International Journal of Information Resource Management (IJIRM)
Volume 3, Number 4 (October, 2026)
E- ISSN: 1118-7786

DIGITAL COMPETENCES AS PREDICTORS OF EFFECTIVE DIGITAL PRESERVATION OF INFORMATION RESOURCES IN THE NATIONAL SPACE RESEARCH AND DEVELOPMENT AGENCY (NASRDA), NIGERIA

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Abstract

Digital preservation has become increasingly important in research institutions because scientific information resources must remain accessible, reliable, and protected for future use. This study examined digital competences as predictors of effective digital preservation of information resources in the National Space Research and Development Agency (NASRDA). A correlational survey research design was adopted. The population comprised 183 staff members drawn from the library, media, ICT, and registry units of NASRDA headquarters and two selected activity centres, and the entire population was used because the size was manageable. A structured questionnaire titled Digital Competences as Correlates of Digital Preservation of Information Resources Questionnaire (DCCDPIRQ) was used for data collection, and a Cronbach Alpha reliability coefficient of 0.99 was obtained for the instrument. Descriptive statistics, Pearson Product Moment Correlation, and multiple regression analysis were used for data analysis. Findings revealed that staff possessed moderate to high levels of digital competence across ICT literacy, information literacy, data management skills, and cybersecurity awareness. Results further showed a significant positive relationship between digital competence and effective digital preservation of information resources ($r = 0.312$, $p < 0.05$). Regression analysis revealed that digital competences significantly predicted digital preservation effectiveness, with data management skills emerging as the strongest predictor ($\beta = 0.341$, $p < 0.05$). The study concluded that digital competences contribute significantly to repository accessibility, reliability, sustainability, and

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preservation efficiency within NASRDA, and recommended continuous professional training and stronger cybersecurity awareness programmes to improve long-term digital preservation practices.

Keywords: Digital competence, digital preservation, ICT literacy, data management skills, cybersecurity awareness, institutional repositories, NASRDA.

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Introduction

Digital information resources have become central to scientific communication, institutional memory preservation, and long-term access to research outputs. Research-driven organizations increasingly depend on digital repositories rather than traditional paper-based systems because digital storage offers wider dissemination and easier retrieval. Growing dependence on digital systems has also raised concerns about repository reliability, technological obsolescence, and long-term accessibility of scientific records. Bamgbose et al. (2025) explained that trustworthiness remains one of the strongest concerns surrounding digital repositories, since sustainable preservation requires systems that maintain integrity and stable access over time. Oberhiri-Orumah and Baro (2022) similarly noted that digital repositories are becoming important instruments for preserving local content and institutional knowledge in Nigeria.

Human competence has gradually become one of the most important factors influencing the effectiveness of digital preservation systems, since technological infrastructure alone cannot guarantee good preservation outcomes. Effective preservation depends on the ability of information professionals to apply ICT literacy, metadata practices, cybersecurity awareness, and data management skills that support sustainable access, retrieval, organization, and protection of digital resources. Sambo et al. (2022) observed that digital literacy skills remain essential for librarians because modern information services require competencies that support organization, retrieval, and dissemination of resources. Areo et al. (2023) explained that preservation activities such as

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digitization and metadata organization cannot function effectively without skilled personnel, while Bamigbola (2021) reported that repository usage among Nigerian lecturers depends strongly on awareness and adjustment factors. These persistent limitations continue to raise concerns about the future sustainability of institutional digital preservation systems in Nigeria.

The National Space Research and Development Agency (NASRDA) is one of the most strategically important scientific institutions in Nigeria because it generates, processes, stores, and disseminates large volumes of digital scientific information, including satellite imagery, geospatial intelligence, and research outputs. Scientific operations within NASRDA depend heavily on digital technologies because space research activities require continuous generation and preservation of sensitive datasets that must remain accessible and reliable over long periods. Effective preservation of these resources therefore requires more than technological facilities; it also depends on the competence of personnel responsible for repository management, metadata organization, and cybersecurity. Odigie et al. (2024) explained that sound metadata practices strengthen discoverability and systematic control of digital resources. Similar concerns apply within scientific agencies such as NASRDA, where poor management of data repositories can weaken institutional memory and threaten long-term accessibility of nationally important scientific records.

