NEED FOR CLOUD-BASED DATABASE SYSTEM FOR EFFECTIVE MANAGEMENT OF BIG DATA AMONG NIGERIAN IT/ICT COMPANIES

Salome Danjuma[1], John Ogbiti[2], Brian Halubanza[3]

Department of Mathematical Sciences, Kaduna State University, Kaduna State, Nigeria
Department of I.C.T and Mathematics, Edo University, Iyamho, Auchi Edo State, Nigeria
Department of Computer Science, Mulungushi University, Zambia
Email: Sallome64@gmail.com, johnogbiti@yahoo.com , bhalubanza@gmail.com

ABSTRACT

The number of massive data collected today by software in different fields vary from academia to business and many other fields, this growth of data is increasingly becoming a huge problem in regards to storage and effective data management to meet up with high performance and scalability needed. The need for highly organised data storage and analysis for the purpose of accessibility by other applications simultaneously on real time bases is greatly on the increase. The emerging of new technology now and then in the IT world with better and well defined features is on the increase. Database vendors have been comfortable for a while in their market as RDBMS have been in control of the market for over forty years without another competing DBMS. In this research work, database types were examined with the aim to assess the challenges faced by existing database management system and how to adopt other alternative database management systems to effectively manage the massive data generated as a result of cloud computing technology. The research conducted eventually indicated reasons for a shift to an alternative NoSQL database based on the challenges analysed from the existing system. The study also investigated the perception of data base administrators of ICT companies in Nigeria in terms of the necessity of using of NoSQL database. The research results indicated quite a number of Companies situated at Lagos and Abuja states of Nigeria that are in use of NoSQL databases which is a new database system that is cloud friendly and can effectively manage large volume of data; quite a number too are considering

adopting NoSQL databases as a result of its benefits in managing data at this era of cloud computing technology.

Keywords: Cloud Computing, Cloud, RDBMS, NoSQL, Database, SQL, MDM

INTRODUCTION

Big data management has become an issue in this era of service oriented computing where virtually all IT resources are delivered as services over the internet. These services need to be properly managed and articulated for integrity and security purposes. Computing resources are continuously moved to the cloud for easy accessibility and on demand purposes; there is a need to effectively and efficiently manage these big ever growing data due to consumers changing needs. Due to the increase of data size storage on user's requirements, products and services with the increase rate of accessibility of data on real time basis affect the system performance. There is a need for effective data management system to close the gap/limitations of DBMS architecture. The existing database architecture was not designed to function with unstructured data for availability and scalability which affects data management in the cloud. Traditional relational database architecture has no benefits from affordable storage resources and processing power cloud computing technology offers. Big Data on the other hand refers to information collected in large volume beyond the capability of traditional database system tools to capture, store, manipulate and analyse data. Based on IBM report, 90% of the world's data were created last two years due to the fact that2.5 quintillion (10^{18}) bytes of data are generated every day. The tremendous increase in global data is highly attributed to digital video, music, smart phones and the internet (Santovena, 2013). Data at this era has grown so large and complex that traditional data management tools cannot effectively manage and control the data because the data management tools are not designed for the present volume, velocity and varieties of data. This created the need for efficient and reliable database management system (DBMS). The NoSQL DBMS should be able to effectively manage the database with real time availability of

data, easily accessible and on-demand. Another existing database is multidimensional database, these databases deal with different sources of data or relational model to express relationship between data which can be accessed in different ways through multidimensional structures (Tatum, 2014). Multidimensional structures are in cubes which are used in data storage. This type of database is good for analytical processing due to their ability to provide results for complex business queries on time. Data on this type of database are viewed from different angles with better view of the problems compared to other data models (Oracle, 2010). NoSQL is a database suited for large volumes storage of structured and unstructured data making it the basis for Service-Oriented System (SOS) like Cloud computing. NoSQL database system do not support SQL query interface for user's interactions therefore providing alternatives to traditional database by allowing projects to be design using Not Only SQL platforms. In this research work the need for a mix-and-match database to improve performances in managing the big data among these ICT firms to supplement limitations of both RDBMS and NoSQL is emphasised. The mix-and-match approach address challenges encountered during data management as a result of limitations from either of the database system. This approach is based on a class of product that lets component database co-exist with relational database and not replace them (McNamara, 2012).

RESEARCH PROBLEM

The research is addressing the problems of effective management of large amount of data or complex data modelling strategy which SQL and relational database were not able to address. (Moniruzzaman & Hossain, 2013). SQL and relational database are the existing Database Management System which have effectively managed data for over forty years but the new technology of cloud clouding where lots of data need to be effectively managed with end result of availability, reliability, consistency, integrity and security; have given the need for adoption of NoSQL database to bridge the gap of relational database limitations among IT/ICT Companies in Nigeria. In Nigerian IT/ICT Companies, information is

accumulating and growing so fast due to usage of internet through mobile technology. According to PewResearch Global Attitudes Project, (2014), Nigeria was recorded the only country in West Africa with highest percentage (60%) of internet usage and social networking on a daily basis. Nigeria is one of the top 15 countries in the world fuelling internet growth, according to (Kelly, 2013). If this is the state and position of Nigeria in technology, then there are needs to prepare for the future in data management assuming the amount of information people upload on internet through social networking every second. Big data go hand in hand with cloud computing (a metaphor for internet), the two cannot be talked about independently because one depends on the other. The adoption of cloud computing had moved so many semi and unstructured data to the cloud which created more complexity in the management of data using the traditional relational database. Cloud computing technology is now ubiquitous in volume (size of dataset), variety (data format), and velocity (speed in data growth). Moniruzzaman & Hossain, (2013), opined that Big Data also refers to dataset that have increased in size becoming difficult to be managed and manipulated with traditional database tools like RDBMS or normal search engines. These challenges for effective data management are not only found among Nigerian IT/ICT companies but also in the global IT market. The way forward on the challenges imposed on data management is the focus for this research. The research is focusing on how to complement the traditional database with rich set of management tools from an alternative database known as NoSQL databases.

RESEARCH OBJECTIVES

The objectives of this Research are:

    a) To study the challenges and problems of the existing database management system among ICT companies in Nigeria with the advent of big data due to cloud computing technology.

b) To assess the awareness of NoSQL databases and their benefits in managing big data among ICT firms in Abuja and Lagos states of Nigeria.

c) To provide appropriate drivers or factors for the adoption of alternative DBMS to improve performances in managing big data among these ICT firms to supplement limitations of each other.

RESEARCH QUESTIONS

The Research is conducted through the following questions:

1. What are the challenges of the existing DBMS among Nigerian ICT companies in regards to scalability and availability?

2. What is the level of NoSQL database awareness among Nigerian IT/ICT companies/database administrators

3. What are the factors that contributed to the creation of big data and the drivers for the adoption of the alternative database system?

These research questions are analytical because the aim of this study is to assess the problems in managing big data with the existing Relational Database Management System (RDBMS) and the need for a NoSQL database approach. The mix-match database approach comprises of both RDBMS and NoSQL, working concurrently in managing big data; thereby improving greater performances.

