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Assessment of Cloud Computing Awareness in Kano Municipal Local Government Area of Kano State of Nigeria

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Abstract: ***The term 'cloud' originates from the world of telecommunications when providers began using virtual private networks (VPN) services for data communication. Cloud computing deals with computation, software, data access and storage services that may not require the end user's knowledge of the physical location and configuration of the system that is proving the services. This study aims at assessing the level of cloud computing awareness and adoption in Kano Municipal Local Government Area (LGA) of Kano State in Nigeria. For these objectives to be accomplished the study uses a survey data by randomly administering questionnaires to 390 respondents from Kano Municipal Local Government. The research employs Statistical Package for Social Science (SPSS) tool as a method of data analysis in order to answer the formulated research questions. From the research findings, although there are factors hindering the use of cloud computing services in Kano municipal LGA, the level of awareness and adoption is encouraging. However, it is recommended that more awareness campaign and proper education should be giving to the populace in Kano municipal LGA so as to enjoy the enormous benefits of cloud computing.***

Keywords: Cloud Computing, Awareness, VPN, SPSS

I. INTRODUCTION

In 1969, Leonard Kleinrock, one of the chief scientists of the original Advanced Research Projects Agency Network (ARPANET) project which seeded the Internet, said: "As of now, computer networks are still in their infancy, but as they grow up and become sophisticated, we will probably see the spread of 'computer utilities' which, like present electric and telephone utilities, will service individual homes and offices across the country." This vision of the computing utility based on the service provisioning model anticipates the massive transformation of the entire computing industry in the 21 century whereby computing services will be readily available on demand, like other utility services available in today's society. Similarly, computing service users (consumers) need to pay providers only when they access computing services. In addition, consumers no longer need to invest heavily or encounter difficulties in building and maintaining complex IT infrastructure. In 2009 the US National Institute of Standards and Technology (NIST) Information Technology Laboratory define cloud computing as a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction [1]. Gartner defines cloud computing as "a style of computing where massively scalable IT- enabled capabilities are delivered as a services to external customers using Internet technologies"[2].
Below are the main technologies behind cloud computing:

A. Grid Computing

It is a network of large numbers of computers that are work together to obtain wide range of computing resources like a mainframe supercomputer. This type of computer network performs large and complex computational operations. The network of computers that represents the Grid computing array may be physically located in different geographical locations [3].

B. Virtualization

The layer between Hardware Abstraction Layer (HAL) and operating system (OS) is called virtualization. Virtualization is the core concept and buildings block behind cloud technology. The virtualization layer takes users request and allocate dynamically the specific computing resources. In 1999 VMware released virtual machine which allows multiple operating systems to run on single personal computers [5]. Virtualization technology helps to utilize servers in more efficient way. for instance, in a data center server,

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utilization is lower than 10 % [4]. The proper use of hardware resources especially servers can provide significant benefits such as reducing operational costs and minimize the upfront costs for Small Medium Enterprise SME's [6].

C. Multi-Tenancy

In multi-tenancy architecture, software instances and hardware systems can be operating at the same time to meet the demand of many client organizations. In this architecture software framework offers virtually partitioned application data and the system is configured in such a way that each client organization are able to work with customized virtual applications. It helps to utilizes IT resources efficiently.

D. Utility Computing

Utility computing represents the model of providing resources on-demand and charging customers based on usage rather than a flat rate. Cloud computing can be perceived as a realization of utility computing. It adopts a utility-based pricing scheme entirely for economic reasons. With on-demand resource provisioning and utility based pricing, service providers can truly maximize resource utilization and minimize their operating costs.

E. Service Models

1) Software as a Service (SaaS): The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure The applications are accessible from various client devices through either a thin client interface, such as a web browser (e.g., web-based email), or a program interface. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user specific application configuration settings. [1]

2) Platform as a Service (PaaS): The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment [1].

3) Infrastructure as a Service (IaaS): The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, and deployed applications and possibly limited control of select networking components (e.g., host firewalls [1].

III. METHODOLOGY

A. Research Instrument

The research instrument used is the questionnaire. The goal of the questionnaire survey was to test the level of awareness of cloud computing in Kano Municipal. A questionnaire survey provides a fast and efficient means of gathering information with regards to the respondents' perception about cloud computing. The questionnaire contains two section. Section one contains the demographic information and section two contains the general information.

B. Reliability of the Research Instrument

To determine the reliability of the research instrument prior to the main study, a pilot study was conducted. A pilot study is usually carried out among a small sample before a full scale wide survey is implemented. Before the actual survey for the study was carried out, the questionnaire was pre-tested by distributing it to 10 individuals. These selected individuals varied in age, gender, educational level and experience. The purpose of the pilot survey is to test the questionnaire to ensure that it is coherent, comprehensible, accurate and that meaningful data analysis can be carried out subsequently. The 10 completed questionnaires were collected from the pilot studies. The common comments from the pilot test was that certain questions were repetitive and the respondents faced difficulties in understanding the requirements of some questions. Many respondents also suggested rearranging the layout of the questionnaire to make it shorter and more appealing. To test the reliability of the research instrument, Cronbach alpha statistical reliability test was carried out. The result of the reliability test is 0.71 which is within the acceptable limit (**.8 < α ≤ .7 acceptable)** [7]. It implies that the research instrument is reliable. Below are the results of the pilot test

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Table 3. 1 Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.716	.642	11

C. Sampling

The survey was based on probability sampling, using the simple random sampling technique. In this technique, every unit had an equal chance of selection [10]. The limitation of this sampling method was that members of a subgroup of interest may not be included in appropriate proportions [10]. In probability sampling, it is important to distinguish between three groups: the population, the sampling frame and the sample.

D. Population of Study

The population refers to the group from which the sample was drawn and to which the findings were to be generalized [11]. The target populace were people from Kano Municipal LGA from various schools, institutions, ministry's, business places and organizations. The population of Kano Municipal LGA as of 2006 census is 365,525.

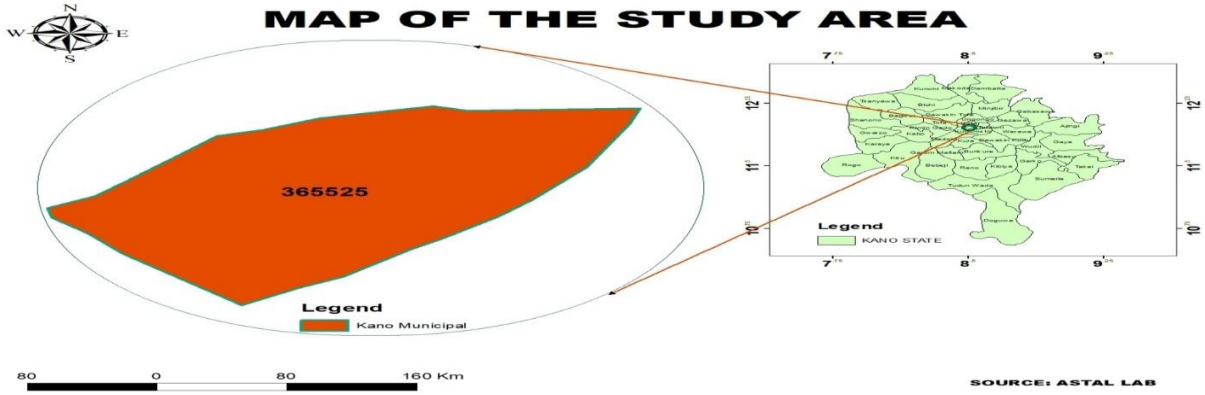

figure 3. 1Map of the study area

E. Sampling Size

The sample referred to the subset of the population that was selected as respondents and the analyzed data was then generalized to the population [8]. To obtain the sample size, Krejcie and Morgan table was used in which from 75,000 to 1 million population, 384 samples are required [9]. Therefore, the target sample size was set at 390 in order to obtain an adequate number of responses so that the findings are generalizable.

F. Method of Data Collection

Two methods of data collection were used. The questionnaire was used as the main instrument for gathering the primary data. The secondary data that includes literature reviews, theories, information etc. were gathered from newspapers, journals, internet and text books. The primary and secondary data were added together to build up this research.

G. Tool for Data Analysis

After the answered survey forms were returned, the responses were edited to ensure completeness, consistency and readability. Quantifiable data from the questionnaires were coded into the Statistical Package for Social Sciences (SPSS 23.0) for analysis. SPSS 23.0 was selected because it was considered to be user-friendly. Statistical techniques were then employed to analyze the data collected from the survey.

H. Descriptive Statistics

They are used to describe the basic features of data collected. The goal is to present the result of the survey data in a more meaningful way which allow for simpler interpretation of data. In this study descriptive statistics used includes histograms percentages frequencies and tables.

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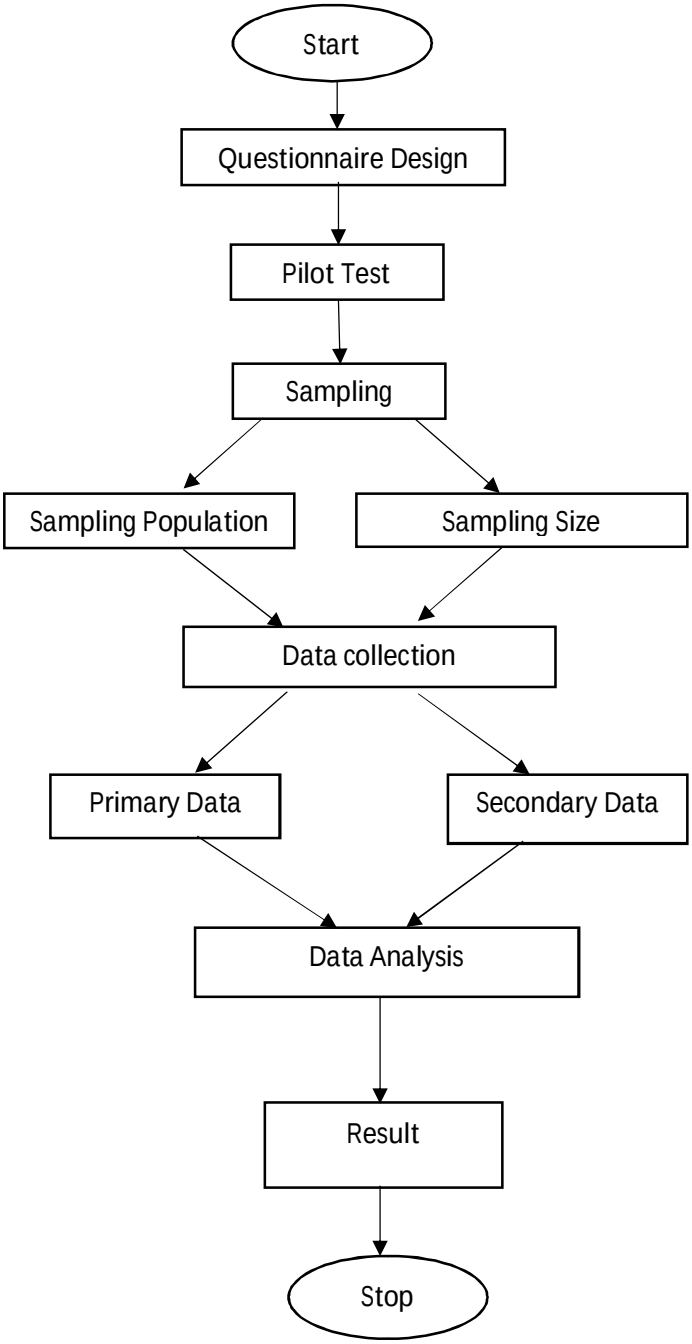

figure 3. 2 flow chart of the methodology

IV. RESULTS AND DISCUSSION

A. Frequency Analysis

A total of 390 questionnaires were distributed in which 367 were successfully returned. 32 of them are considered invalid leaving the total number of valid questionnaire to be 335 in which descriptive statistics was used to analyze the data.

B. Demographic Information

This is the first part of the questionnaire that capture the personal information of the respondent such as age, gender and occupation.