Existing studies have contributed significantly to discussions on digital preservation, repository management, and digital literacy within libraries and academic institutions (Torres & Borges, 2024; Zhu et al., 2026). However, empirical investigations examining the predictive relationship between specific digital competence dimensions and

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digital preservation effectiveness within scientific research agencies in Africa remain limited. This study addresses that gap by investigating digital competences as predictors of effective digital preservation of information resources within NASRDA, thereby extending current knowledge beyond university-based repository studies toward scientific research institutions.

The purpose of this study is to examine the predictive influence of digital competences on effective digital preservation of information resources within NASRDA, with specific attention to ICT literacy, information literacy, data management skills, and cybersecurity awareness. Findings are expected to contribute toward strengthening professional capacity development, digital repository sustainability, and policy formulation relating to the long-term preservation of digital information resources within research-intensive institutions in Nigeria and other developing countries.

Research Questions

The following research questions guided the study:

1. What is the level of digital competence among staff of the National Space Research and Development Agency?

2. What is the relationship between digital competence and effective digital preservation of information resources in NASRDA?

3. What is the predictive influence of digital competence on effective digital preservation of information resources in NASRDA?

Hypotheses

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The following null hypotheses were tested at the 0.05 level of significance:

Ho1: There is no significant relationship between digital competence and effective digital preservation of information resources within NASRDA.

Ho2: Digital competences do not significantly predict effective digital preservation of information resources within NASRDA.

Literature Review

Digital Competence in Information Environments

Digital competence has become one of the strongest requirements for managing digital information environments because modern repositories and institutional information systems depend on personnel who possess practical technological abilities. Sambo et al. (2022) argued that digital literacy skills among librarians remain necessary for effective service delivery. Zhu et al. (2026) similarly proposed a professional competency model for university librarians in the digital intelligence era, noting that librarians increasingly require competencies that extend beyond basic digital literacy. Asiri and Finlay (2025) found that public library professionals in England required continuous competency development to keep pace with evolving digital tools.

ICT literacy remains one of the most discussed dimensions of digital competence because preservation systems rely heavily on personnel capable of operating relevant software applications. Sambo et al. (2022) maintained that ICT competence influences the quality of digital information services, while Bamigbola (2021) explained that technological

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awareness and adjustment capabilities affect repository utilization among Nigerian lecturers. Torres and Borges (2024) identified technological competence and project planning ability as key requirements for librarians working within digitally intensive environments. Current literature therefore suggests that ICT literacy functions as an operational foundation for digital preservation.

Information professionals handling digital repositories must also understand how to classify resources, organize records, and maintain consistency, since poorly managed systems create retrieval difficulties and weaken accessibility. Odigie et al. (2024) explained that sound metadata practices improve scholarly visibility and discoverability, while Oberhiri-Orumah and Baro (2022) observed that managing local content within institutional repositories requires adequate professional competence. Badenhorst and Raju (2023) similarly found that South African academic libraries required stronger research data management competencies among staff.

Cybersecurity awareness has become increasingly important in digital preservation discussions because institutional repositories now face continuous threats relating to data breaches, cyberattacks, and unauthorized access. Preservation of digital resources therefore requires personnel who understand cybersecurity principles and repository security management practices. Bamgbose et al. (2025) noted that trustworthiness remains central to repository sustainability, while Lillian (2024) observed that Nigerian libraries face growing cybersecurity challenges and recommended stronger mitigation strategies, staff training, and policy frameworks.

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Digital Preservation Effectiveness

Digital preservation effectiveness has become an important issue within modern information management systems because effective preservation involves more than storing information electronically. Preservation systems must ensure long-term accessibility, reliability, sustainability, and efficiency capable of supporting institutional continuity without loss of authenticity or usability. Bamgbose et al. (2025) argued that repository trustworthiness strongly influences preservation effectiveness, while Anyaoku et al. (2018) found that many university libraries in Africa adopted limited digital preservation practices, with institutional repositories often lacking clear preservation policies and standards.