LITERATURE REVIEW

Nigeria was ranked the highest country in Africa using internet as at June 30th 2012 with 48.4 million internet users (Dogo, et al., 2013). This is to say that any newly introduced computing technology will have a better adoption and penetration rate in Nigeria. Governments, Businesses, Educational and Research Institutes, Enterprises and many more are moving into Cloud Computing. Cloud Computing has come to stay in Nigeria which lead to how these huge data can be effectively managed and secured by various ICT firms in Nigeria. ICT firms in Nigeria offer ICT solutions for the oil and gas, financial, educational and

industrial sectors of the Nigerian economy. All these activities of IT advancement in Nigeria which include the moving of large amount of data from different sectors to the cloud created the need for efficient and reliable database management system (DBMS). This DBMS should be able to effectively manage the database with real time availability of data; easily accessible and on-demand. Big Data refers to dataset that have increased in size becoming difficult to be managed and manipulated with traditional database tools or normal search engines (George, *et al.*, 2014). The way forward for this challenge is to complement the traditional database with rich set of management tools from NoSQL database systems. Big data deals with structured, semi-structured and unstructured data. Structured data deals with mostly text documents within the database, while semi-structured and unstructured are both data with contents that involves multimedia and social media content (Vargas-Solar, 2013).

Cloud computing technology is closely knitted with big data because big data is generated as a result of cloud computing. Relational database management system (RDBMS) is the common type of existing Database Management System which have effectively managed data for over forty years. The advent of new technology of cloud clouding where lots of data need to be effectively managed with end result of availability, reliability, consistency, integrity and security; have given the need for adoption of a different database with rich tools in managing cloud based data to bridge the gap of the existing database limitations. In this research NoSQL type of database is being looked into as the alternative of the existing database system. The storage and retrieval of these data need an effective Database Management System (DBMS) that can rapidly scale with greater performance of real-time transactions. Big data mostly deal with data on real-time basis due to the size of data on web scale applications. This research will provide an understanding of the need for NoSQL database and the existing traditional database in supporting and managing huge volumes of data among IT companies in Nigerian ICT industry situated at Abuja and Lagos.

Challenges of ICT Companies in Nigeria

The statistic seems that Nigeria the cutting edge in the penetration and adoption of mobile computing, there are underlying challenges like: low penetration of computers, poor electricity supply, and limited network coverage. Other challenges are from the policy and regulations to encourage bandwidth and applications in ICT industry (Odufuwa, 2012). But there are some challenges to harnessing optimum benefit of ICT. The absence of a robust database of subscribers is one of the factors militating against the early adoption of mobile banking. The on-going mandated registration of subscribers is expected to facilitate the success of the mobile money initiative amongst other benefits such as the security of lives and property (FinIntell, 2014).

New Technology and Big Data

The new era of cloud computing, grid computing and utility computing brought about big data plus analytics. Big data comprises of large amount of complex and unstructured data with analytics which are those algorithm used on the data to extract useful information (Simmonds, 2013). The continuous growth of data set which are in terabytes and petabytes, and the use of data analysis system like data mining helps to extract useful information for better decision making. These new technologies make use of effective computational method to check for patterns. Big data is a great tool to predict human behaviour thereby influencing decision making in business and government practices alike (George, *et al.*, 2014). Research has it that, big data in future will affects the landscape of social and economic policy (George, *et al.*, 2014).

The NoSQL database is the alternative way of storing such large amount of data apart from the existing database system (RDBMS) because big data deals with scalable data management which is a challenge to RDBMS. Big data needs a database that can scale easily dealing with different unlimited user's needs over the internet concurrently (Cui, *et al.*, 2014). Presently most IT personnel came to the realisation that NoSQL database is not replacing Relational database but

rather complimenting it. Big data has an evolutionary effect on database administration seeking skills on integrating different types of data store into a data centre using distributed and cluster environments. There is also a need for data movement between relational databases and NoSQL databases as well as knowledge of data analysis such as Hadoop, Map Reduce and much more. Map Reduce is used for data analysis in distributed data processing framework; it deals with complex queries compared to SQL queries. Map Reduce deals with both structured and unstructured with efficiency in batch processing. Hadoop on the other hand have the advantage of both scalability and efficiency of distributed systems (Cui, et al., 2014) and (Agrawal, et al., 2011). The major driver of change in the management of database administration is "big data". This is based on the data generated from different fields and in different format thereby generating large amount of data which become difficult for the existing database to handle. Cloud computing and other internet interaction resulted to big data production, consumption and processing. These gave birth to the 3V aspect of big data known as volume, velocity and variety (Vargas-Solar, 2013); increasing in volume (size of dataset), velocity (speed in processing real time request), and variety (data types and sources). Based on 3V model, big data needs efficient data analysis system to enable coordinated decision making and insight discovery.

Database System

According to Merriam Webster, (2014), database is an organised collection of data/information for the purpose of storage, easy access, updates, analysis and proper management of data. The data could be in the form of graphics, reports, scripts, tables, videos, text etc. To access information from the database is only possible through DBMS because DBMS manages data and makes it available on demand.

Significance of Database in the ICT Community

The purpose of database system is very important in the IT industry. It's more or like the life line of the industry where basic and vital information are stored and properly managed. Some of these significance can be seen thus:

a)   Databases are structured to for the purpose of storage, retrieval, modification and deletion with the help of structured query language operations.

b)   Database is important because of the large amount of information that exist today. There is a need to
      store them and also know about their structure, use and capabilities.

c)   Database system is important because it transform data into information after it has been queried by DBMS; this help to access specified information quickly

d)   Database system also provides security and multi-user access.

DATABASE MANAGEMENT SYSTEM (DBMS)

DBMS is a software that helps you to design and manipulate databases, as well as to access data for a particular function is known as database management system (DBMS). DBMS defines database functionality and operational capabilities in effective data management (Answer.Com, 2014) and also serves as the intermediary between the user and the database. The most widely used DBMS is the Relational Database Management System (RDBMS) that uses the Structured Query Language (SQL) for program interface. The Object-Oriented Database Management System (OODBMS) is the newer DBMS which NoSQL falls under. OODBMS is a database management system that supports the modelling and creation of data as objects (Rouse, 2014). According to Panwar, (2011), DBMS is an application that operates using queries for proper management of databases.

Factors for the Adoption of Alternative DBMS in Managing Big Data in Nigeria

The high level of internet usage in Nigerian had been viewed as a nurturing ground for the growth of cloud computing which is the supporting driver for big

data that requires effective data management tools (Odufuwa, 2012). There are many existing factors from the existing DBMS that support the adoption of an alternative DBMS in Nigeria but the major ones are: mobile technology, availability of skilled database administers, high volume of research in this novel area, government initiatives, and multinational data players in Nigeria.

