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Prospects for Adoption of Green Building Strategies in Abakaliki Metropolis of Ebonyi State, Nigeria

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Abstract

Prospects for Adoption of Green Building Strategies in Abakaliki Metropolis of Ebonyi State, Nigeria” was a study carried out with the sole aim of determining the prospects for the adoption of green building strategies in Abakaliki Metropolis of Ebonyi State. It has two specific objectives as follows: to identify the benefits of green buildings; and to appraise the existing government policies on planning regulation for the adoption of green building strategies in Abakaliki Metropolis of Ebonyi State, Nigeria. Two research questions and two null hypotheses were formulated and tested by the study. The study used descriptive survey design. The area of study was Abakaliki Metropolis of Ebonyi State. Abakaliki is the capital of Ebonyi State and the biggest town in the state. The population of the study was 56 architects who were registered members of the Nigerian Institute of Architects, Abakaliki Branch. There was no sample size as the whole population was used for the study. The two research questions were analysed using mean and standard deviation while the two null hypotheses were tested using Chi-square statistic at 0.05 level of significance. The results of the study showed that: there are significant benefits of green building for its adoption in Abakaliki Metropolis of Ebonyi State ($\chi^2 = 28.88$ at $P < 0.05$); and there are significant government policies on planning regulation for the adoption of green building strategies in Abakaliki Metropolis of Ebonyi State ($\chi^2 = 28.88$ at $P < 0.05$). The study recommended that the Federal Government of Nigeria should organize seminars in all the states and major cities and towns in Nigeria to create awareness of the existence of the concept and benefits of green building. Secondly, the Federal Government of Nigeria and States should enact specific laws on adoption of green building concepts and strategies in Nigeria. .

Key Words: Prospects, Adoption, Green Building and Strategies

Introduction

Background of the Study

Green Building (GB) was defined by the Organisation for Economic Co-operation and Development (OECD, 2003) as those buildings that have minimum adverse effects on the built and natural environment, in terms of the buildings themselves, their immediate surroundings and the broader regional and global setting. According to OECD, a green building is designed to minimize the total environmental impact of its materials, construction, operation and deconstruction while maximizing opportunities for indoor environmental quality and performance. Green buildings are constructed and operated in ways that enhance their impact on the building occupants while reducing impacts on the

environment. Jain (2009) defined green building as one which adopts the best practices of environmental technology for optimizing the use of natural resources for providing clean and cost effective working ambience. Green buildings minimize the consumption of materials and maximize their reuse; create quality buildings that are commercially viable; minimize energy consumption and greenhouse gas emissions; adopt environmentally sound and healthy work practices and during construction.

Green building is also known as sustainable building. It is both structure and the application of processes that are environmentally responsible and resource-efficient throughout a

buildings life-cycle: from planning to design, construction, operation, maintenance, renovation and demolition (Wiki, 2021). A sustainable building is a structure that is designed, built, renovated, operated or reused in an ecological and resource efficient manner. According to Jain (2009), sustainable design strategies use the standard elements of a building-walls, windows and floors to collect, store and release the energy from the sun for heating, lighting and cooling.

The green building concept has gained momentum in developed and developing nations because of the negative impact of carbon dioxide and other dangerous gases emissions into the atmosphere from conventional buildings which have resulted in global warming and their negative impacts worldwide especially changes in weather and climate on Earth. In this study, prospect is defined as the possibility that an idea or something might be successful; adoption means the decision to start something such as an idea or plan; and a strategy is a plan intended to be used to achieve a given task or goal (Hornby,2015).

The study was justified and significant because it would help architects in Abakaliki to start designing sustainable buildings. Builders in the city would also adopt green building strategies during construction, Ebonyi State Government and its building regulatory agencies would bring policies that would encourage adoption of green building strategies thereby reducing negative environmental impact from carbon emission in Abakaliki Metropolis and other urban areas in the state.

Statement of the Problem

Studies in the United States of America have found that every conventional building is producing 40% of carbon dioxide in the environment. Carbon dioxide produces green house effects by depleting the ozone layer (Shabrin and Kashem, 2017). Conventional buildings also consume too much energy in terms of electricity and this affects the finances of occupants negatively. Maintenance and operational costs increase as the buildings get old. Abakaliki Metropolis of Ebonyi State is in dire need of environmentally friendly and affordable houses for its teeming population.

The need for more housing estates from both the federal, state and private developers in the city cannot be overemphasized. As the stakeholders in large scale urban housing development in the metropolis grapple with high cost of conventional building materials, there is need to go green in building as the world is shifting to green buildings. Adopting green building strategies in Abakaliki metropolis of Ebonyi State will require providing answers to the following questions: What are the benefits of green buildings? What are the existing government policies on planning regulation? Given the above situation, and the need to construct environmentally friendly houses to reduce the problems of conventional buildings, it became imperative to undertake the study on “Prospects for Adoption of Green Building Strategies in Abakaliki Metropolis of Ebonyi State, Nigeria.”

Aims and Objectives of the Study

The main aim of the study was to determine the prospects for adoption of green building strategies in Abakaliki Metropolis of Ebonyi State, Nigeria. The specific objectives of the study were:

- To identify the benefits of green building for its adoption in Abakaliki Metropolis of Ebonyi State;
- To appraise the existing government policies on planning regulation for the adoption of green building strategies in Abakaliki Metropolis of Ebonyi State.

Scope of the Study

This study covers the following:

- Academic scope-concepts of green building, benefits of green buildings and government policies on planning regulation.
- Geographical scope- Abakaliki metropolis in Ebonyi State, Nigeria.

Research Questions

The following research questions guided the study:

- What are the benefits of green building for its adoption in Abakaliki Metropolis of Ebonyi State?
- What are the existing government policies on planning regulation for the adoption of green building strategies in Abakaliki Metropolis of

Ebonyi State?

Research Hypothesis

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

HO₁: There are no significant benefits of green building for its adoption in Abakaliki Metropolis of Ebonyi State;

HO₂: There are no significant government policies on planning regulation for the adoption of green building strategies in Abakaliki Metropolis of Ebonyi State, Nigeria;

2.0 Literature Review

2.1 Conceptual Review

Benefits of Green Buildings

According to Davies (2006), Sarma (2014) and Dahiru, Dania and Adejoh (2014), green buildings have these benefits: reduce energy consumption, reduce water consumption. They are cost efficient to run, reduce operational costs, preserve natural resources, reduce greenhouse emissions and improve the quality of life and health of occupants. Other benefits of green buildings according to experts (Jain, 2009; Giduthuri and Vanakuru, 2017 and Ismaila, et al, 2021) are as follows:

- Green buildings have lower running costs by using natural ventilation, energy saving lighting, heating and cooling systems resulting in savings.
- They have lower maintenance costs by using intelligent and sophisticated technology for monitoring all devices installed in the building and so can alert the occupants of imminent faults thus, saving more costly maintenance at a later date.
- Increased productivity-by providing an environment that is capable of adapting to individual or collective requirements thereby producing a comfortable work environment that help people to raise their productivity at work.
- It adapts to changes in the environment because of its robust design and so can respond to personal or group changing requirements, mood and taste.
- Economically, a green building may cost more up front but saves costs through lower operating costs over the life of the building.
- Other benefits are that they improve the health

of the occupants, comfort, reduce pollution and landfill wastes.

- They minimize the consumption of materials and maximizes their reuse; creates a quality building that is commercially viable; minimizes energy consumption and greenhouse gas emissions; adopts environmentally sound and healthy work practices, during both construction and occupancy.
- They have higher occupancy rate and lower tenant turnover; they protect and conserve the environment; average increase in building value is about 7.5% (McGraw Hill, 2006). According to Green Building Council of Australia (2006), green buildings have higher relative return on investment (minimum of 14%).

Given the financial and economic benefits of green building in other parts of the world especially in developed nations as revealed by literature, there is a need to examine the challenges of its adoption in Abakaliki Metropolis of Ebonyi State.

Government Policies on Planning Regulation

Land use planning regulations are rules that govern how land in a particular area can be applied and developed. In Nigeria, it originated from the British colonial masters that formed Nigeria on 1st January, 1914. The British colonial masters used two town planning laws in Nigeria, namely: 1917 Township Ordinance and the 1946 Town and Country Ordinance. The 1946 Town and Country Ordinance was repealed and replaced by the Nigerian Urban and Regional Act, Cap 88 of 1992 which was later amended as Decree No.18 of 1999 (Ogbonna, Obinka and Aguguo, 2017). The law contains three types and levels of physical development plan. The three types of plans are federal, states and local government physical development plans. In addition to the planning regulations mentioned above, builders and developers in every state in Nigeria are required by law to obtain building control approvals from the State Ministry of Housing and Urban Development. The Building

Regulations are a set of minimum requirements designed to secure the health, safety and welfare of occupants and tenants in and around buildings and conserve fuel and energy; and to provide access and facilities for disabled people (Tricker and Algar, 2006).

Aside government policies on planning regulation, there are also government environmental policies for the protection of environment which will affect the adoption of green building strategies in Abakaliki Metropolis of Ebonyi State. The 1999 Constitution of the Federal Republic of Nigeria contains the basis of environmental policy in Nigeria. According to Makinde, Adeyoke and Oyeboode (2007), Section 20 of the 1999 Constitution empowers the Nigerian State to protect and improve the environment and to safeguard the water, air, land, forests and the wildlife of Nigeria. These environmental policies are contained in the Environmental Laws of Nigeria which are applicable and adopted by states in Nigeria including Ebonyi State. Some of the relevant environmental laws to protect the Nigerian environment generally and the built environment in particular according to Budnukaeku and Oku (2021); and Makinde, Adeyoke and Oyeboode (2007) are:

Harmful Wastes Special Criminal Provision Act Cap 165 (LFN) 1990: This Act makes it an offence to carry, deposit, dump, be in possession for the purpose of carrying, depositing or dumping any harmful waste anywhere in Nigerian soil, inland water and sea, including Exclusive Economic Zone of Nigeria.

Land Use Act Cap 350 (LFN) 1990:

This Act was aimed at providing land easily available for development and agricultural purposes, by vesting land in a state in a State Governor; requiring his consent for the transfer or alienation of interest in land and conferring him with power to revoke the right of occupancy for over-riding public interest.

Mineral Act Cap 286 (LFN) 1990: This Act regulates non-oil mining of minerals and prohibits mining operations from cutting or taking protected trees without consent, pollution of water course, unauthorized exploitation of water, water bodies, sacred

areas and other objects of veneration.

National Environmental Protection (Protection Abatement in Industries and Facilities Generating Water) Regulations, Cap 49 (LFN) 1991:

This Act regulates and bans the unauthorized handling of toxic wastes, discharge of effluents, industrial and solid wastes etc, in drains, water bodies and municipal landfills etc. It requires industries to install pollution monitoring devices with a view to making report of intended and accidental discharge of solid, gaseous or liquid wastes. It also empowers the Federal Environmental Protection Agency (FEPA) to require existing industries to conduct environmental audit or environmental impact assessment (E.I.A.) for new projects or to prevent start-up of any new industry or facility that will constitute a new source of pollution.

Environmental Impact Assessment Decree No. 85 of 1992:

This Decree requires proponents of development projects to assess the impact of such project on the environment, designing mitigation measures as may be necessary and to refrain from executing such projects unless FEPA is satisfied that such impacts are negligible and that adequate measures have been taken to mitigate the damages to the environment.

Criminal Code Act Cap 77 (LFN) 1997: The Act contains the basic criminal law offences that relate to damage to the environment, public health and natural resources.

2.2 Empirical Review

Ismaila, Egbo, Kigun and Ayoola (2021), conducted a study on “The Challenges and Prospects of Green Building Construction for Sustainable Urbanisation in Jos Metropolis, Nigeria.” They found that green building was not being adopted and constructed in Jos Metropolis despite the need because there was no awareness on green building concept and developers preferred conventional buildings to green buildings. The study also identified the benefits of green buildings as preservation of natural resources and increase in health and

productivity of occupants.

Zhao, Wang, Qiu, Qu and Zhang (2018), carried out a study titled, "Research on the Application of Green Building Materials in China." The study found that companies and individuals that wanted to apply green building materials faced challenges of lack of enough green building materials; high cost of technological inputs and raw materials for the production of green building materials; and lack of government support to those that want to construct green buildings.

Ogbonna, Obinka and Aguguo (2017), carried out a study on "Property Development and Land Use Planning Regulations in Nigeria." The area of study was Abia State in Nigeria. The study found that the level of compliance to building regulations was insignificant and that the level of compliance to building regulations between buildings constructed in urban areas and those constructed in sub-urban areas was significant. They recommended that Abia State Government should prepare up-to-date land use plans for various categories of towns in urban and rural areas of the state.

Dahiru, Dania and Adejoh (2014), conducted a study on "An Investigation into the Prospects of Green Building Practice in Nigeria," and found that green building was not practiced in Nigeria due to lack of awareness; harsh economic conditions and lack of enabling environment in form of government policy or legislation. It identified health and increase in productivity as benefits of green building.

The study by Sarma (2014) on "Problem, Progress and Prospect of Green Building as a means of Sustainable Urbanization with special reference to Guwahati City of Assam, India," found that green building construction would benefit Guwahati City by reducing energy consumption, bring economic and financial growth and gains; reduce wastes and would make buildings cost efficient to run.

3.0 Methods

The study used survey design. The area of study was Abakaliki Metropolis. Abakaliki is the capital of Ebonyi State, Southeast Region in Nigeria. The population of study was 56 architects who were registered

members of Nigerian Institute of Architects, Abakaliki Branch. There was no sample size as the whole population was used. The instrument for data collection was a questionnaire containing two sections with 6 items per section making it 12 items. It was structured on a five point Likert Type scale of Strongly Agree (SA), Agree (A), Undecided (UD), Strongly Disagree (SD) and Disagree (D). They were assigned weights of 5,4,3,2 and 1 respectively. The research questions were analysed using mean and standard deviation while the null hypotheses were tested using Chi-square statistic. 56 copies of the questionnaire were distributed to the respondents but only 50 copies were returned. The return rate was 89.29%. Analysis of the research questions were based on 50 copies. Criteria for accepting that respondents agreed on an item was that the calculated mean value should be equal to or greater than 3.00 while standard deviation score should be less than 1.0. In the test of hypothesis, null hypothesis or H_0 , was accepted if the Chi-square table value was greater than Chi-square calculated value at 0.05 significant level and at appropriate degree of freedom.

4.0 Results

Presentation of Data Relating to Research Questions

Research Questions 1: What are the benefits of green building for its adoption in Abakaliki Metropolis of Ebonyi State?

Table 4.1: Summary of respondents' views and mean scores of significant benefits of green building showed that there were six benefits of green building, namely: lowers running and maintenance costs, improves health of occupants, reduces environmental pollution and landfills, minimizes consumption of materials and maximizes their reuse, increases productivity of occupants, minimizes energy consumption and green house emissions. Mean score for each benefit was greater than 3.0 and were 4.52, 4.46, 4.38, 4.36, 4.24 and 4.60 respectively. Grand mean value was 4.44. Standard deviation value for each benefit was less than 1.0. It ranged from 0.60 to 0.68. Grand standard deviation value was 0.64. The standard deviation values clustered about the mean, showing

homogeneity in agreement by the respondents. benefits

They agreed that green building had the six

Table 4.1: Summary of respondents' views and mean scores on significant benefits of green building

S/N	Benefits of Green Building	SA	A	UD	SD	D	Total	X	SD	Rmk
1	Lowers running and maintenance costs	26	24	0	0	0	50	4.52	0.66	Agree
2	Improves health of occupants	25	23	0	0	0	50	4.46	0.64	Agree
3	Reduces environmental pollution and landfill wastes	25	24	0	0	0	50	4.80	0.65	Agree
4	Minimizes consumption and maximizes reuse of materials	20	28	0	0	0	50	4.36	0.62	Agree
5	Increases productivity of occupants	18	26	5	0	0	50	4.24	0.50	Agree
6	Minimizes energy consumption and green house emissions	30	20	0	0	0	50	4.60	0.68	Agree
Grand Total								26.66	0.85	
Grand Mean								4.44	0.64	

Source: Field Survey, 2021

Research Questions 2:

What are the existing government policies on planning regulation?

Table 4.2: Summary of respondents' views and mean scores of existing government policies on planning regulation showed that there were six of such policies, namely: Harmful Wastes Special Provision Act Cap 165 (LFN) 1990; National Environmental Protection (Protection Abatement in Industries and Facilities Generating Water) Regulations, Cap 49 (LFN) 1991; Land Use Act Cap 350 (LFN) 1990; Environmental Impact Assessment Decree No. 85 of 1992; Criminal Code Act Cap 77 (LFN) 1997; and Nigerian

Urban and Regional Planning Act (CAP 88 of 1992. Mean score for each government policy was greater than 3.0 and were 4.12, 4.48, 4.64, 4.52, 4.30 and 4.42 respectively. Grand mean value was 4.41. Standard deviation value for each benefit was less than 1.0. It ranged from 0.57 to 0.69. Grand standard deviation value was 0.64. The standard deviation values clustered about the mean, showing homogeneity in agreement by the respondents. They agreed that there were six existing government policies on planning regulation

Table 4.2: Summary of respondents' views and mean scores on existing government policies on planning regulation

S/N	Government Policies on Planning Regulation	SA	A	UD	SD	D	Total	X	SD	Rmk
1	Harmful Wastes Special Provision Act Cap 165 (LFN) 1990;	18	24	4	4	0	50	4.12	0.57	Agree

2	National Environmental Protection (Protection Abatement in Industries and Facilities Generating Water) Regulations, Cap 49 (LFN) 1991	26	22	2	0	0	50	4.48	0.65	Agree
3	Land Use Act Cap 350 (LFN) 1990	32	18	0	0	0	50	4.64	0.69	Agree
4	Environmental Impact Assessment Decree No. 85 of 1992	28	20	2	0	0	50	4.52	0.66	Agree
5	Criminal Code Act Cap 77 (LFN) 1997	20	25	5	0	0	50	4.30	0.61	Agree
6	Nigerian Urban and Regional Planning Act (CAP 88 of 1992	22	27	1	0	0	50	4.42	0.63	Agree
	Grand Total							26.66	3.85	
	Grand Mean							4.44	0.64	

Source: Field Survey, 2021

Testing Hypotheses

Hypothesis 1

HO₁: There are no significant benefits of green building for its adoption in Abakaliki Metropolis of Ebonyi State

Hypothesis 1 was tested using data from Table 4.1 above and table 4.3 below. Table 4.1 showed that the grand mean score for respondents was 4.44 with standard deviation score of 0.64 while Chi-square calculated value was 28.88 (see table 4.3 below). With 15 degrees of freedom at 0.05 level of significance, Chi-square critical value is 24.996. Since Chi-square calculated value of 28.88 was greater than Chi-square critical

value of 24.996, HO was rejected while Hi was accepted, showing that there was significant benefits of green building for its adoption in Abakaliki Metropolis of Ebonyi State. The result is statistically significant. The evidence was that “there are significant benefits of green building for its adoption in Abakaliki Metropolis of Ebonyi State.” In other words, adoption of green building strategies in Abakaliki Metropolis of Ebonyi State will bring significant benefits to the adopters, occupants and users

Table 4.3: Observed and Expected Frequency for Testing Hypothesis 1

Response	Observed O	Expected E	O - E	$\frac{(O - E)^2}{E}$	$\sum(O-E)^2$
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Yes	44	25	19	361	14.44
No	6	25	-19	361	14.44
Total	50	50	-	χ^2	28.88

Source: Field Survey, 2021

Hypothesis 2

HO₂: There are no significant government policies on planning regulation for the Adoption of green building strategies in Abakaliki Metropolis of Ebonyi State, Nigeria

Hypothesis 2 was tested using data from Table 4.2 above and table 4.4 below. Table 4.2 showed that

the grand mean score for respondents was 4.41 with standard deviation score of 0.64 while Chi-square calculated value was 28.88 (see table 4.4 below). With 15 degrees of freedom at 0.05 level of significance, Chi-square critical value was 24.996. Since Chi-square calculated value of 28.88 was greater than Chi-square critical value of 24.996, HO was rejected while H₁ was accepted, showing that there was significant government policies on planning regulation for the adoption of green building

strategies in Abakaliki Metropolis of Ebonyi State, Nigeria. The result is statistically significant. The evidence was that “There are significant government policies on planning regulation for the adoption of green building strategies in Abakaliki Metropolis of Ebonyi State, Nigeria.” In other words, there are existing government policies on planning regulation for the adoption of green building strategies in Abakaliki Metropolis of Ebonyi State

Table 4.4: Observed and Expected Frequency for Testing Hypothesis 2

Response	Observed O	Expected E	O – E	(O - E) ²	$\sum(O-E)^2$
Yes	44	25	19	361	14.44
No	6	25	-19	361	14.44
Total	50	50	-	χ^2	28.88

Source: Field Survey, 2021

Discussion of Findings

Test of Hypothesis I

Test of hypothesis 1 found that “there are significant benefits of green building for its adoption in Abakaliki Metropolis of Ebonyi State.” Six benefits were identified in analysis of Research Question 1 as follows: lowers running and maintenance costs, improves health of occupants, reduces environmental pollution and landfills, minimizes consumption of materials and maximizes their reuse, increases productivity of occupants, minimizes energy consumption and green house emissions. The finding was in line with the findings of Ismaila, Egbo, Kigun and Ayoola (2021), in their study on “The Challenges and Prospects of Green Building Construction for

Sustainable Urbanisation in Jos Metropolis, Nigeria.” The study identified the benefits of green buildings as preservation of natural resources and increase in health and productivity of occupants. The study by Dahiru, Dania and Adejoh (2014), on “An Investigation into the Prospects of Green Building Practice in Nigeria,” found that green building improved health and increase in productivity of occupants. The study by Sarma (2014) on “Problem, Progress and Prospect of Green Building as a means of Sustainable Urbanization with special reference to Guwahati City of Assam, India,” found that green building construction would benefit Guwahati City by reducing energy consumption, bring economic and financial growth and gains; reduce wastes and would

make buildings cost efficient to run.