Accessibility remains one of the strongest indicators of effective digital preservation because repositories exist primarily to keep institutional resources available and retrievable. Odigie et al. (2024) maintained that sound metadata practices improve discoverability because well-organized systems enable easier retrieval of resources. Olatoye (2025) similarly reported that persistent infrastructural, technological, financial, and policy barriers continue to limit digital preservation and access in state-owned university libraries in Southwest Nigeria.

Reliability and sustainability also remain important indicators of preservation effectiveness because institutions require systems capable of preserving resources accurately across periods of technological change and cybersecurity threats. Areo et al. (2023) argued that preservation competencies contribute directly to repository

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sustainability because personnel require practical abilities to maintain digital materials under changing technological conditions. Ashiq et al. (2022) similarly found, in a systematic review of research data management practices, that sustainable data services depend on adequate staffing, training, and institutional policy support.

Relationship Between Competence and Preservation

The relationship between digital competence and digital preservation effectiveness has attracted increasing scholarly attention because institutions now recognize that preservation technologies alone cannot guarantee sustainability without competent personnel. Sambo et al. (2022) observed that digital literacy skills influence information management practices, while Bamigbola (2021) explained that repository usage and adjustment among lecturers depend significantly on awareness and technological understanding.

Socio-technical perspectives further support the argument that repository effectiveness depends on interaction between technological systems and human competences, since preservation infrastructures require continuous human involvement in system management and metadata administration. Oberhiri-Orumah and Baro (2022) explained that managing institutional repository content requires adequate professional capability, while Odigie et al. (2024), Areo et al. (2023), and Badenhorst and Raju (2023) similarly established that structured competency development strengthens repository sustainability and data management practices within academic repositories.

Conceptual Model

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The conceptual model for this study explains the predictive relationship between dimensions of digital competence and effective digital preservation of information resources within NASRDA. The digital competence dimensions examined include ICT literacy, information literacy, data management skills, and cybersecurity awareness, since these areas represent important operational requirements supporting repository administration and long-term preservation. Effective digital preservation represents the dependent variable, since repository sustainability, accessibility, reliability, and preservation efficiency depend significantly on the quality of professional competence within the institution. The present study therefore proposes that stronger digital competences among NASRDA personnel are likely to produce more effective digital preservation outcomes.

Methodology

The study adopted a correlational research design survey because the investigation focused on determining predictive relationships between digital competences and effective digital preservation of information resources within NASRDA. The design allowed statistical examination of measurable variables relating to ICT literacy, information literacy, data management skills, cybersecurity awareness, accessibility, reliability, sustainability, and preservation efficiency.

The population of the study comprised one hundred and eighty-three (183) staff members drawn from the library, media, ICT, and registry units of NASRDA headquarters, Abuja, and two activity centers, namely the Centre for Geodesy and Geodynamics, Toro,

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Bauchi State, and the Zonal Advanced Space Technology Application Laboratory, Kano State. These personnel were selected because they are directly involved in digital information management, repository administration, and preservation of institutional digital resources. The entire population of 183 respondents was used as the sample size because the population was relatively small and manageable, thereby eliminating the need for sampling procedures.

A structured questionnaire titled Digital Competences as Correlates of Digital Preservation of Information Resources Questionnaire (DCCDPIRQ) served as the primary instrument for data collection because the questionnaire method provided measurable responses required for statistical analysis of the relationships between independent and dependent variables. The reliability of the instrument was determined using the Cronbach Alpha statistical technique, which produced a reliability coefficient of 0.99, indicating very high internal consistency and stability of the instrument.

Data collected were analyzed using descriptive statistics, including frequency counts, percentages, mean scores, and standard deviation, for answering the research questions, while Pearson Product Moment Correlation and multiple regression analysis were used for testing the hypotheses and determining predictive relationships between digital competences and effective digital preservation of information resources within NASRDA.

Results and Discussion

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This section presents the results alongside the discussion of findings, organized according to the research questions that guided the study.