Cloud Service Providers Activities in Nigeria

Cloud Computing is gaining ground and more cloud providers are coming into the market with international experience due to the opportunities Nigeria cloud market provided. Inlaks Computers is one of the cloud providers, it has been in operation over 30 years. Inlaks partner with Ramco Company a big data player to use an existing infrastructure for cloud solutions thereby creating the need for an effective database system. BCX is one of the leading cloud providers and data centres in Africa and had officially launched its cloud computing services in Nigeria (Dogo, et al., 2013). Other major players in the Nigerian cloud computing market offering various cloud services are: Dimension Data, MTN Nigeria, EMC Corporation, and Signal Alliance. Director General of National Information Technology Development Agency (NITDA) Professor Cleopas Angaye said that Nigeria is a honeypot for cloud computing and it has the prospect of becoming the African hub of Cloud computing (Dogo, et al., 2013). The activities within these cloud providers and big data player are the drivers of adoption of new database system for effective management of data in the cloud in terms of efficiencies, speed and scalability.

The Need for NoSQL

NoSQL database started as a solution to the limitation of RDBMS, addressing the incapability of the existing database management system. Companies like Amazon, Google, LinkedIn, twitter, Facebook, Yahoo and others saw NoSQL as a solution to their problems of large data management. These companies did not start by rejecting SQL and relational database model but rather used the NoSQL to compliment the limitation of the existing DBMS (Burd, 2011). Interrelated

megatrends of information technology such as big data, big users and cloud computing initiated the need for NoSQL technology adoption. NoSQL is increasingly seen as the best alternative to relational database with the advantage of scaling out beyond limitations and restrictions. Scaling is good majorly on cluster of standard servers and schema less database model which satisfy the requirements needed for the kind of data captured and processed today (Menegaz, 2012). NoSQL databases are simple and provide inexpensive commodity for computing compared with their relational databases. NoSQL databases are open source, this made it easier for adoption and implementations as the existing database (RDBMS) comprises of high cost of licensing and implementation. Free and open source looks appealing to most IT firms to cut down cost (Henschen, 2013).A traditional database design is based on structured data which requires vertical and at times horizontal scaling as data increase. NoSQL is an alternatively more cloud-friendly approach to employ as it is not designed on tables and without SQL language to query the database; it rather offers rich query language thereby making scaling easier. NoSQL relaxes the rules of ACID (atomicity, consistency, isolation, durability), but can withstand hardware failure and have the advantage of high data availability. NoSQL provides high performance with high availability with the given unstructured and messy user requirements in the cloud (Menegaz, 2012).

RESEARCH METHODOLOGY

The methodology on this research is based on quantitative analysis and qualitative analysis approach where statistical modelling, evaluation and intensive research is involved. The data collection was based on DBMS performance and evaluation with the help of Database Administrators (DBA) among Nigeria ICT companies situated at Lagos State and Abuja metropolis. Data was collected through conducting interviews with various database administrators and also through the use of questionnaire forms. The data collected was analysed using analysis tools like: Microsoft's Excel 2013 and IBM's 'Statistical Product and Service Solutions (SPSS) version 21.

Research Model

Research model deals with basic concepts/ideas thereby describing the reality of the study/evaluation and the conditions involved in the study. The concept gives a general expression of particular phenomenon under study (Clark, 2005). In every research, a model need to be developed with a working hypothesis to help the researcher check the data during analysis if it corresponds to the designed model. The research model was based on the following contexts in which every organisation function and operate on:

1. Utilization and challenges faced with an existing system or technologies within an organisation.
2. Understanding new technology processes.
3. Technological impact on the organisation performances

RESEARCH HYPOTHESES

The research hypotheses consist of dependent variable and independent variables.

Dependent Variable

i. The need for NoSQL databases for effective management of big data among IT/ICT companies in Lagos and Abuja states of Nigeria.

Independent Variables

i. RDBMS usage and effectiveness.
ii. RDBMS challenges
iii. Big data growth due to cloud computing
iv. Level of NoSQL awareness
v. RDBMS and NoSQL co-existence.
vi. Management support towards new technology.

Hypothesis 1

H_o: RDBMS usage and effectiveness is not a driver of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

H_A : RDBMS usage and effectiveness is a driver of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

Hypothesis 2

H_o: RDBMS challenges are not the drivers of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

H_A : RDBMS challenges are the drivers of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

Hypothesis 3

H_o: Big data growth due to cloud computing is not a major driver of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

H_A : Big data growth due to cloud computing is a major driver of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

Hypothesis 4

H_o: Level of NoSQL awareness is not a driver of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

H_A : Level of NoSQL awareness is a driver of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

Hypothesis 5

H_O: RDBMS and NoSQL co-existence is not a driver of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

H_A : RDBMS and NoSQL co-existence is a driver of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

Hypothesis 6

H_O: Management support to adoption of new technology is not a driver of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

H_A : Management support to adoption of new technology is a driver of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria

Distribution

The questionnaires were distributed to three different targets. The first target are those who are one way or the other related to the area of research; private mails were sent to expert practitioners in the field of the research whom the researcher read their profile. The second target were big IT companies like cloud providers who manage large amount of data which are of different types and format. The third targets were the professional social sites among DBA experts in Nigeria.

DATA ANALYSIS AND PRESENTATION OF FINDINGS

Normality Tests

The main purpose in carrying out normality test is to check for the appropriate method for data analysis, either parametric or non-parametric because the validity of the data depends on it. The most popular test for normality are Shapiro-Wilk tests and Kolmogorov-Smirnov but Kolmogorov-Smirnov should no longer be used due to its low power. Most researchers advised that normality of a data/sample should be assessed both visually and through normality test, of which the Shapiro-Wilk test provided by the SPSS software is highly recommended (Ghasemi & Zahediasl, 2012).

The table below shows the results of the normality tests:

Table 4.1: Summary of Normality Tests

Normality Tests		
Variables	Kolmogorov-Smirn	Shapiro-W
RDBMS usage and effectiveness	.000	.000
RDBMS challenges	.000	.000
Big data growth due to cloud computing	.000	.000
Level of NoSQL awareness	.000	.000
RDBMS and NoSQL co-existence	.000	.000
Management support towards new technolo	.000	.000

As shown in the result of the normality test in the table above, non-significant result (Sig value of more than 0.05) indicates normality for each variable, while less than 0.05 indicates the data is not normally distributed in both Kolmogorov-Smirnov and Shapiro-Wilk tests. In this case the Sig. value is 0.000 for each variable, suggesting violation of the assumption of normality (PALLANT, 2005). This implies that the data is not normally distributed. The result of the Shapiro-Wilk is chosen over the Kolmogorov-Smirnov test in this research because Shapiro-Wilk test is more accurate for a sample size that is less than 2000.Kolmogorov-Smirnov has a limitation of high sensitivity to extreme values; it has been reported that the Kolmogorov-Smirnov (K-S) test has low power and it should not be seriously considered for testing normality (Ghasemi & Zahediasl,

2012). On this study, the Shapiro-Wilk values are less than 0.05. This implies that the data is non-parametric (e.g., they do not assume that the outcome is approximately normally distributed); therefore non-parametric analytical methods would be used in interpreting the data.

Reliability Analysis

The reliability of research instrument known as the questionnaire can be analysed through using SPSS based on Cronbach's Alpha Coefficients. According to (Field, 2006) and(Sekaran & Bougie, 2010), items with alpha coefficients below 0.6 are consider as poor, while items with coefficients between 0.6 and 0.7 are considered fair. Coefficients with the range 0.7 - 0.8 are rated to be acceptable, with 0.8 and 0.9 as good and finally coefficient greater than 0.9 is being considered excellent. However some researchers advised that these guidelines should be used with caution because the value of alpha depends on the number of item from the scale (Field, 2006).

The overall Cronbach's alpha coefficient for the questionnaire used in this survey was 0.773 which according to (Sekaran & Bougie, 2010) is considered to be 'Good' or 'Acceptable', therefore this means that the questionnaire has an internal consistency of 77.3%.The table below shows the reliability analysis of the questionnaire:

Table 4.2: Summary of Reliability Analysis

Variable	Number of Items	Cronbach's Alpha	Reliability Interpretation
	Reliability Analysis		
RDBMS usage and effectiveness	5	.509	Fair
RDBMS challenges	4	.685	Acceptable
Big data growth due to cloud computing	12	.912	Very Good
Level of NoSQL awareness	6	.887	Good
RDBMS and NoSQL co-existence	4	.814	Good
Management support towards new technolo	4	.829	Good
Average Total	35	0.773	Good

The first variable result from the table shows fair, this is because Cronbach alpha values are somehow quite sensitive to the number of items in the scale. Short scales (e.g. scales with fewer than ten items), provide quite low Cronbach values (e.g. .5). Researchers advised that, in cases like this it may be more appropriate to report the mean inter-item correlation for the items (PALLANT, 2005). The results from the table is valid and reliable as many researchers argued that the maximum alpha should be 0.90 and anything greater gives the impression of duplicated items and thus analysing the same item but in a different context.

Descriptive Statistics

Descriptive statistics is an important procedure in data analysis and interpretations. It is basically used to describe the characteristics of the survey sample. It also checks the variables so as to go in line with the assumptions underlying the statistical techniques for addressing the research questions. Descriptive statistics differs based on whether the data is continuous or categorical variables. In categorical variable, statistics like mean, standard deviation are not necessarily appropriate (PALLANT, 2005). The statistics look at the relationships between items on the questionnaire too. A total of 106 respondents filled the digitally administered questionnaire based on the different characteristics of the respondents.

Gender Distribution of Respondents

Table 4.3: Gender Distribution

Gender		Frequency	Percent	Valid Percent	Cumulative Percent
	Male	80	75.5	75.5	75.5
	Female	26	24.5	24.5	100.0
	Total	106	100.0	100.0	

The table above shows the gender distribution of respondents on which the highest respondents were male. The sample gave a total of 80 male respondents (75.5%) against 26 female respondents (24.5%) of the total population which is 106. This implies that women are less concern about technology and it usage

within the IT industry or it can be as a result of small number of them that are involved in decision making. In terms of data management females are more or less involved in the world of IT.

Age Distribution of Respondents

Table 4.4: Summary of Age Distribution of Respondents

Age Range	Frequency	Percent	Valid Percent	Cumulative Percent
16–20 years	2	1.9	1.9	1.9
21–30 years	27	25.5	25.5	27.4
31–40 years	60	56.6	56.6	84.0
41–50 years	15	14.2	14.2	98.1
Over 51 years	2	1.9	1.9	100.0
Total	106	100.0	100.0	

The table above shows the age range of all the respondents within the sample size. The database administrators that responded within the age range of 16-20 years are 2 representing 1.9% of the population. The age range between 21-30 years are 27 respondents representing 25.5% of the population. The highest number of respondents falls between the ages of 31-40 years with 60 respondents representing 56.6% of the population. The last two age group ranges between 41-50 years and over 50 years with 15 and 2 respondents representing 14.2% and 1.9% respectively. This distribution shows that database administrators between the ages of 31-40 years old responded more to the questionnaire and partake more in the survey.

Educational Distribution of Respondents

Table 4.5: Summary of Educational Level Distributions

Educational level		Frequency	Percent	Valid Percent	Cumulative Percent
	Certificate	1	.9	1.0	1.0
	Diploma	8	7.5	7.6	8.6
	Degree	52	49.1	49.5	58.1
	Masters	41	38.7	39.0	97.1
	PHD	3	2.8	2.9	100.0
	Total	105	99.1	100.0	
Missing	System	1	.9		
Total		106	100.0		

The table above shows the educational level of the respondents; the highest number of respondents came from the degree holders with the total number of 52 people representing 49.5% of the entire population. The second highest are the Masters holders with the total of 41 respondents which is a 39.0% of the population. The rest of the respondents fall in the category of certificate, diploma and PHD with 1.0%, 7.6% and 2.9% of the population respectively. This implies that majority of these DBAs respondent are well educated in their field of practice. Majority of the DBAs have earned their degree in both undergraduate and graduate level, which made this research data more reliable because of the level of knowledge among these DBAs.

Respondents Distribution of Working Experience

Table 4.6: Summary of Working Experience of Respondents

Years		Frequency	Percent	Valid Percent	Cumulative Percent
	Less than 5 years	45	42.5	42.5	42.5
	5–10 years	43	40.6	40.6	83.0
	Over 10 years	18	17.0	17.0	100.0
	Total	106	100.0	100.0	

The table above shows how long the respondents have been managing data within their organisation; many of which fall under the category of 'less than 5 years' with the total of 45 respondents which is 42.5% of the entire population.

The category of '5-10 years' have a quite number of respondents with a total of 43 (40.6%); respondents with over 10 years' experience are 18 in number with 17.0% and the last category had non respondent. The overall result shows that the respondents are well experience with minimum of 2 years and above.

Respondents Distribution of Organisation's Size
### Table4.7: Summary of Respondents Size of Organisation

Size of Org	Frequency	Percent	Valid Percent	Cumulative Percent
50-100	22	20.8	20.8	20.8
200-500	20	18.9	18.9	39.6
1000-2000	38	35.8	35.8	75.5
5000-above	26	24.5	24.5	100.0
Total	106	100.0	100.0	

This table indicated the size of organisation each respondent belongs to in managing data. The highest number came from the organisation with the size of '1000-2000' employees with a total of 38 respondents representing 35.8% of the population. 5000 and above size of organisation respondents summed up to 26 with 24.5% of the population. The rest of the respondents fall under the category of 50-100 and 200-500 with the total of 22 and 20 respondents representing 20.8% and 18.9% of the population respectively.

Respondents Distribution of DBMS Types
Table 4.8: Summary of Different Types of Existing DBMS Usage

Types of DBMS	Percentage
MySQL	85.0%
FoxBASE	2.0%
Oracle	60.0%
Informix	5.0%
Sybase	7.0%
PostgreSQL	18.0%
Others	
Total	
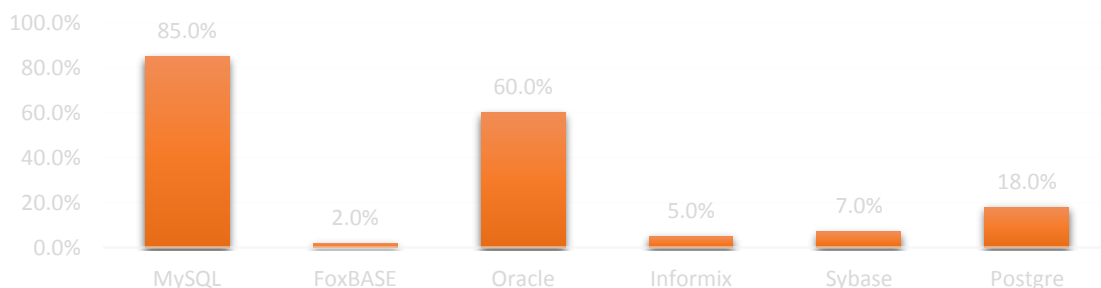
Figure 4.1: Summary of types of DBMS

The table above shows multiple choices of different types of existing database management system in use in many IT/ICT organisations in Nigeria. The most used DBMS used across IT/ICT in Nigeria is RDBMS according to the above chart. The table above shows the results based on the multiple choices of DBMS provided by the questionnaire because more than one DBMS can run concurrently on the same system in managing data and much more. These are the different types of RDBMS used among IT/ICT companies in Nigeria.

Distribution of DBAs by Age and Need for NoSQL Databases

From the age frequency analysis table, it shows that age affects the adoption and usage of technology most especially among DBAs in managing data. The table below represents a cross tabulation of age groups and their perception on the need for NoSQL database within their organisation in managing their huge data where the traditional database system cannot be able to handle.

Table 4.9: Cross Tabulation of Age and Perceived Need for NoSQL Databases

			Need for NoSQL		
			Yes	No	Total
Age Group	16–20 years	Count	0	2	2
		%within Age	0.0%	100.0%	100%
	21–30 years	Count	9	14	23
		%within Age	39.1%	60.9%	100.0%
	31–40 years	Count	18	38	56
		%within Age	32.1%	67.9%	100.0%
	41–50 years	Count	6	9	15
		%within Age	40.0%	60.0%	100.0%
	Over 51 years	Count	2	0	2
		% within Age	100.0%	0.0%	100.0%

Majority of the respondents from the table above, with a "yes" to NoSQL database fall between the ages of 31–40 years old representing 33.1% of the population under same category of age. This implies that the DBAs that fall under this category have a vast experience in the field of database management. The highest respondents to a "No" to NoSQL database fall between the ages of 31–40 years old which represent 67.9% of the population under this category of age. The same category of age have the highest number for both Yes and No to NoSQL database, implying that the age range are more into technology usage and adoption.

Distribution of DBAs Educational Level and Need for NoSQL Databases

Educational level of a population determines the extent to which respondents understand the concept behind the study and the benefits of adopting new technology in managing volume of data. The vaster their knowledge the better way they will respond to the research and its findings. The research assessed the level of education and relate it to the perception towards the need for NoSQL databases in data management.

Table4.10: Cross Tabulation of Level of Education and Need for NoSQL Databases

			Need for NoSQL		
			Yes	No	Total
Educational Level	Certificate	Count	0	1	1
		%within Educational level	0.0%	100.0%	100.0%
	Diploma	Count	1	7	8
		% within Educational level3	12.5%	87.5%	100.0%
	Degree	Count	19	29	48
		% within Educational level3	39.6%	60.4%	100.0%
	Masters	Count	12	25	37
		% within Educational level3	32.4%	67.6%	100.0%
	PHD	Count	2	1	3
		% within Educational level3	66.7%	33.3%	100.0%

The majority of the respondents that says "Yes" to NoSQL database are mostly those that earned their undergraduate studies. They are 19 out of 48 in number representing 39.6% of the population of degree holders. On the contrary 29 (60.4%) out of 48 responded "No" not because they have no knowledge of it but because it has not been implemented in the companies where they are working. Another level after the degree is the Masters level with 12 (32.4%) to "Yes" and 25 (67.6%) to "No". This implies that, most of the respondents that have the knowledge and skills of NoSQL database are degree and Masters holders which is why the awareness and adoption is low.

Distribution of DBAs Years of Experience and Knowledge of NoSQL Databases

The need for NoSQL databases can also be affected by the level of knowledge based on the DBA's years of experience in the field of database management.

Table 4.11: Cross Tabulation of Working Experience and Perceived Need for NoSQL Databases

			Need for NoSQL			
			Enough Knowledge	Little Knowledge	No Knowledge	Total
Working Experienc	Less than years	Count	3	8	32	43
		% within Working Exp	7.0%	18.6%	74.4%	100.0%
	5-10 years	Count	2	17	20	39
		% within Working Exp	5.1%	43.6%	51.3%	100.0%
	Over 10 year:	Count	8	5	4	17
		% within Working Exp	47.1%	29.4%	23.5%	100.0%

The table above indicates DBAs with less than 5 years' experience have less knowledge to no knowledge on NoSQL database with 74.4% of the population under the category. The respondent that falls within the category of 5-10 years of experience have the highest number of DBAs with the knowledge of NoSQL database representing 43.6%of their population.

Distribution of Volume of Data Management and Need for NoSQL Databases

Effective data management within an IT company depends on the type of DBMS in use. When data increased in quantity beyond the capabilities of the traditional database system, then there is a need for a change in the system. The volume of data managed in companies under study are being assessed to relate them to the need of another alternative database known as NoSQL databases.

Table 4.12: Cross Tabulation of Volume of Data and Need for NoSQL databases

			Need for NoSQL		
			Yes	No	Total
Volume of Data Management	Gigabytes	Count	10	20	30
		% within Volume	33.3%	66.7%	100.0%
	Terabytes	Count	13	31	44
		% within Volume	29.5%	70.5%	100.0%
	Exabytes	Count	10	12	22
		% within Volume	45.5%	54.5%	100.0%
	Petabytes	Count	2	0	2
		% within Volume	100.0%	0.0%	100.0%

The table above indicates the volume of data managed in any IT/ICT companies Nigeria and the awareness/knowledge of NoSQL databases for effective data management based on the volume of data in the company.

Test and Analysis of Hypotheses using Spearman's Correlation Coefficient Method

This section tests the research hypotheses and discussion on the research hypothesis findings were conducted. The key thing in interpreting research findings is understanding how analysis results relate to the system under study. Another reason for result interpretation, is to transform the data collected into reliable evidence for the development and performance improvement of the system under study.

Table 4.13: Spearman's Correlation Coefficients Interpretation table

Spearman's Correlation Coefficie	Meaning of Correlation
"Between 0.9 to 1.00"	Very Strong Correlation
"Between 0.7 – 0.89"	Strong Correlation
"Between 0.5 – 0.69"	Moderate Correlation
"Between 0.3 – 0.49"	Moderate to low Correlation
"Between 0.16 – 0.29"	Weak to low Correlation
"Below .16"	Correlation is too low to be meaning

Table 4.14 Summary of Hypotheses Variables

Independent Variables	Dependent Variable
RDBMS Effectiveness	
RDBMS Challenges	
Big data growth/management	NEED FOR NoSQL DATABASE
Level of NoSQL Awareness	
RDBMS &NoSQL Co-existence	
Management Support	

Hypothesis 1: Relationship between "RDBMS Effectiveness & Usage" and "Need for NoSQL databases"

H_o: RDBMS usage and effectiveness is not a driver of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

H_A : RDBMS usage and effectiveness is a driver of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

Table 4.15: Spearman's Correlation Coefficient for RDBMS Effectiveness and NoSQL Databases

		RDBMS Effectiveness	Need for NoSQL
RDBMS Effectiveness	Correlation Coefficient	1.000	.866**
	Sig. (2–tailed)	–	.000
	N	102	28

**. Correlation is significant at the 0.01 level (2–tailed).

Analysis Findings

The correlation from table 4.15 shows strong positive correlation with the correlation coefficient of .866 which is statistically significant at p=0.000 <0.01. There was a strong, positive correlation between the two variables based on the spearman's correlation coefficient guide on table 4.20; therefore, H_o which is the null hypothesis is rejected and H_A being the alternative hypothesis is accepted.

Interpretation of Findings

This implies that RDBMS effectiveness or usage among database administrators trigger/affect the adoption or need to switch to NoSQL databases. The effectiveness of RDBMS in managing large volume of data as a result of cloud computing to meet up with availability and scalability, affects the decision of using the right and competent database system in attaining to the requirements. The effectiveness based on this research can be effective or not effective, in a situation where the database is not effective an alternative database system should be adopted. The initial design for the existing database system might not be for the current need of users but where the existing DBMS becomes incapable to solve the needs on ground then there is a need to switch to a better alternative system is highly recommended based on this research findings (Hadjigeorgiou, 2013)

Hypothesis 2: Relationship between "RDBMS Challenges" and "Need for NoSQL Databases"

H_o: RDBMS challenges are not the drivers of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

H_A : RDBMS challenges are the drivers of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

Table 4.16: Spearman's Correlation Coefficient for RDBMS Challenges and NoSQL Databases

		RDBMS Challenges	Need for NoSQL
RDBMS Challenges	Correlation Coefficient	1.000	.654[**]
	Sig. (2-tailed)	.	.000
	N	105	28
**. Correlation is significant at the 0.01 level (2-tailed).			

Findings from Data Analysis

The **Table 4.16** above shows a significant relationship between RDBMS Challenges and Need for NoSQL databases among Nigerian IT/ICT companies; where the Sig. (2-tailed) value is .000 meaning **P<0.01**. This implies the null hypothesis is rejected and the alternative hypothesis is accepted. The above bivariate Spearman's correlation coefficient is **0.654** based from the Spearman's correlation coefficient guide on table 4.20, which means that the relationship between RDBMS Challenges and Need for NoSQL databases is a moderate positive Correlation.

Discussion on Findings

The correlation from table 4.16 implies that, the challenges of the existing system in managing large volume of data beyond the capabilities of the existing database increases the likelihood of adopting an alternative database; which based on this research is the NoSQL databases. RDBMS are faced with challenges like big data management, increased response time which violate the major characteristic of NoSQL known as availability and complex queries which slow down system transactions. These factors alone increased the possibility of the organisation to consider switching to a better database or co-inhabit the existing database and the alternative database known as the NoSQL databases (Nance, et al., 2013).

Hypothesis 3: Relationship between "Big data growth/management" and "Need for NoSQL databases".

H_0: Big data growth due to cloud computing is not a major driver of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

H_A: Big data growth due to cloud computing is a major driver of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

Table 4.17: Spearman's Correlation Coefficient for Big Data growth/management and NoSQL databases

		Big Data Growth Management	Need for NoSQL
Big Data growth Management	Correlation Coefficient	1.000	.738[**]
	Sig. (2–tailed)	.	.000
	N	54	28

. Correlation is significant at the 0.01 level (2–tailed).

Findings from Data Analysis

From table4.17, the bivariate Spearman's correlation coefficient as 0.738 statistically significant at p=0.000 < 0.01 with level (2-tailed); establishing a strong positive correlation between Big data growth/Management due to cloud computing and the need for NoSQL databases among IT/ICT companies in Nigeria. Therefore, if r_s= 0.738, p=0.000 < 0.01, then H_o which is null hypothesis is rejected and H_A being the alternative hypothesis is accepted.

Discussion on Findings

The correlation therefore implies that, drivers like big data, big users and cloud computing increase the need of NoSQL database within an organisation. Cloud computing is the major driver of big data in the world today due to the alarming rate of cloud adoption in various sector of human life for safe storage and efficient data management. The tremendous increase in global data is highly attributed to different web service applications due to users/customer requirements and need. It will surprise you to know that Google announces that they process 1Pbyte per hour, and the total amount of information in existence this year is forecast to be around $1,270 ZB^2$. Data is growing at a 40% compound annual rate, reaching nearly 45 ZB by 2020. The findings by (Vargas-Solar, 2013) shows that data is growing by the seconds which requires capable system to manage such alarming growth of data in this era where data is needed on real time basis. Also an effective DBMS in the cloud that manages these data should be able to have features like efficiency, fault tolerance, ability to run on

heterogeneous environment, ability to operate on encrypted data and interfacing with business intelligence product.

Hypothesis 4: Relationship between "Level of NoSQL Awareness" and "Need for NoSQL Databases"

H_o: Level of NoSQL awareness is not a driver of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

H_A : Level of NoSQL awareness is a driver of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

Table 4.18: Spearman's Correlation Coefficient for Level of NoSQL Awareness and NoSQL Databases

		Level of NoSQL Awareness	Need for NoSQL
Level of NoSQL Awareness	Correlation Coefficient	1.000	.771**
	Sig. (2-tailed)	.	.000
	N	56	28

**. Correlation is significant at the 0.01 level (2-tailed).


Findings from Data Analysis

Table 4.18 shows the bivariate Spearman's correlation coefficient to be 0.771 statistically significant at p=0.000 < 0.01 with level (2-tailed); establishing a strong positive correlation between level of NoSQL databases awareness and need for NoSQL databases among IT/ICT companies in Nigeria. Therefore if r_s = 0.771, p=0.000 < 0.01, then H_o which is null hypothesis is rejected and H_A being the alternative hypothesis is accepted.

Discussion on Findings

The correlation from the above analysis indicates the level of NoSQL database knowledge among database administrators working in these companies. How many of these DBAs have the knowledge and proficiencies in NoSQL databases? The more the number the greater the adoption level of adoption of NoSQL

databases. How many of these DBAs are aware of the benefits attached to using NoSQL such as:

- NoSQL technology saves your organisation the cost of buying/adding bigger servers.
- NoSQL database is considered an effective alternative to relational database due to its schemaless data mode which is most efficient for different type of data capture and processing.
- NoSQL is based on high performance with high availability and offer rich query language for easy scaling.
- NoSQL database are simple and provide inexpensive commodity for computing and storage.
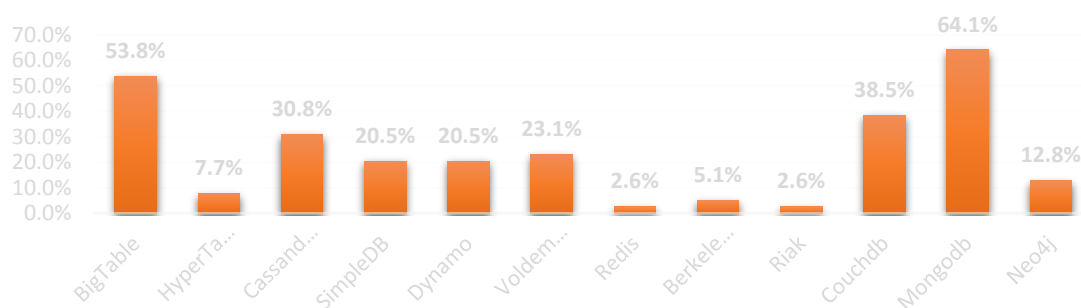
Figure 4.2: Summary of types of NoSQL databases

From the above figure, the level of awareness or knowledge of NoSQL databases among DBAs among Nigerian IT/ICT companies is quite encouraging with Mangodb (a NoSQL database) topping the chart with 64.1%. Based on the interview conducted with some of these DBAs, most of them are aware and have the knowledge of NoSQL databases but their organization are either considering adopting it or the organization are not aware of the database?

Hypothesis 5: Relationship between "RDBMS &NoSQL Co-existence" and "Need for NoSQL databases"

H_0: RDBMS and NoSQL co-existence is not a driver of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

H_A : RDBMS and NoSQL co-existence is a driver of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

Table 4.19: Spearman's Correlation Coefficient for RDBMS &NoSQL Co-existence and NoSQL databases

		RDBMS &NoSQL C existence	Need for NoSQL
RDBMS &NoSQL C existence	Correlation Coefficient	1.000	.599[**]
	Sig. (2-tailed)	.	.001
	N	55	26
**. Correlation is significant at the 0.01 level (2-tailed).*			

Findings from Data Analysis

The table 4.19 shows the bivariate Spearman's correlation coefficient to be 0.599 statistically significant at p=0.000 < 0.01 with level (2-tailed); establishing a moderate positive correlation between RDBMS &NoSQL databases Co-existence and need for NoSQL databases among IT/ICT companies in Nigeria. Therefore if r_s = 0.599, p=0.001< 0.01, then H_o which is null hypothesis is rejected and H_A being the alternative hypothesis is accepted.

Discussion on Findings

The analysis from the table 4.25 implies that, the need for NoSQL database will only be possible among these IT/ICT companies when they know the benefits that come with the co-existence of both RDBMS and NoSQL databases in data management. This then triggers the adoption of NoSQL databases among these IT/ICT companies in Nigeria. RDBMS and NoSQL can co-exist to complement each other limitations, working concurrently in managing big data thereby improving greater performance within the organisation. NoSQL database is an alternative to traditional Relational database, which an organisation can either replace it or employ the mix-and –match approach where both databases function together. Findings from (Nance, et al., 2013) shows that, due to the

challenges in data growth today it is easier to see why some organisations may not want to set up new systems and how emerging organisations would opt for new NoSQL setups for economic reasons.

Hypothesis 6: Relationship between "Management Support towards new Technology" and "Need for NoSQL databases"

H_o: Management support to adoption of new technology is not a driver of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

H_A : Management support to adoption of new technology is a driver of NoSQL database adoption and implementation among IT/ICT companies in Lagos and Abuja states of Nigeria.

Table 4.20: Spearman's Correlation Coefficient for Management Support towards NoSQL databases

		Management Support	Need for NoSQL
Management Support	Correlation Coefficient	1.000	.324[**]
	Sig. (2-tailed)	.	.001
	N	102	97

[**]. *Correlation is significant at the 0.01 level (2-tailed).*

Findings from Data Analysis

The table 4.20 shows the bivariate Spearman's correlation coefficient to be 0.324 statistically significant at p=0.001 < 0.01 with level (2-tailed); establishing a moderate to low positive correlation between Management support towards new technology and need for NoSQL database among IT/ICT companies in Nigeria. Therefore, if r_s = 0.324, p=0.001 < 0.01, then H_o which is null hypothesis is rejected and H_A being the alternative hypothesis is accepted.

Discussion on Findings

This implies that Management support to adoption of new technology is a driver of NoSQL database adoption and implementation among IT/ICT companies in

Lagos and Abuja states of Nigeria. The result from table 4.26 indicate management role towards adoption of new technology is positively low, which is to say they give no much attention to any form of new technology within the organization. Management is the key driver of any change in an organization, if they are IT inclined then adoption to any form of technology will not be a problem but where the management are not IT oriented then it will be difficult to set up new system or technology for the organization. From the survey conducted, findings show that 29.7% are considering adopting NoSQL databases to their organization.
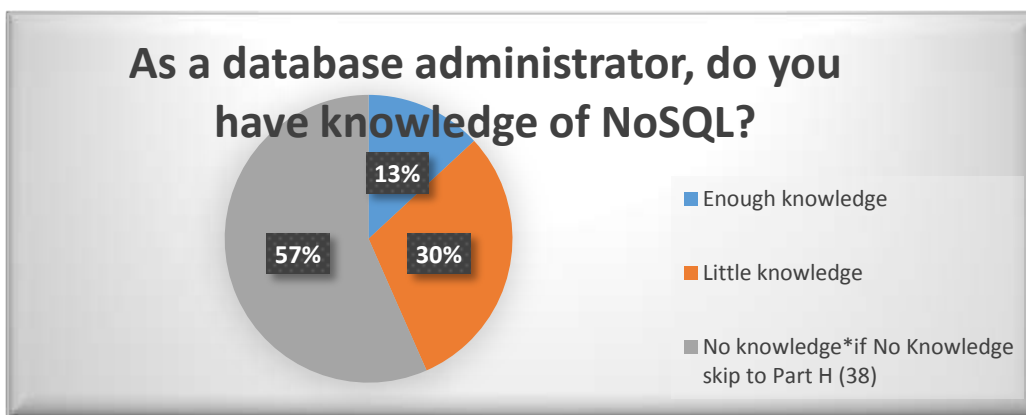
Figure 4.3: Use of NoSQL Databases

This is to say the management of such Companies are IT oriented and have seen the need to adopt and implement such databases for effective management of their numerous amount of data thereby interfacing with business intelligence products.

SUMMARY OF THE RESEARCH OBJECTIVES

In conclusion, this research will summarise the research objectives findings which had been tested and analysed. The hypotheses were developed based on the three objectives.

Relationship between Research Objectives and the Need for NoSQL Databases among IT/ICT Companies in Nigeria

Some of the main objectives of this study is to assess the challenges of the existing database management system, the awareness of NoSQL database among DBAs and the companies at large and lastly to present drivers that is leading to the adoption of NoSQL database system among IT/ICT Companies in Nigeria. Based on the research analysis and findings, it has been concluded that these research objectives affect the need for NoSQL database in data management among IT/ICT Companies within Lagos and Abuja states of Nigeria.

RDBMS Challenges and Need for NoSQL Database

The first objective of the research is to assess the challenges of the existing database known as the RDBMS in managing large volume of data. The analysis conducted based on the objectives, are to check for the significant relationship between RDBMS challenges and need for NoSQL database in big data management. The findings indicate significant moderate positive correlation between RDBMS challenges and the need for a NoSQL database among IT/ICT companies in Nigeria. The result shows the chances of NoSQL databases adoption among the IT Companies are majorly due to challenges associated with heavy queries which slow down system performances.

Big Data Growth/Management and Need for NoSQL Database

This part of analysis covers the third (3) objective in determining the drivers of big data to the adoption of NoSQL and managing big data with the existing database management system as data increases per second with the demand for availability. The overall analysis shows that most of the DBAs agreed to the point that cloud computing is the major driver of big data thereby causing the need for an alternative database system for effective data management. These DBAs are on the general view that, NoSQL database can be the most effective database system in managing big data looking at the characteristics and benefits. A capable system is needed in managing the alarming growth of data in this era where data is

needed on real time basis.Also another driver for the adoption of new database is the rate of internet usage in Nigeria according to (Odufuwa, 2012)(FinIntell, 2014). High adoption and usage of internet can lead to high level of data/information accumulation thereby generating large volume of data that need to be effectively managed to meet user's needs.

Level of NoSQL Database Awareness and Need for NoSQL Database

The second objective of this research is to assess the awareness of NoSQL database among DBAs and the companies at large. A correlation analysis was conducted to show the relationship between these two variables. The Spearman's correlation coefficient from the analysis shows a strong positive correlation between level of NoSQL databases awareness and need for NoSQL databases among IT/ICT companies in Nigeria. This objective was tested to assess how well NoSQL database is known and is being implemented in Nigeria within IT companies compared to the existing system. Though many of these companies may not have implemented NoSQL databases but many of the DBAs are aware of its existence and some have the skills of using it. This is a stepping stone because the more the number, the greater the adoption level of NoSQL databases.

RDBMS &NoSQL Database Co-existence and Need for NoSQL Database

The analysis on this part is still based on the second research objectives which are to assess the awareness of NoSQL database among DBAs and the companies at large. The Spearman's correlation coefficient from the analysis shows a moderate positive correlation between RDBMS &NoSQL databases Co-existence and need for NoSQL databases among IT/ICT companies in Nigeria. This analysis is to assess the knowledge of the DBAs in regards the co-existence between NoSQL and RDBMS (other existing database) database for different applications or different data set. Most of the respondents agreed to the fact that NoSQL database is an alternative of RDBMS database which can either be replace with or the organisation can either employ the mix-and-match approach for both databases.

The general relationship indicates a moderate effect to the adoption of NoSQL databases.

Management Support and Need for NoSQL Database

The analysis on this part deviated from the research objectives but it is important to assess the management attitudes in regard adoption of technology in every organisation. The Spearman's correlation coefficient on this hypothesis shows a moderate to low positive correlation between Management Support towards new technology and need for NoSQL databases among IT/ICT companies in Nigeria. This implies the relationship between the variable Management support and Need for NoSQL database is weak, management do not really and effectively support the advent and adoption of new technology within the organisation. Management can be a major hindrance to the adoption of new technology and at the same time can be drivers of the adoption based on their IT orientation.

RECOMMENDATIONS

NoSQL database is a database technology which is under adoption stage in most country and so organisations will not easily throw the existing database which they have spent lots of resources on just at the mention of new a better alternative. However, majority of the respondents are in support of its benefits in data management and scaling, more awareness need to be carried out to bring this technology of data management into implementation among IT/ICT Companies in Nigeria. Recommendations are based on the research findings.

Educating Management on NoSQL Database Benefits

Management are always the key drivers of change in any organisation. The adoption of any new technology within an organisation follows the approval of the management, therefore management needs to be educated on the importance and need of NoSQL database in this era where information/data have become so vast and big to be managed. The management need to know about capable system that can handle the growing problem on ground. The adoption of new technology

within an organisation is much easier with management that are IT inclined than the other way round. So for IT/ICT Companies in Nigeria to easily adopt and implement NoSQL database, management need to know the benefits in line with business product and minimum CAPEX.

Government Initiatives

In Nigeria, most of the IT/ICT companies are being run and managed by the private companies or international companies. Most of the cloud providers and data centres are privately owned with little or no concern from the government. IT Companies in Nigeria contribute 20% to the country's GDP and is the fastest growing industry in Nigeria among other industries. There is a need for government intervention programmes especially through Ministry of Information Technology and Nigeria Communication and Commission (NCC), to help build Nigerian Information Technology and Management sector. There should be initiatives in funding of projects, development of data centres and DBAs skill developments. Cloud computing have presented us with the trend of accumulating data per second, data will keep on increasing not decreasing therefore capable data management systems are needed to handle such issues with the government help and support.

Benefits for using NoSQL databases

For the companies that are considering migrating to NoSQL databases, it is important to know that NoSQL databases are not the answer to all your challenges. They are meant for specific use case and trade-offs are made to achieve those objectives. In order to achieve good performance, building a caching layer on top of the NoSQL store back-end have been proved to be a successful approach and is being applied by Web social applications, especially gaming sites. Also note that there are NoSQL databases that support SQL-like query language (a subset of SQL), like SimpleDB and Cassandra.

FUTURE WORK

Furthermore, one of the most important aspect that can be explore is the critical study of all the NoSQL databases and which data set to use the database on. Especially since many types of NoSQL databases exist, that would provide insight on how well the different databases perform and whether they can be used at all instead of relational databases. Different sizes of database affect the type of DBMS in use, it is either the DBMS is capable to handle the data or the data are too large beyond the capabilities of the DBMS to handle. Database complexity in number of tables or how RDBMS is deployed in NoSQL database is something critically look into in future. The mix-and-match approach where two types of database system exit together is not in detail in this study which can be considered in the future. Reasons are to understand reliability in terms of performance and scalability of one database type over the other where NoSQL lacks ACID properties and RDBMS lacks availability and scalability.

CONCLUSION

In conclusion, migrating to NoSQL database is not an easy task because of lack of standards which is normal for all new technologies until they mature, interoperability is a concern when thinking of moving applications from one application to another (RDBMS to NoSQL). Organisation needs to understand their data set, which data are access frequently and on time (availability) thereby helping the organisation to know which type of NoSQL databases to be implemented. In achieving higher performance and availability, NoSQL stores make trade-offs of ACID characteristics which do not support ad-hoc and complex queries in transactions. The number one thing to do when moving to NoSQL is to understand how to query your data set and then explore the various NoSQL database solutions. The overall benchmark is for the organisation to know the type of data set they are dealing with and look for capable DBMS to handle such data set. Nigeria IT/ICT companies need to understand the kind of data they are dealing with, the size (items), size of indexes and the operation they perform

on it. This is necessary and important in other to improve business returns with minimum response time.

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