Test of Hypothesis 2

Test of hypothesis 2 found that “There are significant government policies on planning regulation for the adoption of green building strategies in Abakaliki Metropolis of Ebonyi State, Nigeria.” The study found six significant government policies (see Table 4.2) as follows: Harmful Wastes Special Provision Act Cap 165 (LFN) 1990; National Environmental Protection (Protection Abatement in Industries and Facilities Generating Water) Regulations, Cap 49 (LFN) 1991; Land Use Act Cap 350 (LFN) 1990; Environmental Impact Assessment Decree No. 85 of 1992; Criminal Code Act Cap 77 (LFN) 1997; and Nigerian Urban and Regional Planning Act (CAP 88 of 1992). However, none of these government policies was specifically on green building. Lack of specific government policy legislation on green building was given as a reason for the non-adoption of green building concept in Nigeria according to one of the findings of the study by Dahiru, Dania and Adejoh (2014).

Conclusion

The conclusions drawn from the study were that: there are significant benefits of green building for its adoption in Abakaliki Metropolis of Ebonyi State; and there are significant government policies on planning regulation for the adoption of green building strategies in Abakaliki Metropolis of Ebonyi State, Nigeria.

Recommendations

The study recommended that the Federal Government of Nigeria should organize seminars in all the states and major cities and towns in Nigeria to create awareness of the existence of the concept and benefits of green building. Secondly, the Federal Government of Nigeria and States should enact specific laws on adoption of green building concepts and strategies in Nigeria. Thirdly, the Federal Government of Nigeria should fund research on green building materials and the technology for their production in cooperation with private businesses

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Breast Cancer Diagnosis and Prognosis Using Artificial Neural Network

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Abstract

As the mortality rate of breast cancer increases, there is the need to foster efforts to combat this ugly disease and save our mothers and all female folks from untimely death. Various methods being used to diagnosis this disease range from traditional hand sampling of the breast to a more advanced and generally accepted technique known as biopsy, a fine needle aspirations that enable early detection of the disease. Manual analysis of the biopsy image by clinical pathologist have many limitations, hence the need of computer aided approach. Extensive works had been carried out using this approach but more works still have to be done as a better model to rely on have not been achieved. In this thesis, we employed various deep neural network and machine learning frameworks like keras, tensorflow and lightgbm. We also made use of breast cancer histopathology image dataset release by Rui Yan et al, (2019) and Araujo et al, (2017). We deduced a model whose sensitivity score is higher than that of our redecessor. Reversed CRIP-DM methodology by John Rollins and very deep learning feature representation was used in the analysis. Lightgbm was used for the training and validation. At the end a python script was developed to perform real time breast cancer diagnosis.

Keywords: Biopsy, Breast cancer, Histopathology images, Image classification, Deep neural network, Dataset, Feature representations,

Introduction

Cancers have become a major health issues in recent time. According to International Agency for Research on Cancer, a body from the World Health Organizations(WHO), and Global Burden of Disease Cancer Collaboration (GBD), cancer cases have increased by 28% between 2006 and 2016, and it is estimated that 2.7 million new cancer cases will emerge before 2030 (National Cancer Registry, 2013). Out of the different types of cancer, breast cancer is the most common and deadly among women. The World Health Organizations (WHO) has it on record that there are about 1.7 million incident cases from which there are 535,000 death recorded(National Cancer Registry, 2013). In Nigeria, female breast cancer is seen as major cause of morbidity and mortality. Its incidence rate ranges from 36.3 to 50.2 in every 100,000 live births. Reports from the University College Ibadan teaching hospital, shows that there are 600,000 cases of breast cancer yearly in Nigeria

and about 80% of the victims lose their lives (DeSantis et al, 2013).

Therefore, early diagnosis of breast cancer has become necessary. The diagnosis of breast cancers had been since 40 years ago. The use of different methods like breast examination, mammogram (low frequency X-ray), Magnetic Resonance Imaging (MRI), and Ultrasound exist. These methods do not produce accurate breast cancer diagnosis (Abdalla et al., 2009). Biopsy techniques are the main methods relied upon for accurate diagnosis and prognosis of breast cancer. The types of biopsy method used are fine needle aspiration, vacuum-assisted and surgical biopsy. The process involves the collection of samples of cells of breast tumour, fix it on the microscope slide, and then stain it with Hematoxylin and Eosin (Veta et al., 2014). After that, the pathological images are then analyzed and diagnosis by the clinical pathologists. However, manual analysis of breast

cancer images is difficult and time-consuming. It also requires a well trained histopathologist (Spanhol et al., 2016). More so, the result can be affected by the level of experience of the pathologists involved and also, most time the results are subjected to further re-examination because of discrepancy among pathologist.

Therefore, computer assisted approach for the analysis of pathological images plays a significant role in the diagnosis of breast cancer and its prognosis (Aswathy et al., 2017).

Traditional feature extraction methods, like the Scale-Invariant Feature Transform (SIFT) and Gray Level Co-occurrence Matrix (GLCM), rely on supervised information. Furthermore, prior knowledge of data is needed to select useful features. But this approach will produce low quality of extracted features and also, the computational load will be very heavy. At the end of the process, the extracted features will have low level and unrepresentative features of pathological images. And as a result it leads to poor classification and generalization.

Artificial Neural Network methods like the convolution neural network (CNN) can extract features and retrieve information from data automatically. It can also learn advanced abstract representations of data. CNN can solve the problems of traditional feature extraction and have been successfully applied in Computer Vision, He et al.(2015); Xie et al.(2018), Biomedical Science Gulshan et al.(2016); Esteva et al.(2017) and many other fields.

2. Related Works

Breast cancer diagnosis based on image analysis has been studied for more than 40 years, and there have been several notable research achievements in this area. The authors adopted approaches ranged from traditional machine learning algorithm to a more advances deep learning algorithm. The primary aim is to train an existing dataset so as to achieve a reliable accuracy and sensitivity score. Most notable authors like Kowal et al,(2013), Filipczuk et al,(2013),Jackowsli et al,(2012), George et al,(2014), Wang et al,(2016), Asri et al,(2016) made use of clustering algorithms like K-means (KM), fuzzy C-means (FCM), Competitive Neural Network (CNN) and Gaussian Mixture Model (GMM) to perform nuclei segmentation from microscopic image dataset at their

disposal. After which that they used different classification approaches namely: K-Nearest Neighbor, Naive Bayes, and Decision Tree, Support vector Machine (SVM) to classify these images into benign and malignant tumours. Though, their research findings showed good accuracy. But there are some challenges:

1. The numbers of datasets used is small.
2. Data collections are from about 50 to 100 patients
3. The dataset are patched microscopic image instead of whole slide image.
4. They rely on binary classification. Either Benign or Malignant.

With the availability of BreakHis dataset produced by Spanhol et al,(2016), the likes of Spanhol et al,(2016) and Bayramoglu et al, (2016) carried out a histopathology image classification using the BreakHis dataset though still based on binary classification but with improved accuracy as compared to works done using machine learning. Also they made use of deep learning architectures like the AlexNet produced by (Krizhevsky et al., 2012). But the need to carry out multi class classification is paramount. A given predictive model should be able to classify a breast cancer ample into benign or malignant types (i.e InSitu carcinoma or Invasive carcinoma). On this note Araujo et al.(2017), Han et al,(2017), Nawaz et al,(2018), Motlagh et al,(2018), Jiang et al,(2019) used different deep learning algorithms to perform breast cancer multi class classification making use of the Bioimaging2015 and the BreakHis dataset. There were an improve accuracy and sensitivity score. But the number of patients through which the dataset was collected is still considerably small. i.e BreakHis is collected from 82 patients and Bioimaging 2015 is gotten from 249 patients. Rui et al,(2019) published an article with an improve whole side image of 3472 image from more than 1000 patients of diverse age group. Deep trained model deduce from such dataset is believed to robust for future inference of breast cancer patients. Rui et al, (2019), achieve a validation accuracy score of 91.3% and sensitivity score of 89.2%. The aim of our research work is to improve on their results using their dataset in combination with that of Araujo et al. (2017), deep learning feature representation and machine learning

lightGBM algorithm.

Authors	No of Data sets	Accuracy
Kowal et al,2013	500 images	94% on binary class
Fillipczuk et al,2013	737 images	98.51% on binary class
George et al,2014	94 image of 1502 of cell nuclei	94% on binary class
Wang et al,2016	68 image of 3600 cell nuclei	96.19% on binary class
Asri et al,2017	699 images	97.13 on binary class
Spanhol et al,2016a	BreakHis dataset	85% on binary class
Spanhol et al, 2016b	BreakHis dataset	87% on multi class
Bayramoglu et al 2016	BreakHis dataset	83.25% multiclass
Araujo et al,2017	Bioimaging2015	77.883% on multi class
Han et al,2017	BreakHis dataset	95% on multi class
Nawaz et al,2018	BreakHis dataset	95.4% on multi class
Motlagh et al,2018	BreakHis dataset	96.4% on multi class
Jiang et al,2019	BreakHis dataset	98.13% on multi class
Rui et al	3771 whole slide images from above 1000 patients	91.3 on multi class

3. Datasets

Deep learning algorithms learn from big amount of data. The emergence of Imagenet, a deep learning model that was produced using about 100k domestic images of 1k classes acts as a break-through in this field of discipline.

Before now there are very few dataset of Eosin (H&E) stained. The Hematoxylin

of the Reviews medical image dataset. Most times, the available ones are not properly labeled because the cost of sourcing clinical experts to label the image is very high. According to Veta et al, (2013), there is the need to have a large, labeled and open pathological dataset to make image analysis in this domain effective. After the publication of Veta et al (2013), there has been some open challenge of medical image analysis in the domain. Amongst them are:

1. The International Conference on Image Analysis and Recognition (ICIAR).
 2. The International Symposium for Biomedical Imaging (ISBI),
 3. The International Conference on Pattern Recognition (ICPR)
 4. The Medical Image Computing and Computer-Assisted Intervention (MICCAI),
- The pathological image dataset used in these conferences have demonstrated a precise definition of the tasks assessment metric scores to help in performance comparison. But the challenge is that the dataset is relatively small in size and also the number of patients through which the dataset was obtained is few.

On this noted we decided to rely on:

Rui et al, (2019), who in-cooperated with Peking University International Hospital to release a new pathological image dataset of breast cancer. The dataset is in the same format with ICIAR2018 dataset.

2. International Conference on Image Analysis and Recognition (Araujo et al, 2017), from the 15th International Conference on Image Analysis and Recognition. The histopathology images are all digitized with the same acquisition conditions and also with a magnification of 100x or 200x and pixel size of $0.42\mu m \times 0.42\mu m$. Then each image is labeled with one of the classes. We are more concerned about the Benign, InSitu and Invasive classes in this research work.

The overall dataset consists of 3772 high-resolution images of 2048x1536 pixels. The datasets are annotated with Hematoxylin and

highlights nuclei by staining DNA and Eosin

highlights other structures by staining proteins. The preparatory procedure for pathological image used in the pathological routine.

used in this work was the standard paraffin process, which is widely

TABLE 2: Summary of Dataset

Dataset	Benign	InSitu	Invasive	Total
ICIAR2018	100	100	100	300
Rui et al,(2019)	1106	1066	1300	3472
Overall	1206	1166	1400	3772

In particular, the structure of breasts varies with age, such as puberty, sexual maturity, pregnancy, lactation and old age. To ensure the diversity of data to improve the learning ability

in the machine learning algorithm, our dataset covers as many different subsets spanning different age groups as possible, which can fully reflect the morphology of breast tissue

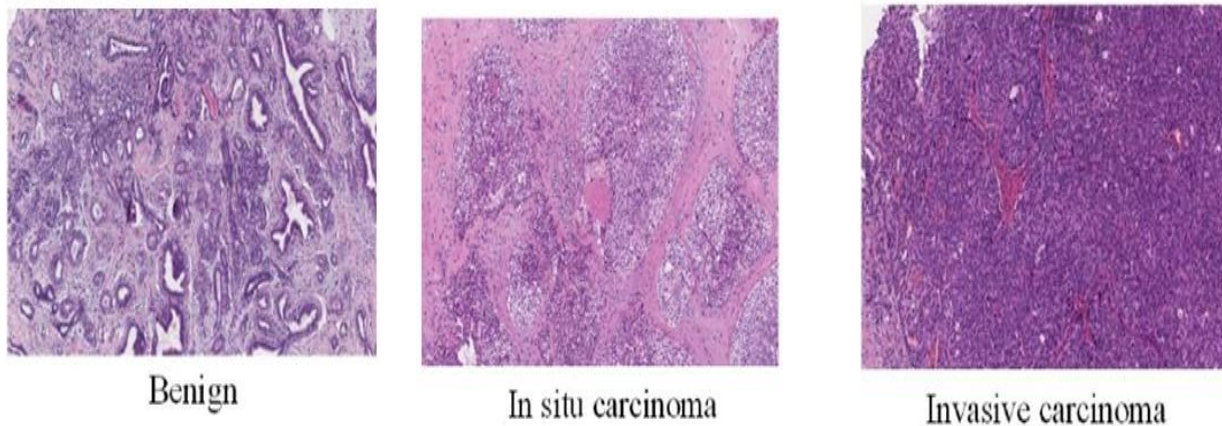


Fig. 1: Examples of microscopic biopsy images in the dataset

4 METHODS

Given a breast cancer pathology image, our goal is to classify it into its classes. That is whether it is Benign, InSitu or Invasive. Many deep convolution Neural Network architectures like the ResNet50, Vgg16 etc have achieved the state-of- the- art result when training on ImageNet of 10million image of 1k classes. Training these neural networks from scratch requires a large number of images as compare to the dataset we have at our disposal. As a result of this, we will experience overfitting if we go ahead to training our dataset with these very deep CNN. In order to avoid this, we employ transfer learning strategy, (a process by which only

a part of the pre-trained neural network is being fitted to a new dataset).

The adopted approach is called deep convolutional feature extraction. So, we made used of ResNet50 architecture to carryout unsupervised feature extraction. This helped us to obtain the image sparse descriptor of low dimensionality. This dimensionality reduction plays great roles in combating overfitting during the supervised training stage.he extracted rich feature is then trained using lightgbm, a distributed gradient boosting framework for machine learning. We used lightgbm because of its high performance and also tolerance to overfitting

.4.1 Data Normalization

The dataset was stained by **Hematoxylin** (H) and **Eosin** (E) during preparation. So in order to make it ready for any improved quantitative analysis, the amount of **H&E** in each image needs to be normalized. The normalization algorithm was deduced from the work of Ruifrok, et al, (2001). The aim of the algorithm was to deconvolve the color formation acquired with red-green-blue (RGB) in a given color image and then calculates the contribution of each of the applied **H&E** stains based on stain-specific RGB absorption.

So, the **H&E** contained in the image is adjusted by decomposing the RGB color of the tissue into **H&E** color space, followed by multiplying the magnitude of **H&E** of each pixel by two uniform variables with the range between 0.7 and 13 (Ruifrok et al, 2001). After the normalization, Hematoxylin (**H**) stained image and eosin (**E**) stained image were also obtained. But we are more interested the **normalized** image to carry out analysis. Fig.24 below diagram below shows the normalized image

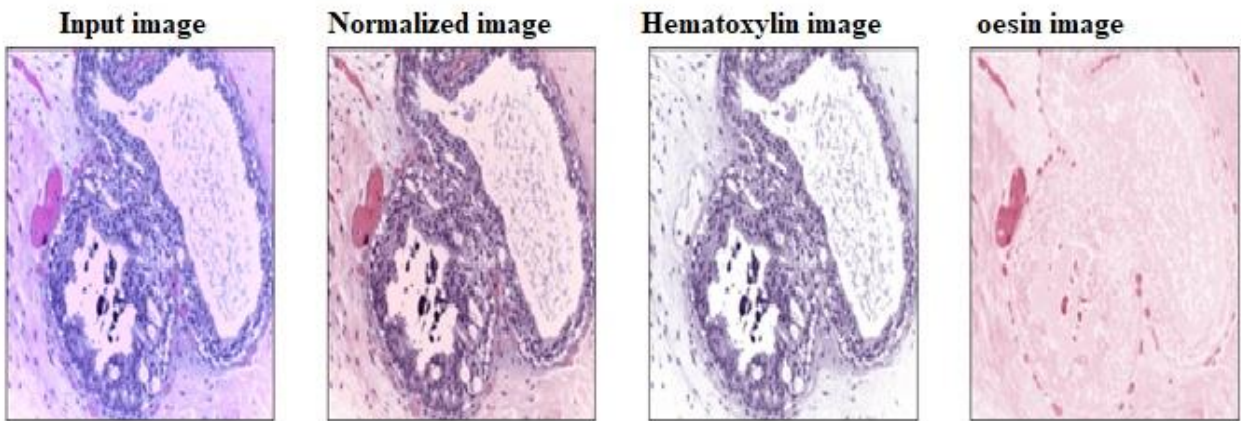


Fig.2: Normalized sample of H&E image

4.2 Data Splitting

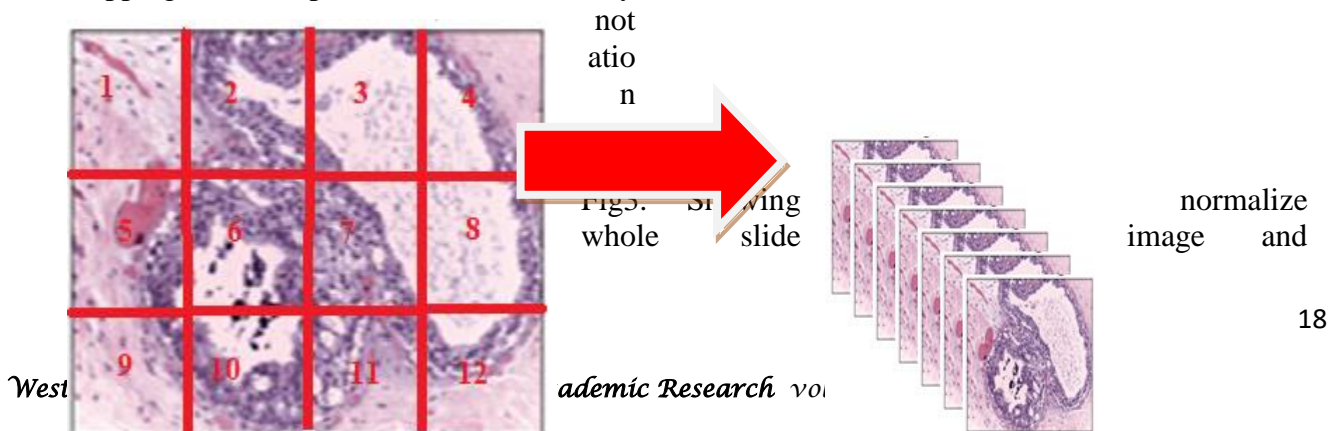
After the image normalization process, there is the need for data splitting. As noted earlier, the image has high resolution of 2048 by 1538 pixels. Such amount of pixels cannot be fed into any neural network because of the computational resources and cost. Even if such graphic processing unit (GPU) exists, the cost will be very high. For every data science modeling, effective use of computational resources is a primary goal. On this note, the large size image was split into patches of smaller size. To determine the number of patches each image will be split into without overlapping, we adopted the normal binary

notation of: **2, 4, 16, 32, 64, 128, 256 and 512 etc.** We also consider that the input size of all deep neural networks which varies from **224 by 224 to 256 by 256.**

Given that the Height of the image: (**H**) = 2048 and the Width (**W**) = 1536.

If we adopt 512 binary notation, then, H will be $2048/512 = 4$ and W will be $1536/512 = 3$.

Such that, the number of patches that each image will be split into is $H*W = 4*3 = 12$. The resized height and width is 512 by 512 non-overlapping pixels



generated patches

In order to preserve the spatial dimension of the image, each split image is saved into a numpy array folder before carrying data augmentation. All these processes are done programmically.

4.3 Data Augmentation and Pre-processing

According to Adrian R, (2017), data augmentation is the process by which a new dataset is generated from existing dataset and that new dataset is then used in the model training instead of the old one. Data augmentation comprises wide range of techniques used to generate new training sample by applying random *jitters and perturbation*. The process also ensures that the class label of the data was not changed. If a dataset was augmented, it will allow the network to continuously see new data with slight changes from the original which will make it learn more robust features. So, in each patched image, we performed 10 random data augmentation with the downscale of 512 X 512 pixels. As noted in the split patches, each image represents 12 crop patches. The patches are then encoded into 12 descriptors.