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1) Age of Respondent:

Table 4. 1 Age of Respondent

Age	Frequency	Percent(%)
18-25	50	14.9
26-35	112	33.4
36-45	133	39.7
46 and above	40	11.9
Total	335	100.0

Out of the 335 respondent 50 are between the age of 18-25(14.9%),112 are between the age of 26-35 (33.4%) 133 are between the age of 36-45(39.7%) and 40 are between the age of 46 and above (11.9%)as shown in the bar chart below

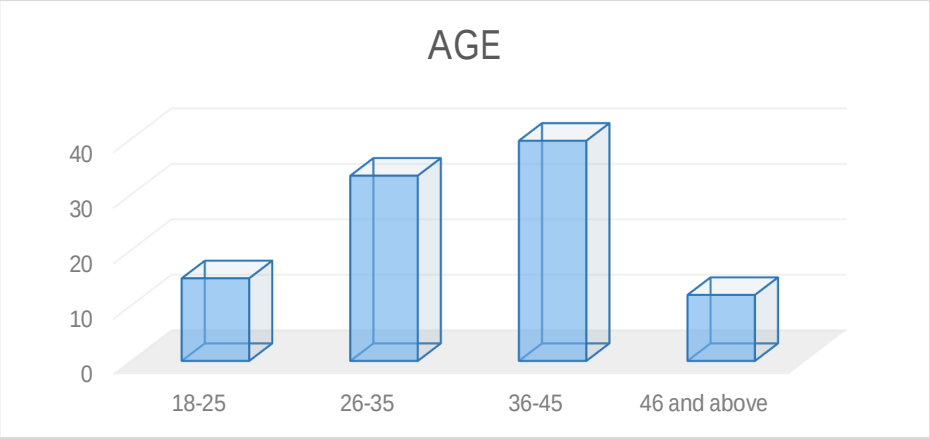

figure 4. 1 Age of respondent

2) Gender of Respondent:

Table 4. 2 Gender of respondent

Gender	Frequency	Percent(%)
Male	210	62.7
Female	125	37.3
Total	335	100.0

From the above table the male respondents are 210 in number (62.7%) and the female are 125(37.3%) as shown in the bar chart below:

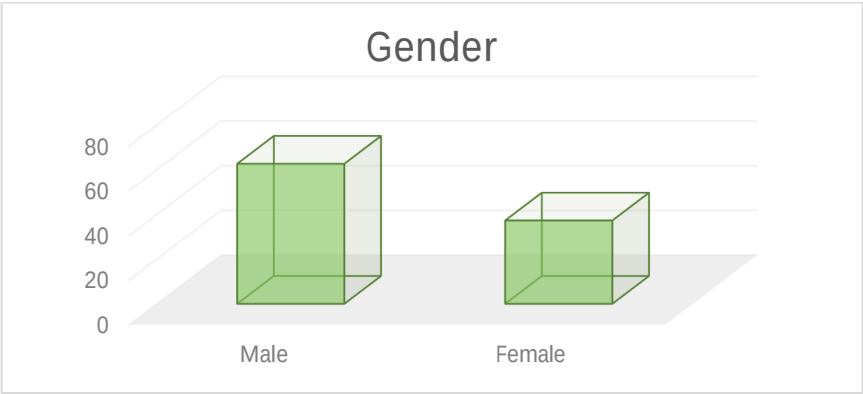

figure 4. 2 Gender of respondent

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3) Occupation of Respondent:

Table 4. 3 Occupation of respondent

Occupation	Frequency	Percent(%)
Private business	171	51.0
Civil servant	106	31.6
Others	58	17.3
Total	335	100.0

From the table above it can be evident that most of the respondent are into private business 51.4% ,31.6% are civil servant and others occupies 17.31%. The group others consist of students, house wives, Islamic teachers etc. The figure below shows the distribution of the occupation of the respondent.

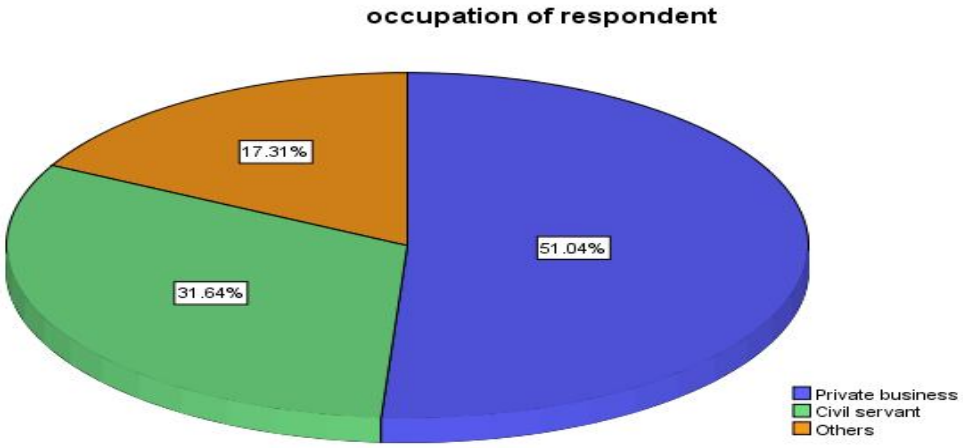

figure 4. 3 occupation of respondent

4) Educational Level:

Table 4. 4 Educational level of respondent

Education level	Frequency	Percent(%)
Primary education	66	19.7
Secondary education	164	49.0
Tertiary level	105	31.3
Total	335	100.0

From the table above, 66(19.7%) have completed primary school,164(49%) have completed secondary school and 105(33.1%) have attended various tertiary institute. The figure below describes the educational level of the respondents.

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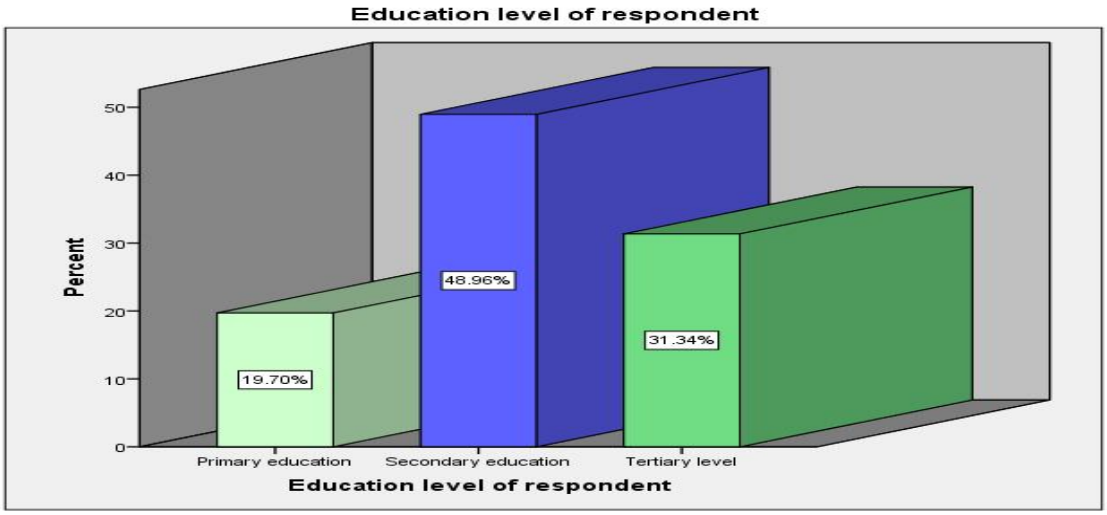

figure 4. 4 Educational level

C. General Information

This is the second part of the questionnaire that was designed with the intention of gathering all the required information about cloud computing in our study area.

1) Type of Internet Usage: Internet is the most crucial part of cloud computing. The question, what do you use internet for? is design to know how they use the internet.

Table 4. 5 Internet usage by the respondent

Type of internet usage	Frequency	Percent(%)
Marketing resources	25	7.5
Educational purposes	61	18.2
Communicating	60	17.9
proving services to customers	60	17.9
Entertainment and personal purposes	129	38.5
Total	335	100.0

From the table above 7.5% of the respondent use the internet for marketing their resources,18.2% for Educational purpose,17.9% for communication,17.9% for providing services to customers and 38.5% for entertainment and personal purposes.

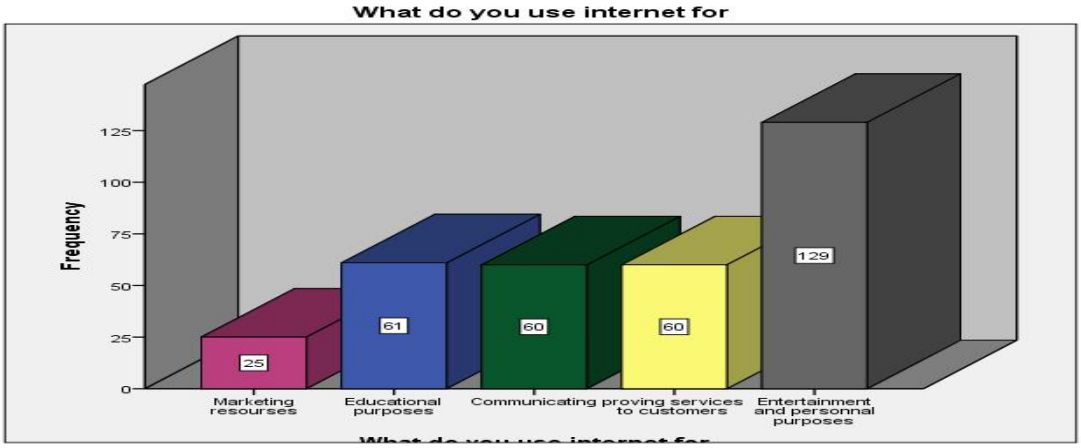

figure 4. 5 Internet usage by the respondent

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2) *Speed of Internet:* The speed of the internet determines the quality of the internet service and also plays an important role in determining the level of adaption and usage of the internet. With this in mind the question how fast is the internet service? was formulated, the following results were obtained as shown in the table below:

Table 4.6 Speed of the internet

Internet speed	Frequency	Percent(%)
Very fast	65	19.4
Moderately fast	184	54.9
Slow	86	25.7
Total	335	100.0

65(19.4%) of the respondent acknowledge that the internet speed is very fast,184(54.9%) that it is moderately fast and 86(27.5%) said that it is slow.

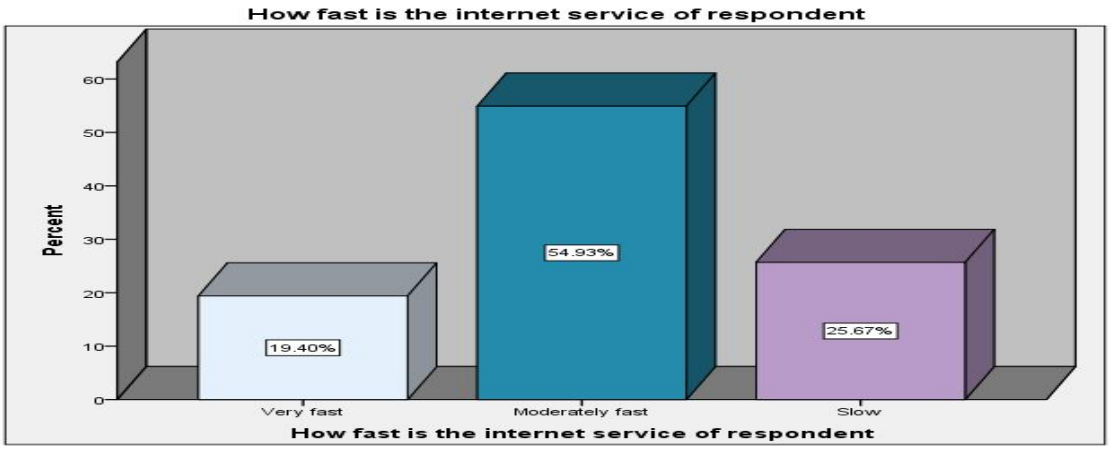

figure 4. 6 The speed of the internet by the respondents

3) *Cost of Internet Service:* It is very important to know the cost of internet services as it is a critical factor in determine the level of adoption of cloud computing. The higher the cost the lower the usage. The respondents were asked to rate the cost of the internet services and the following results were obtained.

