

ASSESSING THE AWARENESS AND ADOPTION LEVELS OF CLOUD COMPUTING IN CONSTRUCTION PROJECTS

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Abstract

This study aims to assess the existing status and awareness of cloud computing applications in construction project delivery in Rivers State, Nigeria. A comprehensive survey including 221 construction professionals was executed utilizing a standardized questionnaire. The results of our study indicate that 38.7% of respondents are very uninformed about the awareness of cloud computing applications in building projects. Of the respondents, 11.8% are unfamiliar of cloud computing, 31.9% lack awareness, and a mere 4.6% possess a high level of awareness regarding the implementation of cloud computing in building projects. This clearly indicates that practitioners lack awareness of cloud computing and its application in building project delivery. The figure of 35.7% signifies that the majority of respondents strongly concur that Cloud computing has a promising future in building project delivery. Of the 82 respondents, 34.5% completely concur with this argument. (10) and (35) represent 4.2% and 14.7% of respondents who disagreed and strongly disagreed with this proposition, respectively. A significant majority of participants reported having limited expertise (0–2 years) with cloudbased technology for project execution. The low adoption rate indicates a more profound issue encompassing infrastructural deficiencies, inadequate information exchange, and organizational discrepancies. A substantial investment in ICT infrastructure and capacity building for small- and medium-sized construction firms is advisable; government and private stakeholders should actively engage in sensitization campaigns to enhance awareness and practical advantages of cloud technologies; and there should be heightened advocacy and research support from professional construction organizations to close the knowledge gap and facilitate strategic technology adoption.

Keywords: Awareness; Cloud Computing; Construction Industry; Rivers State.

Introduction

Cloud computing has emerged as one of the most inventive approaches to managing and processing massive volumes of data. It is more adaptable, scalable, changeable, and costeffective than traditional methods. Emerged in the mid-twentieth century, when early conceptualizations of computing as a type of public service emerged (Nnadi, 2025; Sloniec, 2015), and in the late 1990s, when the concept of cloud computing emerged as a foundation for computing services limited not by technological but by economic justification (Sloniec, 2015). The technology, which consists of networks of distributed computers such as data centers and servers operating to provide on-demand services and resources on the Internet (Abedi, Fathi, & Rawai, 2013), has seen rapid adoption, particularly since the significant partnership of technological giants such as IBM and Google in 2007. Its business model underpins its key point of value,

which is on-demand computing capacity with simple implementation, little maintenance requirements, fewer IT staff, and low prices (Almada-Lobo et al., 2016; Nnadi, 2025).

The construction sector, which is dynamic and complicated, can be reinvented by utilizing cutting-edge technology like cloud computing. Cloud computing usage and exploitation have also become interesting areas in civil engineering and construction, as real-time access to critical project information is made available, and cross-border teams can be formed more easily, streamlining workflows and improving communication and coordination. This is especially critical in an industry where inefficient information management has historically resulted in project cost and schedule overruns, project abandonment, litigation, and client discontent (Afolabi, Ojelabi, Fagbenle, & Mosaku, 2017). Studies have shown that wellmanaged information may alleviate these difficulties the majority of the time, especially because the business has traditionally relied on paper-based information routes. Despite its obvious benefits, cloud computing is underutilized in the construction business, particularly in underdeveloped locations such as Rivers State, Nigeria. This is not a poor uptake because the estimated future potential is low. Many practitioners have expressed a strong (62%) or moderate (33%) view that cloud computing has a future in the delivery of building projects. Nonetheless, nearly half of those asked demonstrate a significant level of ignorance, as seen by the majority of respondents' lack of awareness of the current state and use of cloud computing in building. The latter is consistent with the findings of Odeh et al. (2017), who indicate that awareness is the first stage in new technology adoption and is closely related to adoption rates. Furthermore, cloud-related activities in construction project delivery are still in their early stages of development, with the majority of construction practitioners (85.07%) having only been exposed to this technology for 0-2 years.

