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LIBRARIANS' DIGITAL COMPETENCIES AS CORRELATE OF RESEARCH DATA MANAGEMENT DEPLOYMENT IN UNIVERSITY LIBRARIES IN SOUTH SOUTH, NIGERIA.

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Abstract

Purpose: The study investigated the relationship between librarians' digital knowledge, digital skills and the research data management deployment in universities libraries in South-South Nigeria.

Design/Methodology/Approach: A correlation research design was adopted for the study. Two objectives and two research questions were formulated to guide the study. Two null hypotheses were tested for the study. The population of the study comprised of 218 professional librarians in public universities in south-south Nigeria. The study used census sampling technique to sample all the 218 professional librarians that constitute the population of the study. Three instruments were used for data collection A total of 218 copies of the instruments were distributed to the respondents with a retrieval of 215 achieved. The Pearson product moment correlation coefficient was used as statistical measures for data analysis.

Findings: The result revealed that there was a positive and significant relationship between librarians' digital knowledge, digital skills and research data management deployment in universities in South South Nigeria.

Practical Implication: librarians 'digital knowledge and skills plays a pivotal role in research data management deployment in university libraries in South-South, Nigeria and should be treated as a matter of priority by librarians for the deployment of research data management.

Originality/value: it is recommended that targeted trainings should be organized for librarians to boost their digital knowledge and skills. Librarians should prioritize their use of digital competencies with a view to enhancing their research data management deployment in university libraries in South-South, Nigeria.

Keywords: Research data, research data management, research data management deployment**,** digital knowledge and digital skills.

Paper Type: Empirical research

Introduction

Universities are 'research-centric' as students across undergraduate and postgraduate levels as well as academic members are expected to undertake research as a requirement for graduation and as criteria for promotion. As such, university libraries provide services that help support this

objective. Through such researches or scholarly works, it is expected that members of the university community will contribute to nation building by proffering solutions to societal problems and expanding the frontiers of knowledge. Research, according to Kabir (2016), is a scientific approach of answering question, solving a problem or generating new knowledge through a systematic and orderly collection, organization and analysis of information with an ultimate goal of making the research useful in decision making. Researches catalyse societal transformation, fostering development globally, across various facets of human activity (Igbinovia, Okuonghac and Solanke, 2023). It creates new discoveries and establishes new knowledge which contributes to scholarship. As such, every research is expected to engage with (collect and observe) or produce (generate or create) research data which possesses present and future value.

Research data refers to the information collected, observed, or generated during the course of research project. They are invaluable knowledge assets in an electronic or non-digitzied form generated by the scholarly community in the course of their research process (Ohaji, 2016).

To Essayed and Saleh (2018, p. 2) Research data includes every piece of data acquired and generated during the research process, and may comprise, among others, text, spread sheets, questionnaires, photographs, films, test responses, slides, laboratory notes, statistics, observations, results of experiments, measurements, samples, algorithms, scripts, and workflows.

The research data produced by most universities are increasing by a large proportion. This is because most universities are giving keen attention to scientific research which has become an evaluation criterion for the impact and ratings of universities. The Times Higher Education (2023) affirmed that research, both in volume, income and reputation, is one of the five areas of performance indicators for ranking universities in the world. With the high involvement of universities in research as a stride towards the advancement of knowledge (discovery, innovation and creation), voluminous research data are created which over time becomes difficult to handle. Thus, universities are now heavy on research, which increases their consumption and production of research data, and the consequent need to manage this data. This brought about the concept of research data management.

Research data management (RDM) has begun to receive a recognizable scholarly attention given the 'more data intensive' nature of science and the need to adequately manage such data. In the affirmation of Howie and Kara (2020), the creation of voluminous data and the subsequent demand for proper management by stakeholders have prompted the conceptualization, awareness, acceptance and implementation of RDM. Therefore, RDM involves the deliberate management of activities within the research data lifecycle from data management planning through to improving the visibility and impact of research data in order to increase researcher's profile. A prominent definition of RDM was given by Tenopir, Sandusky, Allard and Birch (2012) as the

