; the lesson is that technology succeeds when embedded in safe, stigma-free settings with patient facilitation—an insight surfaced by observations where certain devices under-performed due to glare, awkward placement, or social discomfort about public learning (Synthesis from multiple case notes in the study.)

Implications for LIS

First, design for heterogeneity: segment by functional abilities, interests, and learning goals—not by age alone—and calibrate offerings to span the spectrum from robust, active seniors to oldest-old cohorts where dementia-friendliness and caregiver supports are paramount. (The paper notes the growing 85+ "old-old" group and the relative paucity of dementia-specific services system-wide.)

Second, embed health and wellbeing as legitimate objectives of library work. Programs that build health literacy, digital inclusion, cognitive stimulation, and social connectedness are not "extras" but core expressions of the public library's social mission in an aging society—as echoed in RUSA 2017's technology and homebound/special populations dimensions and in the study's city-scale activation and national-library outreach.

Third, measure what matters. The study's cases suggest tractable indicators: participation profiles (who shows up, who doesn't), social and intergenerational mixing, cognitive engagement proxies (e.g., frequency and retention in board game clubs), digital self-efficacy gains, and qualitative markers of belonging and reduced isolation. These can be folded into annual planning cycles under the funding/budgets and staff training domains of RUSA.

Fourth, treat "programs" as part of an ecosystem. The strongest examples align space + service + collection + people + partners, e.g., Kaohsiung's non-print reading journeys marshaling city branches, curated booklists, and themed routes; Puli's clinically supported, dementia-inclusive volunteering paired with nostalgia programming and tablet classes; NTL's cross-agency, touring dementia literacy.

Conclusion

The paper ultimately positions public libraries as social infrastructure for aging well—"third places" where older adults gather, learn, maintain health, and feel safe—supported by greenery, vigilant staff, and emergency readiness. In this

reading, the building is more than a container for collections: it is an enabling platform where information, human connection, and creative expression intersect to sustain independence and dignity in later life. As the cases show, Taiwan's libraries are already moving from print-centric service toward multi-sensory, partnership-rich ecosystems that honor older adults as both beneficiaries and contributors. Scaling these practices—through staff development, inclusive design, and evidence-informed planning—will help libraries deliver on their promise as healthy-living infrastructure for a super-aged society.

Acknowledgment and Declaration

Some preliminary drafts of a small number of case descriptions first appeared in the research project report *Guidelines for Services to Older Readers in Taiwan*, which was led by the author at the invitation of the commissioning institution. During the preparation of this work, the author used ChatGPT4o for the long edition of English abstract. Afterwards the author reviewed and edited the content as needed and take full responsibility for the content of the publication.

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Research Article

Exploring Research Trends in Chinese Indonesians: A Bibliometric Study Utilizing the Scopus Database

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Abstract

Studies on Chinese Indonesians have experienced rapid development in the past decade, reflected in the increasing number of scholarly publications. However, the majority are still based on qualitative approaches and case studies. Another fact is that Indonesia has the largest Chinese diaspora in the world. Bibliometrics was used to analyze 496 Scopus indexed documents (2014-2025) with the help of OpenRefine, VOSviewer, and Bibliometrix. The research results show that the research landscape connecting Chinese Indonesians and the Asian region is integrated and multidimensional. Five main thematic clusters cover political-economic relations, social identity, regional collaboration, biomedical genetics, and cultural anthropology. Publications increased from 2017 to 2023. This surge was fueled by the Basuki Tjahaja Purnama blasphemy case and research collaboration during the COVID-19 pandemic, which expanded the use of digital technology and online platforms. This trend is reflected in the increase in contributions to journals such as Sustainability, PLOS ONE, Asian Ethnicity, and Wacana, strengthening the position of interdisciplinary research globally. Indonesia dominates in publication productivity, supported by leading universities such as Universitas Indonesia and Universitas Gadjah Mada, and active collaborations with China, Singapore, and Australia. Among the most prominent authors are Zhang H., Sun Y., and Wang Y., who consistently emerge as key contributors and central to collaborations. Social sciences dominated (28.4%), followed by medicine (12.5%), reflecting an interdisciplinary orientation. Future studies should integrate databases such as Web of Science or Dimensions with a content analysis approach to uncover theoretical connections and emerging themes.

Keywords: *Bibliometric analysis, Chinese Indonesians, Research trends, Scopus database*

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Introduction

The study of Chinese Indonesians has attracted significant attention in academic literature, particularly in the last decade. The study of Chinese Indonesians has attracted significant attention in academic literature, particularly in the last decade. Furthermore, in 2023, Indonesia was recorded as the country with the largest Chinese diaspora in the world (outside of China), with a total of 11.15 million people (Textor, 2024), equivalent to 4% of the total population. This fact has attracted researchers to study Chinese Indonesians and publish in various international journals, particularly those indexed by Scopus. An analysis of Scopus-indexed scholarly publications reveals a growing interest in issues related to ethnic identity, citizenship, social integration, and the political history of this community. Researchers highlight the complex social position of Chinese Indonesians as a minority group with a long history of facing marginalization, prejudice, and state policies of assimilation and discrimination (de Archellie et al., 2025; Harjatanaya & Hoon, 2020; Jailani et al., 2025; Maiddin & Ramle, 2024).

Contemporary trends in the literature highlight the importance of interdisciplinary understanding in studying Chinese Indonesians, including post-colonial approaches, ethnic studies, and citizenship studies. Issues such as ethnicity, hybrid identities, and national loyalties have become key themes widely discussed, particularly in the context of Indonesia's political history from post-independence to post-1998 reform (Chong & Jenne, 2023; Heidhues, 2017; Sidi, 2020). Furthermore, contemporary dynamics such as the role of the younger generation of Chinese Indonesians in education, the economy, and the public sphere are also beginning to receive attention, reflecting the transformation of their identity and participation in modern Indonesian society.

As issues of diversity and social inclusion become increasingly relevant in global and national discourse (Adapa & Yarram, 2022), studies on Chinese Indonesians published in reputable international journals are increasingly enriching our understanding of the dynamics of citizenship and ethnic relations in Indonesia. This demonstrates that this topic is not only important in a national context but also has global relevance in the study of ethnic minorities and social pluralism. In this context, scholarly publications on Chinese Indonesians demonstrate a diversity of approaches, ranging from history and anthropology to sociology, education, and postcolonial studies (Arifin et al., 2017; Joseph & Matthews, 2014; Meyer & Waskitho, 2021; Setijadi, 2016; Xie & Ma, 2023).

Studies on Chinese Indonesians still largely rely on qualitative approaches or case studies. This results in a lack of comprehensive understanding of the key actors in knowledge production, institutional networks, and thematic evolution within these studies over time. Meanwhile, bibliometric analysis is an effective

tool for gaining insight into the evolution of a discipline (Donthu et al., 2021; Ninh et al., 2025; Pessin et al., 2022; Youngblood & Lahti, 2018). This approach allows researchers to evaluate the development of publications in a particular field, identify intellectual trends, and map the actors and institutions that play a crucial role in the dissemination of scientific knowledge (Agostini et al., 2020; Hussain et al., 2024; Karakose et al., 2022; Yan & Zhiping, 2023).

Bibliometrics were used to analyze 496 Scopus-indexed documents from 2014-2025 using VOSviewer, OpenRefine, and Bibliometrix. This study examines trends, patterns, key themes, influential authors and journals, and contributing affiliations. This approach was undertaken to address the knowledge gap regarding how and to what extent this topic has developed in global and national academic discourse, as well as to identify future research opportunities. Specifically, this study will answer the following research questions:

1. Has there been a significant increase in the number of annual publications discussing Chinese Indonesians from 2014-2025?
2. How many total documents were produced by author and collaboration, affiliation, and country during 2014-2025?
3. How is the map of international collaborations shaping up in the study of Chinese Indonesians?
4. What are the main themes or topics that dominate studies on Chinese Indonesians?
5. How is document production from Source and by Subject Area?

By considering these gaps, this study not only presents a comprehensive overview of the development of Chinese Indonesians literature based on Scopus data, but is also expected to identify research trends, academic collaborations, institutional affiliations, and dominant themes in studies on Chinese Indonesians, so that it can provide an empirical foundation, knowledge mapping and a more structured direction for future research.

Methodology

Bibliometric analysis is used to identify the most influential, impactful, and prominent documents, sources, countries, and authors in a field based on publication volume and citation metrics (Mokhtari et al., 2020; Ülker et al., 2023). This analytical approach also facilitates tracking emerging research trends over time, exploring themes relevant to contemporary issues, and identifying knowledge gaps and future research opportunities (Berniak-Woźny & Szelągowski, 2024; Verma & Gustafsson, 2020). In the context of studies on Chinese Indonesians, this method is particularly useful for understanding

the intellectual dynamics of knowledge production related to ethnic identity, migration history, discrimination, citizenship, and social integration.

To simplify the bibliometric analysis process, this study adapts the methodology used in previous studies by Z. Wang et al. (2018), Trinidad et al. (2021), Pessin et al. (2022), Passas (2024), and Cordeiro et al. (2024), which consists of several systematic stages. The first stage is data collection. The data source for this study comes from the Scopus database (https://www.scopus.com), widely known for its coverage of highly reputable journals in the social sciences and humanities.

Several keywords were strategically selected to explore publications relevant to the topic of Chinese Indonesians. The search was conducted using an advanced search query focusing on article titles, keywords, and abstracts. The search strategy employed the Boolean operator "OR," with syntax such as: "Chinese Indonesia" OR "Chinese Indonesian" OR "Chinese Indonesians", this process retrieved 2,888 documents. The second step involved filtering the data based on predetermined inclusion and exclusion criteria. The selected articles were limited to the period 2014-2025, resulting in 1,827 documents. Next, the authors limited the document type to articles, reviews, conference papers, and books, obtaining 1,546 documents.

Based on the search results in the Scopus database, several keywords were excluded because they were deemed irrelevant to the topic of Chinese Indonesians. Keywords that appeared with high frequency but were not directly related to the research focus included general terms such as Human (148 times), China (148), and Article (134). In addition, there were also biological and medical terms such as Female, Male, Adult, Controlled Study, and Genetics, which reflect the context of clinical or biomedical research rather than social and cultural studies. Several geographic keywords such as Malaysia (53), Vietnam (32), India (32), Thailand (31), Singapore (27), Philippines (27), Japan (27), and Taiwan (17) were also excluded because they refer to other regions in Asia that are not the focus of studies on ethnic Chinese in Indonesia.