Those forces that fight the widespread use of cloud computing in the context of delivering construction projects are quite complex, and include political intricacy because of global borders, the problem of data privacy and security level, latency, the issue of reliability, the outlines of electric power, bad broadband networks, high prices of internet access, and the inefficiency of top management to support cloud computing, and the distrust of the cloud provider. These difficulties are worsened by the complexity of migrating existing systems to the cloud, as well as the need for a change in the IT organizational structure. The realization of such barriers is especially important in light of Nigeria's ambitious cloud computing market growth rate of up to \$450 million by 2030 and the provision of more than half a million jobs in Rivers State (Alaloul et al., 2020; Nnadi, 2025). The researcher's goal in the proposed study is to assess how cloud computing is employed in construction project delivery in Rivers State, Nigeria, as well as how existing practitioners understand this technology. After determining the issues and understanding the divergence of views between representatives of different professional associations, the current research aims to provide practical information that may allow implementing this innovative technology even more widely, thus improving the efficacy of the projects, their transparency, and industry competitiveness in general.

Literature Review

Cloud computing is a game-changing technology in a variety of industries, and it essentially provides computing power on-demand via the internet. It is especially suitable to data-intensive industries like construction, where it has the ability to boost efficiency, reduce costs, and foster collaboration (Abedi, Fathi, & Rawai, 2013). Cloud-based solutions can be extremely beneficial to the construction sector, which is decentralized, has teams working across regional boundaries, and handles massive amounts of heterogeneous data (Bello et al., 2021). Historically, the construction sector struggled with information generation, flow, and storage, resulting in cost and schedule overruns, project abandonment, and disputes (Afolabi et al., 2017). Cloud computing could be considered as a way out of this predicament because it allows one to reestablish centralization of information and cooperation inside the project, as well as improve project management as a whole (Sloniec, 2015).

Defining Cloud Computing and its Service Models

Cloud computing is simply the construction of computer application software over the internet, where data is saved on a remote server that is easily available to everybody, rather than locally (Mandiczak, Mesaro, and Kozlovskaja, 2016). It provides a flexible and adaptable data storage environment that meets the business's growth requirements (Ebejer et al., 2013; Nwafor, 2022). Cloud computing services can be broadly classified into three key models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) (Garyaev & Rybakova, 2018; Jin et al., 2010).

Infrastructure as a service (IaaS)

IaaS allows customers to rent only the computer resources they need from a cloud provider, such as processing power, storage, operating systems, and networking elements (firewall or middleware) (Mandiczak, Mesaros, and Kozlovskaja, 2016). Such companies include Amazon Web Services (Abedi, Fathi, & Rawai, 2012). Compared to traditional computing technologies, the paradigm is more flexible and cost-effective because it provides virtualized resources via the internet rather than actual data centers and servers (Kineber et al., 2022; Ogundipe, 2024). It will assist financial institutions in consolidating IT resources in a scalable and flexible manner at the most cost-effective pricing (Ogundipe, 2024).

Platform as a Service (PaaS)

PaaS also provides a hosting environment for applications, allowing customers to design and run their own apps without having to handle hardware, operating systems, or network infrastructure (Mandiczak, Mesaros, Kozlovskaja, 2016). The most popular are Google AppEngine and Microsoft Azure (Garyaev and Rybakova, 2018). PaaS solutions typically improve process efficiency by automating many operations and shortening processing times (Bediako-Kyeremeh, Duorinaa, & Agyemang, 2019).

Software as a Service (SaaS)

SaaS allows the service consumer to access an application provided by a provider without having to handle the operating system, hardware, or network infrastructure. Services are licensed on demand, most

commonly through subscription or pay-as-you-go models. Some popular ones are Zoho Office, Microsoft Windows Live, and other Google programs such as Gmail and Google Docs (Abedi et al., 2012). SaaS allows scalable access to both computer services and resources, integrating hardware and software to be used anywhere through the internet, which is highly important in the spread of IT resources in such an industry as construction (Mandichak, Mesaros, & Kozlovska, 2016).

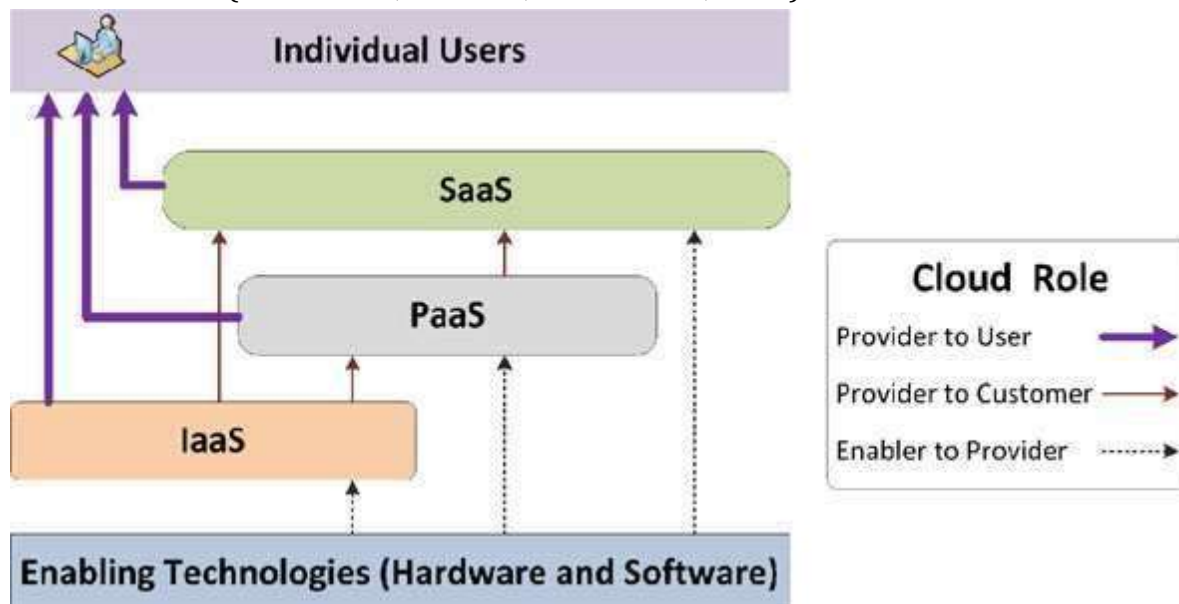


Figure 1: Cloud services and cloud roles

Models of cloud computing types

In addition to the service models, the deployment models of cloud computing may be distinguished as well.

1. Public Cloud Computing

Public clouds are often run in public data centers with large memory spaces and pay-per-use models. The general public has access to the services, which are owned, hosted, and maintained by providers such as Amazon Web Services, Microsoft Azure, and Google Cloud Platform (Mandiczak, Mesaros, and Kozlovska, 2016). This model reduces the maintenance burden on the customer, making it cost effective (Mandiczak, Mesaros, and Kozlovska 2016).

2. Private Cloud Computing.

Private organizations own and run private clouds, which are typically housed in their own data centers. Mandičák, Mesároš, & Kozlovská (2016) suggest that large enterprises with special data control demands choose dedicated solutions that provide high privacy, customizability, and security for a single end-user. Despite being hosted by a third party, the organization retains administrative control (Mandičák, Mesároš & Kozlovská, 2016).

3. Community Cloud Computing.

4. Hybrid Cloud Computing.

The diagram illustrates a cloud-based BIM project collaboration architecture. It features a central **Public Cloud** and a **Private Cloud** associated with a **Project Manager**.

Public Cloud Applications:

- Scheduling:** App 1 v.1, App 1 v.2, App 2
- Costing:** App 1, App 2
- Structural Analysis:** App 1, App 2
- Document:** App 1, App 2
- Energy Simulation:** App 1, App 2
- CAD:** App 1, App 2 v.1, App 3, App 2 v.2

Private Cloud: Contains a **BIM** database.

Participants and Interactions:

- New project participant (1):** Connects to the Public Cloud (2) via the URL `http://xxxx.xxx/xxx/app2_2?loc=xxxx`.
- Project Manager (4):** Connects to the Public Cloud (4) via the URL `http://xxxx.xxx/xxx/app2_2?loc=xxxx`.
- Usage-based bills (5):** Generated from the Public Cloud.
- Location-based Access:** The Project Manager's Private Cloud (5) is linked to the Public Cloud's CAD application (3) via a location-based URL (`loc=xxxx`).

Figure 2: Flow diagram of cloud computing in construction project management (Mandičák et al., 2016).

Theoretical review

The study is based on the Diffusion of Innovation (DOI) theory and the Technology Acceptance Model (TAM) (Abstract, page 1). These theories provide a perspective on cloud computing awareness and adoption in the construction sector.

Technological Acceptance Model (TAM) Davis proposed TAM in 1989, which focuses on perceived usefulness (PU) and perceived ease of use (PEOU) as main predictors of technology acceptance (Mondego

& Gide, 2022). TAM is commonly used to predict technology adoption in a variety of industries, including construction (Nnaji et al., 2023). According to the model, if consumers believe technology is valuable and easy to use, they are more likely to accept it (Mondego & Gide, 2022; Saputra & Darma, 2022). The poor knowledge found in Rivers State shows that practitioners may not yet recognize the full utility or simplicity of use of cloud computing, impeding its adoption.

1 Technological Acceptance Model (TAM)

Davis's (1989) postulation, commonly known as TAM, posits that the adoption of new technology contains two very important principles: the user's perceived usefulness (PU) and perceived ease of use (PEOU). It is the acts of constructing organizations in consuming cloud platforms that have received the most enthusiastic input from professionals who believe that cloud platforms are straightforward and effective in project management. For example, a builder may realize that a cloud-based project management system could be valuable in tracing real-time materials but fail to implement it because it is perceived to be complex and cumbersome.

The TAM has been comprehensively used by other authors in investigating cloud computing in the construction sector (Kineber et al., 2022), and the conclusions indicated that the user attitude toward this tool, the level of making IT litigation, and the support of the organization are critically significant in boosting adoption rates.

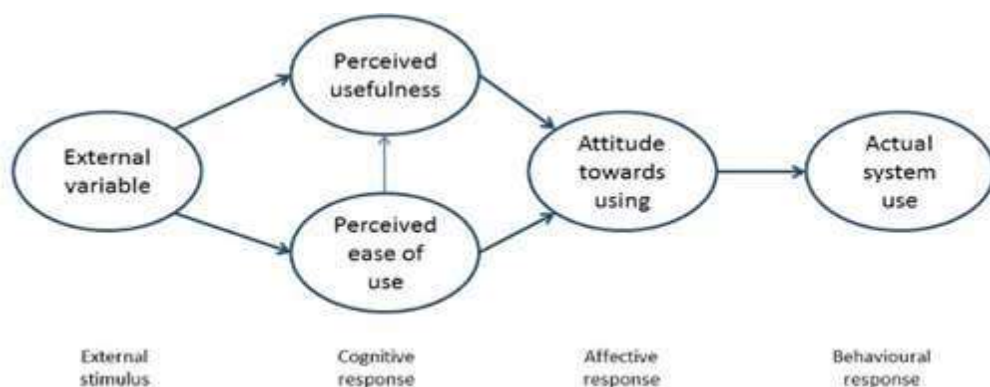


Figure 3: Technology Acceptance Model (Mondego & Gide, 2022)

Empirically, Oluwasanmi (2014): Nigerian IT Sector Awareness Gap Study: Surveyed IT professionals and cloud users in Nigeria. Key finding suggested that Only 15% of respondents understood cloud computing's application in construction. Relevance Highlights systemic awareness deficits in Nigeria's professional base, exacerbated by insufficient outreach from service providers. Afolabi et al. (2017): Cost vs. Innovation Priorities study analyzed economics of cloud-based technologies in Nigerian construction with key finding of 78% of firms prioritized cost over innovation, perceiving cloud solutions as "financially risky" despite long-term savings. Relevance reveals a critical misalignment between perceived costs and actual benefits, stifling awareness. Nwafor (2022): Rivers State-Specific Awareness Audit Study Surveyed 221 construction

professionals in Rivers State. Key findings of 70.6% were "unaware" or "very unaware" of cloud applications. Only 4.6% reported high familiarity while 91% had ≤ 2 years of hands-on cloud experience with relevance that quantifies severe local awareness gaps and links them to minimal practical exposure. Omer et al. (2023): Infrastructure as a Barrier Study: Assessed cloud adoption barriers in Nigerian sustainable construction with key finding Unstable power (cited by 89% of respondents) and broadband penetration $< 30\%$ directly hindered awareness and access. Relevance identifies infrastructure deficits as foundational to low awareness in Rivers State. Odeh et al. (2017): Developing Nations' Education Sector Study also investigated cloud adoption in Jordanian universities with key finding showing only 32% of professionals demonstrated operational familiarity with cloud tools, attributing this to "inadequate training programs." Relevance with Parallels Rivers State's education-practice gap, emphasizing training's role in building awareness. Kimber et al. (2022): Human-Centric Drivers Study: Modeled cloud implementation drivers in Nigerian construction with key finding: "Human satisfaction" (e.g., ease of use, perceived value) was the strongest predictor ($\beta = 0.87$) of cloud adoption intent. Relevance Confirms that awareness interventions must address usability perceptions to trigger adoption.

Methodology

The approach utilized to achieve the first objective of this research is presented in the next section: to assess the current condition and level of awareness of cloud computing applications in construction project delivery in Rivers State, Nigeria. The technique involves the research design and study population, the sampling method, the data collection instrument, and data analysis procedures appropriate for achieving this goal (Nnadi, 2025).

The primary research approach used in this study was a descriptive survey research design. The design was chosen as the best tool for assessing the current state and level of awareness, as well as collecting data on the characteristics of a population or phenomenon. The survey approach was utilized to collect responses to questions from a representative sample of construction professionals, providing insight into what this group knew and felt about cloud computing in their industry. This design is consistent with the purpose of analyzing the existing state of cloud computing applications and awareness in Rivers State's construction industry. The population of the study included all professionals working in the construction business in Rivers State. This comprised project managers, quantity surveyors, civil engineers, builders, architects, and other associated experts, whose information was collected from the state's professional bodies. The overall population was identified as 547 professionals. To pick a representative subset of this population, a purposeful sampling technique was first used. The sample size, however, was determined using Slovin's formula. With a total population (N) of 547 and an anticipated error margin (e) of 0.05 (5%), the sample size (n) was computed as 231 respondents. Of the 231 questionnaires distributed, 224 were returned, and 221 were deemed useful for final analysis, suggesting a good response rate. The major data collection tool was a well-structured questionnaire. This questionnaire was created to gather information about the respondents' awareness of cloud computing, adoption rate, and perceived problems in

construction project delivery. The questionnaire featured multiple-choice questions with the option to select one or more answers, as well as open-ended responses to capture respondents' perceptions of cloud computing. Data was gathered via a combination of physical distribution and online approaches (by email), augmented with personal observations and trips to construction sites. This multi-modal approach sought to maximize reach and elicit full perspectives from the target audience.

To examine data about the current state and level of awareness of cloud computing, descriptive statistical approaches were mostly used. Frequency distribution tables, figures, and charts were used to present the results. For example, the study calculated the proportion of respondents who were "extremely uninformed," "unaware," "neither aware," "aware," or "very aware" of cloud computing applications in construction. This method provides a direct and interpretable assessment of the construction professionals' awareness landscape in Rivers State. This methodical approach assures that the assessment of cloud computing awareness is robust, statistically valid, and directly fulfills the initial goal of the research, offering foundational insights for further assessments of problems and variations in opinion.

Results

The questionnaire included questions and information about awareness levels in building project delivery. Data were gathered from past study works and resources, as well as a quantitative technique using physical and online questionnaire forms. This information was gathered from construction specialists at several construction firms in Rivers State. Primary data were collected through the distribution of questionnaires and interviews and measured using a 5-point Likert scale, while secondary information was gathered from various internet publications, books, journals, magazines, and other published and unpublished documents. The survey questionnaire was delivered to construction firms throughout Rivers state via email and in-person distribution to various specialists. The data collection exercise lasted about four weeks, and it included contacting other construction firms to solicit expert opinions from project managers, quantity surveyors, builders, civil engineers, architects, and other professionals working on various construction projects throughout the state. The demographic parameters of the respondents were evaluated using a basic percentage method and charts. This technique was chosen based on the survey data and the assumptions made about the background population. Data was processed using statistical tools. Data analysis was based on 221 responses after the returned questionnaire was sorted.

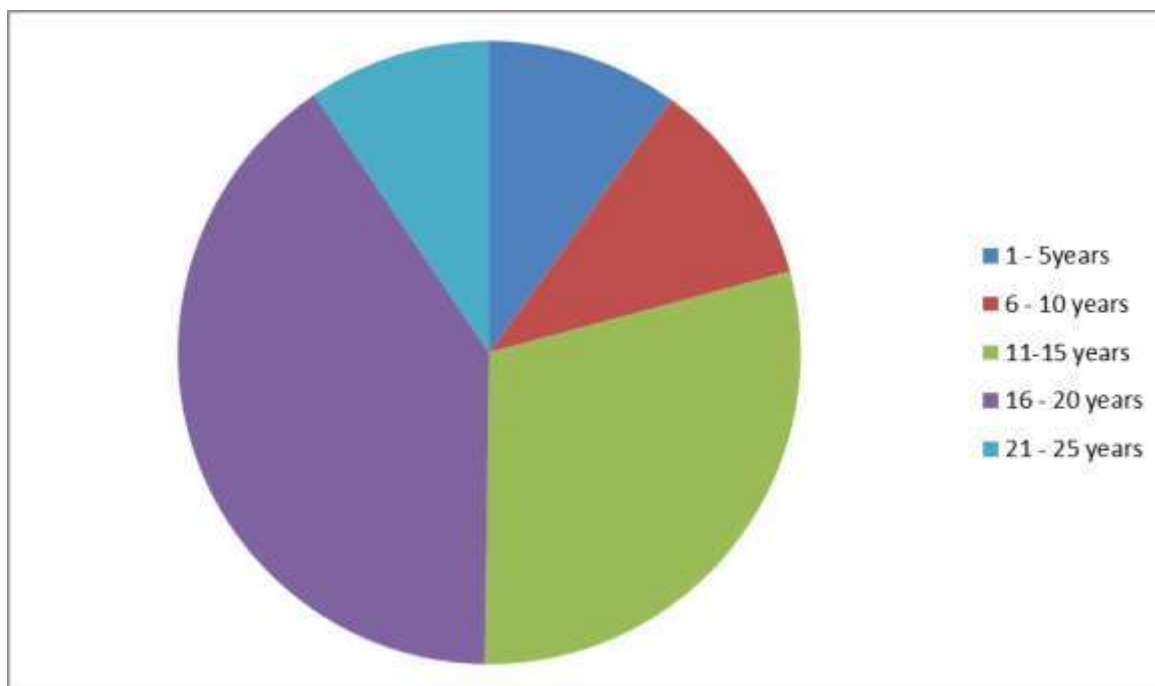


Figure 4: Years of Experience of Respondents in the construction industry

Figure 4 shows the respondents' years of experience in the construction industry. The figure shows that (22) 9.95% of the respondents have spent between 1 to 5 years in the industry. (24) 10.86% between 6 to 10 years, (65) 29.41% 11 to 15 years, (89) 40.27% 16 to 20 years, while (21) 9.50% had spent between 21 to 25 years in the construction industry.

Table 1: Current State and Level of Awareness of Cloud Computing Application in Building Construction Project Delivery in Rivers State

Level of Awareness of Cloud computing					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Unaware	92	38.7	41.6	41.6
	Unaware	76	31.9	34.4	76.0
	Neither aware	28	11.8	12.7	88.7
	Aware	14	5.9	6.3	95.0
	Very aware	11	4.6	5.0	100.0
	Total	221	92.9	100.0	
Missing	System	17	7.1		
Total		238	100.0		

Table 1: Above shows that (92) 38.7% of the respondents are very unaware of the state of awareness of cloud computing application in construction projects. (28) 11.8% are neither aware of cloud computing, (76) 31.9% are unaware, while a paltry (11) 4.6% are very aware of the state of awareness of cloud computing application in construction projects. This is a clear indication that practitioners are not aware of cloud computing and its application in construction project delivery.

Table 2: Future for Cloud Computing in Construction Projects Delivery in Rivers State

Is there a future for cloud computing in construction projects					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	35	14.7	15.8	15.8
	Disagree	10	4.2	4.5	20.3
	Neutral	9	3.8	4.1	24.4
	Agree	82	34.5	37.1	61.5
	Strongly agree	85	35.7	38.5	100.0
	Total	221	92.9	100.0	
Missing	System	17	7.1		
Total		238	100.0		

Table 2; Above reveals that (85) 35.7% indicates a majority of the respondents strongly agreed that there is a future for Cloud computing in construction project delivery. While (82) 34.5% totally agree with this assertion. (10), (35), constituting 4.2% and 14.7% disagreed and strongly disagreed to this assertion.

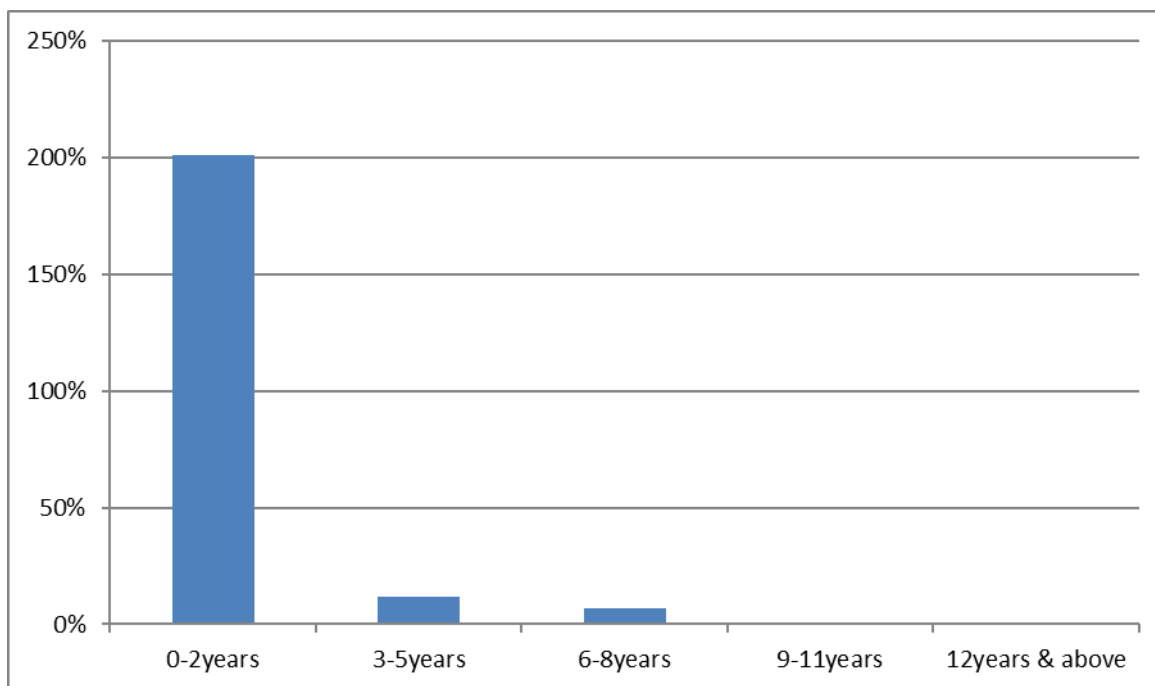


Figure 5: Years of experience using Cloud computing in construction projects

Figure 5; Above shows that 201 indicating most of the respondents have had between 0 to 2 years' experience using cloud related activities in construction project delivery. 12 of the respondents had between 3 to 5 years' experience. While 1 was between 9 to 11 years. And none of the respondents had between 12 years and above experience using cloud related activities in construction project delivery.

Table 3: Training Programme to Upskill Knowledge Using Cloud Computing in Construction Projects

Training programme to upskill knowledge using cloud computing in construction projects					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	35	14.7	15.8	15.8
	Disagree	21	8.8	9.5	25.3
	Neutral	9	3.8	4.1	29.4
	Agree	43	18.1	19.5	48.9
	Strongly agree	113	47.5	51.1	100.0

	Total	221	92.9	100.0	
Missing	System	17	7.1		
Total		238	100.0		

Table 3 above shows that (113) 47.5% % of the respondents are willing to be trained and upskill their knowledge on the use of Cloud computing in construction project delivery. (43) 18.1% of the practitioners are willing. (35) 14.7% and (21) 8.8% strongly disagreed and disagreed respectively in upskilling their knowledge using Cloud computing in construction project delivery.

The study found a generally low level of awareness regarding cloud computing applications in construction project delivery within Rivers State.

- A significant portion of respondents reported being 'very unaware' (38.7%) or 'unaware' (31.9%) of cloud computing, while 11.8% were 'neither aware' nor 'unaware'.
- A very small minority, only 4.6%, indicated they were 'very aware' of cloud computing applications in construction projects.
- This low awareness is further supported by the limited experience of practitioners; a majority (201 out of 221 respondents) had only 0 to 2 years of experience with cloud-related activities in construction project delivery.
- Despite the current low awareness, a substantial majority of respondents (35.7% strongly agreed, 34.5% agreed) believe that cloud computing has a future in construction project delivery.
- Furthermore, 47.5% of respondents expressed a willingness to be trained and upskill their knowledge in cloud computing, with an additional 18.1% also willing. However, 14.7% strongly disagreed and 8.8% disagreed with upskilling.

6. Discussion, Conclusion and Implication

Our study's findings, as given in table 1, demonstrate that (92) 38.7% of respondents are completely uninformed of the prevalence of cloud computing applications in building projects. (28) 11.8% are not aware of cloud computing, (76) 31.9% are clueless, and a dismal (11) 4.6% are highly aware of the prevalence of cloud computing applications in building projects. This clearly demonstrates that practitioners are unaware of cloud computing and its use in building project delivery. The figure of (85) 35.7% suggests that the majority of respondents strongly think that Cloud computing has a future in building project delivery. While (82), 34.5% completely agree with this argument. (10), (35), or 4.2% and 14.7% respectively, objected and strongly disagreed with this assertion.

Furthermore, figure 5 reveals that 201, showing that the majority of respondents have 0 to 2 years of experience with cloud-related activities in construction project delivery. Twelve of the respondents had between three and five years' experience. While one was between the ages of nine and eleven. And none of the respondents had 12 years or more of experience with cloudbased activities in building project delivery. Table 3 demonstrates that (113) 47.5% of respondents are eager to be trained and updated on the usage of Cloud computing in construction project delivery. (43) 18.1 percent of practitioners are willing. (35)

14.7% and (21) 8.8% strongly disagreed, respectively, on upskilling their expertise of Cloud computing in construction project delivery.

Furthermore, the claimed low awareness rate provided results that contradicted Oke et al.'s (2022) findings that 96.2% of Nigerian construction professionals have knowledge of cloud computing. Our responders from Rivers State may have lower exposure levels than Nigerian professionals, explaining the disparity between studies. The investigation reveals a significant regional inconsistency that will impede technology distribution in this area.

The information gained from qualitative observations reveals the most likely reason for this low level of awareness. Rivers State building activities are primarily small-scale or offline in nature, which limits the perception of the need for cloud tools. Insufficient ICT training in local enterprises results in a situation in which appropriately skilled individuals lack the requisite information. According to Alsafi and Fan (2020), cloud adoption in underdeveloped countries is hampered by a lack of technological knowledge and skills. Finally, the findings clearly show that awareness campaigns should become a primary focus. Programs to raise knowledge about cloud technology must include workshops as well as industry seminars, and cloud learning should be integrated into local professional education programs. Most practitioners who demonstrate ignorance of cloud technology represent the first stage in the technology adoption process, which begins with innovation recognition.

Conclusion

The study found that construction professionals in Rivers State, Nigeria, have a limited comprehension of cloud computing principles. In contrast to other Nigerian samples where awareness had nearly achieved saturation, 89.5% of surveyed participants had no grasp of cloud computing services (Table 1). According to research, local professionals and businesses are not very interested in current ICT advancements. The efficient use of cloud solutions in construction necessitates strategic initiatives such as instructional programs, stakeholder involvement, and supportive policies that highlight the benefits of cloud computing. The low awareness perspective within the Technology Acceptance Model (TAM) perspective indicates that practitioners may still have no idea of the value and simplicity of use of cloud computing, which are important factors in influencing technology acceptance. The claimed benefits are impossible to comprehend or value without proper awareness, hence impeding adoption.

Managerial Implications

- Construction firms, professional associations, and government agencies should collaborate to develop awareness initiatives in Rivers State. Such initiatives may need to highlight the actual benefits and utility of cloud computers in terms of building project delivery, moving beyond abstractions to specifics.
- Training and Skill Development: Many professionals indicate a strong desire to learn new skills, making it possible to establish and launch training programs. These programs must be skill-based, and they must address the perceived complexity of cloud technologies in order to make them more accessible and less intimidating to practitioners.

- **Pilot Projects and Demonstrations:** To overcome the lack of practical expertise and ensure success, managers could consider initiating pilot projects using cloud technologies. They can be promoted by presenting successful local instances of usage, which will help us understand the practical worth and popularize it even more.
- Managers should invest in improving key infrastructure, such as reliable electricity and stable broadband connectivity, to support successful cloud computing applications on construction sites, particularly in rural areas.
- **Strategic Integration:** When it comes to cloud adoption, the most important idea for organizations is to fuse together cloud strategies and pretexts on ongoing IT and business operations. This will require a systematic strategy and possibly a re-evaluation of the IT organizational structure to facilitate the transition in an efficient way.

6.5. Limitations and Future Research Directions.

The key drawback of the research on the first aim is that it exclusively focuses on Rivers State in Nigeria. Although the findings are useful in providing local expertise, the information on the level of awareness may not be applicable to other areas or foreign countries with different technological infrastructures, economic conditions, or cloud computing maturity levels. The evaluation of awareness is dependent on self-reported data from questionnaires, which might be subject to response bias. Respondents may overestimate or underestimate their true level of awareness. The study's lack of awareness is general and does not include information on the type of cloud computing (IaaS, PaaS, SaaS) that practitioners are unaware of, nor do the explanations for the lack of awareness go beyond generic comments. The research points out the low experience level (with the majority of respondents experiencing less than two years) without analyzing the level of experience and the nature of cloud tools and applications they have been exposed to in this duration.

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