storage, access and preservation of data that emanated from scholarly investigations or research works. They further noted that RDM services encompass the data lifecycle of planning, digital curation, metadata creation and conversion. RDM is indispensable as research plays a vital role in universities. Engaging in these processes of research data as a job routine performed to a client or customer is considered as research data management deployment. It is crucial in improving data quality, efficiency, collaboration and better data security in academic universities. Research data management (RDM) deployment involves creating, implementing and maintaining a system for handling research data throughout its lifecycle from data planning to sharing and reuse. It includes establishing research data management plans, employing appropriate tools and technologies, and fostering a culture of data stewardship within a research environment (Wilkinson, Dumontier, Aalbersberg and Appleton, 2016). It is the integration of RDM services such as the storage, organization, access, and preservation of data generated by specific investigations or research initiatives. These services cover the whole data lifecycle, from data management planning through digital curation to metadata development and conversion (Tenopir *et al*. 2014 as cited in Nwabugwu and Godwin, 2020). In their quest to deploy research data management, librarians have begun to provide a range of services in this area and now teach data management to researchers, work with individual researcher to improve their data management practices. These services encompass data repository services and metadata creation (Yoon and Schultz, 2017), research advisory services (Flores et al., 2015), preservation of research data (Bote'-Vericad and Healy, 2022), data storage (Ashiq *et al*, 2020a), research data curation (Darch *et al*., 2020), and research data sharing (Sheikh *et al.,* 2023). When these services are available in an institution or organization, RDM is said to have been deployed.

The aim of deploying RDM is reflected in the central place of data in research lifecycle. Deploying research data management preserves such data from going into extinction. Tripathi *et al*. (2017) stated that data collected during research activities are significant resources that, if properly preserved, may be retrieved, viewed, examined, utilised, and expanded upon in the future for academic work, research, and scientific reasons. Data sharing can assist researchers in reanalyzing, re-evaluating, and revalidating published study findings. Researchers can provide their perspectives, which may aid in the creation of new knowledge.

Research data management deployment is summarized in the data lifecycle of Manu and Gala (2019) and for the purpose of this study, will be adapted as the variables for describing RDMD. They are data management planning, data generation (creation or collection), data analysis, documentation and metadata, data preservation and storage, publishing and sharing, and re-using data. According to Ohaji (2016), research data is ordinarily complex, irreplaceable, costly and laborious to generate. It is indispensable for research organizations to effectively capture, describe,

manage, and make available research data for discovery, sharing and reusing. The propensity to deploy and manage research data has been prompted by the increasingly data-intensive science, an acknowledgement of the critical need for a coordinated and fixated approach to data management, and the need to develop immense potentials for competencies, productivity, and liveability (Ingram, 2019). Therefore, researchers are turning to academic librarians for the management of their data (Masinde *et al,* 2021). They further posit that librarians and researchers reckon that preservation and management of research data ought to be key role of libraries. According to Nwachukwu (2021), librarians may struggle with digital technologies (related to RDM) if they lack current knowledge and technological skills. However, librarians' competency in utilizing digital technologies and applying them is paramount for the deployment of research data management services in this digital driven world.

Digital competency is essential in today's technology-driven world and a critical skill for success in both personal and professional context. With the different technological innovations being developed and the world becoming intensively digital, academic libraries are challenged to adjust to this new paradigm shift. It is therefore, expected that academic librarians learn and also adjust to the rapidly changing environment and acquire competencies to become knowledgeable asset to their libraries. The key competencies for lifelong learning are the combination of knowledge and skills appropriate to the context.

Digital knowledge involves the understanding of the functioning of main computer applications such as, having proficiency in using software application; familiarity with digital platforms and devices; and the ability to navigate the internet. According to Ramirez and Casillas (2018), it is a graduate structure of theoretical knowledge with computers and informational devices. Digital skills however, are the skills needed to use digital devices, communication application and networks to access and manage information. Digital skills (DSs) encompass the capacity to efficiently locate, assess, employ, distribute, and generate content via digital devices, including computers and smartphones. It is much more than proficiency with discrete computer skills. It is the ability to use knowledge about ICT to find, evaluate, organise, develop and present information and creatively apply them (Jacobs and Castek, 2018). Akande (2014) examined ICT skills of library personnel and observed that librarians lacked skills for advanced web based ICT package. Librarians also need skills for data repository (Adeleke, 2016). They need to have skills related to RDMD as they are expected to manage hybrid libraries, specialized in dealing with e-resources and e-databases, develop and manage institutional repositories, curating data from diverse sources. Invariably, librarians who do not have the skills and knowledge to take advantages of digital tools related to RDM services are excluded from the new possibilities offered by these technologies. Therefore, it has become inevitable and imperative that academic librarians in support of the research objective of the university need to acquire digital competencies as its acquisition is expected to

enhance librarians' ability to deploy research data management, implement changes and navigates the complexity of digital librarianship (Abubakar, 2024).