Other terms more relevant to medical and biotechnology studies, such as Polymerase Chain Reaction, Genotype, Single Nucleotide Polymorphism, Genetic Variation, Epidemiology, and Risk Factor, were also excluded because they relate to genetic studies, not ethnicity or identity studies. Other irrelevant keywords included Animals, Nonhuman, Body Mass, Obesity, and Diabetes Mellitus, which indicate a predominance of health research. Several economic terms, such as Economic Development, Investment, Commerce, Foreign Direct Investment, and Export, were also excluded because they do not directly relate to the socio-cultural dimensions of the Chinese Indonesians community. Furthermore, there

are terms that reflect other ethnic contexts, such as Indian, Japanese (people), Korean (people), Filipino (people), Malay (people), Thai (people), and Caucasian, which are not relevant to the Chinese Indonesians population. Similarly, keywords such as Religion, Islam, Marriage, and Cultural Heritage, despite their conceptual closeness, do not specifically refer to the Chinese Indonesians ethnic group in the context of this study. This keyword exclusion process aims to clarify the research focus, namely limiting the analysis to publications that truly discuss the topic of Chinese Indonesians without being mixed with medical issues, genetics, or the context of other countries in Asia.

Therefore, the remaining keywords that are relevant to Chinese Indonesians in the Scopus database are, Indonesia, Indonesian, Chinese Indonesians, Jakarta, Chinese Indonesians, Java, Javanese (people), Sunda Isles and West Java. The results of this process left 538 documents. The authors focused on documents published in English and final documents, obtaining 496 documents, considering that English generally has a global reach and is more accessible to the international scientific community and final documents are representative and comprehensive. However, resource limitations and the need to maintain consistency in our analysis led us to limit our selection to English-language articles. The exclusion of non-English language articles could potentially impact the generalizability of the findings, and this aspect is explicitly noted as a limitation of the study in the conclusion.

Furthermore, with the help of the software (https://openrefine.org/), the authors tidied up the messy Scopus CSV data into a neat Excel and changed the data type detection to be based on the entire dataset. After that, we corrected the author keywords, this was done because it was possible to find inconsistencies, and then carried out a data cleaning process so that it could be used for VOSviewer. After completing this process, a final set of 496 relevant documents was obtained for further analysis. The next step focused on analysis and visualization of VOSviewer (https://app.vosviewer.com/), and Bibliometrix software (https://www.bibliometrix.org/). Metadata from the 496 selected articles was exported from Scopus, including important information such as article title, year of publication, journal name, number of citations, author names, institutional affiliation, author's country of origin, keywords, funding source (if any), and cited references.

The analysis results of the Bibliometix (RStudio) software on the completeness of metadata indicate that the data quality is generally very good. Most metadata elements have a perfect completeness level with an "Excellent" status, including the Author (AU), Document Type (DT), Keywords (DE), Language (LA), Publication Year (PY), Title (TI), and Total Citation (TC) columns, all of

which have a missing data percentage of 0.00%. This indicates that the data used is highly accurate and ready for further analysis without worrying about losing important information in the publication's core components. Several other metadata elements were categorized as "Good," including Abstract (AB) with 0.61% missing data, Journal (SO) with 3.04%, Affiliation (C1) and Corresponding Author (RP) with 3.64% each, and DOI (DI) with 5.87%. Despite minor deficiencies in these columns, the data completeness was still very adequate for bibliometric analysis purposes. The only element categorized as "Poor" was Keywords Plus (ID) with a data loss rate of 31.38%, indicating that most documents did not include additional keywords from automatic indexing. Overall, these results illustrate that the analyzed Scopus document metadata is of very good quality, particularly in terms of author identity, title, and publication year, although some improvements are needed in the provision of DOI and Keywords Plus to enhance the comprehensiveness of future analyses.

Table 1 presents the data criteria and a summary of the screening process used in this study. The final step involves data interpretation, which involves reviewing all visualization results and descriptive statistics to explore the deeper meaning of these trends (Hassan & Duarte, 2024; Passas, 2024). The primary focus is on understanding the dynamics of research over the past decade, the involvement of academics from various countries, identifying key actors and primary literature sources, and mapping the central themes that dominate scholarly discourse on Chinese Indonesians. This study acknowledges the limitations of using only one database, Scopus. Consequently, it is possible that some important scientific works not indexed in Scopus were not included in this analysis. Therefore, future research is recommended to combine multiple bibliographic data sources, such as Web of Science (WoS), Dimensions, or Google Scholar, to obtain a more comprehensive coverage of the Chinese Indonesians literary landscape

Table 1 Data Search Criteria

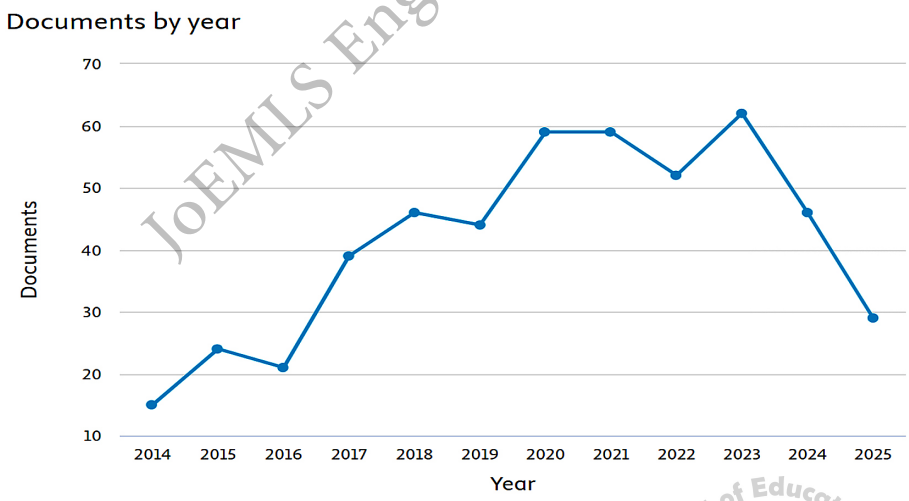
Criteria	Description
Source Database	Scopus (Retrieved on October 5, 2025)
Years	2014-2025
Inclusion Criteria	Article, Review, Book, Conference Paper
Exclusion Criteria	The selected documents are only the final ones, not Articles in press
Search String	TITLE-ABS-KEY ("Chinese Indonesia") OR TITLE-ABS-KEY ("Chinese Indonesian") OR TITLE-ABS-KEY ("Chinese Indonesians")
Documents Total	496
Language	English

Results

Annual Growth of Publications on Chinese Indonesians

Based on data obtained from the Scopus database, the Documents by Year chart shows the development of the number of publications from 2014 to 2025 (See Figure 1). In general, the publication trend shows a consistent upward pattern until 2023, then decreases in the last two years. In 2014, the number of documents recorded was still relatively low, at around 15 publications. However, in the period 2015 to 2018, the number of publications showed a significant increase—from around 24 documents in 2015 to 46 documents in 2018. This increase reflects the increase in research activity and academic involvement in scientific publications during that period. Publication productivity peaked in 2020 and 2021, with approximately 59 documents published in each year. This period marked a highly productive period for research activity, likely influenced by increased research collaboration and the push for publication during the pandemic, which encouraged the use of technology and online platforms. Although there was a slight decline in 2022 to approximately 52 documents, the trend rebounded in 2023, reaching a peak of 62 documents, marking the peak productivity in the past decade.

Figure 1 Documents by Year (2014-2025)



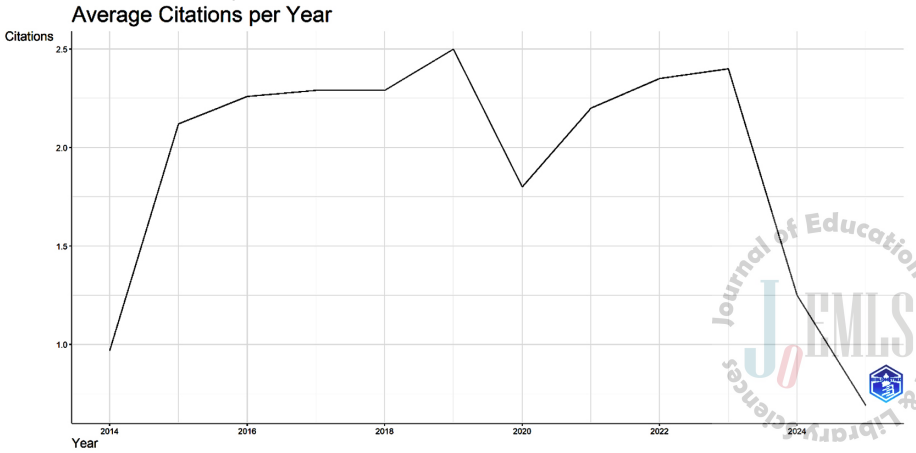
Source: Scopus, retrieved on October 5, 2025.

However, from 2024 to 2025, the graph shows a fairly sharp decline, to approximately 46 documents in 2024 and 29 documents in 2025, respectively. This decline could be caused by two possibilities: first, the incomplete indexing and data input process for Scopus for the current year (2025); and second, changes in research focus or publication priorities that affect the number of scientific outputs. The analysis results indicate that scientific publication activity

experienced positive and significant developments during the 2014-2023 period. This upward trend indicates the growth of a robust research ecosystem, both in terms of individual productivity and institutional collaboration. The decline in the past two years is believed to be temporary and does not reflect a decline in research quality, but rather is related to the dynamics of the publication system and data updates within the scientific indexing framework.

The Average Citations per Year graph from Bibliometrix illustrates the dynamics of the average number of citations per document over the same period (See Figure 2). The apparent pattern shows fluctuations in the level of publication influence, with a peak trend in the middle of the research period and a sharp decline in the last two years. In 2014, the average citation per article was still around 1 citation per document, but increased significantly to more than two citations per document in 2017-2018. This increase indicates that the works published during that period had high academic relevance and influence. The average citation rate peaked around 2018-2019 at around 2.5 citations per document, before experiencing a sharp decline in 2020. This temporary decline was likely due to a decline in cross-disciplinary citation rates during the pandemic, as well as a delay in the circulation of scientific literature. However, the graph shows a recovery in 2021-2023, with the average citation rate again approaching 2.5 citations per document, indicating a rebound in research impact. The drastic decline in 2024 and 2025, with an average citation rate of less than one per document, is likely influenced by the citation lag effect. Publications published in the last two years have not had enough time to accumulate significant citations. Therefore, the decline is temporary and stems from technical bibliometric factors, not a decline in scientific quality.

Figure 2 Average Citations per Year



Source: Bibliometrix, retrieved on October 13, 2025.

The increase in the number of publications does not always correspond to an increase in citation impact. For example, although the number of documents peaked in 2023, the average citations per document in that year did not reach its highest level. This indicates a balance between research quantity and quality, where productivity growth needs to be balanced with efforts to increase the relevance and credibility of research results. This analysis indicates that the 2017-2019 and 2021-2023 periods saw the best combination of productivity and academic impact, while the decline in the past two years was more temporary and does not reflect a long-term trend. Therefore, these results suggest that the research field under study has a strong research foundation and the potential for continued growth, both in terms of scientific output and academic impact, in the future.

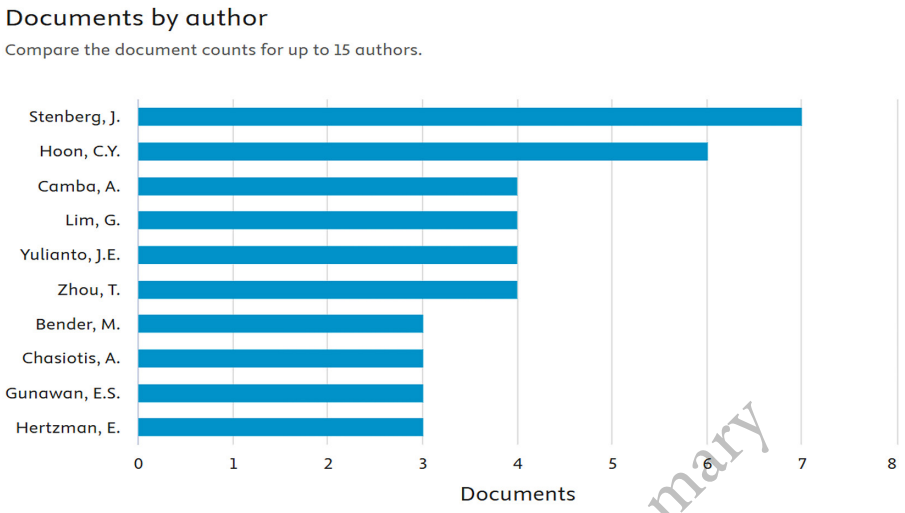
Documents Analysis by Author, Affiliation, and Country

Bibliometric analysis reveals the dynamics of authorship structures and varying collaboration patterns among researchers contributing to this field (See Figure 3 and Figure 4). Based on the Documents by Author results, the distribution of author productivity indicates that only a small proportion of authors have a high publication rate, while the majority contribute a limited number of publications. This pattern illustrates a skewed distribution, where research activity tends to be dominated by a few core authors. Among the most prominent authors are Zhang H., Sun Y., and Wang Y., who consistently emerge as major contributors in terms of both the number of publications and the intensity of collaborations. All three occupy central positions in the research network, indicating a strategic role in the development and dissemination of knowledge on the topic under study. The Collaboration Network visualization reinforces these findings by showing a collaborative structure divided into several thematic clusters. The largest and densest cluster is around authors Zhang H. and Sun Y., who are at the center of collaborations with other authors such as Wang Y., Li C., Chen Y., and Liu J. This cluster reflects an active and interconnected research community, indicating that intensive collaboration occurs around similar themes or disciplines. In addition to this main cluster, there are a number of smaller, relatively independent collaborative groups, such as:[1]

1. The Zhang X. and colleagues cluster (green), which shows weak ties but remains connected to the main network.
2. The Yulianto J.E. and King P. cluster (orange), which indicates local collaboration within an institutional or regional context.

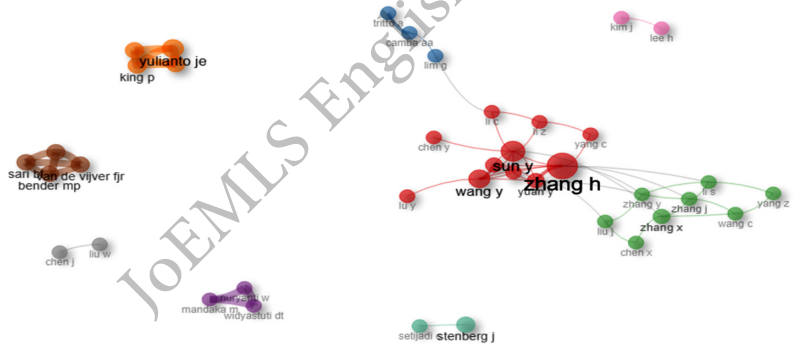
[1] This journal is printed in black and white; for color information and color images, please refer to the electronic version.

Figure 3 Documents by author (2014-2025)



Source: Scopus, retrieved on October 5, 2025.

Figure 4 Collaboration Network



Source: Bibliometrix, retrieved on October 13, 2025.
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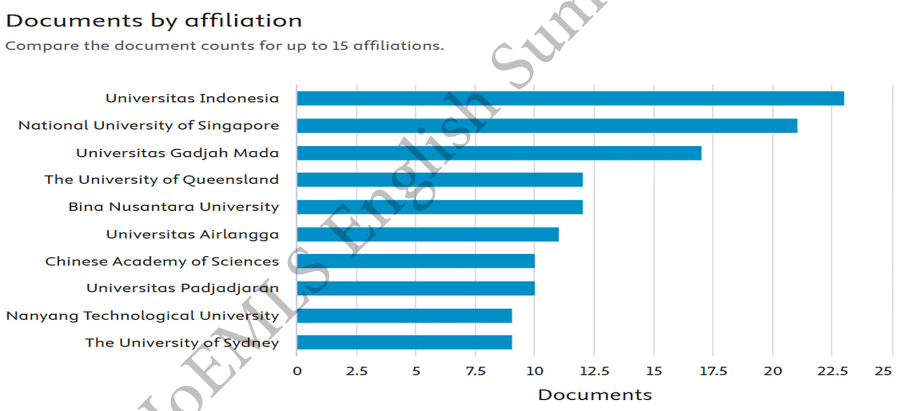
3. The Sari B.A.N., De Vijver F.J.R., and Bender M.P. cluster (brown), which demonstrates a close-knit collaboration pattern.
4. The Nurbayati W., Mandaka M., and Widyastuti D.T. cluster (purple), which indicates small group research activities focused on a specific topic.
5. Bilateral clusters such as Stenberg J. – Setjadi, and Kim J. – Lee H., which depict simple collaboration between individuals.

This collaborative structure indicates that the research ecosystem remains decentralized, dominated by a few lead authors and a number of smaller

networks operating relatively independently. This pattern reflects a general trend in the global research landscape, where only a small number of authors act as core network hubs connecting various research groups. These bibliometric results indicate that publication activity and scientific collaboration are driven by a handful of core authors, while cross-cluster collaboration remains limited. Strengthening cross-cluster networks, both through international collaboration and multidisciplinary collaboration, could be an important strategy for broadening the impact of future research.

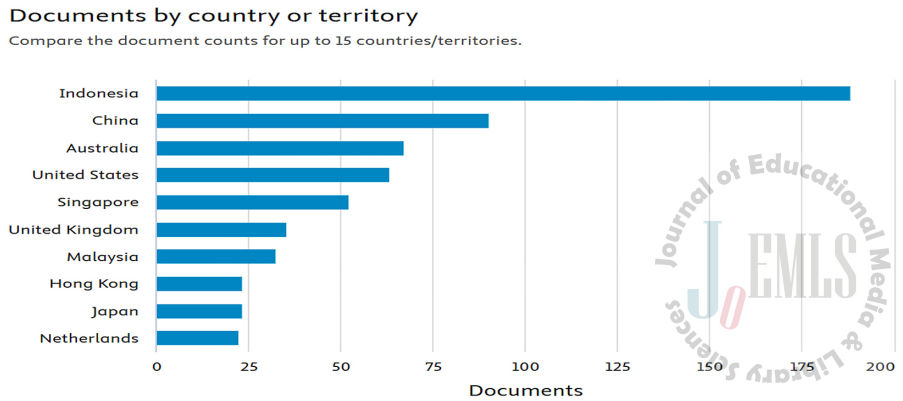
The Documents by Affiliation and Documents by Country or Territory charts demonstrate a strong correlation between centers of scientific production (universities and research institutions) and the geographic constellation of researchers' countries of origin (See Figure 5 and Figure 6). Overall, Indonesia emerged as the leading contributor in terms of publications, with nearly 200

Figure 5 Documents by Affiliation



Source: Scopus, retrieved on October 5, 2025.

Figure 6 Documents by Country or Territory



Source: Scopus, retrieved on October 5, 2025.

documents, and ranked highest in the country category. This pattern aligns with the data in the Documents by Affiliation chart, which shows three major Indonesian universities—Universitas Indonesia, Universitas Gadjah Mada, and Universitas Airlangga—topping the list for publication productivity. This indicates that national research activity is concentrated in large universities with strong research capacity and active international networks.

Furthermore, the involvement of foreign universities such as the National University of Singapore (NUS), the University of Queensland, the Chinese Academy of Sciences, and the University of Sydney demonstrates the transnational nature of Indonesia's academic collaboration network, particularly with partners from Asia and Australia. The fact that Singapore and Australia also rank in the top five in the Documents by Country or Territory chart further strengthens the evidence of cross-border research connectivity in the Asia-Pacific region. China's second-place ranking in terms of the number of documents at the national level is also reflected in the Chinese Academy of Sciences' contribution to the list of major affiliates. This demonstrates a similar pattern: national research strength is reflected in the dominance of large academic institutions that serve as centers for strategic research and international collaboration. Universities such as Nanyang Technological University (Singapore) and The University of Queensland (Australia) demonstrate that research collaboration occurs not only at the national level but also across geographically close regions with shared academic interests, particularly in the context of Southeast Asia and Oceania. The interrelationship between the two graphs highlights three key points:

1. Indonesia's high research concentration is driven by leading national universities, which play a key role in producing scientific publications.
2. Regional and international collaborations are prominent, particularly with institutions in Singapore, Australia, and China.
3. There is a structural relationship between institutional power and national representation, where the productivity of major universities directly strengthens the country's position in the global research landscape.

In the bibliometric context, affiliation and country of origin of research form a mutually reinforcing research ecosystem, reflecting patterns of collaboration and scientific dominance that are regionally oriented but have global impact.

Visually, Indonesia appears to be a major hub of collaboration, indicated by the dark blue color and numerous connection lines connecting it to various other countries (See Figure 7).[2] The strongest collaborative relationships appear to be

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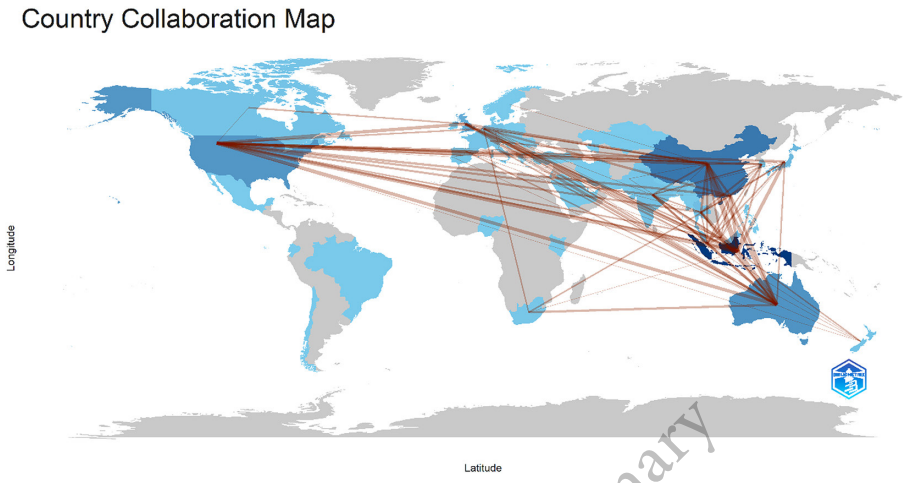
Figure 7 Country Collaboration Map



Source: Bibliometrix, retrieved on October 8, 2025.
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between Indonesia and China, Australia, the United States, and several countries in East and Southeast Asia, such as Singapore, Malaysia, Japan, and Thailand. Furthermore, the active involvement of Western European countries such as the Netherlands, the United Kingdom, and Germany is evident, demonstrating the international reach of research on Chinese Indonesians communities. This apparent pattern of collaboration confirms that the issue of Chinese Indonesians is not only attracting the attention of researchers in Asia but is also a global interest explored through cross-continental collaboration. The dominance of cooperation between Indonesia and China reflects the historical and cultural ties between the two countries, while relations with Western countries demonstrate the academic contributions of international research centers on Asian social, cultural, and political issues. Thus, this map demonstrates that research on Chinese Indonesians thrives within a broad, multinational collaborative ecosystem, combining Asian and global perspectives to understand the dynamics of identity, diaspora, and international relations.

Vosviewer: Visualization of Co-occurrence

The first cluster (red), consisting of 73 keywords, focuses on the dynamics of relations between Indonesia and China in social, economic, and political contexts (See Figure 8).[3] This cluster demonstrates how the interaction between the two countries has become a major focus in various scientific studies, particularly those highlighting the influence of China's foreign policy through the Belt and

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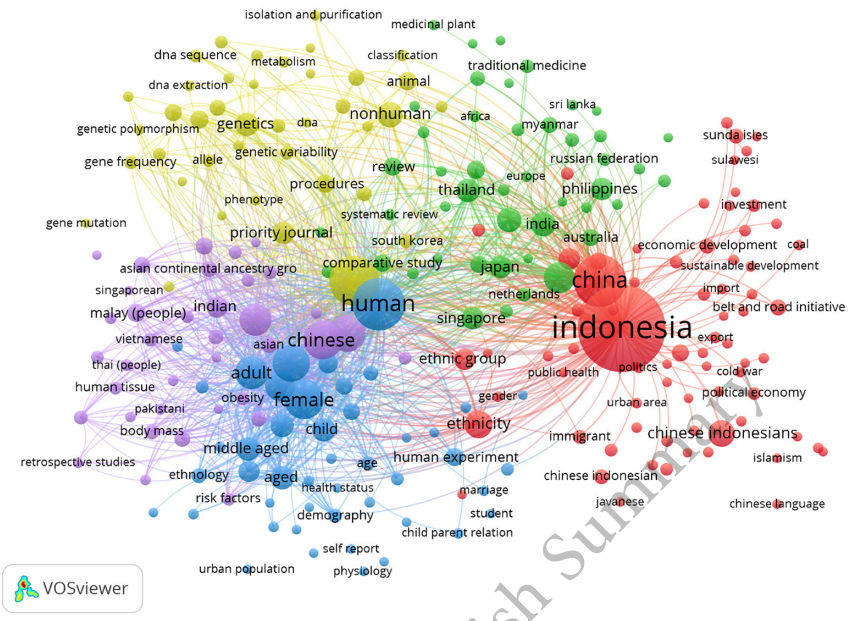
Figure 8 Visualization of Co-occurrence



Source: VOSviewer, retrieved on October 8, 2025.
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Road Initiative (BRI) on economic development in Indonesia. Through a network of keywords such as Indonesia, China, economic development, investment, political economy, and the Belt and Road Initiative, this cluster emphasizes the research orientation on geopolitical and economic issues in the Southeast Asian region. In addition to highlighting macro dimensions such as economic cooperation and infrastructure development, the red cluster also highlights the social and cultural aspects emerging from the relationship between the two countries. This is evident through keywords such as Chinese Indonesians, Islamism, Javanese, and urban areas, which demonstrate the link between global economic policies and social realities and ethnic identities in Indonesia.

The issue of Chinese Indonesians ethnicity is a key component of this cluster, indicating that research focuses not only on economics and politics but also on the processes of social integration and religious dynamics within Indonesia's diverse society. The red cluster represents areas of study that intersect geopolitics, political economy, and the sociology of ethnicity.[4] China's economic influence and foreign policy impact social life in Indonesia, as well

4 This journal is printed in black and white; for color information and color images, please refer to the electronic version.

as how Indonesian society, particularly the Chinese ethnic group, responds to changes occurring in the global and national contexts.

The second cluster, marked in green, consists of 46 keywords and differs from the more geopolitical and economic red cluster, as the green cluster highlights the humanitarian, health, and sociocultural dimensions of Asian societies. This cluster illustrates the trend of research that seeks to understand humans from various dimensions, including biological, social, and cultural dimensions—through a multidisciplinary approach. The themes that emerge in this cluster emphasize the study of population characteristics, social structures, and the dynamics of community life, which include factors of age, gender, ethnicity, and socio-economic conditions.

Dominant keywords such as human, female, aged, middle-aged, child, ethnicity, education, marriage, and students indicate that this cluster focuses on research on human behavior and its social variations. Several other terms, such as socioeconomics, urban population, child-parent relations, and cross-sectional studies, indicate a focus on social and economic environmental factors that influence the lives of individuals and groups. Furthermore, the emergence of keywords such as Chinese, Asian, and ethnology demonstrates the involvement of ethnicity and cultural identity studies, which are an important part of studies in the Southeast Asian region. The green cluster represents areas of interest that emphasize the humanistic and social dimensions of scientific research. This cluster reflects efforts to understand humans not only as biological objects but also as social subjects living within complex cultural contexts and societal structures. Therefore, this cluster shows how research on Indonesia and Asia in general is developing in a broader direction, covering issues of health, education, family, and the ethnic diversity that characterizes societies in this region.

The third cluster is marked in blue and this cluster consists of 46 keywords that describe research fields that focus on the study of the Asian region, especially Southeast Asia, as well as relations between countries in the context of regional social, economic, and political. The main keywords that appear in this cluster include Southeast Asia, Malaysia, Indonesia, China, Thailand, Vietnam, Singapore, Philippines, India, Japan, and Australia. This shows that the main focus of the blue cluster lies in comparative studies between Asian countries, especially in issues related to regional cooperation, economic development, international relations, and socio-cultural dynamics in the region. This cluster's areas of interest include studies on interactions between Asian countries, such as relations between Southeast Asian countries and China, regional economic influence, and geopolitical networks in the Indo-Pacific region. Furthermore, the association of keywords like "United States" and "Asia" indicates that research in

this cluster also considers global factors, such as the role of major world powers in Southeast Asian dynamics.

The relationship between the blue cluster (Southeast Asian studies) and the red cluster (China–Indonesia) appears very close. The red cluster focuses on issues of identity, economics, and bilateral relations between China and Indonesia, while the blue cluster provides the broader regional context in which these interactions take place. This relationship is evident in the strong connection between the keywords China, Indonesia, and Southeast Asia, which serve as the main connecting nodes. In other words, the blue cluster provides a regional and geopolitical framework for the more specific discussion in the red cluster, namely, the position of Indonesia and China within the social, economic, and cultural networks of Southeast Asia.

The fourth cluster is colored yellow. This cluster consists of 40 keywords describing research fields that focus on scientific and methodological aspects, particularly those related to biotechnology, genetics, and the study of both humans and nonhumans. This cluster shows how scientific knowledge is produced through various research processes, publications, and laboratory experiments involving the study of DNA, genes, and genetic variability. Several dominant keywords such as genetics, polymerase chain reaction, gene frequency, genetic variability, review, and priority journal indicate that the main focus of this cluster lies in the development of scientific methods and approaches that support interdisciplinary research.

In a broader context, the yellow cluster represents research domains that form the basis of biomedical and social studies, particularly in understanding humans as scientific subjects. Areas of interest include genetics, biotechnology, public health, and research methodology. This cluster serves as a hub of scientific activity, producing academic articles and publications, thus playing a vital role in the dissemination of research findings across various fields. The relationship between the yellow cluster and the red cluster, which focuses on China, Indonesia, and Chinese Indonesians, demonstrates an interesting epistemological connection. Connecting points such as “human,” “ethnicity,” and “article” indicate that social and ethnic identity research, including studies of Chinese Indonesians, also relies on an empirical scientific approach. Thus, the yellow cluster serves as a methodological bridge, strengthening sociocultural studies in the red cluster through a strong scientific foundation. This relationship demonstrates that studies of humanity and ethnicity in Indonesia are understood not only from a political and social perspective, but also from a scientific and data-driven approach, reflecting the integration of science and social sciences in understanding the dynamics of humanity and identity.

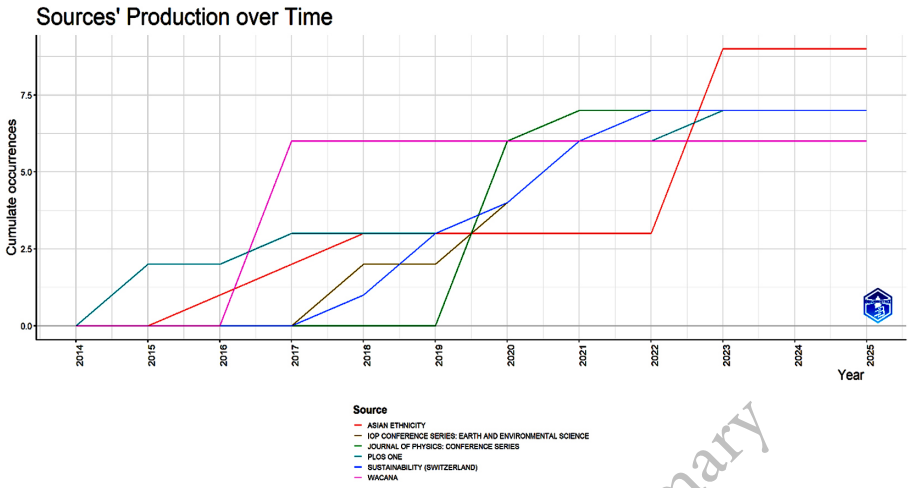
Cluster 5, marked in purple and consisting of 37 keywords, indicates a research focus closely related to human studies, particularly in biomedical and demographic contexts. This cluster includes key keywords such as Chinese, male, female, adult, middle-aged, adolescent, as well as various terms related to epidemiological and health studies, such as case-control study, risk factors, and demographics. The main emerging theme highlights research focused on differences in biological, physiological, and genetic characteristics among ethnically diverse human populations, such as Malay, Korean, and Filipino. This cluster reflects strong research interests in medical and population-based areas, particularly in understanding variations in health and disease risk based on age, gender, and ethnicity. The relationship between the purple and red clusters is established through the keyword "Chinese," which acts as a bridge between scientific-biological and socio-political studies. The purple cluster discusses Chinese identity from a biological and demographic perspective, while the red cluster highlights the dynamics of Chinese identity in the context of culture, economics, and international relations. This connection demonstrates that issues concerning Chinese and Indonesian communities are studied multidisciplinary, encompassing medical, social, and geopolitical dimensions. Thus, this network map illustrates how the theme of "Chinese" serves as a meeting point between research on human populations and discussions of identity and cross-border interactions in Southeast Asia.

Sources'Production Over Time and Documents by Subject Area

The Sources' Production over Time chart shows the development of publications from various sources contributing to research throughout the period 2014-2025 (See Figure 9). Overall, there is an increase in the cumulative number of publications in several key journals, indicating increasingly intensive research activity on the topics studied. The Wacana journal recorded a rapid surge in 2017, then tended to stabilize without significant increases thereafter. Meanwhile, the journals Sustainability (Switzerland) and PLOS ONE have shown consistent growth since 2018, with a sharp increase around 2020-2021, reflecting the growing focus on sustainability and multidisciplinary issues. Two conference journals, the IOP Conference Series: Earth and Environmental Science and the Journal of Physics: Conference Series, also show a gradual upward trend, highlighting the role of scientific forums in disseminating environmental and applied science research.

The journal Asian Ethnicity showed significant growth from 2022 to 2023, indicating increased interest in the study of ethnicity and Asian identity within the context of regional research. Thus, the overall pattern indicates that publications on this topic have experienced a progressive diversification of sources and

Figure 9 Sources' Production over Time



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increased productivity, particularly since 2018. Based on Scopus' Documents by Subject Area data, scientific publications are dominated by the Social Sciences (28.4%), followed by Medicine (12.5%), and Arts and Humanities (10.3%), indicating a strong research orientation toward social, health, and cultural issues. Other fields such as Environmental Sciences (7.0%), Agriculture and Biological Sciences (4.6%), and Economics and Finance (3.7%) also contribute to broadening the scope of research themes. The presence of a significant proportion in the "Other" category (20.5%) indicates the involvement of other disciplines such as engineering, education, and psychology. Overall, this distribution reflects the interdisciplinary nature of the research, with a primary emphasis on the social and humanitarian dimensions while still integrating aspects of science, economics, and technology.

Discussion

Scientific production related to Chinese Indonesians studies in the period 2014-2025 showed a fluctuating pattern with a significant upward trend. In the initial phase of 2014-2016, the number of publications was relatively low and unstable. Entering the period 2017-2021, it experienced a very significant increase, almost doubling the previous year. Two reasons explain this phenomenon: first, in 2017, Indonesia was rocked by racial issues involving then-Jakarta Governor Basuki Tjahaja Purnama (popularly known as Ahok). He was sentenced to two years in prison by a panel of judges at the North Jakarta District Court on May 9, 2017, for blasphemy (Peterson, 2020; Tyson, 2021; Yahya & Susilo, 2024). However, many, including the international community, considered

the case to be fraught with racial sentiment (Mubah & Anabarja, 2020; Salma, 2025; Wardoyo, 2020). Ahok's position as the first ethnic Chinese and Christian governor in the capital of the country with the world's largest Muslim population further strengthens the perception that ethnic and religious dimensions played a significant role in the case (Hadiz, 2019; Hidayah et al., 2025; Mietzner & Muhtadi, 2018). Furthermore, the momentum of the 20th anniversary of the 1998 Reformation (a major event that also affected Chinese Indonesians) in 2018, along with global trends in Chinese diaspora studies in Southeast Asia, strengthened this study's position in academic discourse. Digital access to archives and historical sources also further facilitated cross-border research.

Second, throughout 2020, the world was hit by the COVID-19 pandemic, which also impacted research trends and research methods themselves (Mishra et al., 2021; Tabish, 2020). This meant that research did not involve direct human interaction and did not require leaving the home or office. As a result, many researchers had ample time to produce papers or at least expedite the writing process using research data obtained before COVID-19. Furthermore, the pandemic is not only understood as a health issue, but also as a social and cultural phenomenon that has significantly impacted studies on ethnicity, particularly the Chinese diaspora community. In the health sector, COVID-19 links research on epidemiology, human behavior, and the global societal response to the outbreak. However, the term's presence is also closely correlated with social issues such as discrimination and stigmatization against ethnic Chinese, who at the start of the pandemic were often negatively associated with the origins of the virus. This phenomenon opens up analytical space for how the global health crisis reinforces ethnic prejudice, while simultaneously triggering new dynamics in discourses about diaspora and intercultural relations.

The research map on Chinese Indonesians also shows an interesting epistemological transformation: from an initial focus on issues of post-reform discrimination and assimilation to a more multidisciplinary approach, placing ethnic Chinese as an integral part of the discourse of nationality and Asian connectivity. This shift is in line with the increasing involvement of Southeast Asian and international academics who see the Chinese Indonesians phenomenon no longer solely within the framework of a minority but as a representation of the dynamics of hybrid identity in the era of globalization. The interconnections between disciplines appear to be growing stronger (Mazzocchi, 2019; Muller & Young, 2014). Social studies and the humanities now interact with disciplines such as health, psychology, and environmental studies. This pattern indicates that the issue of Chinese identity in Indonesia has become a field of interdisciplinary analysis, reflecting the complex relationships between

culture, economics, and science. This multidimensional approach shifts the study of Chinese Indonesians from the paradigm of a "closed ethnic community" to a perspective of transnational subjectivity, where identity is formed through knowledge exchange, academic mobility, and digital networks.

Despite the increasing number and citations of documents on Chinese Indonesians, English-language publications dominate, particularly in reputable journals indexed by Scopus. This phenomenon is understandable, given that English has become the lingua franca of science, enabling communication across borders (O'Neil, 2018; Suzina, 2021). However, this dominance also creates serious problems, especially for researchers from non-Anglophone countries. Many important research findings addressing local issues, traditional knowledge, or community dynamics struggle to find publication in international journals simply because of language barriers (Collyer, 2018). This results in what is known as epistemic hegemony (Iveković, 2019; Noda, 2020; Vickers, 2020): theories, methodologies, and academic discourse deemed valid are largely determined by Western academic traditions, while local perspectives are often marginalized. This tendency has implications for how Chinese Indonesians discourse is constructed. Issues that garner global attention—such as the diaspora, ethnic relations, and the geopolitics of the Belt and Road Initiative—are more readily accepted by international journals than research that highlights everyday experiences, local traditions, or cultural interactions at the community level. The result is a thematic bias that places Chinese Indonesians studies within the grand narrative of globalization and East Asian economic policies, while local dimensions such as spirituality, regional languages, or minority social relations remain underrepresented.

The five thematic clusters from VOSviewer's analysis demonstrate that studies on Chinese Indonesians are no longer isolated but networked with regional issues. The politics and economics cluster demonstrates the integration of Chinese Indonesians discourse within the geopolitical context and Chinese investment in Southeast Asia. The humanities and culture cluster emphasizes the relevance of historical narratives and identity representations in shaping multicultural awareness. Meanwhile, the biomedical and genetics clusters signal a methodological shift, where ethnic dimensions are understood not only socially but also biologically—a new phenomenon in contemporary Asian research. The trend of cross-border academic collaboration demonstrates that this research is part of the regional knowledge circulation. Dialogues between Indonesia, Malaysia, and Singapore create an academic space that intersects issues of identity, migration, and diaspora. In this context, Chinese Indonesians serve as a "reflective mirror" for Southeast Asian communities in understanding the balance between nationalism, pluralism, and modernity.

Table 2 Comparative Reflections of Chinese in Indonesia, Malaysia, Thailand and Vietnam

Aspect	Chinese Indonesians	Chinese Malaysians	Thai Chinese	Vietnamese Chinese
Main Focus	Expansion from socio-political and identity studies to health, environment, and biogenetic research; peak publications 2020-2021	Continues emphasis on ethnic politics and affirmative policies; growing inclusion of health, education, and law	Cultural assimilation and urban economy studies; additional works in arts, linguistics, and cultural heritage	Studies link ethnicity with state policies, geopolitics, and economic integration
Identity and Integration	From repression to multidimensional recognition (culture, health, and environmental inclusion)	Citizenship recognition through policy reforms and health/education inclusion	Deep assimilation merging ethnic and national identity	Identity tied to foreign relations and political ideology
Economic & Scientific Role	Trade dominance linked to sustainability, entrepreneurship, and public health; active scientific collaboration with China	Economic participation shaped by redistributive politics and SME innovation	Urban economic participation, tourism, and cultural industries	Trade and production roles conditioned by state control and regional geopolitics
Political and Social Context	Post-reform multicultural inclusion; research diversification post-1998	Ethnic politics institutionalized, influencing education and governance research	Relatively stable; studies emphasize local assimilation and cultural continuity	Shaped by geopolitical tensions (China–Vietnam relations)
Characteristics of Research Output	Strongest interdisciplinary growth (social sciences, medicine, environment, arts); leading regional hub	Balanced output between policy-oriented and empirical research; consistent citation growth	Smaller output but high assimilation focus; emerging arts/humanities research	Politically framed studies dominate; less biomedical inclusion
Dominant Institutions & Collaboration	UI, UGM, Unair, collaboration with Chinese, Australian, and Singaporean universities	UM, USM, UKM, strong China-linked academic networks	Chulalongkorn, Chiang Mai University	Vietnam National University, collaborations with Chinese Academy of Social Sciences
Scientific Dimension	Increasing biomedical, genetic, and environmental studies involving Chinese descent populations	Health disparities, education, and policy evaluation	Minor biomedical engagement	Limited biomedical, more on political and cultural studies
Pandemic Influence (2020-2021)	Surge in publications related to identity, health, and digital transformation	Growth in policy, education, and social resilience research	Cultural continuity and local adaptation studies	Political resilience and China–Vietnam relations under stress

Source: Compiled from Various Sources.

Studies of Chinese communities in Southeast Asia demonstrate an increasingly complex and interdisciplinary development, reflecting the distinct social, political, economic, and scientific dynamics of each country. Indonesia,

Malaysia, Thailand, and Vietnam display overlapping patterns but also unique characteristics influenced by colonial history, state policies, and geopolitical relations with China. In terms of research focus, there has been a general shift from the study of politics and identity to broader issues such as health, the environment, and biogenetics. This phenomenon is most pronounced in Indonesia, which has seen an expansion from post-New Order studies on discrimination and identity to interdisciplinary research encompassing public health, environmental sustainability, and scientific collaboration with China. In Malaysia, research remains strongly focused on ethnic politics and affirmative action policies, but has begun to integrate dimensions of education, law, and health (Lee, 2023). Thailand exhibits a more cultural orientation, focusing on assimilation, urban economics, and cultural heritage (Teng & Bui, 2020), while Vietnam focuses more on the relationship between ethnicity, state policy, and regional geopolitics, particularly in the context of China–Vietnam relations (Barabantseva, 2015).

An identity and integration perspective, Indonesia exhibits a fascinating transformation process—from repression to multidimensional recognition encompassing cultural, health, and environmental aspects. In Malaysia, Chinese integration is institutionally regulated through policy reforms and citizenship recognition, albeit within the confines of the Bumiputera political system (Koh, 2015). In contrast, Thailand exhibits a very high level of assimilation, with ethnic identities almost completely fused into the Thai national identity (L.-J. Wang, 2018). Vietnam exhibits a different pattern: Chinese identity is more often linked to political ideology and foreign policy, reflecting the context of a socialist state and its fluctuating bilateral relations with China (Thayer, 2017). From an economic and scientific perspective, all four countries demonstrate the active involvement of Chinese communities in urban economies and trade, but within different frameworks. In Indonesia, the Chinese economy is increasingly linked to issues of sustainability, social entrepreneurship, and cross-border scientific collaboration. Malaysia places it within the context of redistribution politics and innovation within Micro, Small, and Medium Enterprises. Meanwhile, in Thailand, economic contributions are more closely tied to tourism and the creative industries, and in Vietnam, Chinese economic activity is often influenced by state policies and regional geopolitical dynamics.

In terms of the impact of the COVID-19 pandemic, all four countries saw a surge in publications in 2020-2021. In Indonesia, the pandemic triggered increased research on identity, health, and digital transformation. Malaysia focused on social resilience and education policy, Thailand emphasized local cultural continuity, and Vietnam highlighted political resilience and foreign

relations amid geopolitical tensions. The four countries reflect different historical trajectories and ethnic policies, but share a common pattern of knowledge globalization and academic integration with China. Indonesia has emerged as a regional research hub with the most interdisciplinary approach, Malaysia has maintained its relevance through ethnic politics and affirmative action policies, Thailand has demonstrated steady cultural assimilation, and Vietnam remains a unique case where Chinese ethnicity has been consistently linked to foreign policy and state ideology.

Beyond language and themes, the analysis also uncovers institutional gaps. Highly indexed publications tend to originate from large universities with access to international research networks and global funding. Conversely, regional or smaller institutions face limited research infrastructure and publication incentives. This imbalance reinforces the concentration of knowledge production in a handful of elite institutions, resulting in narratives about Chinese Indonesians being written more often from outside the perspective of their own community. These global trends highlight the need for affirmative strategies within the Southeast Asian research ecosystem. Strengthening bilingual publications can bridge the gap between local contexts and global networks, enabling researchers to write in Indonesian without losing opportunities for international visibility. Furthermore, expanding institutional support for universities outside metropolitan centers is crucial to enable them to contribute to global academic discourse. Only then can research on Chinese Indonesians move beyond mere objects of study to epistemic subjects that contribute to defining the direction of contemporary Asian scholarship.

Conclusion and Recommendations

The study of Chinese Indonesians is indeed very special considering interesting facts such as: the largest Chinese diaspora in the world is Indonesia, the richest people in Southeast Asia are Chinese Indonesians, and the long history of relations between Indonesia and China since the 5th century AD which resulted in cultural acculturation between Indonesians and Chinese people. Due to the large number of studies on Chinese Indonesians and the limited capabilities of the authors, this study only examines the years 2014-2025 in the Scopus database. The authors also implemented a strict protocol to ensure the data results are relevant and reflect the actual study of Chinese Indonesians. Overall, the bibliometric mapping reveals an integrated and evolving research landscape connecting Indonesia, China, and the broader Asian region. Five thematic clusters illustrate multidimensional scholarly interactions: the red cluster emphasizes political and economic ties such as the Belt and Road Initiative and Chinese Indonesians identity; the green cluster explores humanitarian and

demographic aspects related to gender, ethnicity, and social identity; the blue cluster highlights regional collaborations in Southeast and East Asia; the yellow cluster focuses on genetics and biomedical studies; and the purple cluster reflects anthropological engagement with ethnic and cultural diversity. Together, these patterns position Indonesia and China as important hubs bridging political, social, and scholarly research in Asia.

From a productivity perspective, Indonesia leads in terms of the number of publications, supported by major institutions such as Universitas Indonesia, Universitas Gadjah Mada, and Universitas Airlangga. Collaborations with countries like Singapore, Malaysia, and Australia strengthen Southeast Asia's academic connectivity. The dominance of the Social Sciences, along with significant contributions from Medicine and the Arts and Humanities, demonstrates a strong interdisciplinary orientation. A temporal analysis of production sources over time shows a steady increase in academic output from 2014 onwards, with a significant acceleration after 2018. Journals such as Sustainability (Switzerland), PLOS ONE, and Asian Ethnicity show consistent publication growth, reflecting expanding international collaborations and interdisciplinary interests. Meanwhile, the journal Wacana experienced an initial surge, representing a strong initial local platform that laid the foundation for subsequent international visibility. Despite these insights, this study is limited by its reliance solely on Scopus data, which may overlook relevant works indexed in other databases. Furthermore, the bibliometric approach emphasizes quantitative patterns without fully capturing the qualitative depth or contextual impact of the research.

In terms of subject areas, the majority of documents fall within the Social Sciences (28.4%), followed by Medicine (12.5%) and Arts and Humanities (10.3%). This distribution highlights a strong interdisciplinary orientation, with research spanning human behavior, public health, and cultural studies. Significant shares in Environmental Sciences (7.0%) and Agricultural and Biological Sciences (4.6%) demonstrate a growing focus on sustainability and ecological resilience—issues of increasing relevance in regional and global contexts. Recent thematic trends demonstrate an increasingly humanistic research direction, where the focus is no longer on ethnic differences but rather on human experiences and social relations across identities. This approach enriches understanding of how Chinese Indonesians negotiate discourses of nationhood and universal humanity. Thus, research on Chinese Indonesians is not simply a study of ethnicity but also part of an effort to build a more inclusive Asian epistemology that is reflective of global social change. Future studies should integrate multiple databases, such as Web of Science or Dimensions, to improve the comprehensiveness and reliability of the data.

Incorporating content analysis or citation network approaches is also recommended to uncover deeper theoretical connections and emerging themes. Strengthening international collaborations and diversifying publication outlets will further enhance the global visibility and scientific influence of Asian research networks.

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Research Article

Exploring Related Researchers in Institutional Repositories Based on Machine Learning: A Case Study of Fu Jen Catholic University

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Abstract

This study uses journal articles from Fu Jen Catholic University's institutional repository as a case study to explore researcher relationship analysis methods based on machine learning techniques. Our methods involve extracting features and vectorizing textual data by integrating natural language processing (NLP) techniques, and utilizing three clustering algorithms—hierarchical clustering, K-means, and DBSCAN—for comparative analysis. The results indicate that K-means achieves the best clustering performance. Through title analysis and calculating cluster keywords using the TF-IDF method, K-means effectively groups related articles with minimal irrelevant data and reveals researchers' primary and secondary expertise. Finally, the study visualizes researcher relationships by social network analysis and promotes collaboration and interdisciplinary exchange among researchers. This research enhances the practical value of institutional repositories and provides a concrete implementation framework for researcher relationship analysis.

Keywords: *Institutional repository, Natural language processing, Text clustering, Researcher relationship analysis*

Summary

Introduction

With the rapid advancement of scientific research, interdisciplinary collaboration has become increasingly common, and the boundaries between research fields are gradually diminishing. Conventional academic classification

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systems—such as those used in institutional repositories or university research databases—often rely on administrative divisions such as colleges or departments. However, even within the same department, faculty members may pursue diverse research topics, while researchers from different colleges may share overlapping interests. As a result, traditional disciplinary classification frameworks cannot adequately capture the complexity of modern scholarship or effectively identify potential collaborators.

In response to these challenges, this study examines how machine learning (ML) and natural language processing (NLP) can be utilized to explore potential researcher relationships within institutional repositories. By analyzing Chinese-language journal articles stored in the Fu Jen Catholic University (FJCU) institutional repository, this research proposes a content-driven approach that complements existing administrative classifications and introduces a new framework for understanding academic connections.

Institutional repositories (IRs) play an essential role in archiving and disseminating scholarly work, enhancing visibility, citation impact, and knowledge accessibility. However, their potential for research analytics—such as mapping intellectual structures and identifying collaboration networks—remains underdeveloped. The present study aims to transform IRs from passive storage systems into active knowledge infrastructures that visualize research clusters and relationships.

Main Objective

This research explores how NLP and machine learning can be applied to institutional repository data to identify relationships among researchers based on thematic similarities in their publications. The objectives are threefold:

1. Framework Construction: To develop a computational workflow that preprocesses, vectorizes, and clusters large-scale textual data using NLP and machine learning methods.
2. Algorithmic Evaluation: To compare the effectiveness of three clustering algorithms—Hierarchical Clustering, K-means, and DBSCAN—in grouping thematically related documents.
3. Network Visualization: To construct an interactive visualization of researcher relationships that can support institutional analytics and collaboration discovery.

Through these objectives, the study enhances the analytical value of Fu Jen Catholic University's institutional repository and provides a replicable framework for other institutions seeking data-driven approaches to research mapping and management.

Methods

Dataset

The dataset comprised 11,143 Chinese-language journal articles authored by 1,101 faculty members of Fu Jen Catholic University, as recorded in its research talent database (as of September 2021). Each record contained basic bibliographic metadata, including author name, department, publication title, and journal source. Because many entries lacked keywords or abstracts, supplementary information was retrieved from public databases, including the "Taiwan Periodical Literature System" and "Airiti Library." After data enrichment, 2,711 records included both abstracts and keywords, 5,412 contained only keywords, 29 contained only abstracts, and 2,991 remained incomplete.

Preprocessing

Data preprocessing involved deduplication, normalization of variant Chinese characters, and tokenization using CkipTagger. Custom dictionaries were created to retain specialized terms and academic expressions (e.g., "葡華字典," "類神經網路") that were often missed by standard segmentation models. Common stop words and filler terms were removed to improve textual clarity. To further enrich semantic representation, each token was mapped to its Wikipedia category labels (updated as of May 2024), thereby expanding conceptual coverage and grouping semantically related terms such as "左傳," "春秋," and "穀梁傳" within the same contextual network.

Feature Representation

Documents were converted into numerical representations using Word2Vec embeddings, trained on a hybrid corpus of Chinese Wikipedia articles and the expanded Fu Jen dataset (titles, abstracts, and keywords). Each term was embedded in a 300-dimensional vector space, and the vector representation of each document was calculated as the mean of its constituent word vectors.

This approach effectively preserved semantic relationships while maintaining interpretability and computational efficiency, making it suitable for large institutional datasets with varied text quality.

Clustering

Three clustering algorithms were evaluated:

1. Hierarchical Clustering: Applied Euclidean distance with a distance threshold of 20, producing 218 clusters comparable to Taiwan's official academic subfield classification (Ministry of Education, 2017).
2. K-means Clustering: The optimal number of clusters (k = 221) was determined using the elbow and silhouette methods to balance cohesion and separation.

3. DBSCAN: Parameter tuning (ε = 1.05, MinPts = 2) produced 562 clusters but yielded excessive noise and instability, making it less suitable for textual data.

The K-means model achieved the best performance, generating coherent and interpretable clusters that accurately reflected thematic relationships.

Relationship Modeling

Each researcher was represented as a vector indicating the proportional distribution across clusters. The similarity between any two researchers was calculated using cosine similarity.

A web-based visualization system was developed to dynamically display these relationships. Users can search by name, set similarity thresholds, and explore interactive network graphs in which node size represents research volume and edge thickness reflects thematic closeness.

Results

Algorithmic Performance and Thematic Grouping

The comparative analysis revealed substantial differences among the clustering techniques. Hierarchical clustering generated 218 clusters, K-means produced 221, and DBSCAN created 562. The latter exhibited noise-dominant groupings, with 85.9% containing two or fewer entries. In contrast, K-means achieved a balanced distribution and the most semantically coherent groupings, verified through TF–IDF keyword analysis. Table 1 presents the results of the three clustering algorithms.

Table 1 The Comparative Results of the Three Clustering Algorithms

Algorithm	No. of Clusters	Largest Cluster	% of Minimal Clusters
Hierarchical	218	441	9.6
K-means	221	248	12.2
DBSCAN	562	120	85.9

A case analysis using the paper “Forecasting the Singapore Exchange MSCI Index Using Neural Networks and Grey Prediction” confirmed that K-means grouped 91 related articles—most of which dealt with financial modeling, econometrics, and predictive analytics—whereas Hierarchical Clustering grouped only 52. Thematic coherence was validated by shared keywords such as “financial data analysis,” “market trends,” and “technical analysis,” indicating strong alignment between clustering outputs and domain semantics.

Researcher Network Visualization

The resulting researcher similarity network revealed hidden interdisciplinary structures within the university. For the same economics faculty member, 21 related researchers were detected at a similarity threshold of ≥ 0.5. Among

them, 12 were from the College of Management, 3 from the College of Social Sciences, and 6 from other colleges, including the College of Education and Communication. The closest link (cosine similarity 0.95) involved a scholar in international finance, confirming the model's ability to identify cross-college thematic proximity.

The visualization platform enables users to adjust similarity thresholds and observe how collaboration density changes. These analytics can help users identify the most suitable academic collaborators.

Conclusion

This study applies machine learning and natural language processing to analyze Chinese-language journal articles stored in an institutional repository, aiming to uncover potential academic relationships among researchers. The objective is to help scholars identify prospective collaborators and promote interdisciplinary exchange. While similar in intent to *NTU TOPICs*, this project focuses on institutions that lack access to large-scale databases and rely solely on internal repository data. It demonstrates how comparable analytical outcomes can be achieved under such constraints, offering a practical framework for similar contexts.

Unlike citation-based analyses that depend on complete bibliographic metadata, this study focuses on publication content—titles, abstracts, and keywords—to construct content-based research clusters that transcend traditional departmental boundaries. Visualization techniques were applied to present the researcher's relationships. Experimental results indicate that Hierarchical Clustering and K-means perform best in different scenarios, with K-means showing greater accuracy in discipline-specific clustering. The findings further suggest that dataset characteristics, such as cluster density, influence algorithm performance.

Future directions include adopting soft clustering to reflect researchers' multiple topic affiliations, integrating multilingual datasets to capture global academic activity, and enhancing the web interface to improve usability and feedback evaluation.

Acknowledgment and Declaration

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this tool, the authors reviewed and edited the content as needed and take full responsibility for the final content of the publication.

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ROMANIZED & TRANSLATED REFERENCES FOR ORIGINAL TEXT

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附　錄

教育資料與圖書館學 學術出版倫理聲明
Academic and Publishing Ethics Statement of *JoEMLS*

Version 3

教育資料與圖書館學（以下稱本刊）秉持學術規範與同儕評閱精神，重視投稿論文的嚴謹度外，亦重視學術與出版倫理。JoEMLS網站上的所有資訊都遵循學術出版透明度和最佳實踐原則（*Principles of Transparency and Best Practice in Scholarly Publishing*）中的描述指南。

無論中、英文稿件，作者於投稿前即需確認文中主要論述、研究發現與結論建議等，皆有其原創性並符合學術引用規範之要求。投稿至本刊之所有稿件均使用Turnitin系統進行內容相似度比對。本刊所收錄稿件必須滿足未曾於紙本或網路電子形式媒體上之公開發表，且投稿同時需提供保證與授權書，保證論文沒有一稿多投，內容亦絕無涉及任何抄襲型態與侵害他人著作權之情事。研究論文經本刊雙匿名送審且獲接受建議後刊登全文，惟作者仍須對論文正確性與嚴謹性負責。

本刊另將於取得作者、審稿者之同意後，對相關作者回應與同儕評論內容另作揭露。如本刊「投稿須知」所示：本刊作者同意其投稿之文章經本刊收錄後，無償授權本刊以開放取用（Open Access）以及非專屬授權之方式，再授權予其他資料庫業者收錄於各該資料庫中，並得為重製、公開傳輸、授權使用者下載、列印等行為；以及為符合資料庫之需求，並得進行格式之變更。

除上述基本規範之外，茲針對總主編（Chief Editor）與執行編輯（Executive Editor）、評閱者、投稿論文作者等不同職務角色應具之出版倫理，參考Committee on Publication Ethics（COPE）建議，分述有關責任，以及判斷處置危害倫理行徑如下：

一、總主編與執行編輯責任

1. 務求公平並客觀的評估投稿論文，不受種族、膚色、性別、語言、宗教、政治或其他見解、國籍或社會出身而影響投稿人權益。
2. 評估投稿論文時僅依照其學術價值判斷，不作學派、學院、商業影響力上之考量。
3. 給予投稿者適當管道表達意見，並遵循適當處理程序。
4. 注意任何潛在的利益迴避問題（包括財務、學術合作方面或其他存在於來稿作者、評閱者與編輯團隊之間的利害關係）。
5. 確實參考編務諮詢委員之意見，並依論文領域與投稿人研究背景推薦匿名外審委員，須迴避與作者有直接關係的評審，務求審慎客觀評閱稿件，提供作者建設性建議。
6. 依循適當審查程序主審投稿論文，綜合外審評審意見並客觀審查本文後提供作者相關修稿建議，審慎客觀地依論文品質決定予以退稿或者已達刊登標準。
7. 本刊總主編有相對權利與義務依COPE所揭示精神，處理違反學術倫理之稿件。
8. 為接受刊登論文擔任最後把關，綜合所有相關評閱者與領域主編意見，以確認刊登論文品質。

二、評閱者責任

1. 即時並公正、客觀地評閱來稿，並務必確認接受刊登之論文可增進教育資料與圖書館學品質。
2. 對於來稿論文內容須予以保密，且銷毀審查過程中所產生之文件。
3. 當發現所評閱之稿件與其他已刊登論文內容相似時，應提醒本刊總主編或執行編輯，並作建議適當之處置方式。

三、作者責任

1. 保證稿件目前只有投稿教育資料與圖書館學，絕無同時投稿其他期刊或刻正進行評閱程序中，且論文未在其他刊物與媒體公開發表過。如投稿稿件為會議論文或學位論文改寫者，另見本刊「投稿須知」之規定。
2. 投稿論文為本人之著作，其他共同作者亦參與論文撰寫且有實質貢獻，論文絕無抄襲之情事，資料精確且來源可信，為學術研究之原創論文。
3. 如發現投稿論文有錯誤時，應立即主動通知本刊總主編或編輯團隊。
4. 相關學術與出版倫理事項，另見本刊「投稿須知」之規定。

四、判斷與處置危害倫理行徑

1. 無論本刊所委請之評閱者、總主編與執行編輯，或任何編輯團隊成員，於任何時間發現作者有違反學術倫理之失允行為時，皆應提醒本刊總主編或編務諮詢委員會迅做處理。
2. 行為失允之準則應包含但並不限於上述倫理聲明。
3. 凡知曉任何違反學術倫理行徑，總主編與執行編輯應蒐集足夠之訊息與證據，展開調查與討論。所有指控皆應被認真對待，並以同樣標準處理，直至達成適當決策或結論為止。

㈠ 調查方式

⑴ 總主編應決定初步調查方針，並於適當時機尋求執行編輯與編務諮詢委員會成員之建議。
⑵ 應在不驚動非相關人士之前提下蒐集足夠適切證據。
⑶ 召開編務諮詢委員會進行討論後達成決議，並請作者提出說明。

㈡ 處分方式

針對違反學術倫理之情節輕重，已投稿論文將與退稿並撤除，相關撤除之情境，則參據Elsevier政策分為文章撤回（Withdrawal）、文章撤銷（Retraction）、文章移除（Removal）與文章置換（Replacement）等。[1] 並自以下處分項目中，採行一項（含）以上之作業措施：

⑴ 該作者將於教育資料與圖書館學留有相關紀錄，且將依情節輕重，評估禁制投稿期限，或者未來無限期拒絕接受稿件投遞。
⑵ 可向觸犯倫理規範人士之所屬機構或校院辦公室寄發正式信函告知其行徑與調查結果。
⑶ 於本刊公布其失允之事實。

[1] 相關說明另見邱炯友，「編者言：期刊稿件倫理爭議處理之思考」，教育資料與圖書館學53卷，2期（2016年春季號）：135-138。

附　錄

生成式AI之自我揭露與誠信原則
Guidelines on Self-Disclosure and Integrity in the Use of Generative AI

（1st ed. 第一版）
教育資料與圖書館學2025年12月6日發布
Published by *JoEMLS* on December 6, 2025

隨著大型語言模型（Large Language Models, LLMs）等生成式AI技術的迅速發展，研究者在進行研究、撰寫或翻譯時使用AI工具已日趨普遍。為維護研究透明度與學術誠信，本刊生成式AI之自我揭露與誠信原則（以下簡稱為「*JoEMLS AI*誠信原則」）要求凡於研究或稿件撰寫過程中使用AI工具生成任何內容者，作者皆需於內文適當位置標示引述／引用或另行提供AI使用聲明。通常這些標示可出現於：作者註記（Author Note）、研究方法（Research Method）、致謝（Acknowledgement）、引用文獻（Citation；含內文之圖表註記note），以及附錄（Appendix）等五個標示處。

本刊基於排版與版面考量，避免「作者註記」項目過於繁複，特將AI相關之使用聲明統一移置於文章末尾，並以「致謝與聲明（Acknowledgment and Declaration）」為標題揭露AI工具之使用情形，而此部分屬於本刊必備項目。若AI技術對研究設計、資料處理或方法流程等事項具有實質影響，則務必另於「研究方法」章節中詳加描述與說明。[1]

以下內容包含APA與Chicago Style（含Turabian Manual）引文格式示例，以及「致謝與聲明（Acknowledgment and Declaration）」之文字模板，並加入補充說明以利作者判斷。

一、引文格式範式與範例 Citation Formats and Examples

㈠APA格式

儘管APA格式要求作者將「交談標題」置於參考文獻裡，但是作者仍要注意到：由於作者可能會多次提問AI並做細部修正，若欲完整與準確地呈現作者與AI的互動內容，以供讀者未來研究複製檢驗或延伸探討議題之用，則純粹單靠參考文獻所呈現提問的交談標題仍將難以達到此目的；因此，作者於必要時應在論文本文中多加敘述細節，或另於附錄中表達。

【內文引用範式 In-Text Citation Format】

敘述式引用（Narrative citation）：
AI 公司名稱（YYYY）或AI Company Name (YYYY)

括號內引用（Parenthetical citation）：
（AI 公司名稱，YYYY）或 (AI Company Name, YYYY)

[1] AI工具之使用日漸多元複雜，因此易產生某些模糊情境。例如，兩種可能無需特別引用或揭露AI使用情境：AI工具已被整合於搜尋引擎之中（視同搜尋引擎之引用規範），或是某常用軟體已兼具AI功能（仍視為該常用軟體之功能）。另外，「附錄」則有利於呈現AI之提問（prompt）層次過程之內容資料。本文件「*JoEMLS* AI誠信原則」2026新修訂版將再詳細規範與分類選項，以便利投稿者依據各類情境進行處理。

【內文引用範例 In-Text Citation Example】

敘述式引用（Narrative citation）：

例句：根據Anthropic（2025）對於學術期刊出版透明度重要性的詮釋……

或or

According to Google's (2025) interpretation of the types of academic misconduct in scholarly journal publishing, ...

括號內引用（Parenthetical citation）：

例句：生成式AI之學術期刊審查倫理其涵蓋了以下幾點……（OpenAI, 2025）。

或or

The current status of article processing fees charged by scholarly journals involves the following aspects ... (Microsoft, 2025).

【參考文獻範式 Reference Format】[2, 3]

中文：

AI 公司名稱。（YYYY年MM月DD日）。交談標題〔生成式AI交談〕。工具名稱／模型。https://XXXXXXXXX

英文：

AI Company Name. (year, month day). Title of chat [Generative AI chat]. Tool Name/Model. URL of the chat

【參考文獻範例 Reference Example】

Anthropic。（2025年12月2日）。學術期刊出版透明度的重要性〔生成式AI交談〕。Claude Sonnet 4.5。https://claude.ai/share/8a8ed4ba-a16d-4ebb-8830-f1813a17db7c

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Perplexity AI。（2025年12月2日）。期刊文章文後參考文獻羅馬化的優點〔生成式AI交談〕。Perplexity Pro。https://www.perplexity.ai/search/qi-kan-wen-zhang-wen-hou-can-k-sEjmA.BdSA6_u6cRlETMlQ#0

[2] 此「交談標題」類似對AI之首次提問（prompt），無需呈現歷次細化提問與互動細節，字數雖未限定但仍以易於編輯標題與理解為考量。

[3] 若作者認為公開「交談標題」（提問內容）及其歷次對話與具體的詳細網址，都無關於於讀者掌握閱讀與理解意義；或於論文「研究方法」內僅提及研究設計，例如述及：「我使用了生成式人工智慧（AI）工具 Claude 3.7 Sonnet（Anthropic，2025），產生了一份高中生在12年級結束時應該掌握的語法概念列表。」則可僅只揭露AI工具之使用即可，而不需呈現「交談標題」，且網址亦僅及於AI工具官網即可。此範式為：AI公司名稱。（年份）。*AI工具名稱/模型*（英文Italic，首字母大寫；中文則用標楷體）[大型語言模型]。工具網址。資料詳見APA官方部落格文章Citing generative AI in APA style: Part 1—Reference formats. APA Style, https://apastyle.apa.org/blog/cite-generative-ai-references。

㈡ Chicago格式（18th ed.）與Turabian Manual

【內文敘述 In-Text Description **】**

當作者於論文中使用AI生成文本時，必需明確表明AI工具之使用。例如：

中文例句：

……以下有關學術期刊出版透明度中的同儕評審過程之重要性敘述是於2025年12月2日由Claude Sonnet 4.5生成：

同儕評審是學術出版的核心機制，其透明度直接影響研究品質的把關。傳統的匿名評審雖然保護評審者，但也可能產生偏見或不負責任的評論。越來越多期刊開始採用開放式同儕評審，公開評審者身份和評審意見這不僅提高評審品質，也讓讀者能更全面地評估研究成果。透明的評審過程還能幫助年輕學者學習如何進行建設性的學術批評。[10]

英文例句：

…. The following content about plagiarism as academic misconduct was generated on December 2, 2025, by Gemini 3 Pro: “Plagiarism: Plagiarism involves presenting someone else’s work, ideas, or words as your own without proper acknowledgment. It is not limited to copying text; it also applies to code, images, and data.” [14]

【對應上例，註釋 Note **呈現方式** Formatting of Notes **】**

[10] 由Claude Sonnet 4.5生成的文本，Anthropic，2025年12月2日，https://claude.ai/share/8a8ed4ba-a16d-4ebb-8830-f1813a17db7c。

[14] Text generated by Gemini 3 Pro, Google, December 2, 2025, https://gemini.google.com/share/d5d63287d55d.

此外，作者也可以將自己下達AI的提問（prompts）內容列出於文內，或者將其列於註釋（note）裡。若有多次細化提問時，則這些提問文字扼要摘錄即可。例如文內陳述「提問」：…。本研究以AI工具提問「請解釋該如何製作一般家庭式配方的披薩麵糰？」（…. We have tried to ask AI to explain how to make pizza dough from common household ingredients ？）。

但是，若提問（prompt）標題未包含在文本中，則可以在註釋中呈現；而已再行編輯AI生成的文本，則應於文本中或註釋結尾說明（例如：「已作樣式與內容之編輯」“edited for style and content”）。但不需要說明任何有關引號或字體的變動；這些更改可以默默施加，而無須說明（見CMOS 13.7和13.8）。例如：

英文：

[18] Response to “Explain how to make pizza dough from common household ingredients,” OpenAI, March 7, 2023. edited for style and accuracy.

中文：

[18] 對「解釋如何用製作一般家庭式配方的批薩餅麵團」的回應，OpenAI，2023年3月7日。已重做格式編輯與檢視正確性。

【參考書目範例 Bibliography Examples **】**（注意：不適用於期刊投稿）

若作者想將AI提問與對話內容呈現於文末的「參考書目（bibliography）」時，則使用出版者/開發商之名稱，而勿採該AI工具名；但需列出該資訊之連結網址。

Bibliography

Anthropic. Response to “The importance of peer review processes in academic journal publishing transparency?” Claude Sonnet 4.5, December 2, 2025. https://claude.ai/share/8a8ed4ba-a16d-4ebb-8830-f1813a17db7c.

參考書目

Anthropic. 提問「學術期刊出版透明度中的同儕評審過程之重要性？」之回應。Claude Sonnet 4.5，2025 年 12 月 2 日，https://claude.ai/share/8a8ed4ba-a16d-4ebb-8830-f1813a17db7c。

二、文章末尾之「致謝與聲明（Acknowledgment and Declaration）」

【範式聲明 Template Statement **】**

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在本文撰寫過程中，作者為了[某種原因]而使用[工具/服務名稱]。使用此[工具/服務]之後，作者已根據需要再進行審視與編輯該內容，並對此發表之內容擔負起全部責任。

Acknowledgment and Declaration

During the preparation of this work the author(s) used [NAME TOOL / SERVICE] in order to [REASON]. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

【聲明範例 Statement Example **】**

致謝與聲明

在本文撰寫過程中，作者為了長摘要之英文翻譯需求，而使用ChatGPT 4o。使用此工具之後，作者已進行審視並編修，且對此發表之內容擔負起全部責任。

Acknowledgment and Declaration

During the preparation of this work, the authors used ChatGPT 4o for investigation in managing interview transcripts. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the final content of the publication.

參考來源：

Elsevier. (2025, July 29). *How do I submit a manuscript in Editorial Manager?* https://www.elsevier.support/publishing/answer/how-do-i-submit-a-manuscript-in-editorial-manager

McAdoo, T., Denneny, S., & Lee, C. (2025, September 9). *Citing generative AI in APA style: Part 1—Reference formats. APA Style*. https://apastyle.apa.org/blog/cite-generative-ai-references

McAdoo, T., Denneny, S., & Lee, C. (2025, September 9). *Citing generative AI in APA style: Part 2—AI as a search engine and AI integrated into common software*. APA Style. https://apastyle.apa.org/blog/cite-generative-ai-search-software

University of Chicago Press. (2025, December 5). *The Chicago Manual of Style online*. https://www.chicagomanualofstyle.org/home.html

附　錄

JoEMLS 註釋（Notes）暨參考文獻（References）羅馬化英譯說明

2015年1月31日修訂

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   範例2 －參考文獻（References）
   林雯瑤、邱炯友（2012）。教育資料與圖書館學四十年之書目計量分析。教育資料與圖書館學，*49*(3)，297-314。【Lin, Wen-Yau Cathy, & Chiu, Jeong-Yeou (2012). A bibliometric study of the *Journal of Educational Media & Library Sciences,* 1970-2010. *Journal of Educational Media & Library Sciences*, *49*(3), 297-314. (in Chinese)】

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