Based on the formula below as deduced by Boureau et al, (2010), the set of 12 descriptors is combined through a 3 normal pooling to form a single descriptor. They suggested a hyperparameter of $p=3$.

Eqn 1.

From the above formula, N is the number of patch per image, di is the descriptor of a patch and dp is a pooled descriptor of the image. So, the p-norm of a vector gives the average for $p = 1$ and the max for $p \rightarrow \infty$. This means that for every whole slide image, we obtained 10 (number of augmentation) X 1 (patch size of 5) X 3 (CNN encoder) = 30 descriptors

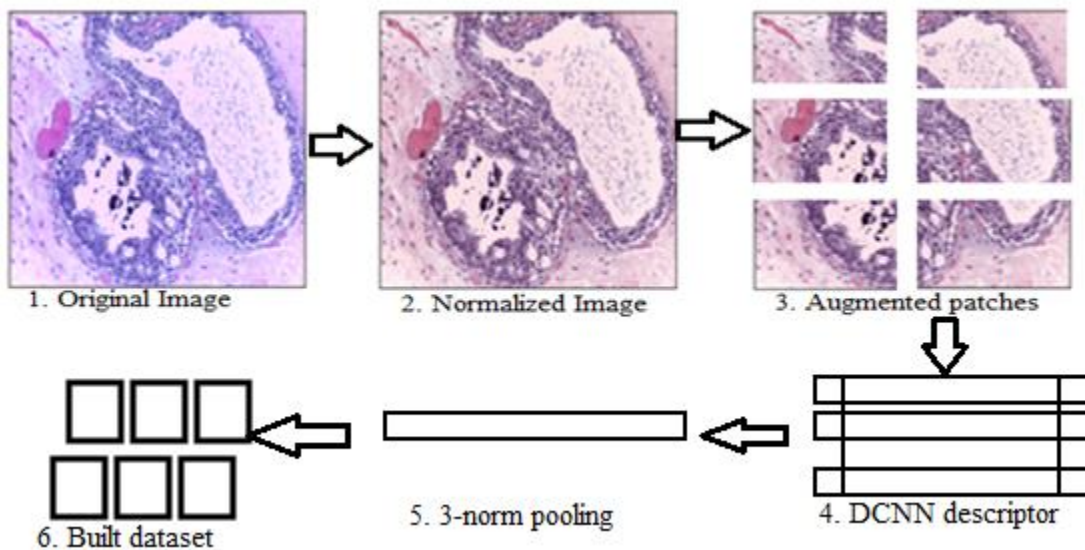


Fig 4. Data preprocessing

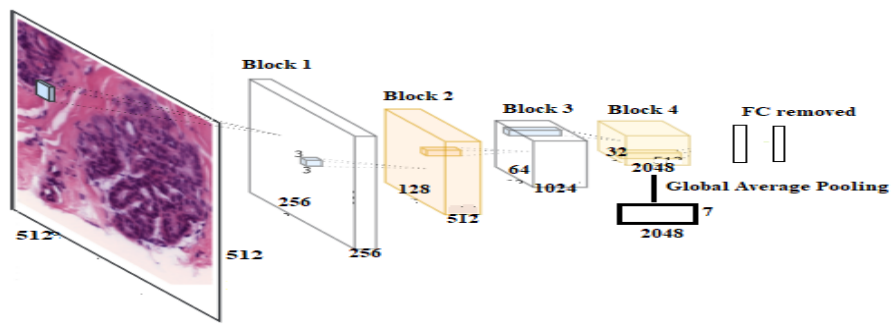
pipeline

4.4 Feature extraction

This is the process in which the number of features in a dataset is reduced by creating new features from the existing ones and then does

away with the old ones. The new features must have the quality of the original set of features (i.e., it is in linear combination of the existing

features). Deep convolutional neural network with millions of



parameter have achieved the state-of-the-art results in image recognition and classification. Amongst these architectures is

Figure

Fig. 5: Schematic overview of the Resnet50 network architecture for deep feature extraction

Figure 3 below. The output volume of the feature map via the global average pooling will be $7 \times 7 \times 2048$ making it a one-dimensional feature vector of 100,352-dim per image for a 32 bit float

So, instead of allowing the network to propagate through the entire network, we stop it at the global average pooling layer, extract the values from the specified layer and then treat the values as a feature vector. The extracted feature vectors are then used for the training using lightgbm.

data was split into ten (10) folds so as to maintain the class distribution. Augmentations increased the size of the dataset by 30(1 patch sizes x 3 encoders x 10 affine augmentations). During this process, we made such that the descriptors of each image remained correlated. To make sure that there is no information leakage, the entire descriptors of each image in the dataset was saved in the same fold. For each combination of the encoder, the crop size and the scale we trained 10 gradient boosting

models with 10-fold cross-validation. , this leads to the increase in the diversity of the models with little data bagging. Furthermore, we recycled each dataset 5 times with different random seed. This means that a total 10 (number of folds) \times 5 (seeds) \times 4 (scale and crop) \times 3 (CNN encoders) = 600 was trained in the gradient boosting models.

During the cross-validation stage, all folds whose models not trained on this fold was predicted. We also extract 30 descriptors for each image and use them with all models trained for particular patch size and encoder. The predictions were then averaged over all augmentations and models. In the end, the predicted class was determined by the maximum probability score.

5. Results

The validation was done using the 10-folds stratified cross-validation. The accuracy was 93% and area under the ROC curve was 0.99. Figure 4 below show the results

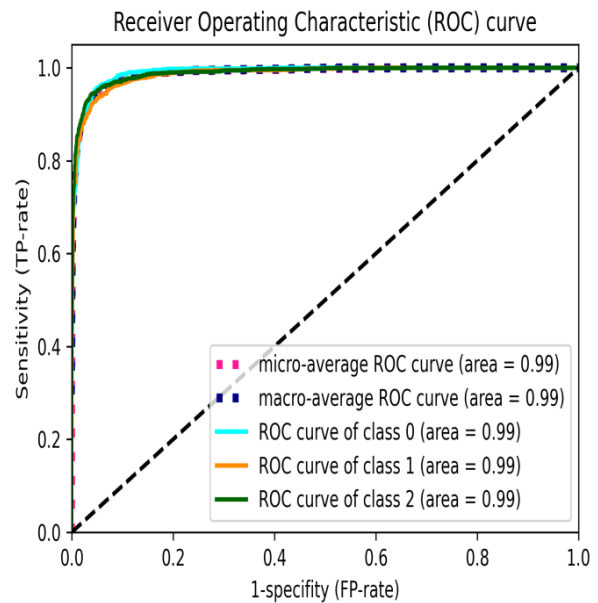
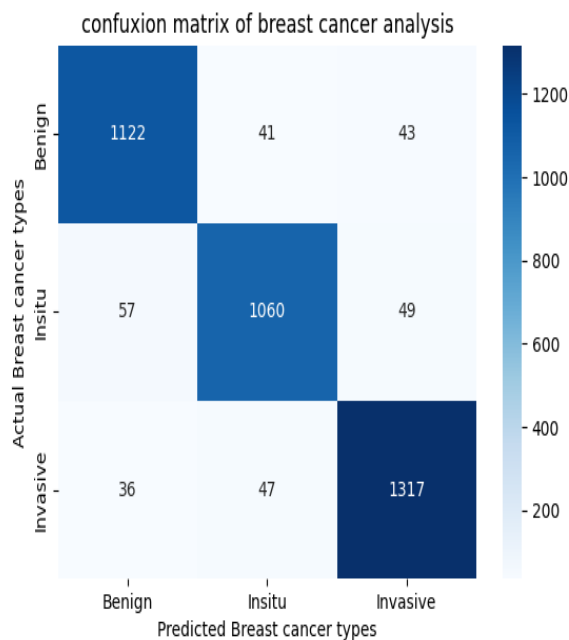


Figure 6: showing Confusion matrix and RUC-ROC curve

5.1 Result Comparisons

Our primary aim in the research work was to train a breast cancer image classification model that will have improved accuracy and sensitivity

score as compare to the work of Rui et al (2019). Table 3 below gives a quick summary of the comparisons

Table 3: Comparison of Sensitivity and Accuracy

Methods	Image-wise Accuracy (%)	Sensitivity of all classes (%)
Rui et al, 2019	91.3	89.2
Our Model	93	99

6. Conclusion & Recommendation

In this paper, we proposed an effective method for the classification of H&E stained histological breast cancer images. We made used strong data augmentation and deep convolutional features extracted using ResNet50 pertained model on ImageNet and applied light gradient boosting algorithm for the training. This enabled us to achieved high accuracy and sensitivity. To the best our knowledge, the reported results are superior to the work done by on.

our predecessor that used same dataset. Also, as new framework, deep learning architecture and libraries is evolving on daily bases, the best of breast cancer histopathology image classification is yet to be achieved. More high quality image dataset will prove a robust model at that can be globally accepted. So, future works can utilize more dataset and new architecture like the vision transformer to see if the accuracy and sensitivity of model can be improved

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Environmental Costs and Performance of Listed Service Companies In Nigeria

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Abstract

This study examined the relationship between environmental costs and performance measures of listed service companies in Nigeria. Research questions and hypotheses were developed in line with the specific objectives of this study. The ex-post facto research design was adopted and the theoretical framework of this study was anchored on stakeholder's theory. Secondary data with respect to the dependent and independent variables were obtained for a period of 10 years spanning from 2009-2018. The data obtained were analyzed using descriptive and inferential statistical techniques. Based on the test of hypotheses, it was found that environmental costs have significant relationship with the performance measures of firms. Specifically, it was observed among others that the level of environmental costs was significantly affected by return on assets (ROA), return on equity (ROE) and earnings per share (EPS). On the basis of the findings, it was recommended among others that the management of firms should ensure full disclosure by reporting environmental related costs in their financial statements irrespective of the performance recorded in any given year. Additionally, as a matter of fact, the accounting regulatory framework should consider developing environmental disclosure index in order to facilitate the disclosure of environmental related costs by firms.

Keywords: Environmental costs, Return on Assets, Return on Equity, Earnings per shares, Performance Measures.

1. Introduction

Corporate entities operate in a very dynamic business environment which has so far resulted to high level competition among firms in related industries or businesses. This has created renewed challenges for the management of firms who are now confronted with the task of discovering means of gaining competitive advantage over their competitors. Given the perceived importance of the business environment to the overall success of firms, several environmental rules and regulations have evolved within and outside organizations and across countries and jurisdictions. There has been increased global concern on the natural environment within

which firms operate. These concerns are partly due to the perceived threats posed by the presumed harm on the host communities and the environmental challenges caused by the activities of companies (Akrouf and Othman 2016; Adinehzadeh, Jaffar, Shukor and Abdul Rahman, 2018). No doubt, the magnitude and increase in ecological concerns boarding firms, has further sparked a growing number of studies designed to ascertain the level of damages and environmental hazards which the entire ecosystem and firm are exposed to due to the varying activities of corporate organizations (Buisse and Verbeke, 2003; Kassins and Vafeas, 2006). The need for

modern organizations to be environmentally responsible can no longer be over emphasized. This is why topical issues that have been debated in the accounting domain center on the level and nature of environmental practices of firm with emphasis on the need for corporate entities to be more environmental accountable in all ramification (Delmas and Toffel, 2008). To date, while the focus of most prior studies on environmental costs have been on the drivers of environmental reporting or the disclosure practices of listed firms, with much focus on the manufacturing sector (JO and Harjoto 2012; Michelin and Parbonetti 2012; Ali and Attan, 2013; Ashafoke and Ilaboya, 2027), much efforts have not been tailored at unveiling the bi-directional relationship between environmental costs among firms and measures of corporate performance of firms. This situation ignited the interest of this current study which has been designed to ascertain the link between environmental costs and performance measures of listed service firms in Nigeria.

Statement of the Problem

Studies have so far examined the relationship between environmental and social cost accounting and corporate performance in both developed and developing countries. Some of these studies (Egbunike and Okoro, 2018; Ingram and Frazier, 2010; Freedman and Jaggi, 2012; and Makori and Jagongo, 2013) assessed the connection between environmental accounting and corporate performance with the measures of corporate governance.

Interestingly, despite the much clamored importance of environmental

Reporting among firms (Klassen and McLaughlin, 1996; Delmas and Toffel, 2008; Cortez and Cudia, 2011; Makori and Jagongo, 2013; Jeroh and Okoro, 2016). It is sad to observe that while the concept of environmental cost has received wide attention in the accounting literature in developed and developing economies (Delmas and Toffel, 2008), research evidence from prior studies have continuously produced mixed outcomes. For instance, while findings from the study of Makori and Jagongo (2013)

suggest that the relationship between environmental cost and performance indices like earnings is significant but negative; Jeroh and Okoro (2013) averred that environment costs have positive with firm performance.

Additionally, most studies on environmental costs and environmental accounting in Nigeria and beyond have focused mainly on sectors like oil and gas, manufacturing, industrial goods and the like (Uwuigbe, 2012; Jeroh and Okoro, 2016; Ashafoke and Ilaboya, 2017) with little concern on the financial and service sectors. In this vein, Esira, Ikechukwu and Ikechukwu (2014) found that there is a significant relationship between environmental costs and the profitability of oil and gas firms in Nigeria. Similarly, by obtaining data from the manufacturing sector, Nham, Tran and Nguyen (2012) found that since pollution control does not enhance or destabilize the financial attainment of firms, environmental performance of firm recorded a negative association with their respective financial performances.

While concerns have been ascertaining the extent to which environmental costs affects firms and their performance indices, concerns have not been tailored at finding out the possible effect which the performance of firm may have on the level of disclosing environmental issues. There is there a gap in literature as to the need for continuous research into this area, especially as regulatory requirements for the improvement in reporting practices of firms is currently experiencing a dramatic turnaround. This thrust of this study is to take a generalized approach that will fill the above research gaps by ascertaining the level of association between environmental costs and selected performance measures by obtaining data from listed service firms (financial) in Nigeria.

objectives of the StudyThe broad objective of this study is to investigate the relationship between environmental costs and performance of listed financial service companies in Nigeria. The specific objectives are to:

1. Determine the relation between environmental costs and Return On Assets (ROA) of listed

- service companies in Nigeria,
2. Examine the statistical link between environmental costs and Return On Equity (ROE) of listed service companies in Nigeria, and
 3. Assess the relationship between environmental costs Earnings per share (EPS) of listed service companies in Nigeria.

Research Questions

In Line With The Objective Of The Study, The following research question were raised:

1. What is the relation between Return On Asset (ROA) of listed service companies in Nigeria?
2. What is the statistical link between environmental costs Return On Equity (ROE) of listed service companies in Nigeria?
3. What is the relationship between environmental cost and Earning Per Share (EPS) of listed service companies in Nigeria

Review Of Related Literature

2. Conceptual Review

Environmental accounting, also called green accounting, refers to the modification of the system of national Accounts to incorporate the use of depletion of natural resources. Environmental accounting is a field that identifies resources use, measures and communicates costs of a company's or national economic impact on the environment. (Labaran 2011). According to Hadani and Coombes (2015); Liket and Maas (2016), environmental accounting can be defined as a voluntary, non-obligatory, and non-reciprocal transfer of wealth from corporate entities to its external stakeholders. For the purpose of this study, we measured environmental accounting in the form of social donations and other associated environmental costs incurred by reporting entities. Thus, environmental accounting encompass actions that appear to further some social good, beyond the interest of the firm and that which is required by law. Environmental accounting focus largely on the recording and reporting of all environmental costs incurred by corporations. Such costs may sometimes be connected to social and charitable causes, education, culture, arts, minorities, healthcare, and disaster relief (Godfrey, 2005; and Fan, Wong and Zhang, 2007). Environmental costs consist of environmental measures and environmental losses. They include cleanup cost, costs of recycling materials or

Research Hypothesis

Ho1: There is no significant relationship between environmental costs and Return on Assets (ROA) of listed service companies in Nigeria

Ho2: There is no significant statistical link between environmental costs and Return on Equity (ROE) of listed service in Nigeria.

Ho3: There is no significant relationship between environmental costs and Earning Per Share (EPS) of listed service in Nigeria.

Scope of the study

This study investigate the link between environmental cost and the performance of listed service companies in Nigeria using environmental costs, return on asset, return on equity, earnings per share and firm size . The study period spanned from 2009 to 2018 which marks the post global financial crisis era

conserving energy, closure cost, capital expenditure and development expenditure. These costs are incurred in preventing, reducing or repairing damage to the environment and conserving resources. The reporting of environmental costs in the financial statements of firms provides useful information that will guide users and satisfy their decision making needs (GRI,2013).Research evidence indicates that environmental reports are used to satisfy different decision making needs, depending on the various user groups (Kamala,2015; and Kamala, Wingard and Cronje, 2015).According to Environmental Accounting Guidelines (2002), the reporting of environmental costs encompass theidentification, measurement, allocation, and integration of environmental costs into identified businesses and communicating such information to the variousstakeholders. Accordingly, CIMA- (2012), defines the disclosure of environmental costs as the public disclosure of information about the environmental performance of firms. Environmental costs accounting encompass part of what experts have previously described as social responsibility disclosures which covers all disclosures that relate to the interactions betweenorganizations and their physical/social environment.Jeroh and Okoro (2016) posit that by their very nature, environmental costsare usually divided into monetary or non-monetary costs.

Research evidence indicates that the provision of information on environmental costs tend to be vital for probity and accountability such that non-disclosure of such information may have adverse effect on the economic decision of various users of accounting information (Ashafoke and Ilaboya, 2017). Corporate performance encompasses three specific areas of a firm outcome, namely financial performance. According to Makori and Jagongo (2013), a positive relationship seems to exist between firm performance (when measured by the net profit after tax margin) and social and environmental accounting, but with return on equity which is said to exhibit a negative relationship with social and environmental accounting. Prior studies conducted by Nnamani, Onyekwelu and Ugwu (2017); Agbiogwu, Ihendinihu and Okafor (2017) indicated that environmental and social cost significantly affect the return on assets of firms. Given the diverse findings of prior studies and the presumed few empirical outcomes with data from the financial service sector, this study assesses the link between environmental costs and firm performance by focusing on three performance variables - return on assets, return on equity and earnings per share. Investors are mostly interested in ROA as they indicate the company's capability to generate returns that commiserate with the accumulated assets/investments in assets of the entity over time (Al-Matarneh, 2009). This study thus examines the influence which environmental costs may have on the Return on Asset (ROA) of financial service firms, by obtaining evidence from Nigeria.

Angelia and Suryaningsih (2015), argued that in most instances, investors assess companies based on their respective environmental engagements. In this way, companies that engage more on environmental activities are rated high when compared with companies that engage less on environmental concerns. As indicated in the literature, ROE is favored by several economists and finance experts who are more concerned about short-term performance of the firm in addition to the rate of return of business over the whole existing capital (Demsetz and Villalonga, 2001; Wahla, Shah and Hussain, 2012; Nuzula, 2019). In view of the aforementioned, this study shall also measure performance with ROE for the purpose of unveiling the link between environmental costs' and firm performance among firms in the financial service

sector in Nigeria. Results from prior studies on the link between EPS and environmental costs have been mixed, while studies like those of Malarvizhi and Ranjanni (2016) and Pandey and Kumar (2016) suggests that there is no significant relationship between profitability measures like EPS and environmental costs, we observe that in a Nigerian study, Ezeagba, John-Akamelu and Umeoduagu (2017) reported a significant relationship between environmental costs and EPS. This therefore calls for further studies to clarify the link between EPS and environmental costs. It is on this note that this study also sets out to examine the relationship between environmental costs and the reported EPS of firms by drawing evidence from listed financial service firms in Nigeria. The size of firms vary in many ways and it becomes essential for studies to consider how the size of a firm affects the quality and type of reported information incorporate reports. According to Meek, Soa and Skousen (2007), based on the information asymmetry theory, large firms have lower information asymmetry as they have strong governance and control mechanisms thus increasing the quality of disclosure (environmental costs disclosure inclusive). Conversely, on the basis of the agency theory, it is believed that larger firms witness greater agency costs which may result in more opportunistic practices. In view of the above, in examining the relationship between environmental costs and the performance of listed service firms in Nigeria, this study introduces firm size as a control variable.

Theoretical Framework

Several theories have been linked with studies on corporate governance and corporate governance measure as they affect indices like performance, financial reporting and reporting quality, firm characteristics, environmental costs among others (Hawley, Crane and Matten, 2007; Jeroh, 2017). These theories range from the agency theory which was expanded into stewardship theory, stakeholder theory, legitimacy theory, resource dependency theory, transaction cost theory, political theory and ethics related theories. In spite of the bulk of theories in this area of study, this study shall be anchored on the stakeholders' theory and legitimacy theory. The stakeholder's theory states that firms should not only be responsible to shareholders, but also to a wider group of stakeholders which includes employees, representatives, customers, suppliers, government,

industries, bodies, local communities among others (Hobbs, 2009). The theory advocates that managers in organizations have a network of relationships to serve. This view is to be considered too narrow, as managers' actions impact other interested parties, other than shareholders. This study shall be hinged on the stakeholders' theory because

L Legitimacy Theory

Legitimacy theory according to Aghdam (2015), imply companies' consideration, concern and expectation of community to appear legitimate in stakeholders' point of view and pledge that their activities are socially acceptable. As the organization continues to operate within the domain and norms of society, a firm will use many disclosure strategies to preserve an image of a socially responsible corporate citizen and to ensure continued access to resources needed for the success of the business. Legitimacy theory is the theory that underpin this research because it seeks to show that companies' operations are carried out according to the way that will not harm the society.

Empirical Review

There is avalanche of empirical evidence on the nexus between environmental accounting and corporate performance in Nigeria; however, there is dearth of empirical evidence on social donation, corporate performance and mediating role of industrial categories in Nigeria. Nnamani, Onyekwelu and Ugwu (2017) examined the effect of sustainability accounting and reporting on financial performance of firms in Nigeria brewery sector. Data of total asset, return on equity, total personal cost to turnover and return on asset were obtained from the annual reports and accounts of three (3) brewery firms quoted on the Nigerian Stock Exchange. Data were analyzed using the OLS estimation technique and findings indicated that sustainability reporting has positive and significant effect on the financial performance of the brewery companies investigated. Gamble, Hsu, Kite and Radtke (2015) investigated environmental disclosures in annual reports and accounts by using 234 companies in 12 industries during the period 1986-1991 (OLS). Return on asset was employed as proxy for performance and research and development for environmental disclosure. The study found a significant increase in environmental reporting in annual reports in 1989. However, certain industries (e.g. petroleum refining, hazardous waste management and

from the above, it is obvious that the stakeholder theory assesses various concerns, actions and practices within the organizations against the expectation of a variety of stakeholder groups. To this end, the environmental costs practice of firms is not an exception

steel manufacturing) were judged to have provided the highest quality of disclosures in their annual reports while the period 1989-1991 produced a significant increase in environmental disclosures. Emeakponuzo and Udih (2015) assessed the role of environmental accounting practices by corporate firms in emerging economies. The study utilized twenty-five (25) quoted companies and the hypotheses of the study were tested via Chi-square and Kendall Coefficient. The study found that environmental accounting practice is significant in benchmarking standard for corporate reporting. Also compliance with environmental protection laws may not have had significant influence on environmental accounting practice due to enforcement and compliance issues. Makori and Jagongo (2013) assessed environmental accounting and firm profitability of some selected firms listed in Bombay Stock Exchange, India. The study employed descriptive approach and primary data were basically relied on. Analysis was done via chi-square and findings shows that the greatest challenges militating against EMA implementation in developing economies are connected with the difficulties in defining, unraveling, recognizing, categorizing, measuring and controlling environmental protection costs.

Gap in Literature

There is conflicting findings as regards the nexus between environmental cost accounting and corporate performance. The mixed results may be connected with the methodological approaches employed by these sets of studies. Given the methodological bottlenecks resulting to the conflicting findings as well as choice of proxy for environmental cost and bearing in mind that most prior studies on environmental cost accounting focused on the manufacturing sector, yet, the activities of companies in other sectors also have environmental implications on their respective host communities. This study seeks to fill the gap in literature by examining the nexus between environmental costs and the performance of listed service firms in Nigeria.

3. Methodology

The ex-post facto research design was adopted in this study, because the data obtained for this study already existed and the researchers does not have the capacity to manipulate their outcomes, thus removing any form of researcher's bias in arriving at dependable conclusion.

Population of the Study

The population of this study comprised of all service firms listed on the floor of the Nigerian stock exchange as at 31st December, 2018.

Sample and Sampling Technique

This study focuses on listed service firms in Nigeria (financial) and the purposive sampling technique was the basis of arriving at the sample size for this study. On this note, the following selection criteria were established to guide the inclusion of a company in the sample of this study:

- i. The company must be a listed service company
- ii. The company must be in operation within the study period (2009 -2018).
- iii. The company must have published annual reports throughout the study period and must have consistent data set for all the variables of this study. The choice of the purposive sampling technique was deemed appropriate since it helped in reducing the problem of missing data set which is believed to be common with most studies in Nigeria and other developing economies. In all, only 34 firms listed in the financial service sector met the above stated criteria.

Model Specification

The models for this study were developed in line with the specific objectives and hypotheses of this study. These are:

Environmental Cost=f(Return on Asset,Size)

Environmental Cost=f(Return on Asset,Size)

Environmental Cost=f(Earnings Per Share,Size)

Eqs 1-3 above can be rewritten in its explicit form as below:

$$EnvCost_t = \beta_0 + \beta_1 ROA + \beta_2 FSIZE + \epsilon_t$$

$$EnvCost_t = \beta_0 + \beta_1 ROE + \beta_2 FSIZE + \epsilon_t$$

$$EnvCost_t = \beta_0 + \beta_1 EPS + \beta_2 FSIZE + \epsilon_t$$

Where

EnvCost = Environmental Cost (Measured by dummy variation of 1

where costs have been incurred on Environmental

engagements as indicated in the Environmental Section in annual reports of each firm, otherwise 0).

ROE = Return on Asset (Measured by earnings divided by total assets)

ROE = ROE of firms (Measured as the net profit after tax for each firm divided by shareholder's equity).

EPS = EPS of firms (Measured as the Net Income divided by the number of outstanding ordinary shares).

SIZE = Firm Size (proxy by Log of Total Assets).

= Error Term (variables not captured in the model).

Method of Data Analysis

Given the nature of the data obtained in this study, the ordinary least square (OLS) regression technique was adopted. The analysis of data comprises both descriptive (mean, standard deviation and correlation) and inferential statistics (Ordinary Least Squares). The OLS technique is consistent with its unbiased estimation technique hence it was considered as appropriate for this study. From the result of the OLS regression, the R² obtained which is the co-efficient of determination was used to assess the total variation in the dependent variable that could be explained by the independent variables taken together. The R² for degree of freedom is used to justify the inclusion or exclusion of variables in each of the specified models. Additionally, the F statistics was used to test each hypothesis of the regression plane. The F statistics was used to test the statistical significance of each independent variable in explaining the changes in the dependent variables.

things being equal. The statistical analysis was done The a-priori expectations are a₁>0, a₂>0, <0 all via STATA 13.0 version

This study examined in the link between

environmental costs and the performance of listed firms in Nigeria, The data obtained in this study was analyzed using bot descriptive (mean, standard deviation and correlation) and inferential (OLS) statistics. The data used in this study are presented in appendix II. The analysis

of data are presented in order of priority: analysis of mean and standard deviation, which was closely followed by the correlation result and trends in performance measures of the study. The test of research hypothesis and discussion concludes this chapter

Data Analysis Descriptive Statistics

Table 4.1: Result of the Descriptive Statistics

Variables	Obs	Mean	Std. Dev.	Min.	Max
envcost	340	.2529412	.4353382	0	1
roa	340	1.183706	10.42128	-56.22	115.41
roe	340	10.02256	79.77542	-394.32	1222.87
eps	340	.5565882	1.878551	12.66	21.35
firmsize	340	7.818941	1.009809	5.58	10.77

Source: Researcher's computation via STATA 13.0

Table 4.1 reports the descriptive statistics of the dependent variable (EnvCost), the independent variables (ROA, ROE and EPS) and the control variable (FIRM SIZE). The mean value of EnvCost was approximately 0.253 with a standard deviation of approximately 0.44.

by the high standard deviation that the value of ROE varies largely among firms with marked differences.

Additionally, EPS recorded a mean and standard deviation of approximately 0.557 and 1.879 respectively; with values ranging from a minimum of -12.66 to a maximum of 21.35. The minimum EPS of -12.66 was recorded by Union bank Plc. in 2011, whereas, the maximum EPS of 21.35 was recorded by AxaMansard Plc. in 2018.

Furthermore, the result for the control variable reveals the FSIZE obtained a mean of approximately 7.819, with a corresponding measures among the sampled Nigerian firms.

ROA recorded a mean and standard deviation of approximately 1.184 and 10.421 respectively; whereas the mean for ROE stood at approximately 10.023 with a standard deviation of 79.775. The large variation in the ROE as indicated

of ROE varies largely among firms with marked standard deviation of 1.0098. The minimum and maximum values of FSIZE were 5.58 and 10.77 respectively.

Noteworthy, the variations and sizes of the value of standard deviation for all variables indicates that the variables were not constant, yet in some cases, varied largely across firms; hence this permitted the researcher in examining the nexus between environmental costs and selected corporate performance

Correlation Analysis

Table 4.2: Correlation Matrix for all Variables

	ENVCOST	ROA	ROA	EPS	FSIZE
ENVCOST	1.0000				
ROA	-0.0106	1.0000			
ROE	-0.0610	-0.0930	1.0000		
EPS	0.2758	0.1495	0.0103	1.0000	
FSIZE	0.4995	0.0647	0.0032	0.3534	1.0000

Source: Researcher’s computation via STATA 13.0

In addition to testing for the direction of relation Additionally, the result of correlation matrix among variables, prior empirical studies have used as shown in Table 4.2 revealed that while ROA the correlation analysis to test for the presence and ROE had negative relationship with otherwise of multi-collinearity among variables. The ENVCOST; EPS and FSIZE were found to be result showed that there is the absence of multi-positively related with ENVCOST. collinearity between each pairs of the independent variables of the specified models of this study. This is evident from the result in Table 4.2 as the correlation coefficient between the independent variables (ROA, ROE and EPS) and the control variable ranged between 0.0032 and 0.4995.

Multi-Collinearity and Test for Heteroscedasticity

Table 4.3: Variance Inflator Factor Results for Independent Variables

VARIABLE	VIF	1/VIF
EPS	1.16	0.858586
FSIZE	1.14	0.874988
ROA	1.03	0.968547
ROE	1.01	0.990743
MEAN VIF	1.09	

Source: Researcher’s computation via STATA 13.0

Table 4.4: Result for Breusch-Pagan/Cook Weisberg Test**BREUSON-PAGAN /COOK-WEISBERG TEST FOR HETEROSCEDASTICITY**

HO: CONSTANT VARIANCE	
VARIABLES: FITTED VALUES OF ENVCOST	
OHI2 (1)	= 35.60
PROB > OHI2	= 0.0000

Source: Researcher’s computation via STATA 13.0

As evident in Table 4.4, the chi2 (1) of the fitted values of ENVCOST is 35.60 with a p-value of 0.0000. This result therefore confirms the OLS regression outcome in the following section of this report can be relied upon. the absence of heteroscedasticity problem in the data set. With the above results,

Test Research Hypotheses**4.3.1 Test of Hypotheses I**

H₀₁: There is no significant relationship between environmental costs and the Return On Assets (ROA) of listed services companies in Nigeria. Hypothesis I is presented below

In order to test the above hypothesis, data for Return on Asset (ROA) was regressed against data

Table 4.5: OLS Result showing the nexus between environmental costs (ENVCOST), and return on asset (ROA)

Variables	Coeff.	Std.Err.	T	P> t
C	-1.438096	0.1603889	-8.97	0.000
ROE	-0.0018001	0.001973	-0.91	0.362
FSIZE	0.216547	0.020362	10.63	0.000
F(2, 337)	56.58			
Prob > F	0.0000			
R-squared	0.2514			
Adj. R-squared	0.2469			
N	340			

Source: Researcher’s computation via STATA 13.0

The result in Table 4.5 reveal that about 25% of the changes in the environmental disclosure practices of listed service firms was accounted for by changes in the value of ROA over the study period. In addition, it was observed that with a regression coefficient of about 0.0018001, an inverse relationship tend to exist between, movement in ROA and the level of environmental costs’ disclosure among firms. Impliedly, a unit

increase in ROA reduces the possibility of full disclosure of environmental costs by firms. From the results of the F-Statistics of 56.58 and a P-value of 0.0000, the null hypothesis that there is no significant relationship between environmental costs and the Return on Assets (ROA) of listed service companies in Nigeria is rejected.

Decision: From the result in Table 4.5, we therefore reject the null hypothesis and accept the

alternate hypothesis which means that there is significant relationship between environmental costs and the Return on Assets (ROA) of listed service companies in Nigeria.

Test of Hypothesis II

H₀₂: There is no significant statistical link between environmental cost and the ROE of listed service companies in Nigeria.

4.6: OLS Result showing the nexus between environmental costs (ENVCOST), and Return on Equity (ROE)

Variables	Coeff.	Std.Err.	T	P> t
C	-1.428074	.1599822	-8.93	.000
ROE	-0.0003418	.0002568	-1.33	.184
FSIZE	.2154308	.0202912	10.62	.000
F(2, 337)	57.20			
Prob > F	.0000			
R-squared	.2534			
Adj. R-squared	.2490			
N	340			

Source: Researcher’s computation via STATA 13.0

Table 4.6 presents the regression result for test of hypothesis II. As indicated in the table, about 25% of the variations in environmental costs among listed service firms in Nigeria was accounted for by changes in the values of ROE over the study period. In addition, it was observed that with a regression coefficient of about -0.0003418, a negative relationship tend to exist between movements in ROE and Environmental Costs among the sampled firms. Impliedly, a unit increase in Environment Costs possibly reduces the ROE firms. From the results of the F-Statistics of

In order to test the above hypothesis, data for ROE was regressed against data for environmental costs (ENVCOST) for the sampled firms and the result from the test of Hypothesis II is presented below.

Table

57.20 and a P-value of 0.0000, the null hypothesis that there is no significant statistical link between Environmental Costs and the ROE of listed service companies in Nigeria is rejected.

Decisions: From the result in Table 4.6, we therefore rejected the null hypothesis and accept the alternate hypothesis which means that there is significant statistical link between Environmental Costs and the ROE of listed companies in Nigeria. This is because, ROE was found to have significant effect on environmental disclosure among firms

Test of Hypothesis III

H₀₃: There is no significant connection between Environment Costs and the EPS of listed service companies in Nigeria.

In order to test the above hypothesis, data for EPS was regressed against data for

Environmental Costs (ENVCOST) for the sampled firms and the result from the test of Hypothesis III is presented below

:Table 4.7: OLS Result showing the nexus between environmental costs (ENVCOST), and Earning Per Share (EPS)

Variables	Coeff.	Std. Err.	T	P> t
C	-1.310268	0.1678265	-7.81	0.000
EPS	-0.0263038	0.0116021	2.27	0.024

F_{SIZE}	0.1980535	0.0215834	9.18	0.000
F(2, 337)	59.45			
Prob > F	0.0000			
R-squared	0.2608			
Adj. R-squared	0.2564			
N	340			

Source: Researcher's computation via STATA 13.0

The regression result for the test of Hypothesis III is presented in Table 4.7. Again, from the results, in the table, it is evident that about 26% of the variation in Environmental Costs among listed service firms in Nigeria was actually accounted for by changes in the value of EPS over the study period.

Additionally, it was observed that with regression coefficient of about 0.0263038, a positive relationship tends to exist between movement in EPS and Environmental Costs among the sampled firms. Impliedly, a unit increase in EPS increases the possibility of full disclosure of Environmental Costs by firms. From the results of the F-Statistics of 59.45 and a P-value of 0.0000, the null hypothesis is that there is no significant relationship between Environmental Costs and the EPS of listed service companies in Nigeria is rejected.

Decision: From the result in Table 4.7, we therefore reject the null hypothesis and accept the alternate hypothesis which means that there is a significant relationship between Environmental Costs and the EPS of listed service companies in Nigeria. This is because EPS was found to have significant positive effect on environmental disclosures among firms.

Discussion and Findings:

This study aimed at assessing the relationship between selected performance measures and Environmental Costs among listed service firms in Nigeria. In this study, secondary data were obtained with respect to the variables of interest for a 10-years period covering 2009-20189. To achieve the broad and specific objective of the study, hypothesis

were formulated and regression models were developed to guide the testing of the hypothesis which was done via windows software- STATA 13.0 version.

First, from the correlation analysis conducted, we observed that the independent variables did not show signals of the existence of multi-collinearity (see Table 4.2). This is evident from the result of the Pearson Correlation (Pearson R), as the correlation coefficient between the independent variables (ROA, ROE and EPS) and the control variable ranged between 0.0032 and 0.4995. With this range of values, no Pearson Correlation (Pearson R) between pairs of independent variable in each of the regression models (each independent variable and the control variable) has value of 0.80 or above; a suggestion that the models specified are fit and devoid of issues of multi-collinearity. This was further confirmed by the result of the multi-collinearity test as indicated in Table 4.3. Accordingly, the mean VIF obtained for the independent variables did not exceed the standard VIF level ($1.09 < 10.00$) which means that multi-collinearity does not exist among the independent variables used in this study. Again, the variable was further subjected to tests for heteroscedasticity using the Breusch-Pagan/Cook Weisberg Test which interestingly revealed in Table 4.4 that the fitted value of ENV COST is 35.60 with a p-value of 0.0000; thus confirming heteroscedasticity problem in the data set. These results however, proved that from the tests of hypothesis could be relied upon. From the result of the test of hypothesis I, we observed from the evaluation of the regression result that R^2 is 0.2514 suggesting a

25.14% of the explanatory ability of the estimation for the systematic variation in the dependent variable (ENVCOST) with an adjusted value of 0.2465. The evaluation of the slope coefficients of the explanatory variables revealed the existence of a negative relationship between ENVCOST and the Explanatory (ROA = 0.0018001). However, with an F-value of 56.58 (p-value = 0.0000), there was a strong evidence that ROA has significant negative effect on environmental costs among listed service firms in Nigeria. This finding corroborates that Ong, Teh and Ang (2014) and Nuzula (2019). Furthermore, from the result of the test of Hypothesis II, we noticed from the evaluation of regression result that R^2 was 0.2534 suggesting about 25% explanatory ability of the estimation of the systematic variation in the dependent variable (ENVCOST) with an adjusted value of 0.2490 (24.90%). The evaluation of the slope coefficients of the explanatory variables revealed the existence of a negative relationship between environmental costs (ENVCOST) and the ROE firm (coefficient of ROE = 0.0003418). Impliedly, the costs incurred by firms for environmental engagements are largely affected by amount of computed values of EPS of firms. However, with an F-value of 57.20 (p-value = 0.0000), there was a strong evidence that ROE has significant negative influence on environmental costs among firms. Finally, from the test of Hypothesis III, we noticed from the evaluation of regression result that R^2 was 0.2608 which suggests 26.08% of the explanatory ability of the estimation for the systematic variation in the dependent variable (ENVCOST) with an adjusted value of 0.2564 (25.64%). The evaluation of the slope coefficients of the explanatory variables further revealed the existence of a positive association between environmental costs (ENVCOST) and EPS (coefficient of EPS = 0.0263038). With an F-value of 59.45 (p-value = 0.0000), there was strong evidence that EPS has significant positive influence on environmental costs of listed service firms in Nigeria. This result is in consonance with the finding of Ezeagba, John-Akamelu and Umeoduagu (2017), but at variance with that of Pandey and Kumar

(2016) and Malarvizhi and Ranjani (2016).

5. Summary of findings

This study examines the nexus between environmental cost and selected measures of corporate performance with evidence from selected listed service companies in Nigeria. Data for both the dependent and independent variables were obtained for a period spanning from 2009 – 2018 and were analyzed by means of descriptive (mean, standard deviation and correlation) and inferential (ordinary least square) statistics. Based on the analysis of data and test of Hypothesis, the following findings emerged:

1. That there is significant relationship between environmental costs and Return On Asset (ROA) of listed service companies in Nigeria.
2. The ROE has significant negative effect on environmental costs of listed service companies in Nigeria.

That there is significant positive relationship between environmental costs and the EPS of listed service companies in Nigeria.

Conclusion

This study was motivated by the inclusive nature of studies carried out on environmental accounting and disclosure practices in Nigeria and beyond. However unlike most prior studies, this study examined the effect of selected class of performance measures on environmental costs of firms in Nigeria.

The study found that corporate performance indicators such as return on assets, return on equity and earning per share have significant effect on environmental costs among firms. The implication of this study's result is that the level of disclosure of environmental related costs depends on the respective performance of listed firms over time.

Recommendations

We therefore recommend that

1. The management of firms should ensure full disclosure by reporting environmental related costs in their financial statements irrespective of the performance recorded in any given year.
2. The accounting framework should

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Capstone Project : Marketing-Airplane Passenger Satisfaction Prediction Using Machine Learning Techniques

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Abstract

Customer satisfaction questionnaires are a rich and strong source of information for companies to seek loyalty, customer and client retention, optimize resources, and repurchase products. Several advanced machine learning and statistical models have been employed to estimate the customer satisfaction score; however, there is not a single model that can yield the best result in all situations. Ensembles of regression techniques have demonstrated their effectiveness for various applications, where the success of these models lies in the construction of a set of single models. I performed an experimental study using a real dataset of 90917 samples from US airline carrier 'Falcon airlines', in order to verify the benefits of ensemble models for predicting customer satisfaction. Accordingly, in this project I evaluated the following models; Logistic Regression, Decision Tree, Bagging classifier and Random forest. The obtained results indicate that the Random forest performs better in terms of Recall and Precision.

Keywords: Logistic regression, customer satisfaction, Bagging classifier and Random forest.

Introduction

Problem Description

Airline businesses globally are faced with the challenge of grounding especially due to the pandemic. To stay in business, Airline operators need to determine relative parameters that can contribute to the satisfaction of passengers. This is the dilemma of a reputed US airline carrier 'Falcon airlines'. They aim to determine the relative importance of each parameter with regards to their contribution to passenger satisfaction. To achieve this Aim a random sample of 90917 individuals who travelled using their flights is provided. The on-time performance of the flights along with the passengers' information is published in the Marketing Project-Flight data.csv file named 'Flight data'. These passengers were asked to provide their feedback at the end of their flights on various parameters along with their overall experience. These collected details are as available in the Marketing Project-Survey data.csv 'Survey data'.

In the survey, the respondents were requested to express their satisfaction or not with their

overall flight experience and that is captured in the data of survey report under the variable labelled 'Satisfaction'. The need for this study by 'Falcon airlines' is to give themselves a competitive edge over other airline operators by identifying critical factors that lead to customer satisfaction.

Motivation For Project

It is obvious that at the end of the pandemic, there will be an increase demand for air travel as most persons may wish to be on vacations. Hence the need for 'Falcon airlines' to carry out this study to ascertain Passengers level of satisfaction with their services to give themselves a competitive edge over other airline

Aim and Objectives

This project was a few weeks' efforts to develop a predictive model for Airline passenger satisfaction using data from US airline carrier 'Falcon airlines'. I hope the outcome of the project will help streamline the analysis and prediction of passenger's satisfaction for US

airline carrier 'Falcon airlines' and other airlines.

The objective of this project are-

1. To understand which parameters play an important role in swaying a passenger feedback towards 'satisfied'.

2. To predict whether a passenger will be satisfied or not given the rest of the details are provided, using supervised machine learning techniques.

3. To compare different classification techniques to understand which is best suitable for this application.

No doubt the development of a framework and codes that incorporate analytics and machine learning concepts studied in the program is the goal. The success of the project is predicated on the accuracy of the classification results and the extent of analysis conducted. It is my hope that the final report will serve as a benchmark for further development on this topic.

Research Methodology

The typical machine learning approach was followed in this project. The identified .Working steps of Machine learning technique

Limitations of the Study

In this project, I evaluated the effectiveness of using specific supervised machine learning techniques to address the problem of predicting passengers satisfaction on Airline flight and survey data provided. The limitations of the methods applied in the course of this project study are as follows:

I used a pre-labelled dataset to train the algorithms. However, usually, it is difficult to find labelled data and thus applying supervised machine learning techniques may not be feasible. In such cases, the option should be to evaluate unsupervised techniques which were beyond the scope of this project.

Lterature Review

This part of the project seeks to review considerable literature on the subject matter. A few researchers have also conducted literature reviews of articles published on airline passenger satisfaction and the techniques used.

Air travel is one of the most convenient way for long distance travel at both national and international level [Park et al.,2009]. There are many airline service providers (ASPs) around the world. The competitive world motivates the

dataset has labelled class variable, which was used as the prediction variable in machine learning models.

Through exploratory analysis, we analysed the data set in detail and identified possible predictors. Through various visualization techniques, we observed the separation between Satisfied and neutral or non-satisfied passengers.

To solve the Airline passenger satisfaction prediction problem, we experimented with a few supervised machine learning techniques – Logistic Regression, Decision tree, Bagging classifier and Random Forest,

Performance measures, like Confusion Matrix and Area Under Curve (AUC), was used to compare the performance of the models.

This analysis was conducted using Python through Jupyter notebook. In-built libraries and methods were used to run the machine learning models. When needed, functions were defined to simplify specific analyses or visualizations. The diagram below shows in detail the full process that was followed in the project

This project considers marketing survey and flight data that was mined by US airline carrier 'Falcon airlines' only.

I evaluated a few machine learning algorithm – Logistic Regression, Decision tree, Bagging classifier and Random Forest. Although the result of the study using these algorithms is good, it is necessary to evaluate other techniques to determine which algorithm works best for this application.

Due to the large size of data, I was limited by computation capacity to explore different other techniques

airlines company to attract the customers. However, a traveller considers quite a few factors before deciding on any airline. These points can be airfare, tour time, quantity of stoppages, number of baggage allowed, and existing customer feedback etc. Therefore, all ASPs are working in all these client service areas to enhance their facility and in-flight remedy in order to attract the customers.

It is very vital to recognize the desires and remedy level of customers i.e. customer satisfaction for the duration of the flight. Therefore, client remarks are very important or any airline industry. There could be quite a possible approaches to gather the customer feedback. The most easiest and regular way is the customer feedback structure available during the journey. However, most of the passengers do no longer show any activity in filling feedback forms. Another shortcoming of this strategy is that it may additionally or can also not have appropriate questionnaire and might also be biased on positive parameters i.e. the

feedback form may also only have sure unique questions. Other processes for purchaser feedback collection could be via online website or online mobile purposes of the airlines. After the journey, an electronic mail with a link can be despatched to the passenger to request for a feedback. However, there is no guarantee of its success. Another strategy is to send a message on passenger's cellular cellphone and ask them to rate your provider (1 for negative and 5 for excellent) on certain parameters. All these standard strategies opted by means of the industry are limited to certain parameters only. The greater handy way for a passenger is to express their feedback, as they want. Therefore, the most convenient way for the passengers to share their opinions is the social media instead of feedback form. Social media presents a platform the place a consumer can freely categorise his feedbacks on any issues

Summary of related work

Pramod., et al 2019] in their work "a literature review: customer satisfaction on airline tweets using machine learning"; presents the earlier work done by the various researchers in the field ;

they observed all through flight. Twitter [<https://en.wikipedia.org/wiki/Twitter>] is one of the famous platforms worldwide. The information from Twitter can be utilized to strengthen a recommender system [Abel et al., 2019]. In addition, travellers are more comfortable in sharing their views about tour experiences on Twitter.

A variety of fundamental issues influences the emotions of a passenger in air travel. These issues can be cabin crew behavior, food quality, loss of baggage, seat comfort, flight delay, airfare etc. All these issues may give upward push to each superb and bad emotion. Also, if there is a continuous trend of terrible tweets for an airline, then it might also put a negative impact to the financial growth of the airline company. Therefore, it is vital to understand the issues that provide upward e to terrible tweets so that the respective airline company can take splendid action on time. There are large number airlines operating every day to join different geographical places [www.quora.com]. Therefore, we might so anticipate a large number of people journeying every day in these flights. In addition, the number of tweets by passengers for airways would be very large. Therefore, it is a difficult assignment to extract the hidden emotion at the back of a tweet. Therefore, we required some tools and techniques that are in a position to take care of such a large quantity of tweet database and can provide insights to assist airline industry

of customer satisfaction of airline tweets using machine-learning techniques such as logistic regression, SVM, KNN, random forest, Naïve Bayes classifier, AdaBoost etc as shown below

Authors	Description	Publishing Year
T.HemakalaandSanthoshkumar	<p>In this research, design a framework for sentiment analysis with opinion mining for the case of airlines service feedback. Most available datasets of hotel reviews are not labelled which presents many works for researchers as far as text data pre-processing task is concerned. Twitter is a SNS that has a huge data with user posting, with this significant amount of data, it has the potential of research related to text mining and could be subjected to sentiment analysis. The airline industry is a very competitive market, which has grown rapidly in the past 2 decades. Airline companies resort to traditional customer feedback forms which in turn are very tedious and time-consuming. In this work, worked on a dataset comprising of tweets for 6 major Indian Airlines and performed a multi-class sentiment analysis. This approach starts with pre-processing techniques used to clean the tweets and then representing the tweets as vectors using a deep learning concept to do a phrase-level analysis. The analysis was carried out using 7 different classification strategies: Decision Tree, Random Forest, SVM, K-Nearest Neighbors, Logistic Regression, Gaussian Naïve Bayes and AdaBoost. The outcome of the test set is the tweets sentiment.</p>	2018
Guoning Hu et al.	<p>Analyze the opinion of 19M Twitter users towards 62 popular industries, encompassing 12,898 enterprise and consumer brands, as well as associated subject matter topics, via sentiment analysis of 330M tweets over a period spanning a month. We find that users tend to be most positive towards manufacturing and most negative towards service industries. In addition, users tend to be more positive or negative when interacting with brands than generally on Twitter. We also find that sentiment towards brands within an industry varies greatly and we demonstrate this using two industries as use cases. In addition, we discover that there is no strong correlation between topic sentiments of different industries, demonstrating that topic sentiments are highly dependent on the context of the industry that they are mentioned in. We demonstrate the value of such an analysis in order to assess the impact of</p>	2017
	<p>brands on social media. We hope that this initial study will provide valuable information for both researchers and companies in understanding users' perceptions of industries, brands and associated topics and encourage more research in this field.</p>	

Yasmin Yashodha	This study examines the extensive strategic analysis of AirAsia Berhad that has enabled it to sustain its competitive advantage as Asia's leading low-cost carrier (LCC). The study demonstrates the diverse business-level, corporate-level and competitive strategies of AirAsia Berhad, played crucial roles in the LCC to successfully penetrate the under-served market segment of the airline industry within the ASEAN region. An in-depth analysis using a wide array of academic resources, relevant financial, legal and management resources and authorized website including face-to-face interviews were used to provide a more consequential comprehension on the varied business and international strategies that were implemented by AirAsia Berhad. This research exhibits critical analysis pertaining to the current macro environment of the aviation industry which includes the PESTEL framework and Porter's Industry Analysis. The competitive environment analysis for AirAsia Berhad is thoroughly scrutinised to examine the driving determinants that attributed to the organization's competitive advantage in the industry.	2012
M. Vadivukarasi et al.	In Twitter, the customer of airline services can tweet their opinion about their travelled experiences in flight. So Twitter contains a massive amount of data and information regarding airline services. These tweets are collected and explored the sentiments about the airline services to track customer satisfaction reports and to discover location of the customer.	2018
Janet R. McColl Kennedy et al.	Contextualized in post purchase consumption in business-to-business settings, the authors contribute to customer experience (CX) management theory and practice in three important ways. First, by offering a novel CX conceptual framework that integrates prior CX research to better understand, manage, and improve CXs—comprised of value creation elements (resources, activities, context, interactions, and customer role), cognitive responses, and discrete emotions at touchpoints across the customer journey. Second, by demonstrating the usefulness of a longitudinal CX analytic based on the conceptual framework that combines quantitative and qualitative measures. Third, by providing a step-by-step guide for implementing the text mining approach in practice, thereby showing that CX analytics that apply big data techniques to the CX can offer significant insights that matter. The author highlights six key insights practitioners need in order to manage their customers' journey, through (1) taking a customer perspective, (2) identifying root causes, (3) uncovering at-risk segments, (4) capturing customers' emotional and cognitive responses, (5) spotting and preventing decreasing sales, and (6) prioritizing actions to improve CX. The article concludes with directions for future research.	2018

Rida Kha and Siddhaling Uro agin	Social media today is an integral part of people's daily routines and the livelihood of some. As a result, it is abundant in user opinions. The analysis of brandspecific opinions can inform companies on the level of satisfaction within consumers. This research focuses on an analysis of tweets related to airlines based in four regions: Europe, India, Australia and America for consumer loyalty prediction. Sentiment Analysis is carried out using TextBlob analyzer.	2018
Ankita Rane and	The airline industry is a very competitive market which has grown rapidly in the past 2 decades. Airline companies resort to traditional customer feedback	2018

nandkumar	forms which in turn are every tedious and time consuming. This is where Twitter data serves as a good source to gather customer feedback tweets and perform a sentiment analysis. In this paper, we worked on a dataset comprising of tweets for 6 major USA Airlines and performed a multi-class sentiment analysis. This approach starts off with pre-processing techniques used to clean the tweets and then representing these tweets as vectors using a deep learning concept (Doc2vec) to do phrase-level analysis. The analysis was carried out using 7 different classification strategies: Decision Tree, Random Forest, SVM, K-Nearest Neighbors, Logistic Regression, Gaussian Naïve Bayes and AdaBoost. The classifiers were trained using 80% of the data and tested using the remaining 20% data. The outcome of the test set is the tweet sentiment (positive/negative/neutral). Based on the results obtained, the accuracies were calculated to draw a comparison between each classification approach and the overall sentiment count was visualized combining all six airlines.	
Yun Wan and Qigang Gao	In the airline service industry, it is difficult to collect data about customers' feedback by questionnaires, but Twitter provides a sound data source for them to do customer sentiment analysis. However, little research has been done in the domain of Twitter sentiment classification about airline services. In this paper, an ensemble sentiment classification strategy was applied based on the Majority Vote principle of multiple classification methods including Naive Bayes, SVM, Bayesian Network, C4.5 Decision Tree and Random Forest algorithms. In our experiments, six individual classification approaches, and the proposed ensemble approach were all trained and tested using the same dataset of 12864 tweets, in which 10-fold evaluation is used to validate the classifiers. The results show that the proposed ensemble approach outperforms these individual classifiers in this airline service Twitter dataset.	2015

MustafaAltinkök	This research was conducted for the purpose of analyzing the effect of the movement education program through a 12-week coordination on the development of basic motor movements of pre-school children. A total of 78 students of pre-school period, 38 of whom were in the experimental group and 40 of whom were in the control group, were incorporated into the study in line with their own consent after their families had also been informed.	2016
M.Vadivukarassial.	Analyzed the twitter airline dataset for finding the best and the worst airlines and also to predict the most common issues occurred during their services. Then the word clouds of negative tweets are created and also the location of the negatively tweeted customer is predicted and visualized using geographical analysis. Finally training and testing was done on the dataset and also compared with several different classifiers such as Logistic Regression classifier, K-Neighbors classifier, SVC, Decision Tree classifier, Random Forest classifier, AdaBoost classifier and Gaussian NB. The results of four experiments demonstrate that the Random forest approach works best in real-world practice on sentiment classification of tweet data.	2018
Bee Yee Liau and Pei Tan	The purpose of this paper is to study the consumer opinion towards the low-cost airlines or low-cost carriers (LCCs) (these two terms are used interchangeably) industry in Malaysia to better understand consumers' needs and to provide better services. Sentiment analysis is undertaken in revealing current customers' satisfaction level towards low-cost airlines. About 10,895 tweets (data collected for two and a half months) are analyzed. Text mining techniques are used during data preprocessing and a mixture of statistical techniques are used to segment the customers' opinion. The results with two different sentiment algorithms show that there is more positive than negative polarity across the different algorithms. Clustering results show that both K-	2016
	Means and spherical K-Means algorithms delivered similar results and the four main topics that are discussed by the consumer on Twitter are customer service, LCC tickets promotions, flight cancellations and delays and post-booking management.	
Xiang Ji et al.	An important task of public health officials is to keep track of health issues, such as spreading epidemics. In this paper, we are addressing the issue of spreading public concern about epidemics. Public concern about a communicable disease can be seen as a problem of its own. Keeping track of trends in concern about public health and identifying peaks of public concern are therefore crucial tasks. However, monitoring public health concerns is not only expensive with traditional surveillance systems, but also suffers from limited coverage and significant delays.	2015

Methodology

This methodology served as the deliverables of the project. It describes the results of each phase that was tried out and do a comparison between them to identify which is the best technique to address the airline passenger satisfaction prediction problem. Each phase of the project has an output that describes the findings in that phase. These deliverables were used in this final project are explained below

project deliverables

Methodology Phases	Project Deliverables
Understanding the dataset	Report on the summary of the dataset and each variable it contains along with necessary visualizations
Exploratory Data Analysis	Report on analysis conducted and critical findings with a full description of data slices considered Visualizations and charts that show the differences between satisfied and neutral or non-satisfied passengers Python code of the analysis performed
Modeling	Report on the results of the different techniques tried out, iterations that were experimented with data transformations and the detailed modeling approach Python code used to build machine learning models
Final Project Report	Final report summarizing the work done over the course of the project, highlighting the key findings comparing different models and identifying best model for predicting airline passenger satisfaction

Tools used

This project was entirely done using Python, and the analysis was documented in a Jupyter notebook. Standard python libraries were used to conduct different analyses. These libraries are described below–

- **sklearn** – used for machine learning tasks
- **seaborn** – used to generate charts and visualizations
- **pandas** – used for reading and transforming the data
- **Gridsearch** – used for model tuning

Dataset

The problem consists of 2 separate datasets: Flight data & Survey data. The flight data has information related to passengers and the performance of flights in which they travelled. The survey data is the aggregated data of surveys

collected post service experience. You are expected to treat both the datasets as raw data and perform any necessary cleaning/validation steps as required

Data Information

```
<class 'pandas.core.frame.DataFrame'>
```

```
Int64Index: 90917 entries, 0 to 90916
```

```
Data columns (total 24 columns):
```

```
# Column                               Non-Null Count  Dtype
---  ---
0  CustomerId                            90917 non-null  int64
1  Satisfaction                           90917 non-null  object
2  Seat_comfort                           90917 non-null  object
3  Departure_Arrival_time_convenient     82673 non-null  object
```

4	Food_drink	82736 non-null	object
5	Gate_location	90917 non-null	object
6	Inflightwifi_service	90917 non-null	object
7	Inflight_entertainment	90917 non-null	object
8	Online_support	90917 non-null	object
9	Ease_of_Onlinebooking	90917 non-null	object
10	Onboard_service	83738 non-null	object
11	Leg_room_service	90917 non-null	object
12	Baggage_handling	90917 non-null	object
13	Checkin_service	90917 non-null	object
14	Cleanliness	90917 non-null	object
15	Online_boarding	90917 non-null	object
16	Gender	90917 non-null	object
17	CustomerType	81818 non-null	object
18	Age	90917 non-null	int64
19	TypeTravel	81829 non-null	object
20	Class	90917 non-null	object
21	Flight_Distance	90917 non-null	int64
22	DepartureDelayin_Mins	90917 non-null	int64
23	ArrivalDelayin_Mins	90633 non-null	float64

Objects will need to be converted to category as demonstrated with a few variable.

DATA TYPES: float64(1), int64(4), object(19)

Exploratory Data Analysis

```

In [196]: df_outer.describe()# displays the statistical summary for the merged dataset
Out[196]:

```

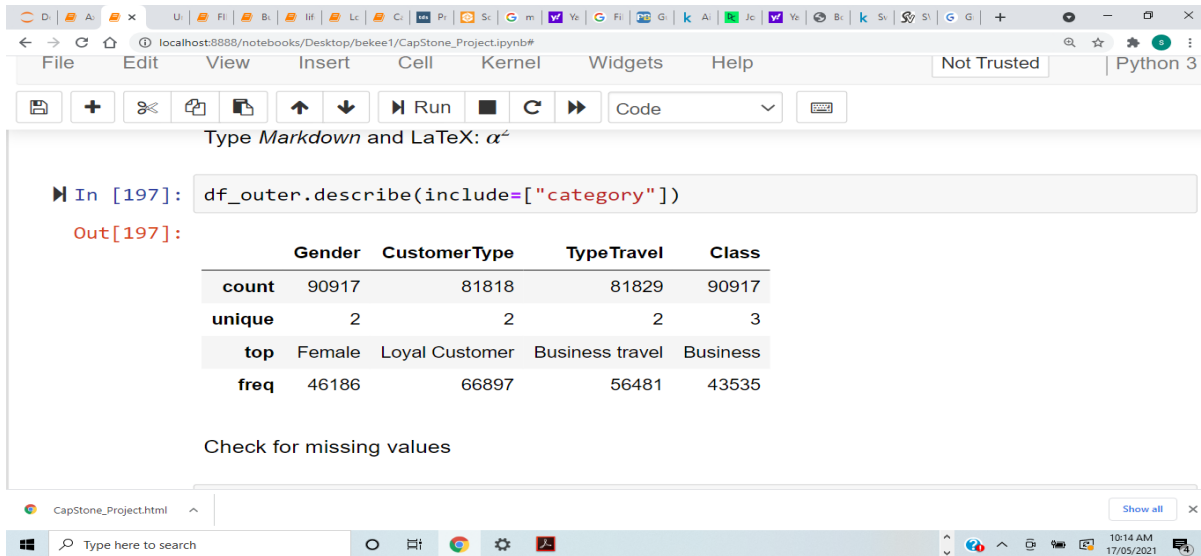
	CustomerId	Age	Flight_Distance	DepartureDelayin_Mins	ArrivalDelayin_Mins
count	90917.000000	90917.000000	90917.000000	90917.000000	90633.000000
mean	195423.000000	39.447166	1981.629442	14.686593	15.058930
std	26245.621549	15.129794	1026.779932	38.669260	39.038523
min	149965.000000	7.000000	50.000000	0.000000	0.000000
25%	172694.000000	27.000000	1360.000000	0.000000	0.000000
50%	195423.000000	40.000000	1927.000000	0.000000	0.000000
75%	218152.000000	51.000000	2542.000000	12.000000	13.000000
max	240881.000000	85.000000	6950.000000	1592.000000	1584.000000

```

In [197]: df_outer.describe(include=["category"])
Out[197]:

```

Mean Age respondents is 39.4 and Standard deviation 15.1, mean light distance 1981.6 & Standard deviation 1026.8, mean DepartureDelayin_Mins 14.6 Std 38. ArrivalDelayin_Mins 15.1 Std 39.0



Gender have unique count of 2, top being female, CustomerType have unique count of 2, top being Loyal Customer with count indication some value are missing same to TypeTravel and Class with 3 unique count

Data set

The problem consists of 2 separate datasets: Flight aggregated data of surveys collected post service data & Survey data. The flight data has information experience. You are expected to treat both the related to passengers and the performance of flights datasets as raw data and perform any necessary in which they travelled. The survey data is the cleaning/validation steps as required

Data Information

<class 'pandas.core.frame.DataFrame'>

Int64Index: 90917 entries, 0 to 90916

Data columns (total 24 columns):

#	Column	Non-Null Count	Dtype
0	CustomerId	90917 non-null	int64
1	Satisfaction	90917 non-null	object
2	Seat_comfort	90917 non-null	object
3	Departure_Arrival_time_convenient	82673 non-null	object
4	Food_drink	82736 non-null	object
5	Gate_location	90917 non-null	object
6	Inflightwifi_service	90917 non-null	object
7	Inflight_entertainment	90917 non-null	object
8	Online_support	90917 non-null	object
9	Ease_of_Onlinebooking	90917 non-null	object
10	Onboard_service	83738 non-null	object
11	Leg_room_service	90917 non-null	object
12	Baggage_handling	90917 non-null	object
13	Checkin_service	90917 non-null	object
14	Cleanliness	90917 non-null	object
15	Online_boarding	90917 non-null	object
16	Gender	90917 non-null	object
17	CustomerType	81818 non-null	object
18	Age	90917 non-null	int64
19	TypeTravel	81829 non-null	object

20 Class	90917 non-null object
21 Flight_Distance	90917 non-null int64
22 DepartureDelayin_Mins	90917 non-null int64
23 ArrivalDelayin_Mins	90633 non-null float64

Objects will need to be converted to category as demonstrated with a few variable.
 DATA TYPES: float64(1), int64(4), object(19)

Data Preprocessing

The data set contains CustomerId variable which of type int, in my opinion I feel this variable may not add any significant value to prediction variable so I decided to drop it.

```
df_outer.drop(
  columns=["CustomerId"], inplace=True)
```

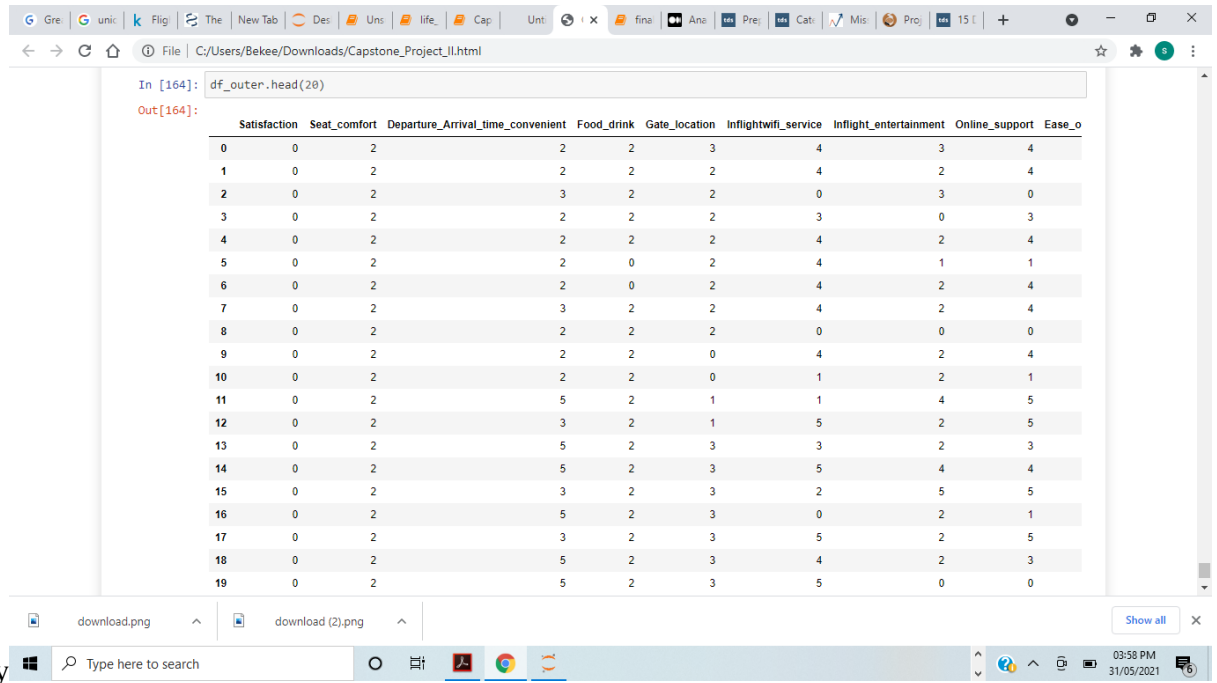
Fixing Categorical Variables (Data Type)

Before putting our data through models, two steps that need to be performed on categorical data is encoding and dealing with missing nulls. Encoding is the process of converting text or boolean values to numerical values for processing. This approach was adopted for 19 columns that

are of type object. First the object were converted to Categories and the Ordinal values were passed as shown below;
 categorical_variables=df_outer.select_dtypes(exclude=["number","bool_"]).columns.tolist()
list of categorical variables

```
for column in categorical_variables:
  df_outer[column]=df_outer[column].astype('category')
<class 'pandas.core.frame.DataFrame'>
Int64Index: 90917 entries, 0 to 90916
Data columns (total 23 columns):
```

#	Column	Non-Null Count	Dtype
0	Satisfaction	90917 non-null	category
1	Seat_comfort	90917 non-null	category
2	Departure_Arrival_time_convenient	82673 non-null	category
3	Food_drink	82736 non-null	category
4	Gate_location	90917 non-null	category
5	Inflightwifi_service	90917 non-null	category
6	Inflight_entertainment	90917 non-null	category
7	Online_support	90917 non-null	category
8	Ease_of_Onlinebooking	90917 non-null	category
9	Onboard_service	83738 non-null	category
10	Leg_room_service	90917 non-null	category
11	Baggage_handling	90917 non-null	category
12	Checkin_service	90917 non-null	category
13	Cleanliness	90917 non-null	category
14	Online_boarding	90917 non-null	category
15	Gender	90917 non-null	category
16	CustomerType	81818 non-null	category
17	Age	90917 non-null	int64
18	TypeTravel	81829 non-null	category
19	Class		n-null



Missing Value

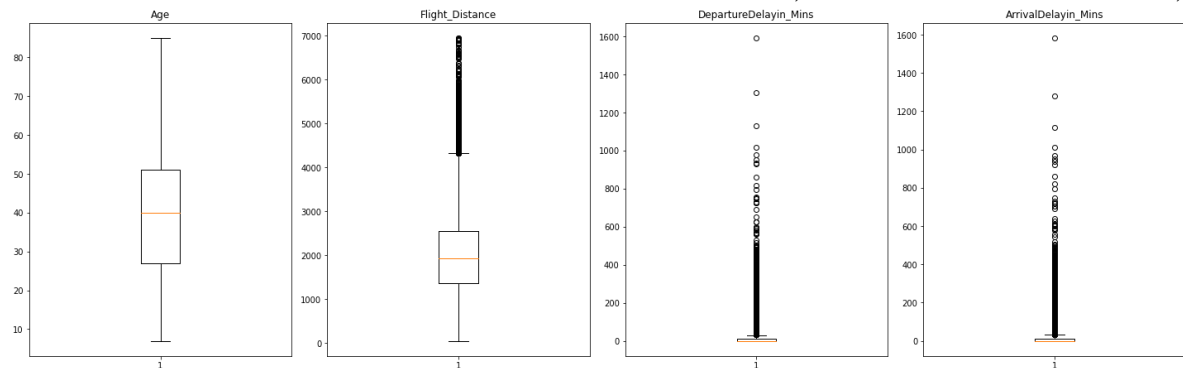
Missing value in a dataset is a very common phenomenon in the reality. Missing value correction was carried out on the data set to reduce bias and to produce data set suitable for modelling. The following variables contained missing values

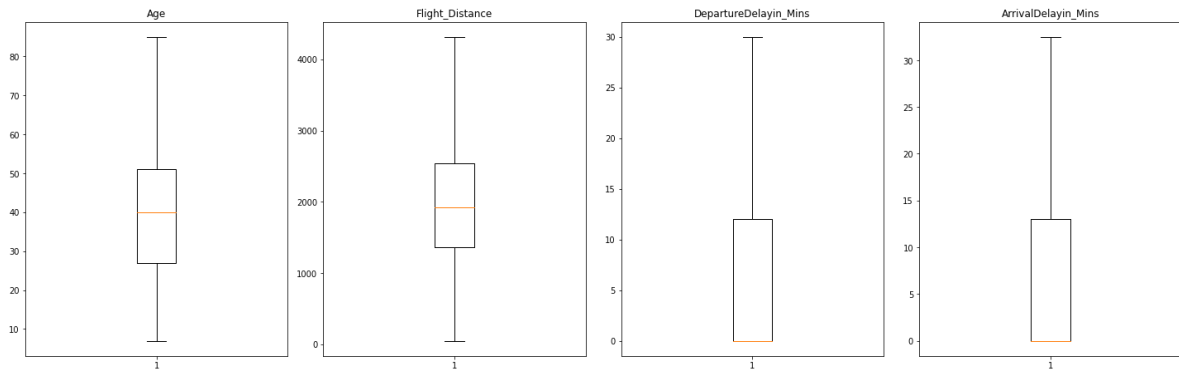
- : Departure_Arrival_time_convenient 8244
- Food_drink 8181
- Onboard_service 7179
- CustomerType 9099
- TypeTravel 9088
- ArrivalDelayin_Mins 284

They were corrected with the following codes for numerical and categorical respectively

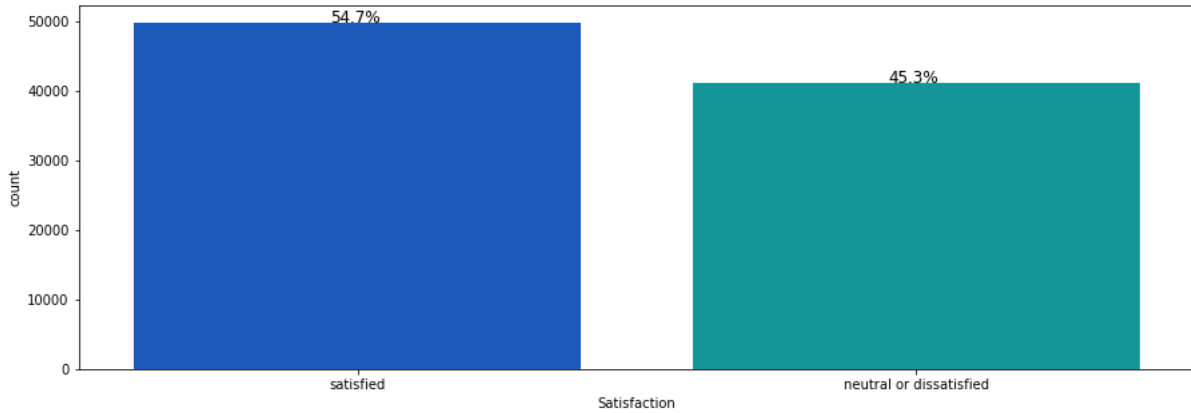
Outlier Detection & Treatment

Outlier detection and treatment was carried out on the dataset, the outcome is shown below;

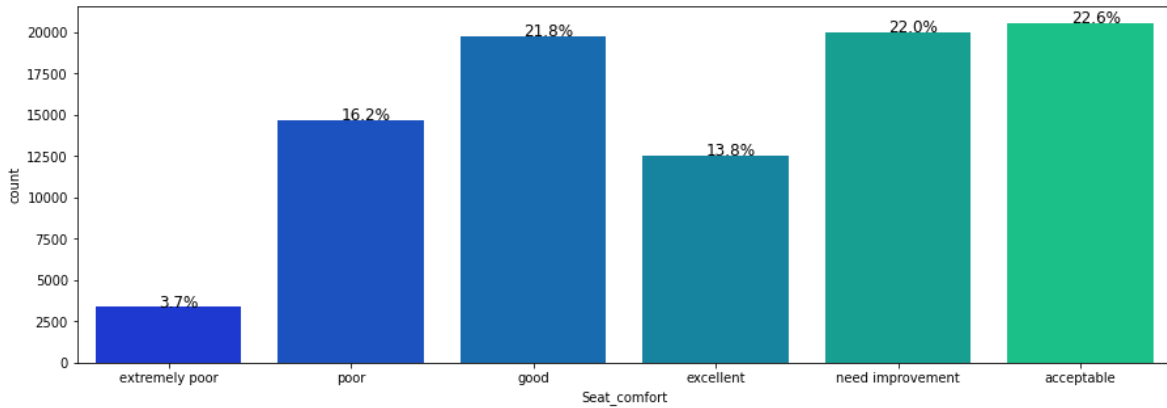




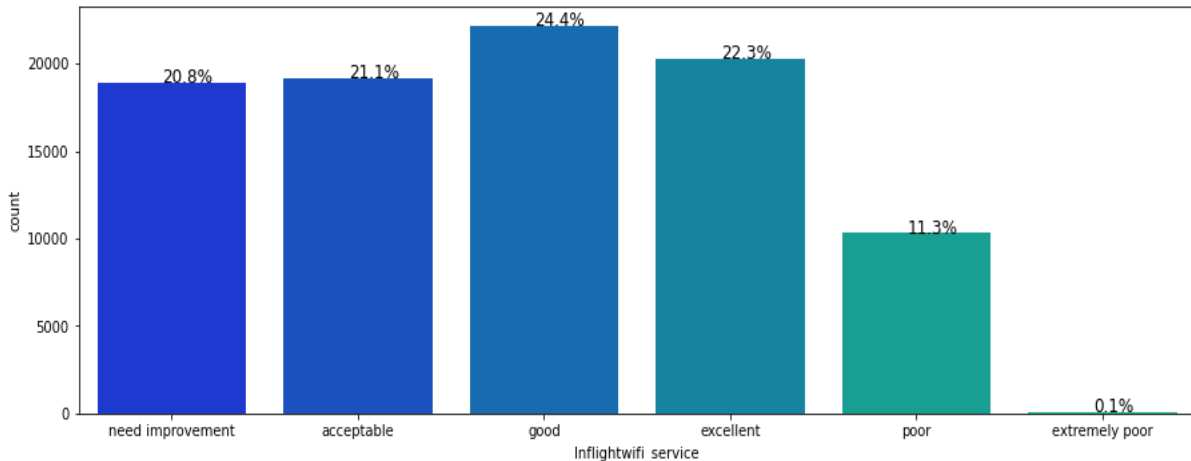
Exploratory Data Analysis



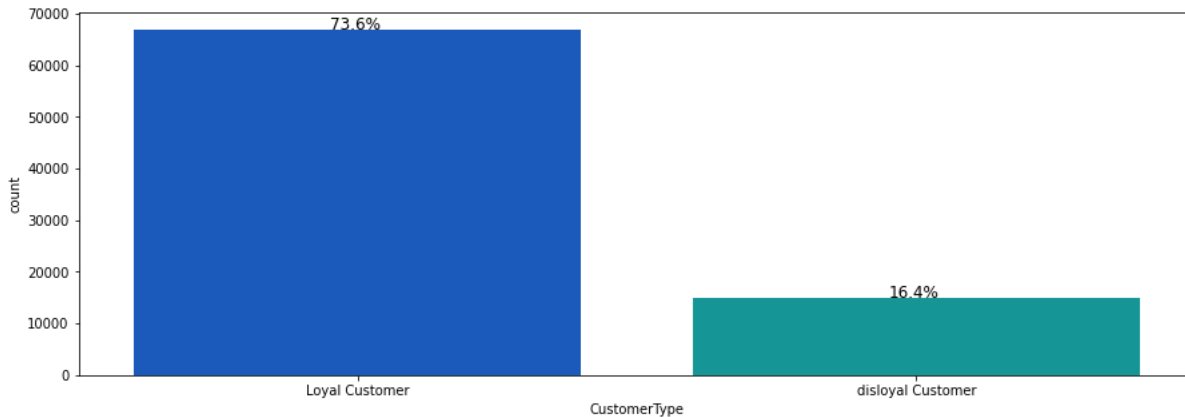
54.7 % of the passengers are satisfied while 45.3% are of the respondent fall into the group neutral or dissatisfied



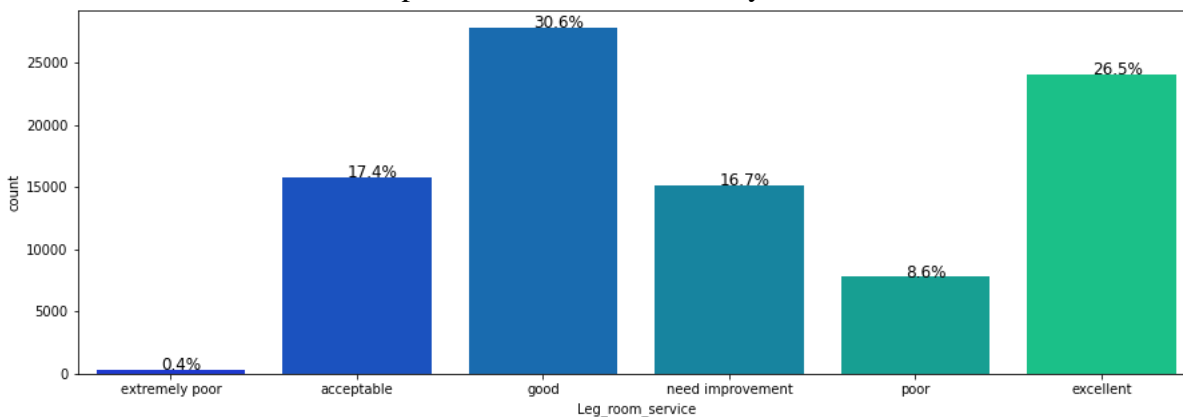
Seat_Comfort 22.6% respondent acceptable, 22% indicate seat need improvement, 21.8% indicate good, 13.8% excellent



inflight service has six categories with 24% good, 22.3 excellent and 21%, 20.8 acceptable & need improvement repectively



About 74% the repondent are loyal customers of the



airline

Good has the has highest percentage, followed by excellent and acceptable with 17 & 16.7 respectively

Alternate Analytical Approach

The two objective of this project are-
 1.To understand which parameters play an important role in swaying a passenger feedback towards ‘satisfied’.

Building Model

Logistic regression is a is a type of supervised machine learning used to predict the probability of a target variable. The most common logistic regression models a binary outcome; The output of the dependent variable is represented in discrete values such as 0 and 1, true/false, yes/no, etc. In some case logistic regression can model scenarios

Security are classification problems, such as attack detection, logistic regression is a useful analytic technique.

With the above explanation, it is clear that logistic regression modelling technique suit the Airline passenger satisfaction prediction problem.

Importing the libraries

To build our model, the first step is to import the necessary libraries. I used the Pandas library to load in the CSV or the dataset, and Numpy to convert the data frame into arrays.

2. To predict whether a passenger will be satisfied or not given the rest of the details that are provided in the data set.

The alternate approach to this problem would be to build, test and implement a classification model.

where there are more than two possible discrete outcomes that is referred to as Multinomial logistic regression. Logistic regression is a useful analysis method for classification problems, where you are trying to determine if a new sample fits best into a category. As aspects of cyber

The screenshot shows a Jupyter Notebook with the following code:

```

import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.tree import DecisionTreeClassifier
from sklearn.model_selection import train_test_split
from sklearn.metrics import confusion_matrix, classification_report
from sklearn.metrics import accuracy_score, precision_score, recall_score, f1_score
import scipy.stats as stats
from sklearn import metrics
from sklearn import tree
from sklearn.model_selection import GridSearchCV
from sklearn.ensemble import BaggingClassifier
from sklearn.ensemble import RandomForestClassifier
import warnings
warnings.filterwarnings('ignore')

# Read the dataset
data = pd.read_csv('C:/Users/Bekee/Desktop/Marketing Project-Survey data.csv')

# covina data to another variable to avoid any changes to orinal data

```

The second step was to define the target variable(Y) and To split the data into two sets, we will use Sklearn. the independent variables, and then split the data set into the train_split_function can be used and we can specify training set and the test set. We will use the training set to the amount of data we want to set aside for training and train our logistic regression algorithm. Similarly, the test data set will be used to validate the logistic regression model.

```

From sklearn.model_selection import train_test_split
# Splitting data into training and test set:
X_train, X_test, y_train, y_test =train_test_split(X, y, test_size=0.3, random_state=1,stratify=y)
print(X_train.shape, X_test.shape)
(63641, 22) (27276, 22)

```

Building The Logistic Regression Model

Next was to build the logistic regression model and fit it to the training data set. First, we will need to import the logistic regression algorithm from Sklearn

```

In [173]:
# Removes the limit from the number of displayed columns and rows.
# This is so I can see the entire dataframe when I print it
pd.set_option("display.max_columns", None)
pd.set_option("display.max_rows", None)
pd.set_option("display.max_rows", 200)

# To build linear model for statistical analysis and prediction
import statsmodels.stats.api as sms
from sklearn import metrics
from sklearn.linear_model import LogisticRegression

logreg = LogisticRegression(solver='newton-cg',max_iter=1000,penalty='none',verbose=True,n_jobs=-1,random_state=0)

# There are several optimizer, we are using optimizer called as 'newton-cg' with max_iter equal to 10000
# max_iter indicates number of iteration needed to converge

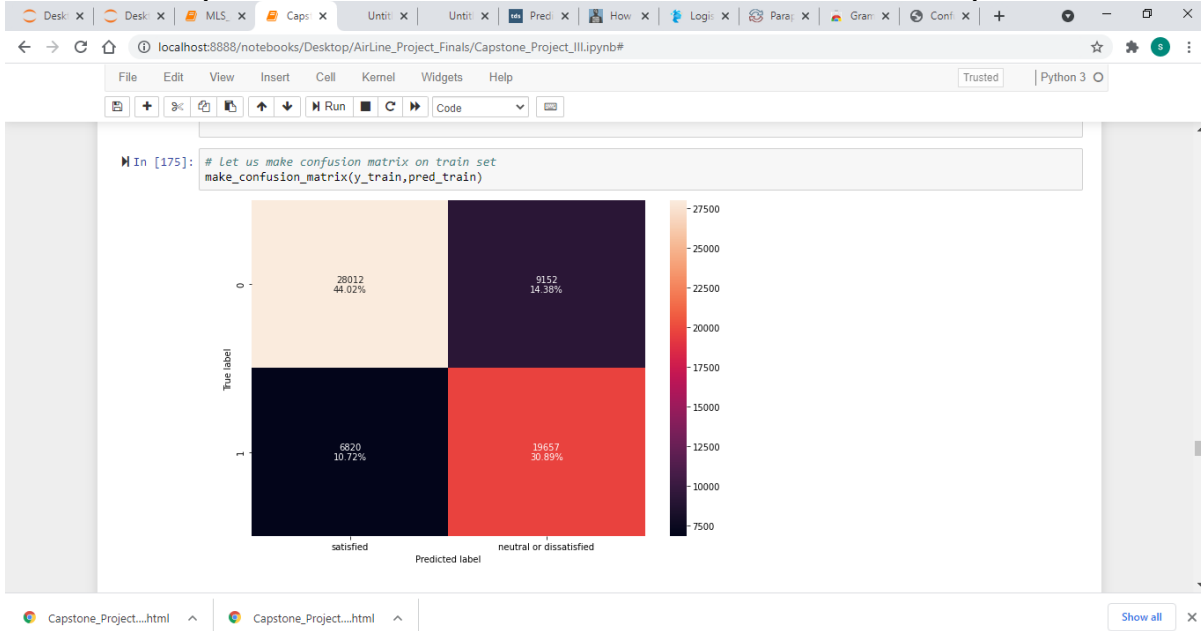
logreg.fit(X_train, y_train)

[Parallel(n_jobs=-1)]: Using backend LokyBackend with 8 concurrent workers.
[Parallel(n_jobs=-1)]: Done 1 out of 1 | elapsed: 7.6s finished

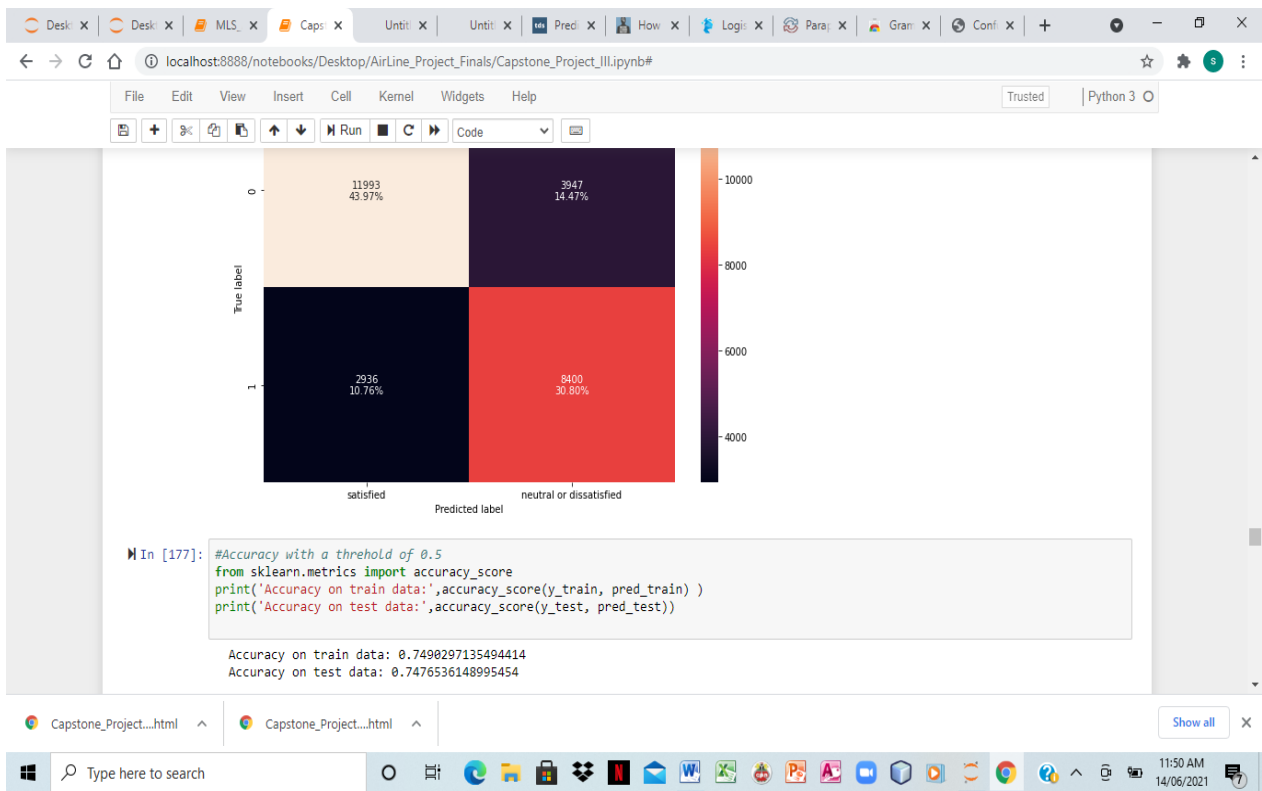
Out[173]: LogisticRegression(max_iter=1000, n_jobs=-1, penalty='none', random_state=0,
                             solver='newton-cg', verbose=True)

```

Next, was to create predictions on the test dataset and train data with the model performance as shown



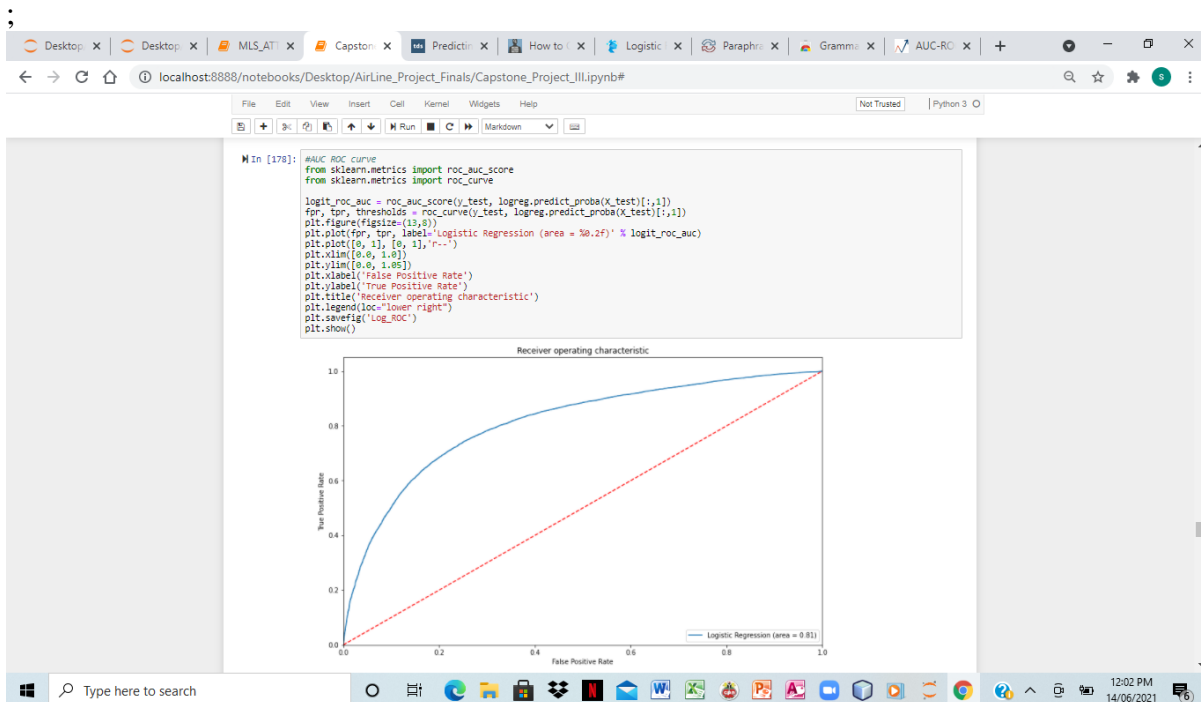
low. Accuracy of 74% and precision 75%



Next the AUC-ROC curve was used to visualize how well our machine learning classifier is performing.

The Receiver Operator Characteristic (ROC) curve is an evaluation metric for binary classification problems. It is a probability curve that plots the TPR against FPR at various threshold values and essentially separates the

‘signal’ from the ‘noise’. The Area Under the Curve (AUC) is the measure of the ability of a classifier to distinguish between classes and is used as a summary of the ROC curve. The result obtained is as below



The AUC of 0.81% looks quite good performance .

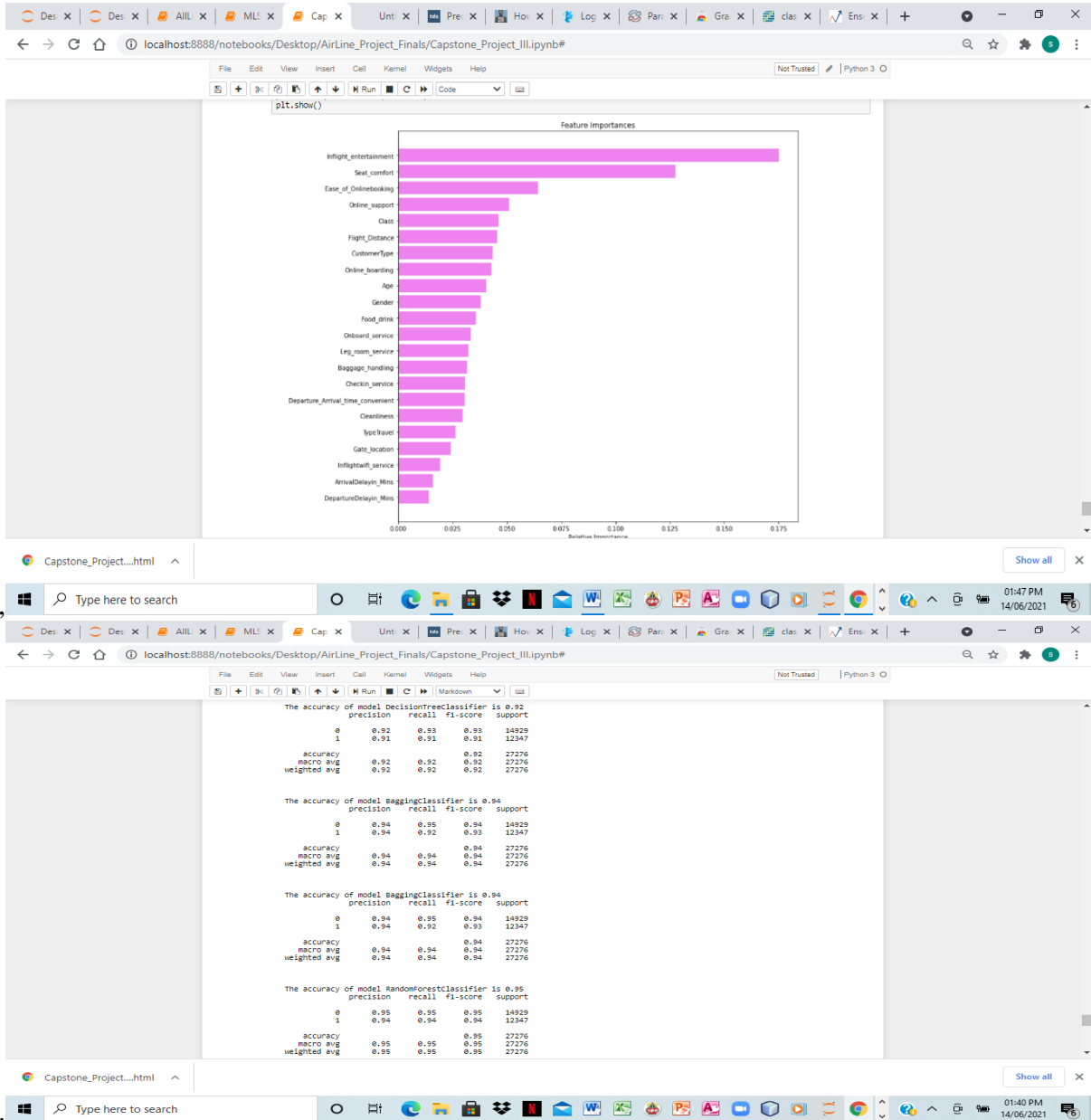
Build Different Models

DecisionTreeClassifier, RandomForestClassifier, BaggingClassifier were used on the data set. A result of the comparison of the different models are as bellow The best model is the rf, rf_wt

performance of 95% accurate prediction on Recall and Precession.

Feature Importance

The RandomForestClassifier was used to check for featre importance and the result obtained is as below

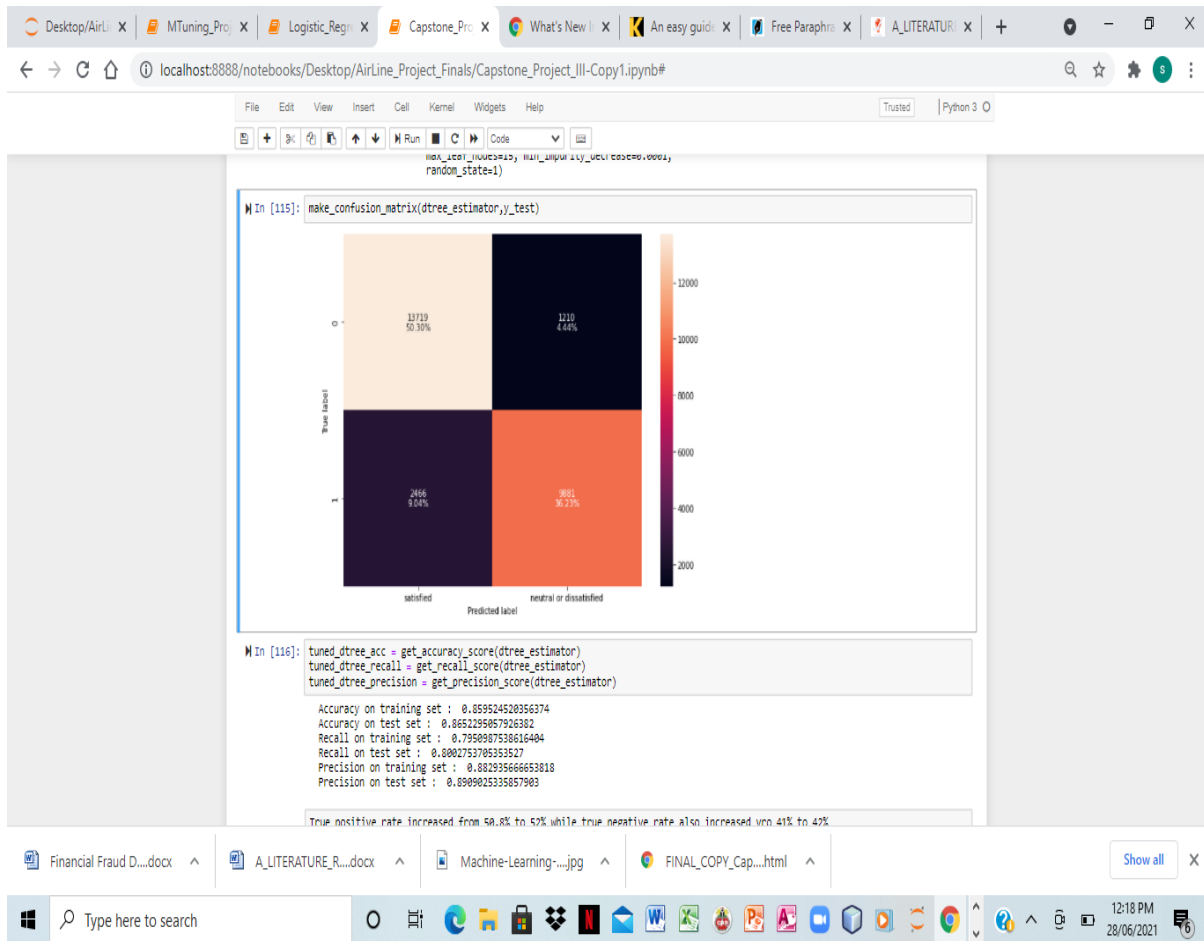


Inflight_entertainment is the most important feature for prediction followed by Seat_comfort ,Ease_of_Onlinebooking and Online_support.

Tunned Models Compared Alongside Initial Models

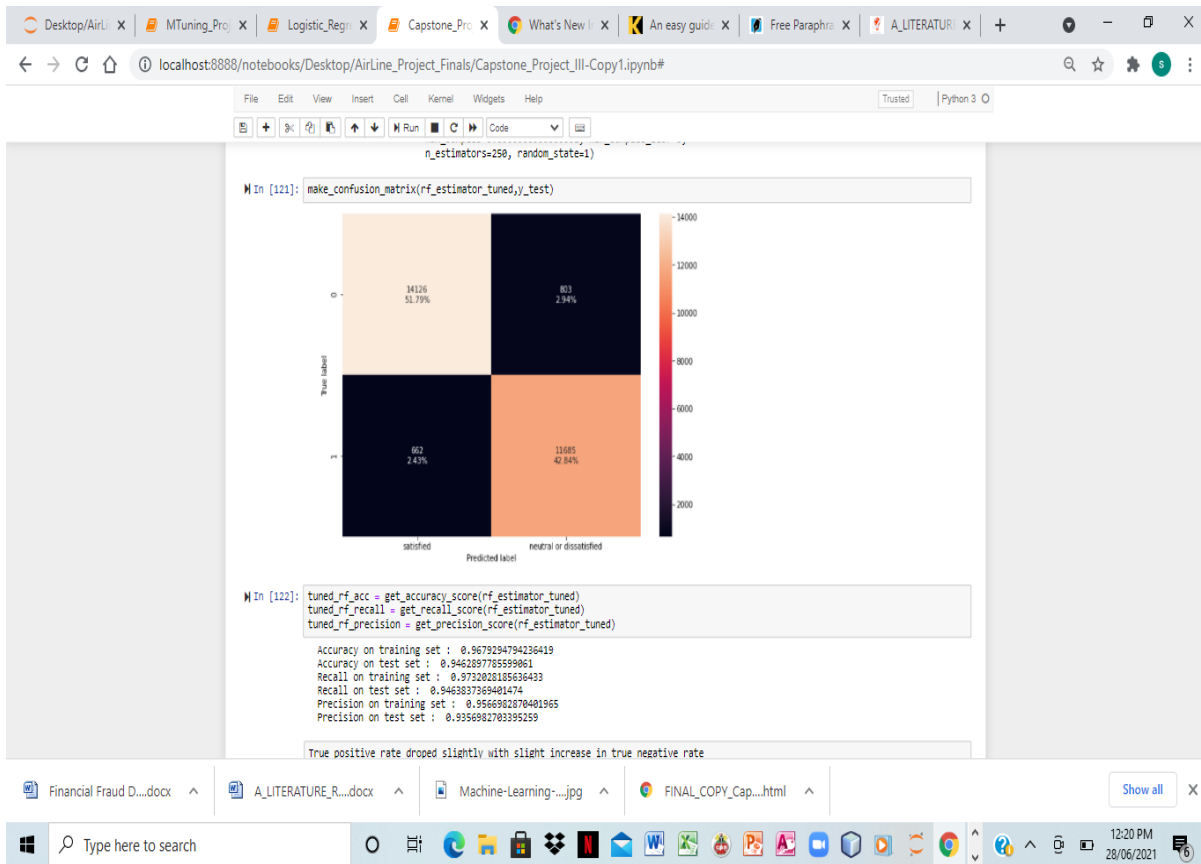
The results of the comparison of the different models are as bellow.

Tunned Decision tree



**TUNNED
FOREST**

RANDOM



Model Comparison Results.

[Parallel(n_jobs=-1)]: Using backend LokyBackend with 8 concurrent workers.

[Parallel(n_jobs=-1)]: Done 1 out of 1 | elapsed: 11.9s finished

The accuracy of model LogisticRegression is 0.75

	precision	recall	f1-score	support
0	0.75	0.80	0.78	14929
1	0.74	0.68	0.71	12347

accuracy	0.75	27276		
macroavg	0.75	0.74	0.74	27276
weightedavg	0.75	0.75	0.75	27276

The accuracy of model DecisionTreeClassifier is 0.92

	precision	recall	f1-score	support
0	0.92	0.93	0.93	14929
1	0.91	0.91	0.91	12347

accuracy	0.92	27276		
macroavg	0.92	0.92	0.92	27276
weightedavg	0.92	0.92	0.92	27276

The accuracy of model DecisionTreeClassifier is 0.87

	precision	recall	f1-score	support
0	0.85	0.92	0.88	14929
1	0.89	0.80	0.84	12347

accuracy	0.87	27276		
macroavg	0.87	0.86	0.86	27276
weightedavg	0.87	0.87	0.86	27276

The accuracy of model BaggingClassifier is 0.94

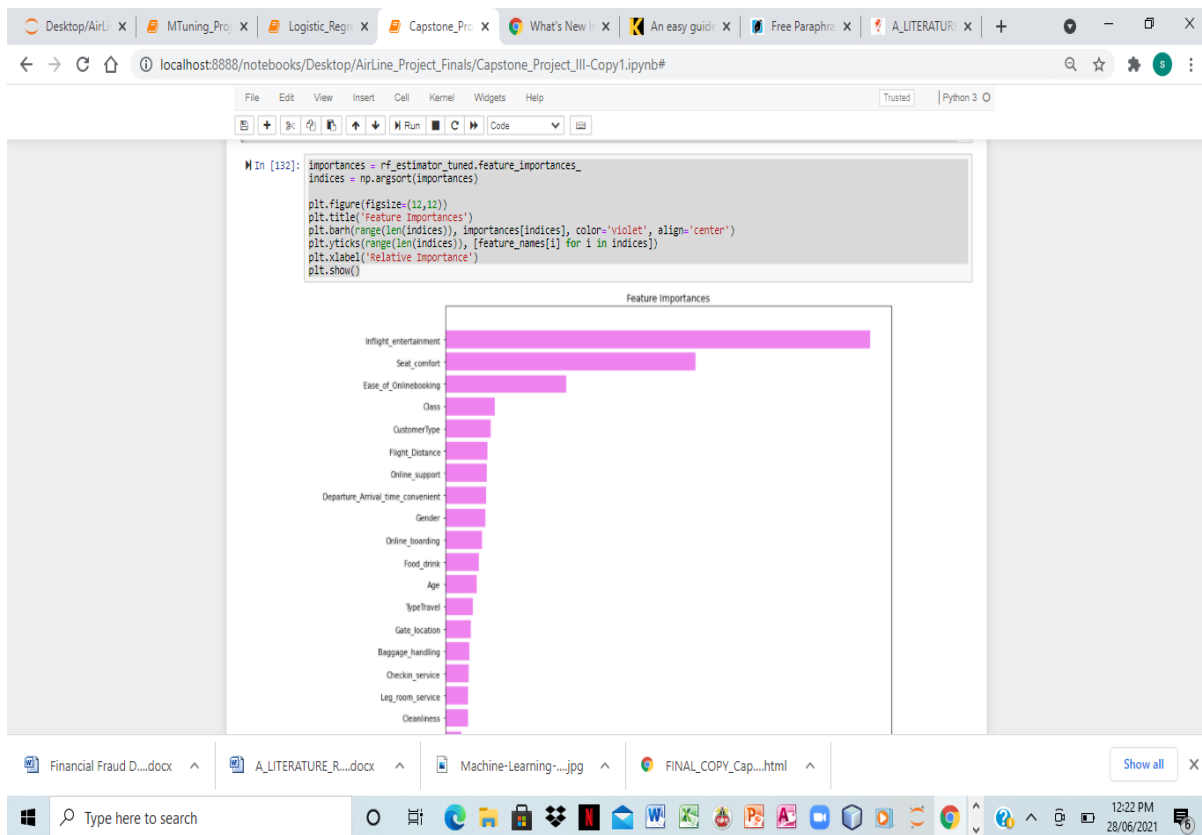
	precision	recall	f1-score	support
95	0.94	14929		

```

1    0.94  0.92  0.93  12347
accuracy                0.94  27276
macroavg    0.94  0.94  0.94  27276
weightedavg 0.94  0.94  0.94  27276
The accuracy of model BaggingClassifier is 0.95
precision recall f1-score support
0    0.96  0.95  0.95  14929
1    0.94  0.95  0.95  12347
accuracy                0.95  27276
macroavg    0.95  0.95  0.95  27276
weightedavg 0.95  0.95  0.95  27276
The accuracy of model RandomForestClassifier is 0.95
precision recall f1-score support
0    0.95  0.95  0.95  14929
1    0.94  0.94  0.94  12347
accuracy                0.95  27276
macroavg    0.95  0.95  0.95  27276
weightedavg 0.95  0.95  0.95  27276
The accuracy of model RandomForestClassifier is 0.95
precision recall f1-score support
0    0.95  0.95  0.95  14929
1    0.94  0.94  0.94  12347
accuracy                0.95  27276
macroavg    0.95  0.95  0.95  27276
weightedavg 0.95  0.95  0.95  27276
The accuracy of model DecisionTreeClassifier is 0.92
precision recall f1-score support
0    0.92  0.93  0.93  14929
1    0.91  0.91  0.91  12347
accuracy                0.92  27276
macroavg    0.92  0.92  0.92  27276
weightedavg 0.92  0.92  0.92  27276
The accuracy of model RandomForestClassifier is 0.95
precision recall f1-score support
0    0.96  0.95  0.95  14929
1    0.94  0.95  0.94  12347
accuracy                0.95  27276
macroavg    0.95  0.95  0.95  27276
weightedavg 0.95  0.95  0.95  27276
The accuracy of model BaggingClassifier is 0.95
The accuracy of model RandomForestClassifier is 0.95

```

Randomforestclassifier Important Features



Inflight_flight entertainment is the most important variable for predicting airline passengers satisfaction followed by seat_comfort, ease_of_online booking, Class, customerType and Flight_Distance.

Conclusion

A predictive classification model has been built. I recommend that airlines should focus on improving the Inflight_entertainment experience. Given the performance in terms of Precision and Recall, the model can be deployed to identify passengers who may not be satisfied or are indifferent to the Airline services and shall take appropriate actions to build and improve on services that drive passengers satisfaction. Factors that drive satisfaction - Inflight_entertainment, Seat_comfort, Ease_of_Onlinebooking and Online_support. In addition, airlines should also focus on passengers prioritize on ease and convenience in their travel. Finally, I hope that the model will provide a reference for airlines and be utilized for business value.

Business Insights and Recommendations

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Lecture slides and Jupyter notebook on Supervised learning and Model tuning file from Greatlearning.

A review of Information Communication Technology (ICT) methods for road infrastructure monitoring

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Abstract

Road infrastructure is critical to a country's economic growth because it supports other infrastructural developments. The high cost associated with building new roads has caused a shift in focus to the effective maintenance of road assets in many developed countries. This has not been the situation in many underdeveloped countries, where roads have been allowed to deteriorate and road infrastructure monitoring is still carried out manually. Due to the cost, time, subjective nature, and other biases of human inspectors, the manual approach to road infrastructure monitoring has proved insufficient. Information communication technology (ICT) monitoring methods make use of the facilities provided by ICT and its tools to provide monitoring in chosen domains. The mobility and penetration of mobile-based information and communication technology (ICT) devices make them ideal for monitoring infrastructure. In this paper, we review ICT-based road monitoring methods and provide an overview of the current community-based infrastructure monitoring approach using mobile phones.

KEYWORDS: Infrastructure monitoring, Community-based monitoring, Mobile crowdsourcing, Human sensing.

I. Introduction

A road network is the heart of any country's development and the major factor for its successful planning towards the achievement of sustainable development (Adebayo, 2015). Road transport's role in the economic development of any country cannot be overemphasized, which is buttressed by Adepoju (2021), who described roads as the glue for bringing together a nation's developmental elements. He went further to say that roads are needed for tapping resources, connecting people and places, and linking organizations. Somuyiwa et al. (2020) further asserted that roads are critical infrastructure for sustainable development as their efficiency is related to consumption, distribution, and production. Road infrastructure cuts across different sectors that are crucial to the growth of developing countries, including health, education, agriculture, power, transportation, and land use management.

The Nigerian road system consists of three trunks: trunk A for the Federal Government, trunk B for the States, and trunk C for the local governments. It is estimated to span approximately 200,000 kilometers, with ownership divided as follows: Federal roads account for 36,000 kilometers (18%), state roads account for 32,000

kilometers (16%), and local government roads account for 132,000 kilometers (66%) (Muhammad and Sebastian-Dauda, 2017). The high number of local roads necessitates the periodic monitoring and evaluation of local road conditions to demonstrate the necessity and value of their maintenance (Li et al., 2021). The World Road Federation (WFRF), on the other hand, says that local road maintenance in many countries is often put off in favor of a country's high-traffic, strategic road network, which is usually in cities.

In developed countries, the need for automated road management systems began in the 1960s when the focus shifted from the building of new road infrastructures to maintaining existing infrastructures due to increasing costs. Currently, methods for monitoring and reporting road problems in Nigeria are inadequate across federal, state and local governments. Available information shows that the methods employed by governments include manual routine checks by government staff, reports by paid political appointees and paper-based petitions by local residents. There is no visible promotion of the reporting apparatus to the public, and where it is available, it is not easy to use by citizens due to its manual nature. Also, there

are no proper feedback mechanisms to alert the public on the status of their reports, which has led to apathy and a lack of community ownership of the roads infrastructure.

Manual road monitoring is commonly defined as visual assessments of field conditions carried out by one or more people looking at the pavement via the windshield of a vehicle or while walking on it. A manual survey's results can be written down on a piece of paper, entered into a mobile device, or entered into a computer. Several researchers have noted that manual road monitoring and reporting is time-consuming and makes repair decisions slow and costly, which can lead to neglect over long periods of time, causing repairs to be expensive and the roads more accident-prone. Also, monitoring and reporting on road infrastructure by hand is hard, subjective, and doesn't happen very often (Radopoulou et al., 2016; Li et al., 2020; Li et al., 2021). Another major disadvantage of manual road inspections is the safety issues that is associated with it.

A major gap noted in Nigeria is that the method for road infrastructure monitoring has not taken full advantage of the potential of ICT and mobile technology. Reports indicate that 170 million Nigerians use mobile phones, with about 40 million using smartphones, and smartphone users are projected to reach more than 140 million by 2025. Because of this, it is important that infrastructure monitoring use the latest ICT-based methods for road monitoring so that agencies in Nigeria in charge of road maintenance can get quick, accurate, and location-based reports.

In this paper, we first carried out a review of ICT use in monitoring and reporting and the advantages it has brought to the domains in which it has been applied. Then, we classified and discussed ICT-based road monitoring systems in the literature looking at their advantages and disadvantages. Finally, we considered mobile crowdsourcing as a current community-based method for road monitoring and the challenges the system may pose to members of the community who use the system for reporting road issues. We then talk about future work in mobile crowdsourcing for road monitoring in developing countries, taking into account development and evaluation frameworks.

2. ICT in monitoring and reporting

Current developments have made ICT affordable, and this has led to an increased interest in using ICT tools for data collection, monitoring, and reporting in many developing countries. The advantages provided by using ICTs for monitoring

and reporting include more efficient data collection capability, quick data analysis, varied report presentation formats, and ease of dissemination of information. ICTs offer many promising solutions for monitoring and reporting because they make it easy to quickly collect and centralize data at the facility level and send data to the right government agencies so they can provide the solutions that are needed (Callen et al., 2020).

ICT-based approaches for monitoring and reporting are more cost-effective for data collection, analysis, monitoring, and reporting for assessment, and can therefore play an important role in affordable and efficient decision-making by policymakers. These developments have led to reforms in many developed countries' agencies, causing them to become smart in their approach to carrying out public engagements. ICT has been applied in many domains and has improved the potential of the monitoring and reporting activities carried out within these domains. For example, the use of ICTs to monitor and report on the management of water resources has made people more aware of the need to conserve water and do other things related to water management (Fathy, 2014; Otukey, 2016; Yasin et al., 2021).

Another area where ICT monitoring has found increased use is in disaster management, where ICT-based monitoring and reporting have been used to provide timely and effective information both for citizens and government agencies responsible for disaster management (Sakurai & Murayama, 2019; de Meira & Bello, 2020; Amosun et al., 2021). The agricultural sector of developing countries has been improved by using ICT-based tools for monitoring, reporting, and evaluation. Recently, the Nigerian government launched the Nigeria Digital Agriculture Strategy (NDAS) to provide a framework for carrying out operations in the agricultural sector using ICT. Proper monitoring using ICT tools has been shown to improve farming methods and increase crop yields (Mbagwu et al., 2018; Oluwatayo & Ojo, 2019).

Furthermore, the use of ICT in the health sector has improved both individual health management and the activities of personnel in the medical industry. Developments such as reminder apps for hospital appointments and drug usage (Medisafe, MyTherapy, DoseCast, etc.), systems for monitoring healthcare providers, patients' remote monitoring, and monitoring of vital signs are ensuring healthy habits by individuals (Thakkar et al., 2016; Kalid et al., 2018; Baridam & Govender, 2019; Babar & Carine, 2020; Sobreiro & Oliveira,

2020). The use of ICT for monitoring and reporting during epidemics and pandemics has made a difference in the way diseases are managed today, unlike in the past when a lack of information for disease control led to the deaths of millions of people. Most of the control of the COVID-19 pandemic was due to the use of ICT tools to teach people how to avoid getting sick and to help scientists work together to find possible cures (Wirth et al., 2020; Radanliev et al., 2020; Ienca & Vayena, 2020; Ye, 2020; Mao et al., 2021).

3. ICT-based monitoring and reporting for road infrastructure

The growth, availability, and ubiquity of ICT-based devices have caused a great change in the way infrastructural projects are monitored and reported. Many developed and some developing countries have adopted, and are encouraging the active use of ICT tools for the monitoring and reporting of road

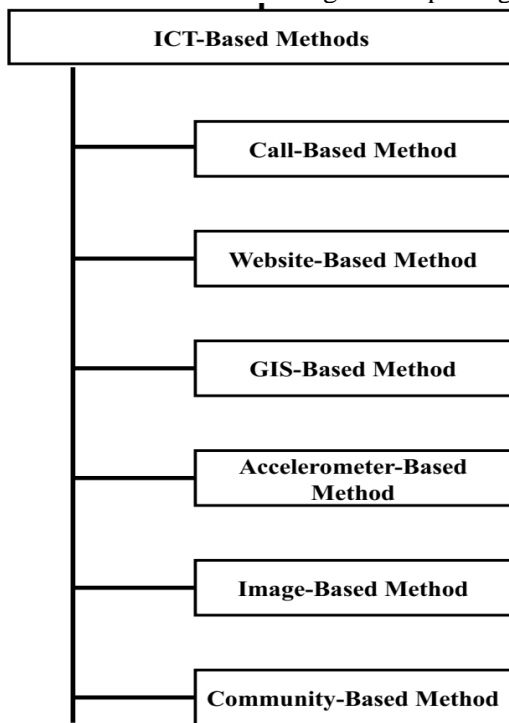


Figure 1: ICT-based road monitoring methods. The categorization is from the authors review and observations.

3.1 Call-based road monitoring

The call-based approach to road monitoring involves citizens reporting road issues by making calls to the agencies responsible for road construction and maintenance. In this method,

infrastructural development. One of the advantages of ICT-based systems for monitoring and reporting road infrastructure is that such systems can use GIS, remote sensing (RS), and GPS to provide location-specific data to agencies responsible for road maintenance operations. ICT methods are also useful because they can be used for different kinds of data collection and communication. This means that different groups can collect data about roads in the ways that work best for them, whether they do it remotely or in person. Research has shown that ICT-based road monitoring and reporting systems have been implemented as call-based, web-based, GIS-based, sensor-based, and image-based, and with current trends for citizen participation in governance as smartphone photo-based crowdsourcing monitoring and reporting. In the following section, we will provide a discussion of the various identified reporting methods in figure 1.

citizens who identify road faults make a call to report them to the agency and are required to provide detailed information about the location, nature of the fault, and other information. This method places stress on the caller since most phone calls are not audible, making explanation difficult. The caller bears the burden of calls, especially in developing countries like Nigeria with no public 311 lines for reporting non-emergency issues. Most of the time, citizens who want to report may not know the number of the necessary agencies. Other issues with this method include difficulty identifying locations; it is not picture-based; hence agency workers can doubt report it; location information is dependent on the caller's descriptive ability; etc.

3.2 Geographical Information System (GIS)-based road monitoring

A GIS is a computer-based information system that collects geographic data about an object or area, represents the data in digital form, and analyses it to produce outputs from queries to solve identified problems. Today, geographic information systems (GIS) have become a critical tool for urban and resource planning and management. Their ability to store, retrieve, analyze, model, and map broad areas with massive amounts of geographical data has resulted in an explosion of applications. Progress in GIS research has brought digital geographic information within reach of almost everyone using tools like Google Maps and

Microsoft Visual Earth (Goodchild, 2007), which is being used by researchers for creating GIS monitoring and reporting designs for road monitoring and reporting (France-Mensah et al., 2017; Ahmadi et al., 2017).

GIS road fault identification systems use static or dynamic road image data obtained from satellites. The obtained data is referenced to a traditional map of the study area and then a geodatabase is created in a GIS software environment like Arc GIS and ESRI's ArcView (Ibochi et al., 2013; Adebayo, 2015) or in a normal database environment like MS Access and then linked to GIS software (Kiema and Mwangi, 2009). Spatial analysis is carried out with a spatial query tool created for the identification and extraction of road information from the database, and results are presented in digitized map forms.

GIS-based software implementation is very expensive. This cost comes from data collection using satellites, their hardware, and software, and the cost of training personnel for many governments who want to cut costs is prohibitive. There is dependence in most instances on the government for data, which may provide data that is consistent with the government's purpose. Difficulty in the integration with traditional maps is another problem due to the complexity of GIS map structures. Finally, using GIS for road data information collection and analysis is time-consuming, which can lead to delays in decision making.

3.3 Web-based road monitoring

Web-based Road monitoring makes use of the websites of road maintenance agencies for monitoring and reporting road issues. In this method, a citizen who notices a road problem can

Figure 2: FERMA report a bad road page. This page was obtained from the Nigerian Federal Roads Maintenance Agency (FERMA). <https://ferma.gov.ng/report-a-bad-road/>

go to the agency's website and fill out a form describing themselves and the road problem. The federal road maintenance agency (FERMA) of Nigeria, for example, makes use of its website to collect road fault information from citizens. They are required to enter their details and emails, plus road location information. They can also upload pictures or videos of the road they are reporting. This method is not automated, users have to take pictures and then go to the websites to fill out forms and upload data at a cost borne by them. Sometimes people will take a picture and then forget they took the picture. The process wastes time, the data costs are high, and very few people know about these websites.

The image shows a screenshot of the 'Report a Bad Road' form on the Federal Road Maintenance Agency (FERMA) website. The form is titled 'Report a Bad Road' and includes the following fields: 'FIRST NAME (REQUIRED)', 'SURNAME (REQUIRED)', 'YOUR EMAIL (REQUIRED)', 'YOUR TELEPHONE (REQUIRED)', 'ADDRESS/STREET WHERE BAD ROAD IS (REQUIRED)', 'CITY/TOWN (REQUIRED)', 'STATE (REQUIRED)', and 'HOW WOULD YOU DESCRIBE THE STATE OF THE ROAD (REQUIRED)'. Below these fields is a section for uploading photos or videos, with instructions: 'YOU CAN UPLOAD UP TO 4 PHOTOS/VIDEOS OF THE ROAD (ALLOWED FILE TYPES: JPG, JPEG, PNG, MP4 (FOR VIDEO) WITH A MAXIMUM SIZE OF 4MB EACH)'. There are four 'Choose File' buttons, each with a 'No file chosen' status. At the bottom of the form is a 'Send' button.

3.4 Accelerometer-based road monitoring

In recent years, research into the use of accelerometer-based methods for monitoring and reporting on different phenomena has been carried out by many authors. An accelerometer is an electromechanical device that measures acceleration or g-force. It can be used as a stand-alone or embedded in a device and has a 3-axis that measures static or dynamic acceleration forces. They sense movement or vibration in 3 directions, x, y, and z-direction. Accelerometers have been used in many engineering fields and in products such as digital cameras and computers. They are also used in cars for crash detection and airbag deployment, and more recently for road fault detection (Bello-Salau et al., 2015).

Accelerometer road fault measurements are also called vibration-based methods. This approach is based on the measurement or collection of vibration data from a 3-axis accelerometer attached to the vehicle or that of a smartphone as a vehicle moves along a paved road. The process involves several filtering steps to extract these features that define road damage (Lee et al., 2021). Two approaches have been identified in the literature for extracting and identifying vibration data using the accelerometer. They are the statistical approach and the machine learning approach.

The statistical approach makes use of the mean, standard deviation, Z-difference, variance, and energy of the Z-axis acceleration signals

computed using MATLAB, LABVIEW, or other statistical software. The obtained signals or vibrations are then compared against a set threshold signal to identify portions of higher energy content, which usually indicate the presence of road anomalies (Mednis et al., 2011; Strutu and Popescu, 2014). But in the machine learning approach, acquired data is first preprocessed and then filtered to extract the time, frequency, or wavelet domain frequencies of the signals. Consequently, machine learning algorithms like Support Vector Machine (SVM), rain forest (RF), k-nearest neighbors (kNN), decision trees, etc. are used to analyze the signals and carry out the classification and detection of faults (Eriksson et al., 2008; Akanksh, 2018; