Berkala Ilmu Perpustakaan dan Informasi, Vol. 18, No. 2, Desember 2022, Hal. 232-246
https://doi.org/10.22146/bip.v18i2.5415
ISSN 1693-7740 (Print), ISSN 2477-0361 (Online)
Tersedia online di https://journal.ugm.ac.id/v3/BIP

Systematic literature review and bibliometric analysis of archivist competencies in digital curation

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Submitted: August 24, 2022, Revised: September 27, 2022, Accepted: October 3, 2022

ABSTRAK

Pendahuluan. Sebagai salah satu tugas arsiparis, konsep kurasi digital harus dijalankan dengan perencanaan dalam memastikan pelestarian arsip jangka panjang secara digital. Sebagai profesional informasi, arsiparis harus menguasai kompetensi untuk menjadi kurator digital di masa depan. Penelitian ini bertujuan untuk mengetahui kompetensi apa saja yang harus dikuasai oleh arsiparis dalam kurasi digital.
Metode Penelitian. Metode yang digunakan yaitu tinjauan literatur sistematis pada 11 artikel terseleksi dari database SCOPUS yang terbit mulai tahun 2018-2022 dan analisis bibliometrik menggunakan VOSViewer untuk mengidentifikasi peluang penelitian dalam topik sejenis.
Data Analisis. Metode analisis SLR terdiri dari tiga langkah yaitu *planning, conducting*, dan *reporting*. Analisis bibliometrik menggunakan *co-occurrence* untuk memvisualisasikan *keyword network, density,* dan *overlay.*
Hasil dan Pembahasan. Terdapat beberapa topik penelitian mengenai kurasi digital yang masih belum banyak diteliti yaitu kompetensi, *cultural heritages*, *data management*, *career*, dan *learning*. Melalui tinjauan literatur sistematis ditemukan bahwa terdapat empat kategori kompetensi arsiparis yang harus dimiliki dalam kurasi digital yaitu kognitif, fungsional, sosial, dan meta kompetensi.
Kesimpulan dan Saran. Kompetensi yang ditemukan berimplikasi pada arsiparis untuk menggabungkan keterampilan teknis dan personal dalam kurasi digital. Hasil yang ditemukan juga dapat menjadi peluang bagi penelitian selanjutnya untuk mengkaji kompetensi digital pada topik-topik yang masih jarang diteliti.

Kata kunci: arsiparis; kompetensi; kurasi digital

ABSTRACT

Introduction. *As one of the main tasks of an archivist, a digital curation concept need to be conducted by having a plan to ensure long-term preservation. As information professionals, archivists should have a sufficient competency to become digital curators in the future. This study aims to determine what competencies an archivist should have in digital curation.*

Data Collection Methods. *This study used a systematic literature review (SLR) involving 11 selected articles from SCOPUS published in 2018-2022 and bibliometrics analysis using VOSViewer to identify research opportunities in archive field.*

Data Analysis*. The SLR analysis method consisted of three steps: planning, conducting, and reporting. The bibliometric analysis used co-occurrence to visualize keyword network, density, and overlay.*

Results and Discussion. *Several topics regarding digital curation have not been widely studied, such as competence, cultural heritages, data management, career, and learning. This paper found that archivist competencies in digital curation can be divided into four categories: cognitive, functional, social, and meta-competence.*

Conclusion. *Archivists should combine technical skills and personal skills as the competencies to become s future digital curators by. Based on the findings, the result can be an opportunity for further research to explore digital curation competencies in topics that are still rarely studied.*

Keywords: *archivist; competencies; digital curation*

A. INTRODUCTION

Digital curation is a new term in the archival world that focuses on efforts to maintain and add value to digital information. This effort aims to make it more reliable for use today and in the future (Poole, 2016). Digital curation builds a new concept that bridges the boundaries between archivists, librarians, records managers, and other information professionals, namely ensuring the accessibility of information. These concepts open up new opportunities for information professionals in the field of collection management. The demand for digital information that is easily accessible, accurate, and highly usable for researchers, the information industry, and all information users has exposed the importance of digital curation. In the library and museum sector, the concept of curation concentrates on creating value-added collections and documenting individual objects and collections by recognizing the relevance of context and history for research purposes. While in the archive sector, digital curation is formed from perceptions between creators and from the terms archiving and preservation (Post et al., 2019).

The emerging concepts behind digital curation in the various sectors offer prospects to build relationships and promote proactive services. So digital curation is widely interpreted as an effort to maintain and add value to digital information now and in the future. Greater openness and transparency in almost all sectors of society became important. These factors create a need for service policies, technology, and expertise in digital curation that information professionals must possess. As information professionals, digital curators' responsibility is to meet the needs of curating activities in a digital environment. Some requirements must be met by preparing and equipping the required competencies to create a reliable digital curator.

Many researchers and practitioners have argued a set of competencies of digital curation in the broader context including familiarity with digital technologies, the knowledge of digital curation tools, the ability to initiate and manage projects, programs, and services, and strong interpersonal skills (Kouper, 2016). As a new field of professionalization, digital curation needs such understanding to advance the field faster and make organizational and technological changes to address the much-discussed deluge of digital data. Le Deist and Winterton articulate the concept of professional competence into two dimensions. The first dimension is developed conceptually or consists of operational skills. The second dimension assesses competence in an occupational manner (Fraser-Arnott, 2017). Although this concept is not intended specifically for professionals in the field of digital curation, it has become a reference for several research in formulating what skills and competencies a digital curator must possess (Feng & Richards, 2018; Madrid, 2014; McFadzean, 2017).

McFadzean (2017), examines the digital curators' skills such as curation, assessment, strategy, and management activities. It was found that the digital curator's technical skills must have collective reasoning that synergizes between personal knowledge and data created or collected through the help of artificial intelligence. Advances in technology enable digital curators to manage the volume, variety, and speed of information by linking collective reasoning with artificial intelligence systems (Madrid, 2014). In this case, digital curators as information professionals have the task to balance transactional skills and services to create innovations in providing access to public memory through digital curation activities.

This task and objective of digital curation align with archivists' tasks that must digitally plan and manage data from the very beginning

of the archives lifecycle to maintain long-term preservation of records despite evolving formats and the rapidly obsolete nature of technology. The Digital Curation Center (DCC) summarizes that maintaining, preserving, and adding value to digital data throughout its life cycle is the task of digital curation. DCC also emphasized that digital curation consists of various activities to promote the maintenance, accessibility, and preservation of digital data (Ray, 2017). A future archivist needs to prepare his duties as a digital curator to perform preservation that consists of providing access, planning, assessment, creating added value, active management, and managing information by applying the principles of provenance and research in the context of curation (Sabharwal, 2017).

The involvement of archivists in developing standards and resources for digital asset curation activities is closely related to digitization programs such as providing online access to all collections, digital data acquisition, and digital collection documentation (Karatas & Lombardo, 2020). Digital curation standards and protocols for archive sectors must be articulated comprehensively. The importance of articulating a broader notion of professional competence for digital curation in the archive fields will guide the advancement of digital curation as a profession. However, Feng (2018) found that professional competence concepts in the digital curation context were not articulated clearly and consistently in practice and theory. Compared to other disciplines that fully developed competence concepts, digital curation competence concepts have not developed comprehensively. It drives the need for a professional competence concept related to digital curation's current and future practice.

Based on previous research, no further research have done regarding what competencies an archivist must have in digital curation. Along with the increasing need for information accessibility through digital curation, there is a need for a synergy between the skills and knowledge that archivists must possess to have competence in digital curation activities. So through this background, this research aims to find out what competencies an archivist should have as an information professional in digital curation by identifying and discussing the findings of previous research and seeing future research opportunities on similar topics. Several literature results from previous studies have different conclusions, so a systematic literature method is used to validate the dimensions of archivist competence in digital curation in each study. In addition, this article also uses a bibliometric approach to visualize research on the topic of archivist competence in digital curation. The combination of these two approaches aims to find out how systematic literature reviews can be used against rigorous and comprehensive literature published in the field that offers an overview of the existing knowledge and how bibliometrics can be used to determine the direction of future research related to digital curation topics that are still developing.

B. LITERATURE REVIEW

Digital Curation

Digital curation is a concept that focuses on managing and adding value to digital information so that it can be used today and remains accessible in the future. Digital curation has various terms, such as curation, digital preservation, and digital curation. The concept of digital curation comes as a new approach to creating, collecting, and managing digital assets. The term "digital curation" was introduced in London, on 19 October 2021 in "Digital Curation: digital archives, libraries, and e-science seminars". Sectoral speakers from the archives, libraries, information management, and data processing sectors attended this seminar on the development of data curation and digital preservation (Poole, 2016).

Digital curation develops along with the development of a scientific discipline. As a multi-discipline, digital curation implies that the scope and volume of digital information will continue to increase, so education and training to follow the development of digital curation must be carried out. Along with its development, digital curation bridges practice, research, training, formats, and multi-disciplinary training. Digital curation activities include the

actions required to manage digital material throughout its life cycle for access availability now and in future generations. In addition, the digital revolution has led to an increase in digital-born material that drives the need for a trusted digital repository for long-term access availability, equipped with appropriate metadata standards to ensure interoperability. So digital curation can be said to archiving to ensure the long-term preservation of data and content through the use of technology (O'Flaherty, 2015).

To align the task of digital curation, the Digital Curation Center (DCC) designed a graphic pattern to describe the life cycle of digital archiving. The DCC life cycle can be used as a framework for planning curation activities, especially in digital archiving. Curation through a life cycle approach can help an organization or institution to prepare an adequate filing system in a digital environment. There are three main components to the digital curation lifecycle. The first component creates information description and management, is the initial stage of information creation, preservation and maintenance planning, and the development of metadata standards according to the needs and systems used to ensure long-term interoperability and accessibility. The second component is planning for preservation, which includes developing a storage option strategy, maintaining metadata, and developing procedures and policies. The third component is the third stage of community monitoring which is the target of the data to monitor changes in data needs, ensure the long-term preservation process runs according to procedures or policies, and ensure that the system or device is still relevant for use (Odhiambo, 2018)

Digital Curators Competencies

Digital curation tasks and activities need new roles and responsibilities that combine professional information skills in the library or non-library and information science sectors (Vivarelli et al., 2013). Many current programs take a relatively pragmatic approach that emphasizes digital curation skills that are currently needed, but fewer programs adopt a competency-based approach that aims to build a range of competencies that are needed for digital curation work. To articulate digital curators' competencies, Feng (2017) adopted Le Deist and Winterton's multi-dimensional and holistic model of professional competency. There are four types of competencies namely cognitive competency, functional competency, social competency, and meta competency. Cognitive competency is the skills to learn existing and new knowledge. Functional competency is related to the technical skills needed in digital curation activities. Social competency is related to the social skill that must be owned personally. Meta-competency is high-level abilities that cannot be generically measured and overlapped with managerial competency.

There are several technical competencies that digital curators need to possess, such as the skills to select and evaluate digital documents for the long term. For this reason, a digital curator must master knowledge about the function of each digital entity and its preservation. This knowledge must also be supported by an understanding of data from different digital objects to carry out the storage process and establish appropriate procedures, standards, and policies to ensure the accessibility of digital objects. Doing digital requires readiness to provide adequate infrastructure to ensure access, storage, and security are available. In providing digital infrastructure, a curator must have the ability to establish collaborative relationships with IT professionals. This ability is protected the available technology threats such as cybercrime. In addition to readiness in terms of infrastructure, a curator must know to ensure authentication, integrity, and accuracy of digital objects (Madrid, 2014).

A digital curator must master technical skills such as providing long-term access, traceability, retrieval, use, and reuse facilities. These technical skills aim to enable interoperability and help any stakeholders who use them to become easily access the content. Not only technical competence, but a digital curator must be prepared with soft skills such as the ability to negotiate, manage, team building,

and collaborative problem solving (Poole, 2016). The skills and qualifications needed when working in the digital environment are focused on content, services, and application of technology in the digital environment. There are six skills categories that information professionals must have in digital curation: 1) Ability to understand the devices used hardware and software; 2) Carry out project planning and management; 3) Sorting, selecting, and appraising collections; 4) Standard metadata; 5) The review process includes risk assessment, compliance, and audit processes; 6) Education and training (Kim et al., 2013).

C. RESEARCH METHODS

The method used in this study is a mixed method, which combines a quantitative approach using bibliometrics and a qualitative using a systematic literature review with the Preferred Reporting Items For Systematic Review and Meta-Analyses (PRISMA) approaches. The mixed methods of literature review aim to identify the knowledge base and scientific topic evolution (Tlili et al., 2022). A systematic literature review is an important step to take before undertaking any research as it plays a role in building the foundation for accumulating knowledge. The use of the PRISMA approach in a systematic literature review aims to synthesize (summarize) research results. This method of synthesizing the results of qualitative research is called meta-synthesis. By definition, meta-synthesis is a technique of integrating data to obtain new theories or concepts or a deeper and more thorough level of understanding (Torres-Carrión, 2018). These will facilitate the expansion and improvement of theory, reduce research gaps, and uncover overlooked areas by previous research. However, bias in reporting results may occur, and interpretation of results tends to be subjective in the systematic literature review. As part of the literature review, bibliometric analysis was used to analyze and view the data to gain a multidimensional perspective of research trends in similar topics and increase the study's validity. Bibliometric analysis is a quantitative method for analyzing bibliographic data in journal articles. This field analysis is used to reference scientific literature cited in journals for scientific research and to classify scientific literature according to research.

The first method is a systematic literature review that consists of three stages. The first stage is the planning stage, which consists of formulating research questions and limitations. The second stage is conducting stage, which consists of tracing and identifying appropriate references to research, extracting and synthesizing data using PRISMA approaches as a search strategy. The third stage is reporting stage, which consists of translating the results into articles.

The second method, this study also combines bibliometrics analysis to visualize bibliographies or data sets containing bibliographic fields, including title, author, journal name, and so on, using VOSviewer software. The use of VOSviewer in this study aims to find topics that still have the opportunity to be researched and find the most widely used references in the same fields. Data in the form of articles found in literature sources are then analyzed through VOSviewer to obtain images that show maps and themes based on the output categorization that has been determined. The type of VOSviewer analysis used in this study is co-occurrence to analyze the frequency of different keywords that occur from research topics, the output has three visualizations namely network, overlay, and density.

Formulating Research Questions

Research questions and limitations identification use the PICOC approach that consists of five criteria: population, intervention, comparison, outcomes, and context (Wohlin et al., 2012). The limitations of this research support the effectiveness of searching relevant articles to answer research questions by formulating five criteria of the PICOC approach. Population criteria, including research literature on archivist competence in digital curation. Intervention criteria, including limitations on archivist competencies required in digital curation. Comparison criteria, including a comparison of archivist

competencies in digital curation in the last five years. Outcomes criteria, including research trends and archivist competence needed in digital curation. Context criteria, including a review of the results of research investigations. Based on the scope formulated from the five criteria, there are research questions (RQ) as follows:

RQ1 : How many keyword clusters were found in VOSviewer regarding research on archivist competence in digital curation?
RQ2 : How much research is relevant to archivists' competencies in digital curation?
RQ3 : What are the archivist competencies needed in digital curation?

Search Strategy

The search strategy in this study aims to extract articles that will be used as research data.

For the search strategy, this research uses the PRISMA approach. PRISMA is a data search strategy through the search terms used, literature sources from online databases, inclusion and exclusion criteria used, quality assessment, and an explanation of the results of data searches. The research article selection process in the PRISMA approach is divided into identification, screening, and determination of selected articles to be included for further review in this research based on the inclusion and exclusion criteria. (Handayani, 2017).

First, we create search terms combinations and integrations of synonymous vocabularies using Boolean operator search methods such as OR, AND, and NOT. This function aims to produce search results combination of two or more keyword elements related to the research topic. The search term formulation in this study uses a combination of synonym word integration of Boolean operators as "Digital AND Curation OR Competence OR Archive". This term formulation is used as a keyword to search articles in literature sources.

This study uses one type of database as a literature source, SCOPUS. A keyword search in the SCOPUS database found 262 articles. Then, the journal articles used in this study are identified and extracted following the inclusion and exclusion criteria. These inclusion and exclusion criteria identify relevant journal articles to answer the research question (Handayani, 2017). The inclusion criteria in this research are all journal articles published from 2018 to 2022, relevant to the research topics, fully accessible, and published in English. Then the exclusion criteria are journaled articles published before 2018-2022, irrelevant to the research topics, not fully accessible, and published in other than the English language.

The article selection process consists of three stages. 1) Identification, this step will exclude articles identified as published before 2018-2022 and identified as not relevant to research topics. 2) Screening, this step will exclude articles that are not fully accessible and not published in English. 3) Included, at this stage articles that have been filtered from the identification and screening process will be selected for quality assessment.

Quality Assessment

Assessment of the quality of search results aims to evaluate the quality of articles based on

their relevance to the research topics and the usefulness of the data obtained. The quality consists of assessment questions. Each questions has three answer options, namely: Yes = 1; Partially = 0,5; No = 0 (Adrian et al., 2016). The questions that support the assessment criteria of search results are:

Q1 : Does the research explain digital curation?
Q2 : Does the research explain competencies?
Q3 : Does the research explain archivists' competencies in digital curation?

D. RESULTS AND DISCUSSION

Result of Search Process

Based on the search strategy in the SCOPUS, there are three steps of the article selection process. The steps are identification, screening, and determination of articles to be included as research data. First, the identification steps found 262 articles related to the search keywords. Furthermore, we identified

and filtered to exclude 79 articles published before 2018-2022 and 31 articles irrelevant to the research topics. Then, in the screening steps, we excluded 104 articles with limited access and 37 articles that did not use English. Then, the last step shows 11 articles that will be included for quality assessment and further review in this study. The search strategy workflow used in this study is shown in Figure 1.

Discussion

Through the systematic literature review method, the next step is to review the collected primary data. Furthermore, identifying findings from 11 articles as primary research data following the research question in this study. This part will answer the following research questions by the literature review results.

RQ1: How many keyword clusters are found in VOSViewer regarding research on archivist competence in digital curation?

The items found from the research keyword mapping from VOSViewer are 43 keywords items divided into 5 clusters symbolize by the colors red, green, blue, yellow, and purple showed in Figure 2. Based on Figure 2, the network visualization of studied topics related to archivist competence in digital curation. If the circle gets bigger, the research topic is studied more than others, such as digital curation, data curation, information processing, and articles. On the other hand, the farther and smaller the circle, the less attention to the theme by researchers, such as competencies, cultural heritages, data management, career, and learning topics. In addition, the closer distance from each keyword means it has a stronger relationship.

Historical traces or years of research publications regarding archivist competence in digital curation can be seen through the visualization overlay in Figure 3. Based on Figure 3, we get an overview of the period of the article with the year of publication between mid-2018 to 2020 by giving color gradations ranging from dark blue to yellow. The brighter the colors and visible lines, the more these keywords are used in the relatively new research. Digital curation keywords are widely used in the study with research averages starting from mid-2019 to early 2020, as well as its relation to archivists' competencies that are in the light blue to green period, which is research with an early 2020 timeframe.

Furthermore, density visualization will show research gaps in Figure 4. Based on Figure 4, the thinner and faded the color display, the less frequently these keywords use. It can be a research gap in the topics of digital curation and its relation to archivist competence. These keywords include competencies, learning, cultural heritage, information management, design, data management, data analysis, and career, so these keywords can be an opportunity for further researchers to conduct studies and research more deeply.

RQ2: How much research is relevant to archivists' competencies in digital curation?

Identification and screening results of the search strategy selected 11 articles as relevant articles to the research topics by conducting a quality assessment. The article quality assessment assesses the relevance level of each article to archivists' competencies in digital curation topics. Quality assessment results will get the highest score of 3 and the lowest score of 0. Articles will include as research data if has a minimum score of 1,5 because it is considered to have a relationship between at least two assessment criteria. The assessment shows three articles have a value of 3 (A5, A6, A9), two articles have a value of 2,5 (A1, A7), five articles have a value of 2 (A2, A3, A8, A10, A11), and one article have a value of 1,5 (A4). Based on the quality assessment result, all selected articles are appropriate to be studied more deeply as

research data. The distribution of quality assessment results is shown in Table 1.

Based on the period of 11 relevant articles published in 2018-2022, there are two articles published in 2022 (A10, A11), one article published in 2021 (A9), one article published in 2020 (A8), three articles published in 2019 (A5, A6, A7), and four articles published in 2018 (A1, A2, A3, A4).

Based on the research method, eight articles used qualitative methods (A1, A2, A3, A4, A6, A7, A8, A9, A11), 1 article used quantitative methods (A10), and 1 article used mix-methods (A5). Based on the approach, in articles with qualitative methods, three used a literature review approach (A2, A4, A11), one used a content analysis approach (A1), one used an exploratory approach (A6), one used a grounded theory approach (A9), and three used a case study approach (A3, A7, A8). For research with quantitative methods, one article used a bibliometric (A10). Then for the mix-method research, one article used literature review, content analysis, and case studies (A5). Listed of selected journal articles is shown in Table 1.

RQ3: What are the archivist competencies needed in digital curation?

Based on the analysis of 11 selected articles, there is a synthesis to answer the research questions. There are two dimensions regarding archivist competence in digital curation, namely occupational and personal. Occupational dimensions include cognitive competence and functional competence. Meanwhile, the personal dimensions include social competence and meta-competency. The distribution of archivist competencies in digital curation results can be seen in Table 2.

Cognitive competence is the skills to learn existing and new knowledge about digital curation. These competencies refer to concepts and theories about digital curation through education, and training, or can also be obtained through experience as tacit knowledge. Three articles discuss cognitive competence, namely A1, A5, and A7. Article A1 explains that this competence includes knowledge and the application of knowledge (Feng, 2018). Article A5 indicates that digital curation knowledge consists of the ability to understand the digital curation process through a life cycle approach, standard formats, metadata, principles, and practices of the systems or technologies (Tammaro et al., 2019). The A7 article also explains that digital curators need to have broad knowledge and understanding of technology, digital materials, risks, the origin of preserved data, information architecture, digital object creation contexts, preservation strategies, and user needs (Cushing, 2018).

Functional competencies is an ability that is related to the technical skills needed in digital curation activities. This competency includes mastery of standard formats, metadata, and the use of systems or technologies used in digital curation. Seven articles discuss functional competencies, namely A2, A3, A4, A5, A8, A10, and A11. Article A5 explains that archivists as digital curators must master the technical aspects of data and archive management, such as 1) Data management includes formatting and naming, verification, cleaning, and data conversion processes; 2) Data description and documentation is an activity to create metadata based on vocabulary and standards; 3) Deposit or publishing is a process of storing data to the repository, setting the identifiers, providing data statistics, anonymization, and security; 4) Preservation and archiving (Tammaro et al., 2019). Articles A2, A4, A8, A10, and A11 also explain that an archivist must master technical skills in the ingest, appraisal, selection, storage of digital content, access, and preservation processes (Altenhöner & Nadal, 2022; Broodryk, 2018; DeRidder, 2018; Piotrowski & Marzec, 2022; Shajitha, 2020). Article A3 explains that the functional skills that an archivist in digital curation must have are to ensure that the information collected or created will always maintain accessibility and interoperability through digital technology for the long term (Higgins, 2018).

Social competence is a social skill that must be owned personally in digital curation. These competencies are related to the organization such as data creation, data use, and collaboration where data is stored. Three articles discuss

social competence, namely A5, A6, and A7. Marciano (2018), explains that digital curation is a profession that includes technical skills and public services. The digital curator's role in skill training and outreach must require good communication, instruction, and presentation ability. Articles A5 and A7 emphasize the importance of communication skills (soft skills) including (Cushing, 2018; Marciano et al., 2018): 1) Ability to work with different levels of experience, education, and needs; 2) Skills in teaching and presentation; 3) Ability to design and present the presentations effectively; 4) Ability to prepare training and informational materials; 5) Interpersonal skill and good communication ability; 6) Build collaborative relationships; 6) Build trust with research in a rapidly changing field. Furthermore, article A6 also explains social competence. A Digital curator's responsibility is to run the curation process across units or departments, so it requires the ability to collaborate between individuals in an institution with different areas of expertise. This article also describes digital curators must be able to work in a process regulated by regulation or policy and have technical skills with the technology used (Post et al., 2019).

Meta-competency is a high-level ability needed to perform digital curation that cannot be measured in general. This competency relates to learning, reflecting, and enduring uncertainty ability. A digital curator must have the ability to adapt to a constantly changing environment. 2 articles discuss meta-competency, namely A5 and A9. Article A5 explains that an archivist in digital curation must be able to face all forms of risks and challenges related to changing situations and rapidly outdated technology. These competencies cover the concepts of access and open knowledge, ethics of data sharing, digital data security, intellectual property, and data protection through the force of law (Tammaro et al., 2019). Article A9 describes meta-competency based on a workflow that develops and maintains the process in digital curation practices. Digital curators can use workflows to reflect on and plan the systems, techniques, and tools development of digital curation practices. Digital curation is a sociotechnical work where practitioners can discuss workflows with the wider community of practice for comparison in various institutional contexts (Colin Post & Chassanoff, 2021).

High-level competence is closely related to digital curator ability in managerial tasks as a decision maker. Monitoring digital curation projects is an important activity to plan the process for better project development in the future. These competencies require an economic value to build communication with the potential stakeholder related to digital curation system development. The importance of establishing relationships with stakeholders is one of the reasons why technical and personal skills must be balanced. To be able to achieve the goal of digital curation, digital curators must collaborate with various stakeholders, both internal and external. The practice of digital curation that continues to evolve internationally also demands an understanding of professional networks and communities. It is important to gain views, compare, and harmonize digital curation policies and procedures globally. Knowing the quality standards of practices, services, and systems broadly can be the basis for managerial functions in digital curation to make the best choices or decisions for their organizations.

In addition, it also requires the ability to manage standard metadata, access control, and authentication procedures to ensure security and avoid information threats or digital object corruption. It is necessary to maintain digital curation activities by improving employee skills through education or training so that they can adopt new developments in digital curation easily. All organizational environments must master this ability, both employees and decision makers who can comply with all applicable regulations, procedures, and policies for using and managing digital objects.

E. CONCLUSION

Archivists' competencies in the digital era are divided into four categories. There are cognitive, functional, social, and meta-

competence. As future digital curators, archivists need to combine technical occupational competencies (such as expertise in metadata standards and information organizing), with personal competencies (such as social skills to communicate well and create collaborative relationships). Archivists also must have further related skills to the managerial function as information professionals in the field of digital curation, as well as high-level skills that enable planning for the development of digital curation practices. The findings from a bibliometric analysis indicate that there are 5 clusters of research keywords regarding archivist competence in digital curation. There are still several research topics regarding digital curation that have not been widely studied, including those related to competence, cultural heritages, data management, career, and learning. It can be an opportunity for further research to examine digital curation seen from the topics that are still rarely studied especially the relationship between competence, human resource management, and archivist readiness in terms of regulations, procedures, and policies in managing digital objects.

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FIGURE LIST

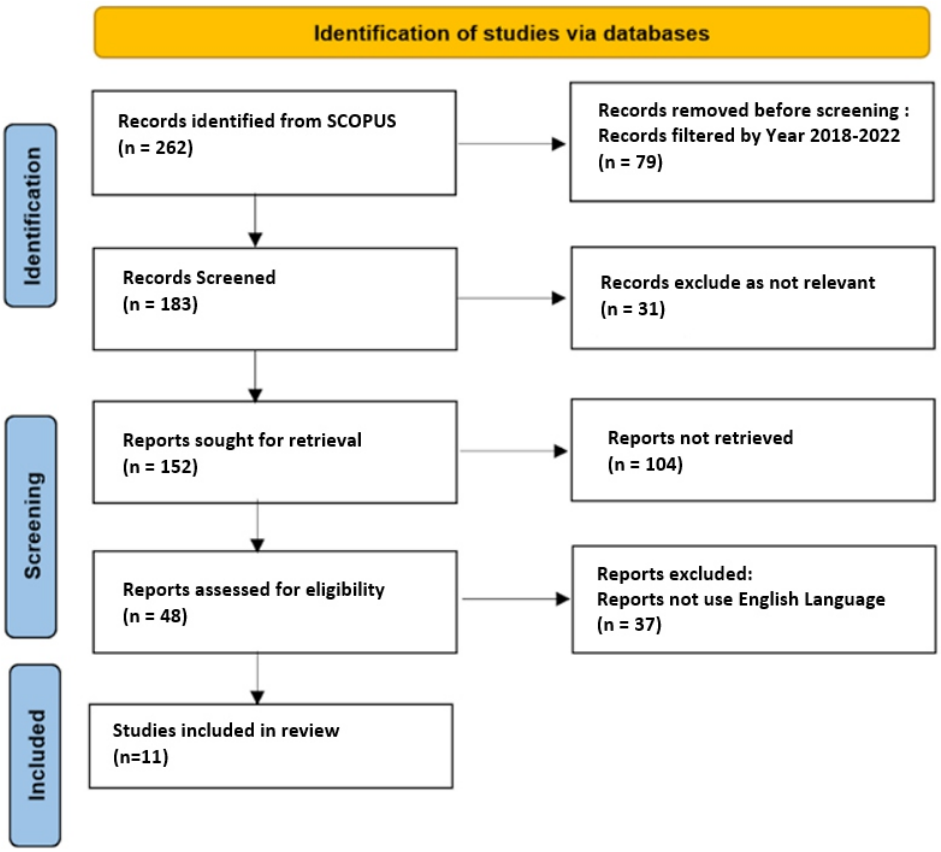

Figure 1. Article Selection Results based on PRISMA Approach
(Source: Research Data, 2022)

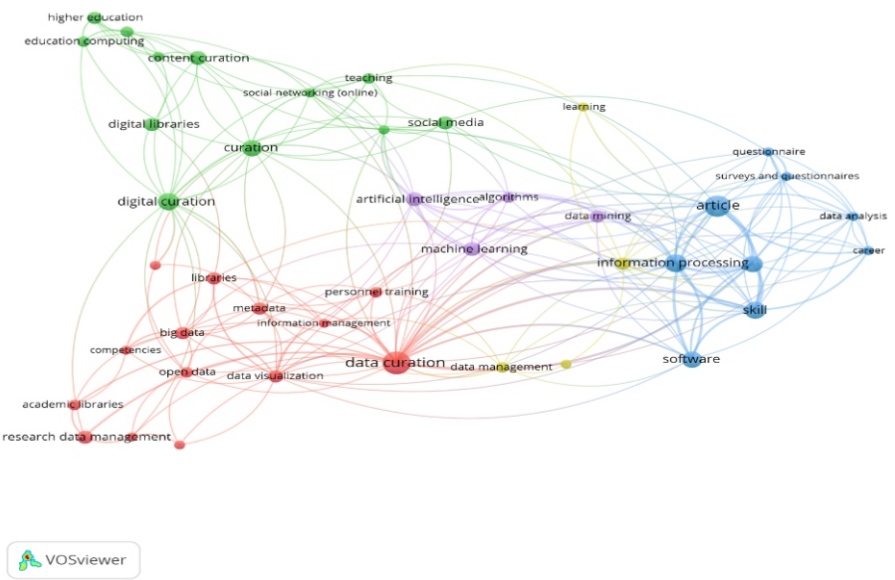

Figure 2. Network Visualization of Keyword Cluster
(Source: VOSViewer, 2022)

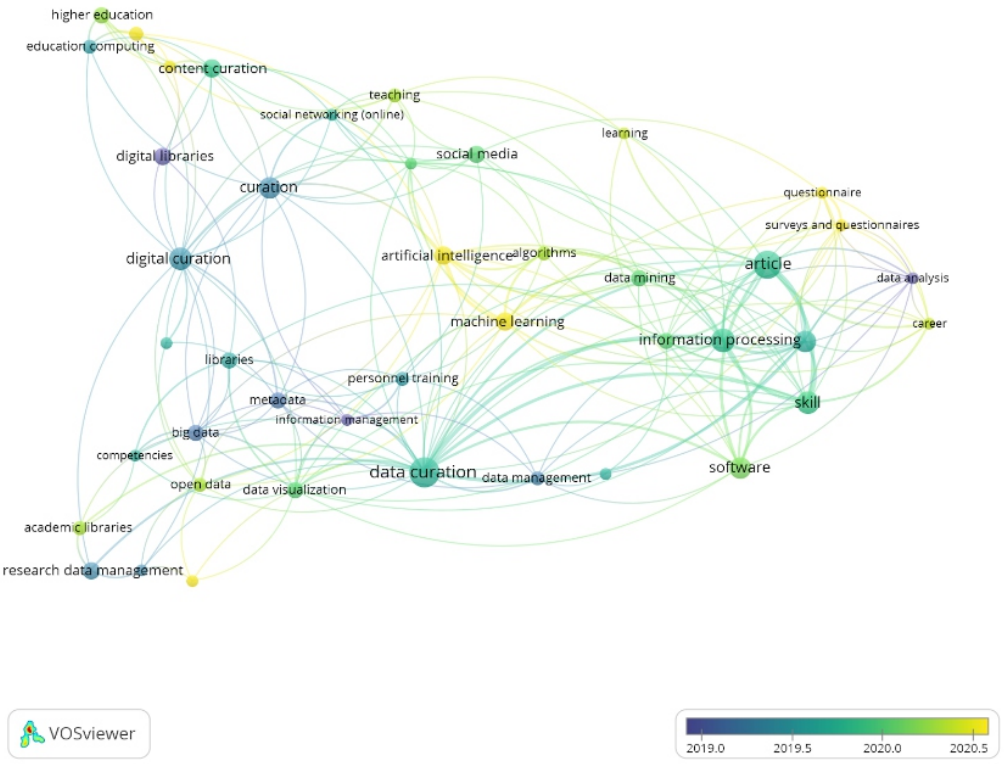

Figure 3. Overlay Visualization
(Source: VOSViewer, 2022)

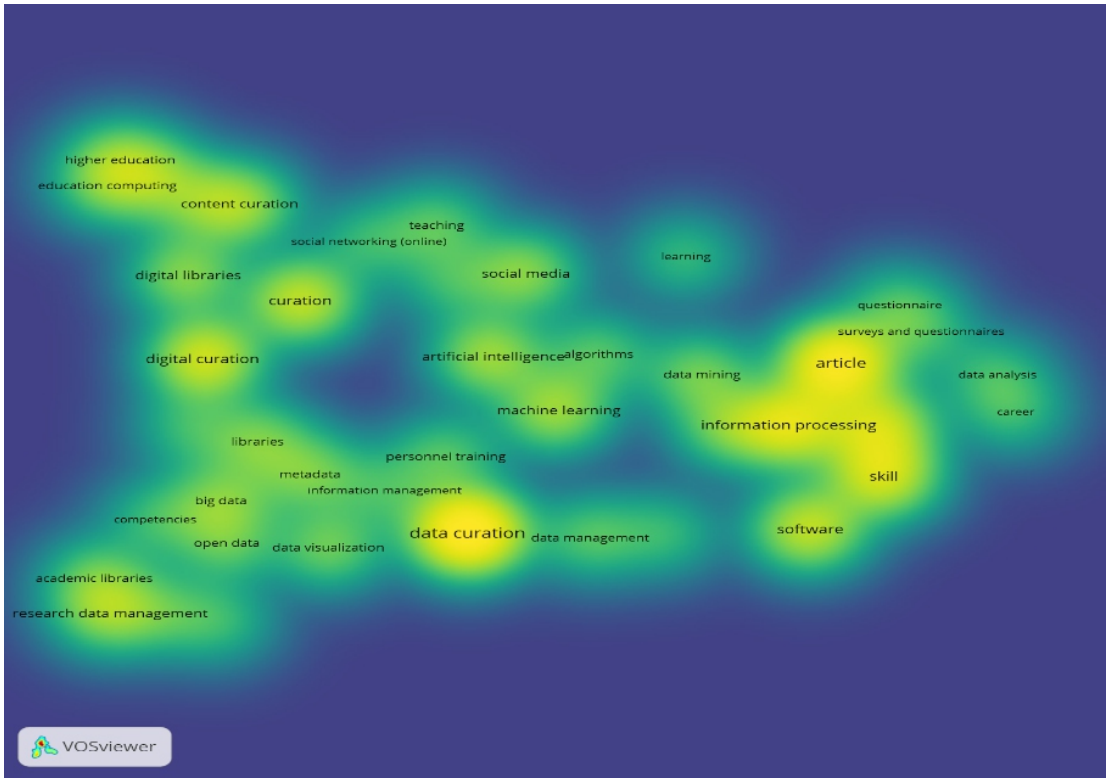

Figure 4. Density Visualization
(Source: VOSViewer, 2022)

TABLE LIST

Table 1. List of Selected Journal Articles

Code	Author	Title	Journal	Year	Method	Quality Assessment Score
A1	Feng, Y., & Richards, L	A review of digital curation professional competencies: theory and current practices	Records Management Journal, 28(1), 62-78	2018	Qualitative	2,5
A2	Chris Broodryk	Documenting performance. The context and processes of digital curation and archiving	South African Journal, 31:2-3, 214-21	2018	Qualitative	2
A3	Higgins, S.	Digital curation: the development of a discipline within information science	Journal of Documentation	2018	Qualitative	2
A4	Deridder, J.L.	Digital curation fundamentals	Journal of Web Librarianship	2018	Qualitative	1,5
A5	Tammaro, A. M.,	Data curator's roles and responsibilities: An international perspective	Libri, 69(2), 89-104	2019	Mix Methods	3
A6	Post, C., Chassanoff, A.,	Digital curation at work: modeling workflows for digital archival materials.	ACM/IEEE Joint Conference on Digital Libraries (JCDL) (pp. 39-48). IEEE.	2019	Qualitative	3
A7	Amber L. Cushing	Digital curation on a small island: a study of professional education and training needs in Ireland	Archives and Records, 40:2, 146-163	2019	Qualitative	2,5
A8	Shajitha, C.	Digital curation practices in institutional repositories in South India: a study.	Global Knowledge, Memory, and Communication, 69(8/9), 557-578	2020	Qualitative	2
A9	Post, C., & Chassanoff, A	Beyond the workflow: archivists' aspirations for digital curation practices.	Archival Science, 21(4), 413-432.	2021	Qualitative	3
A10	Piotrowski, D. M., & Marzec, P	Digital curation and open - source software in LAM - related publications.	Journal of Librarianship and Information Science	2022	Quantitative	2
A11	Altenhöner, R., & Nadal, J.	Preservation storage and curation strategies: Introduction.	IFLA Journal	2022	Qualitative	2

(Source: Research Data, 2022)

Table 2. Archivist Competence in Digital Curation Result

Archivist Competence in Digital Curation	Definitions	Article Code
Cognitive Competency	The skills to learn existing and new knowledge about digital curation.These competencies refer to concepts and theories about digital curation through education, and training, or can also be obtained through experience as tacit knowledge	A1, A5, A7
Functional Competency	The ability is related to the technical skills needed in digital curation activities. This competency includes mastery of standard formats, metadata, and the use of systems or technologies used in digital curation.	A2, A3, A4, A5, A8, A10, A11
Social Competency	These competencies are related to the social skill that must be owned personally in digital curation such ascollaboration in data creation, data use, and data storage.	A5, A6, A7
Meta-Competency	High-level ability needed to perform digital curation that cannot be measured in general. This competency relates to learning, reflecting, and enduring uncertainty ability.	A5,A9

(Source: Research Data, 2022)