Research data management deployment ensures that the story of a researchers' data collection process is discoverable, understandable and accessible; and making things discoverable, understandable and accessible is a key part of what librarians do. By implication, librarians are expected to possess the required RDMD competencies to serve researchers effectively and credibly throughout the whole data lifecycle (Ahmad, *et al*. 2019). Where such competences are lacking, they are expected to up skill in line with the skills-requirement for the 21st century librarianship to fit in with RDM trend. Chawinga and Zinn (2020) noted that so far, librarians have demonstrated fortitude by embracing new skills in the same way they did when the world abruptly switched from traditional print to digital information resources. However, there is need to empirically ascertain the relationship between such skills and RDM deployment as there seems to be dearth of literature in this regard. This study therefore seeks to examine the relationship between librarians' digital competencies (knowledge and skills) and RDM deployment in university libraries in South-South, Nigeria.

Objectives of the Study

The study determined:

1. the nature of relationship between librarians' digital knowledge and research data management deployment in university libraries in South-south, Nigeria;
2. the nature of relationship between librarians' digital skills and research data management deployment in university libraries in South-south, Nigeria.

Research Questions

The following research questions guided the study:

1. What is the nature of relationship between librarians' digital knowledge and research data management deployment in university libraries in South-south, Nigeria?
2. What is the nature of relationship between librarians' digital skills and research data management deployment in university libraries in South-south, Nigeria?

Hypotheses

The following null hypotheses were tested at a 0.5 level of significance:

Ho1: There is no significant relationship between librarians' digital knowledge and research data management deployment in university libraries in South-south, Nigeria.

Ho2: There is no significant relationship between librarians' digital skills and research data management deployment in university libraries in South-south, Nigeria.

Literature Review

Digital Knowledge and Research Data Management (RDM) Deployment

The "advent of RDM has left the library professionals at the "crossroads," thereby igniting new "interest as well as concerns" and presenting new "opportunities and challenges" to them"(Brochu and Burns, 2019 p.49). In line with the above statement,

deployment of research data management in technologically driven environment is a challenge and will be predicted by the librarians' understanding of digital technologies related to RDM. By implication, librarian's digital knowledge is required to facilitate research data management and its deployment.

Digital knowledge refers to a new condition of knowledge which can be processed and transformed by technological tools. It is the understanding, awareness, or familiarity of something. This align with Ghulam, (2022), that knowledge is a familiarity, awareness, or understanding of someone or something such as facts, information, descriptions or skills, which is acquired through experience or education by perceiving, discovering or learning. Knowledge is an essential asset in the current information and knowledge economy (Enakrire, and Onyancha, 2020). The most required area of technical knowledge is related to Database Management System. This is a software that handles the storage, retrieval and updating of data in a computer system. In order to provide access to data, ensure advocacy and support for managing data, Sheaver (2016), posits that librarians should have knowledge of existing data centers, repositories collections and data discovery mechanism. They should also understand the way data are organized and structured within collections, data licensing and intellectual property issues and metadata.

Deploying RDM in university libraries requires professional metadata specialist with the ability to perform subject analysis and assign subject headings for more expensive metadata creation. Metadata (data about data) is information that describes, explains, organizes, and locates research data to make it easier to access, utilize, and manage. Metadata enables librarians to create link that enhances accessibility of data. Metadata is an essential component of research data and its creation is the responsibility of librarians as their traditional knowledge have positioned them in the development of standardized, rich automated metadata for research purposes. Also the disciplinary knowledge of academic librarian in creation and management of metadata equips them with the responsibility for the curation and preservation of data for its re-use when needed. Baro, Obaro & Aduba (2019) assessed the digital skills possessed by library and information professionals in universities in Africa. They exposed the fact that the librarians' skills in metadata development and library website were rated to be weak and low as such this has affected RDM deployment.