Table 4. 7 Cost of internet services

Cost	Frequency	Percent(%)
Very expensive	124	37.0
Moderate	191	57.0
Cheap	20	6.0
Total	335	100.0

From the table above,124(37%) of the respondents said that the internet service is very expensive,191(57%) said that is moderate and 20(6%) said that it is cheap.

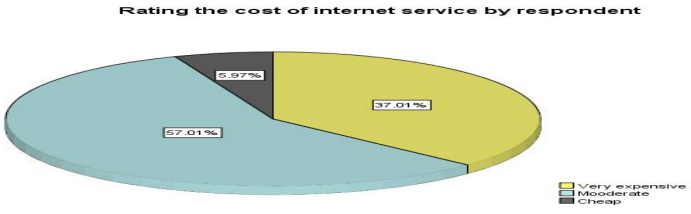

figure 4. 7 Cost of internet services

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4) *Familiarity with Cloud Computing:* The question, do you know what cloud computing is? was design to know the level of awareness of cloud computing among the respondents. Some of the respondents know what cloud computing is while others have ideas and some don't know. The following results were obtained and shown in the figure below

Table 4. 8 Familiarity with cloud computing

Cloud computing	Frequency	Percent(%)
Very good	73	21.8
Good	175	52.2
Fair	87	26.0
Total	335	100.0

73(21.3%) of the respondents know cloud computing very well,175(52.2%) have good understanding of cloud computing and 87(26%) have a very limited knowledge of what cloud computing is.

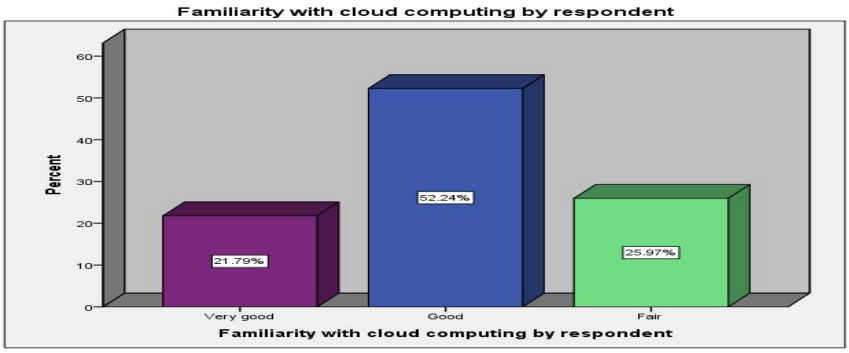

figure 4. 8 familiarity with cloud computing

5) *Familiarity with Cloud Computing Concept:* Many people use the internet which is an integral part of the cloud computing but the concept of cloud computing i.e. how it works, its component, service models and deployment model might not be well known to the respondents. The question, are you familiar with cloud computing concept? Becomes necessary. The table below shows the result obtained from the respondents.

Table 4. 9 Familiarity with cloud computing concept

Familiarity with cloud computing concept	Frequency	Percent(%)
Yes	169	50.4
No	166	49.6
Total	335	100.0

From the table above it is evident that 169(50.4%) of the respondents know the concept of cloud computing and 166(49.6%) don't know the concept.

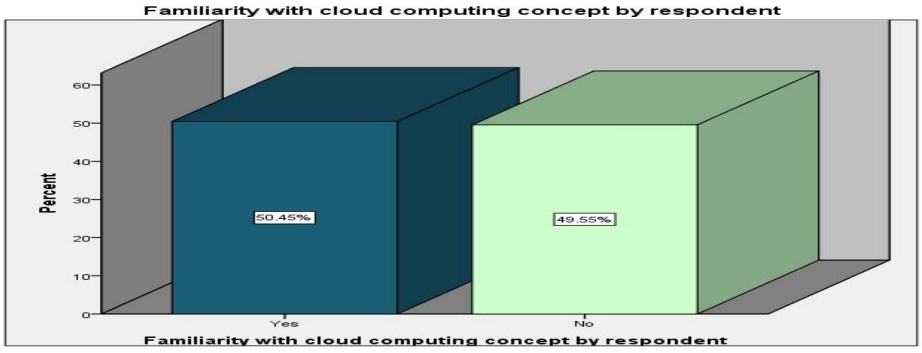

figure 4. 9 Familiarity with cloud computing concept

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6) *Purpose for Using Cloud Computing:* Cloud computing have so many application and people tend to use those applications for either personal purpose or professional purpose. With this in mind the question, what do you use cloud computing for? was formulated. The following are the responses from the respondents.

Table 4.10 Purpose of using cloud computing

Why using cloud computing	Frequency	Percent(%)
Personal	291	86.9
Professional	44	13.1
Total	335	100.0

291 (86.9%) use cloud computing services for personal purpose while 44(13.1%) use it for professional purpose.

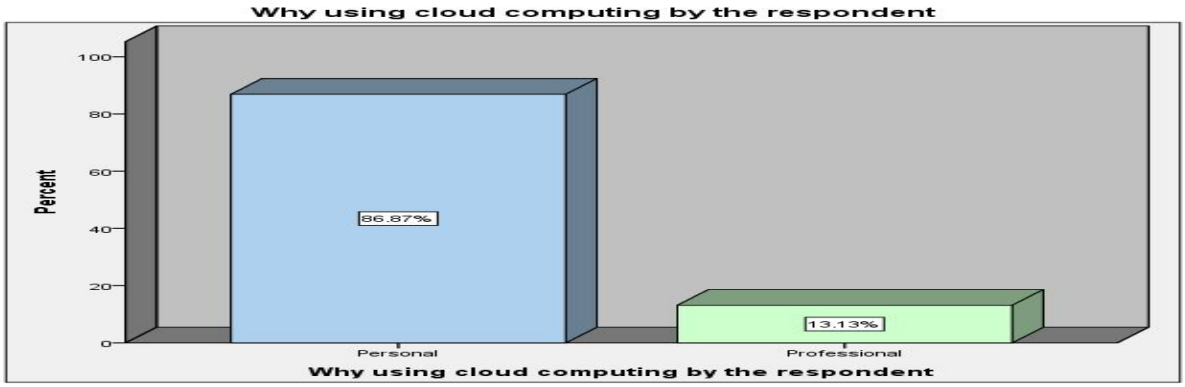

figure 4. 10 Why using cloud computing

7) *Type of Services Frequently Used:* Cloud computing have various service models (IAAS, SAAS, PAAS) as discussed in the literature review. To know the usage of these service models the question what type of cloud computing services do you use? was asked and some few options were given to assist the respondents. The table below shows the result that was obtained.

Table 4. 11Type of cloud computing services used

Type of cloud computing services	Frequency	Percent(%)
Social networking	178	53.1
Software and applications	72	21.5
File sharing services	44	13.1
Storing services	41	12.2
Total	335	100.0

178(53.1%) make use of mostly social networking,72(21/5%) uses software and applications,44(13.1) use file sharing services and 41(12.2%) uses storing services.

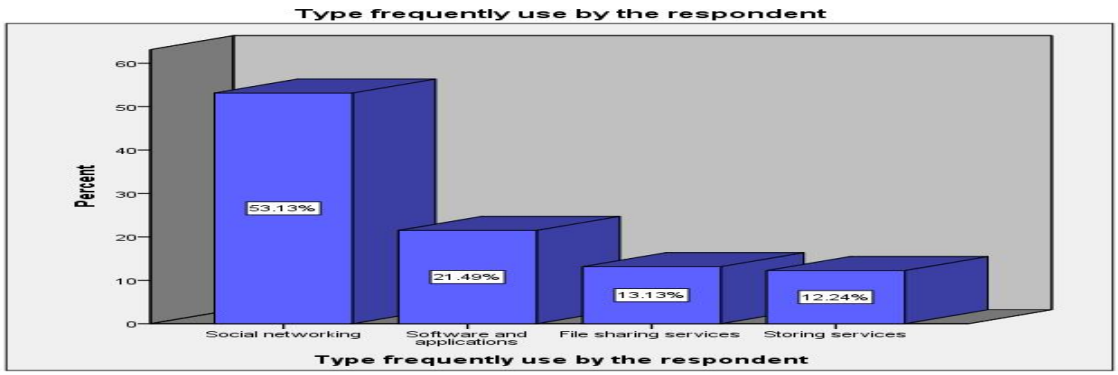

figure 4. 11Type of services frequently used by the respondent

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8) Use of Email:

Table 4.12 Use of Email

Email	Frequency	Percent(%)
Gmail	171	51.0
Outlook	39	11.6
Yahoo mail	88	26.3
Others	37	11.0
Total	335	100.0

From the table below most the respondent uses Gmail 171(51%),39(11.6%) uses outlook,88(26.3%) use yahoo mail and 37(11%) use other applications as shown in the chart below:

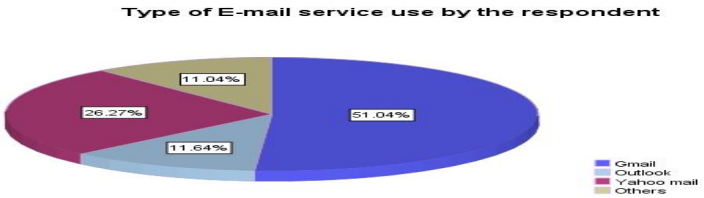

figure 4. 12 Type of email service

9) Type of Social Media: It is evident that most respondent use cloud computing for personal use and mostly on social media.Some common social media applications were choosen to see which one is the most commonly used.

Table 4.13 Social media

Social media	Frequency	Percent(%)
Facebook	137	40.9
Tweeter	60	17.9
WhatsApp	100	29.9
Instagram	28	8.4
Skype	10	3.0
Total	335	100.0

From the above table,137(40.9%) uses facebook,60(17.9%) uses tweeter, 100(29.9%)uses whatsapp,28(8.4%) uses Instagram and 10(3%) uses Skype.

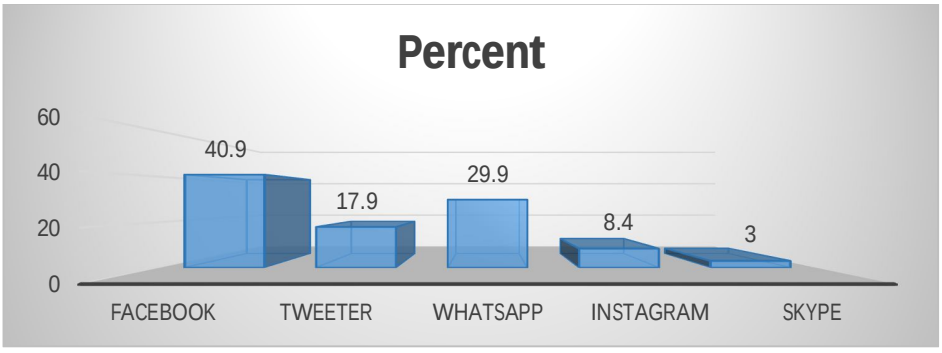

figure 4. 13Usage of social media applications

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10) File Sharing Applications:

Table 4. 14 File sharing Applications

File sharing Applications	Frequency	Percent(%)
Xender	182	54.3
Flash share	36	10.7
Google drive	69	20.6
Others	48	14.3
Total	335	100.0

From the table above it can be seen that 182(54.3%) Xender for transferring files,36(10.7%) uses flash share,69(20.6%) uses google drive and 48(14.3%) uses other applications.

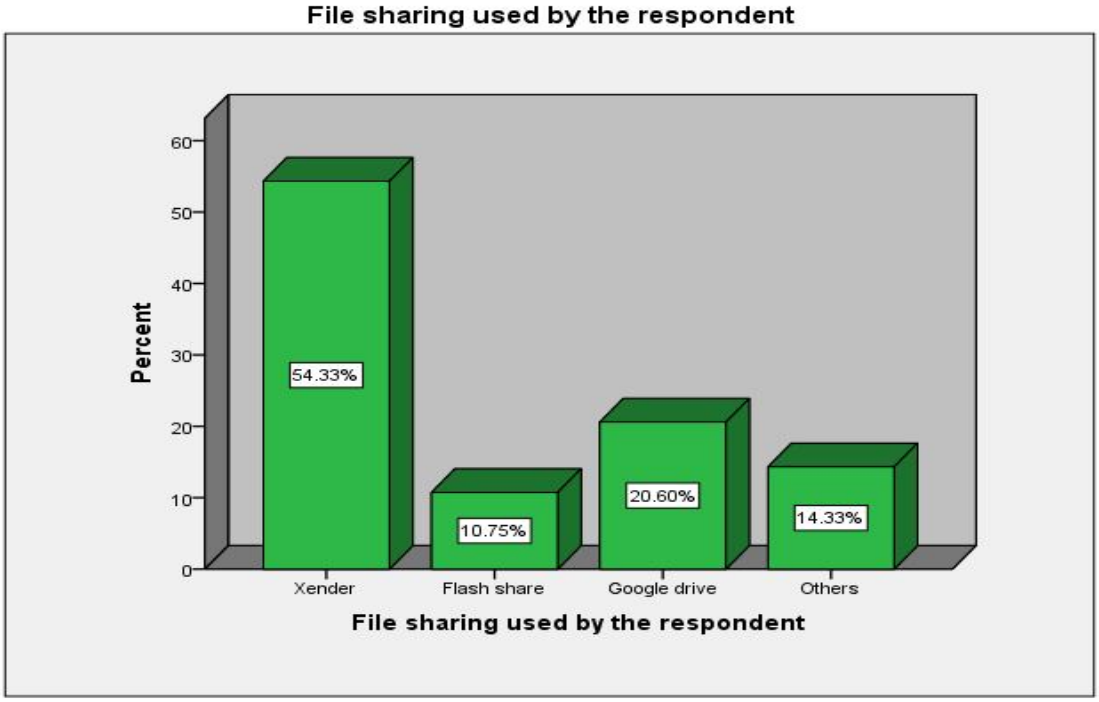

figure 4.14 File sharing by respondents

11) Storage Service: Some common storage services applications were listed and the respondent were asked to choose the one they use most frequently. The following results were obtained.

Table 4.15 Storage services

Storage services	Frequency	Percent(%)
Google drive	143	42.7
Dropbox	102	30.4
One drive	12	3.6
iCloud	54	16.1
Others	24	7.2
Total	335	100.0

Google drive have the highest with 42.7%, then drop box with 30.4%, iCloud with 16.1%, others 7.2 % and one drive with 3.6%.

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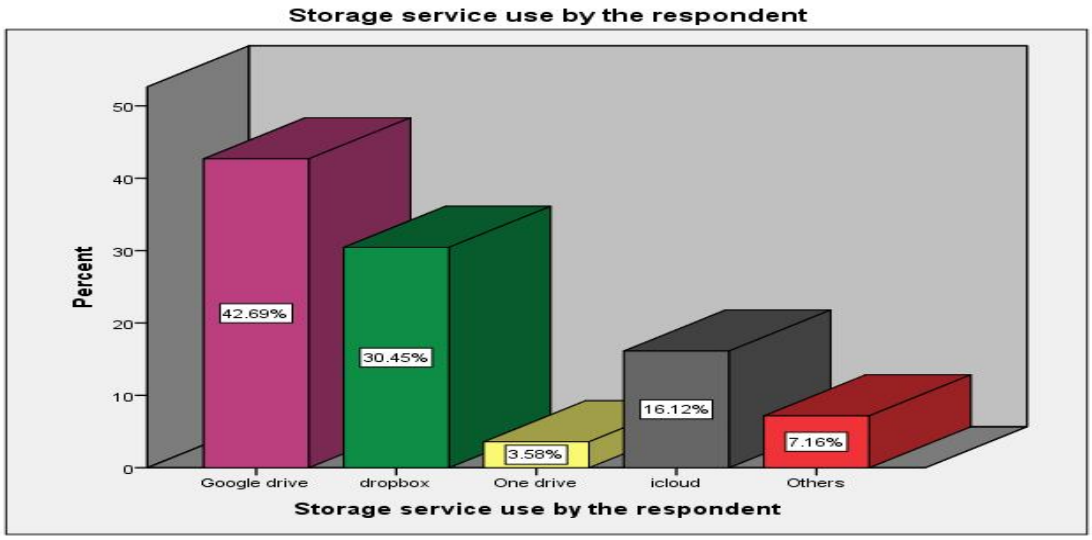

figure 4. 15 Storage services

12) *Reason for Limited use of Cloud Computing:* Some factors that limit the use of cloud computing were listed and the question, what is the reason for limited use of cloud computing? was asked. The following were the response of the respondents.

Table 4. 16 Reason for limited use of cloud computing

Reason for limited use of cloud computing	Frequency	Percent(%)
Lack of awareness	125	37.3
Data security	34	10.1
Poor internet service	95	28.4
Cost	65	19.4
Lack of integration from service providers	16	4.8
Total	335	100.0

From the above table it can be evident that 125(37.3%) believe that lack of awareness is the main factor, 34(10.1%) choose data security,95(28.4%) choose poor internet service,65(19.4%) choose cost and 16(4.8%) choose lack of integration from service providers.

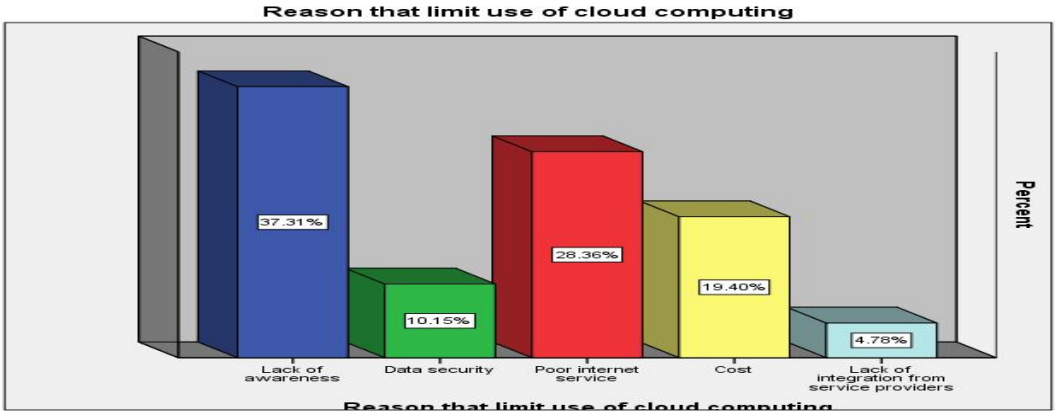

figure 4. 16 Reason that limit the use of cloud computing

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D. Discussion of the Result

From The results, it can be deduced that the respondent uses the internet frequently and that the cost of internet service is moderate and affordable leading to more adoption of the technology. The level of familiarity shows that 21.8% are very much familiar with cloud computing 52.24% have good knowledge of it, only 25.96% have little or no awareness of cloud computing which is very encouraging. But when it comes to the actual concept of cloud computing only 50.4% of the respondent know the concept and 49.6% have little or no knowledge about the concept.

Most of The respondents uses cloud computing for personal purpose 86.9%. They use the social media more frequently (53.13%). The most used social media application is Facebook with 40.9% followed by WhatsApp 29.9%. The most common file sharing app is Xender (54.3%). Furthermore, the respondents use Gmail as their predominant email application and Google drive for storage. The result is consistent with the fact that most people that use smart phones use the android operating system in which Gmail and Google drive are android application.

It was observed from the result that the major factor limiting the use of cloud computing is lack of awareness (37.31%). Many people are not fully aware of cloud computing. More awareness campaign should be embarked on to educate the populace on the enormous benefit of cloud computing. Most people view cloud computing as just a platform for entertainment as such the business side of cloud computing is left behind. Cost of internet services is also a very important factor with 18.1%. Another factor is poor internet service (28.36%). With poor internet, accessing cloud computing service becomes a problem. this problem still exists but it has drastically improved with the adoption of 4G networks by the mobile network service providers.

V. CONCLUSION

The purpose of this research work is to evaluate the level of awareness and uses regarding cloud computing services and application in Kano Municipal LGA. For this purpose, a survey was conducted through the use of questionnaires to evaluate the objectives from respondents in Kano municipal LGA. Findings are showing that most of the respondents are familiar with cloud computing but use it for personal purpose and ignore the professional aspect. Cloud computing eliminates the need to install and run the application on the client computer, facilitates the development and deployment of applications without the cost and complexity of buying and managing the underlying hardware and software layers. It also provides storage and computing capabilities. An increase in the awareness and familiarity with cloud computing amongst the populace of Kano Municipal LGA will serves as the perfect recipe for increased adoption. There is therefore the need to focus and raise awareness on its benefits and importance.

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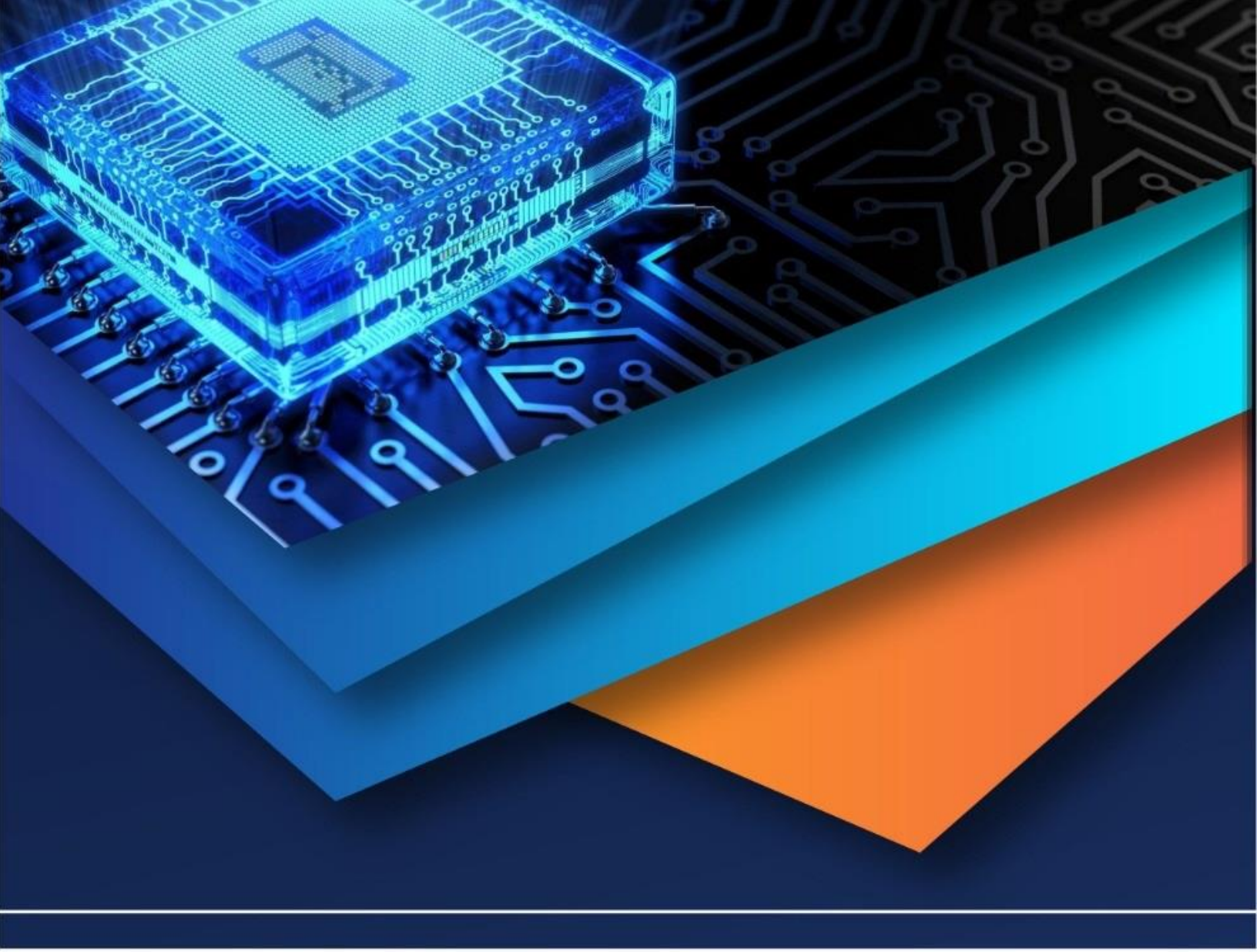

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