Research Question One: What is the Level of Digital Competence among NASRDA Staff?

Digital competence among NASRDA staff was assessed using major dimensions relating to ICT literacy, digital communication, data analysis, problem-solving ability, and digital security awareness. Results are presented in Table 1.

Table 1
Level of Digital Competence among NASRDA Staff (N = 183)

S/N	Digital Competence Variable	Mean (x̄)	SD	Rank	Decision
1	Technical skills	3.42	0.81	1st	High
2	Digital communication and collaboration skills	3.38	0.84	2nd	High
3	Data analysis and interpretation skills	3.31	0.86	3rd	High
4	ICT literacy competence	3.24	0.89	4th	High
5	Information literacy competence	3.18	0.92	5th	High
6	Data management skills	3.11	0.95	6th	High
7	Digital problem-solving skills	2.97	1.01	7th	Moderate
8	Cybersecurity awareness and safety skills	2.88	1.04	8th	Moderate

Note. Source: Field Study (2026).

Results in Table 1 show that technical skills recorded the highest mean score (x̄ = 3.42, SD = 0.81), indicating strong agreement regarding the presence of technical competence among staff. Digital communication and collaboration skills also recorded a

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high mean score ($\bar{x}$ = 3.38), suggesting adequate collaborative competence for repository operations. Cybersecurity awareness and digital safety skills recorded the lowest mean score ($\bar{x}$ = 2.88, SD = 1.04), with a wider spread of responses indicating comparatively weaker competence in this area. Overall, staff generally demonstrated moderate to high digital competence, although a clear gap remains in cybersecurity awareness and advanced problem-solving skills.

Findings therefore demonstrate that NASRDA staff possess foundational technological adaptability necessary for managing digital repositories and supporting preservation activities within a technologically intensive scientific environment. This adaptability is important for repository sustainability because preservation systems continuously undergo software upgrades and technological migration that require personnel capable of adjusting to new demands. Sambo et al. (2022) similarly found that digital literacy competence contributes significantly to effective digital information management. These findings reinforce the view that institutions with technologically competent personnel are more likely to maintain stable repository systems. The comparatively low cybersecurity rating aligns with Lillian (2024), who observed that Nigerian libraries generally require stronger cybersecurity training to protect digital collections.

Research Question Two: What is the Relationship between Digital Competence and Digital Preservation Effectiveness?

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The relationship between digital competence and effective digital preservation of information resources was examined using Pearson Product Moment Correlation, since preservation effectiveness depends strongly on the ability of personnel to manage digital technologies and support long-term accessibility of preserved scientific records. Results are presented in Table 2.

Table 2

Pearson Correlation Analysis between Digital Competence and Digital Preservation Effectiveness

Variable Pair	r	p-value	Decision
Digital Competence Score vs Preservation Effectiveness Score	0.312	0.000*	Significant

*Note. *Significant at the 0.05 level. Source: Field Study (2026).*

Results in Table 2 show that digital competence recorded a correlation coefficient of 0.312 with digital preservation effectiveness, indicating a moderate positive relationship between the two variables. The positive direction suggests that improvements in staff digital competence are associated with corresponding improvements in preservation effectiveness. The probability value of 0.000 indicates that the relationship is statistically significant at the 0.05 level, since the calculated p-value is lower than the accepted significance threshold. Findings therefore support the rejection of the null hypothesis (Ho1), which stated that no significant relationship exists between digital competence and effective digital preservation of information resources within NASRDA.

This finding confirms that digital competence contributes significantly to accessibility, sustainability, reliability, and preservation efficiency of institutional digital

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resources managed within NASRDA. The result corresponds with Areo et al. (2023), who argued that preservation of digital materials depends heavily on professional competencies, and aligns with Bamgbose et al. (2025), who explained that repository trustworthiness depends strongly on management quality and institutional preservation structures. The relationship identified in this study therefore demonstrates that preservation effectiveness depends strongly on human operational capability, since repository infrastructures cannot function effectively when personnel lack sufficient competence.

Research Question Three: What is the Predictive Influence of Digital Competence on Digital Preservation Effectiveness?

The predictive influence of digital competence on digital preservation effectiveness was examined to determine whether competence dimensions possessed by staff significantly predict preservation outcomes within NASRDA, using the coefficient of determination, beta coefficients, and significance values. Results are presented in Table 3.

Table 3
Multiple Regression Analysis Showing Predictive Influence of Digital Competence on Preservation Effectiveness

Variable	Beta (β)	t-value	Sig.
ICT Literacy	0.284	3.117	0.002
Information Literacy	0.263	2.964	0.004
Data Management Skills	0.341	4.012	0.000
Cybersecurity Awareness	0.219	2.538	0.012

Note. Source: Field Study (2026).

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Model Summary

Model Summary	Value
R	0.558
R^2	0.311
Adjusted R^2	0.297
F-value	19.844
Sig.	0.000

Note. Source: Field Study (2026).

Results in Table 3 show that the digital competence dimensions collectively produced a coefficient of determination (R^2) of 0.311, indicating that approximately 31.1 percent of the variation in digital preservation effectiveness was jointly explained by ICT literacy, information literacy, data management skills, and cybersecurity awareness among NASRDA staff. The regression model produced an F-value of 19.844 (p = 0.000), confirming that the model is statistically significant. Data management skills recorded the strongest beta coefficient (β = 0.341, p = 0.000), followed by ICT literacy (β = 0.284), while information literacy and cybersecurity awareness also produced statistically significant predictive contributions. These findings support the rejection of the null hypothesis (Ho2), which stated that digital competences do not significantly predict effective digital preservation of information resources within NASRDA.

The strong predictive influence of data management competence demonstrates that preservation effectiveness depends heavily on the systematic handling of institutional information resources, since repositories containing poorly organized records often experience retrieval difficulties and accessibility problems. Odigie et al. (2024) similarly

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observed that sound metadata practices improve discoverability and scholarly visibility. These findings suggest that scientific agencies operating data-intensive environments such as NASRDA require stronger investment in professional data management competence to support preservation continuity.

Cybersecurity awareness also demonstrated statistically significant predictive influence on preservation effectiveness, since preservation systems remain vulnerable to cyber threats, unauthorized access, and data corruption capable of weakening repository trustworthiness. Bamgbose et al. (2025) explained that repository trustworthiness depends strongly on repository integrity and secure information management, while Lillian (2024) emphasized that Nigerian libraries require stronger cybersecurity mitigation strategies to safeguard digital collections against evolving threats. These findings confirm that sustainable preservation requires personnel capable of both technical competence and cybersecurity awareness and contribute to growing discussions on digital resilience within African information environments, where institutions continue to invest heavily in infrastructure without corresponding attention to competence development.

Recommendations

Based on the findings, the following recommendations are made:

1. Continuous professional training should be organized regularly for librarians, ICT personnel, and records managers to strengthen digital preservation competences and improve repository management practices within the agency.

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2. Digital preservation certification programmes should be encouraged for personnel handling institutional repositories because specialized competence development can improve preservation quality and repository sustainability.

3. Cybersecurity structures and staff awareness programmes should be strengthened continuously to improve data integrity, institutional trust, and protection of scientific digital resources against technological threats.

4. Metadata standardization practices should be implemented across NASRDA digital repositories because consistent metadata structures improve accessibility, discoverability, and long-term management of preserved information resources.

5. An institutional digital preservation policy should be developed and enforced to provide structured guidelines supporting sustainable preservation practices, repository management, and long-term accessibility of institutional scientific information resources.

Conclusion

This study established that digital competences significantly predict effective digital preservation of information resources within NASRDA, since ICT literacy, information literacy, data management skills, and cybersecurity awareness contributed meaningfully toward repository accessibility, reliability, sustainability, and preservation efficiency. Results further demonstrated that preservation sustainability depends strongly on human capacity, since repository systems require competent personnel capable of managing technological infrastructures and protecting digital repositories against operational and technological threats. Technological investment alone therefore remains insufficient for

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sustainable digital preservation, because effective repository management depends heavily on professionally competent personnel.

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