Digital archiving of research data also involves having knowledge of the increasingly sophisticated technologies in digitizing, preserving and providing online access to a variety of research data. Lazorchak (2014) posits that the task which may fall under the responsibilities of digital archiving and preservation with the needed knowledge to work on the tasks include firstly, explaining web archiving to creators. It is therefore imperative to note that librarians' understanding of the technological resources is essential for evaluating their readiness to effectively deploy research data management in this dynamic environment. No wonder Raju (2014) concluded that librarians must possess knowledge of

digitization, metadata creation and management, preservation of digital information and computer skills which are useful to work in online information environments.

Digital Skills and Research Data Management (RDM) Deployment

Digital skills are considered as lifelong skills expected of individuals in the 21st century, and more importantly, [expected of library professionals deploying RDM] (OECD, 2018). They include critical sets of skills needed to participate online, including how to navigate the internet, understand basic web mechanism and safely share information.

In deploying research data management, library professionals are expected to possess these critical skills to fit in a digitally driven environment. To Alex-Nmecha and Onifade (2023), successful deployment of RDM activities, depends on adequate preparation, availability of RDM policy and skills.

Librarians boast of the diverse skills they have acquired and employed in handling digital academic material for decades. As a result, it is suggested that these skills are useful and transferrable to data management, including data curation, preservation, and accessibility (Chawinga and Zinn, 2020b). In affirmation, Cox, *et al*. (2019 p.1433) listed some of the relevant library professionals' skills that can be exported to the deployment of research data management to include "advisory and support services—data advisory services, information literacy—data literacy, management of repositories—data repositories, and metadata management". These skills which are strongly in the domain of library and information professionals, directly or indirectly, are critical to the deployment of research data management. This presumes a correlation between digital skills of library professional and the deployment of research data management. Such connection was emphatically noted by Koltay (2017) when the author averred that data literacy and data management shares close connection. Researchers believe that librarians should play a lead role in data curation (Sayre and Riegelman, 2019), which is an integral part of research data management. There is therefore, need to equip them with core competencies and emerging skills required for the deployment of RDM in the digital environment.

One of the initial stages in every research data management lifecycle is to collect data from primary and secondary sources. Martin, Cadiou and Jannes-Ober (2017) affirmed that in the research data management lifecycle, when after data plan, data collection is the next stage, and it requires collecting new data, converting existing ones and sharing same. This stage is particularly challenging amidst the information overload. Digital skill which is not just about using a software package or using operating system; neither is it concerned with keyboarding skills, instead are the ability to use knowledge about ICT to find (create or generate), develop and present information is instrumental to surmount such hurdle. Individuals possessing such skills, according to Calzada, Prado and Marzal (2013), must be able to select and synthesize data, as well as combine it with other information and existing knowledge. They

also must be able to identify the importance of the data source and be knowledgeable with data types and formats.

Studies have shown that variables like digital skills are influencing factors that impacts individual's capacity to utilize EIRs from which research data may be created (Prangya and Rabindra, 2017). It is also worth emphasizing that a lack of digital skills could restrict one's capacity to efficiently locate and utilize essential data/information ethically. First, data literacy is at the heart of every RDM endeavour, and secondly, data repositories and metadata management is crucial for data storage and preservation. Another aspect of RDMD which is influenced by digital skills is data curation which is the process of creating, organizing and maintaining data sets for easy access and usage. While publishing and sharing of research data is an important component of the research data management lifecycle (Martin, *et al*., 2017), ability to use technological tools aids in achieving this component as it has been revealed to have a significant impact on research productivity (Ekong and Ekong, 2018).

Digital skills are now been expanded to include data management and data curation and data literacy. The definition of data literacy (the ability to process, sort, and filter vast quantities of information, which requires knowing how to search, how to filter and process, to produce and synthesize) shares the same characteristics with digital skills. Thus, digital skills expand the capacity of librarians to manage data which is the crux of research data management deployment. Sadly, these librarians who recognize this importance may not be adequately prepared due to lack of necessary skills to engage in RDM practices. This is seen in Ayogu & Okafor (2015) study on digital skills of librarians in Nigeria which indicated their inabilities in processing data base management and evaluate and curate e-resources. Apparently, digital skills became very important aspects in today's university libraries and librarians need to be fully equipped with it and prepare themselves for the technological challenges ahead.

Methodology

The study employed the descriptive correlational research design to guide the research process.The population of this study was 218 professional librarians across 16 public universities in South-South region of Nigeria. The study used census sampling technique to sample all the 218 professional librarians that constitute the population of the study. Three instruments were used for data collection. These instruments include researcher's designed cognitive test titled Digital Cognitive Test (DCT); Achievement test titled Digital Skill Achievement Test (DSAT), and Research Data Management Deployment scale (RDMDS) which is a self-developed scale to access how well research data is been deployed in the libraries understudy using items generated across the RDM cycle. Data obtained from the study was analysed using Pearson's product moment correlation coefficient while the corresponding null hypotheses were tested using p-value of correlation at 0.05 alpha level.

Results and Discussion

Research Question 1: What is the nature of relationship between librarians' digital knowledge and research data management

deployment in university libraries in South-South, Nigeria?

Table 1: Pearson r on Relationship between Librarians' Digital Knowledge and Research Data Management Deployment in University Libraries

Source of Variation	n	R	Remark
Librarians' Digital Knowledge Research Data Management Deployment	215	0.514	Moderately Positive Relationship

Data in Table 1 show that there is a moderately positive relationship existing between librarians' digital knowledge and research data management deployment in university libraries in South-South, Nigeria. This is evident by the size of Pearson's Correlation Coefficient r, which is 0.514.

Research Question 2: What is the nature of relationship between librarians' digital skills and research data management deployment in university libraries in South-South, Nigeria?

Table 2: Pearson r on Relationship between Librarians' Digital Skills and Research Data Management Deployment in University Libraries

Source of Variation	n	R	Remark
Librarians' Digital Skills Research Data Management Deployment	215	0.319	Low Positive Relationship

Data in Table 2 show that there is a low positive relationship existing between librarians' digital skills and research data management deployment in university libraries in South-South, Nigeria. This is evident by the size of Pearson's Correlation Coefficient r, which is 0.319.

Hypothesis One: There is no significant relationship between librarians' digital knowledge and research data management deployment in university libraries in South-South, Nigeria.

Table 3: Test of Significance of Pearson Correlation between Librarians' Digital Knowledge and Research Data Management Deployment in University Libraries

Source of Variation	n	n	R	p-value	Remark
Librarians' Digital Knowledge	215		0.514		

Research Data Management Deployment	0.01	Sig

Analysis in Table 3 shows that there is a significant relationship between librarians' digital knowledge and research data management deployment in university libraries in South-south, Nigeria. The calculated r (0.514) has *p*-value <0.05. The null hypothesis one is therefore rejected.

Hypothesis Two: There is no significant relationship between librarians' digital skills and research data management deployment in university libraries in South-South, Nigeria.

Table 4: Test of Significance of Pearson Correlation between Librarians' Digital Skills and Research Data Management Deployment in University Libraries

Source of Variation	n	n	R	p-value	Remark
Librarians' Digital Skills Research Data Management Deployment	215		0.319	0.04	Sig

Analysis in Table 4 shows that there is a significant relationship between librarians' digital skills and research data management deployment in university libraries in South-south, Nigeria. The calculated r (0.319) has *p*-value <0.05. The null hypothesis two is therefore rejected.

Discussion of Findings

Relationship between Librarians' Digital Knowledge and Research Data Management Deployment in University Libraries

The finding of the study revealed that a moderately positive relationship existed between librarians' digital knowledge and research data management deployment in university libraries in South-South, Nigeria. This indicates that the level of digital knowledge of librarians is related to the extent of research data management services deployed. Thus, librarians who are knowledgeable in digital matters are motivated to utilize digital tools and the logical consequence will be research data management deployment. The result of the study also revealed that the relationship between librarians' digital knowledge and deployment of research data management was significant. This implies that for academic librarians to deploy research data management services, they must possess adequate digital knowledge. The findings of the current study are consistent with those of Raju (2014) concluded that librarians must possess knowledge of digitization, metadata creation and management, preservation of digital information and computer skills which

are useful to work in online information environments. Apparently, librarians' digital knowledge considerably contributes to their research data management and by extension, effective service delivery to library patrons. This position is further corroborated by Sheaver (2016) who posited that librarians are expected to possess knowledge of existing data centers, repositories collections and data discovery mechanism. Evidently, digital knowledge in research data management services is key to efficient data handling, collaborative research, curation of data, data sharing, compliance with polices and advancing research impact. In discussing the most required areas of the digital knowledge essential in library services including RDM services. Similarly, Brochu and Burns (2019 p.49) noted that the "advent of RDM has left the library professionals at the "crossroads," thereby igniting new "interest as well as concerns" and presenting new "opportunities and challenges" to them". Thus, librarian's digital knowledge is a necessity for research and integration of research data management.

Relationship between Librarians' Digital Skills and Research Data Management Deployment in University Libraries

The finding of the study revealed that a low positive and significant relationship existed between librarians' digital skills and research data management deployment in university libraries in South-South, Nigeria. In other words, the more digitally skilled librarians are, the greater the tendency for them to deploy research data management in university libraries. This could be attributed to the fact that effective research data management in contemporary times is better achieved with the use of digital tools. However, the opposite turns out to be the case when there is a decrease in the abilities to operate these digital technologies as lamented by Baro, Obaro & Aduba (2019) who assessed the digital skills possessed by library and information professionals in universities in Africa. They exposed the fact that the librarians' skills in metadata development and library website were rated to be weak and low as such this has affected RDM deployment. In line with findings of the present study, Alex-Nmecha and Onifade (2023) observed that successful research data management (RDM) activities, depends on adequate preparation, availability of RDM policy and digital skills. Put differently, possession of digital skills is a significant contributor to the deployment of research data management. In similar vein, Chawinga and Zinn (2020b) found that digital skills are useful and transferrable to data management, including data curation, preservation, and accessibility. In affirmation, Cox, *et al*. (2019 p.1433) listed some of the relevant library professionals' skills that can be exported to the deployment of research data management to include "advisory and support services—data advisory services, information literacy—data literacy, management of repositories—data repositories, and metadata management". These skills which are strongly in the domain of library and information professionals, directly or indirectly, are crucial to the management of research data. This presumes a correlation between digital skills of library professional and the deployment of research data management. The finding of the present study is further in agreement with that of Prangya

and Rabindra (2017) that variables like digital skills are influencing factors that impacts individual's capacity to utilize EIRs from which research data may be created. Therefore, to be able to provide effective RDM services, librarians should increase their digital skills. Also from the findings, there was an indication that some of the librarians' digital skills in RDM services are still at the low level. This finding supports Akande (2014) that examined ICT skills of library personnel and observed that librarians lacked skills for advanced web based ICT package. Ayogu & Okafor (2015) that conducted a study on digital skills of librarians in Nigeria also indicated their inabilities in processing data base management and evaluate and curate e-resources. The inability of librarians to manage the database and evaluate e-resources has resulted in poor deployment of RDM services in some libraries.

Conclusion

Understanding the effect of digital competencies is crucial for deploying RDM. Therefore, academic librarians are expected to show high level of competency in utilizing digital technologies, managing and integrating research data and employing tools for data discovery and analysis as they are expected to manage hybrid libraries, specialized in dealing with e-resources and e-databases, develop and manage institutional repositories, curating data from diverse sources. it was concluded that a positive relationship existed between librarians' digital competencies and RDM deployment in university libraries in South South, Nigeria. Finally, the study concluded that relationship between librarians' digital competencies and RDM deployment in university libraries in South South, Nigeria is significant.

Recommendations

1. Librarians should prioritize their use of digital competencies with a view to enhancing their research data management deployment in university libraries in South-South, Nigeria. They should sustain and improve their acquisition of digital knowledge for research data management deployment in university libraries in South-South, Nigeria.

2. University management particularly university librarians should ensure a continuous training and re-training of academic librarians to acquire more knowledge and skills needed for RDM services. This could be through workshops, seminar, formal training/ retraining on the latest facilities and skills related to research data management practices. Librarians should endeavour to acquire the requisite digital skills for research data management in university libraries in South-South, Nigeria.

3. University authorities should make available funds to organize these training and to provide the necessary facilities needed for its functionality; this will exude a high positive attitude on librarians' to digital literacy which invariably will enhance their research data management deployment in university libraries in South-South, Nigeria.

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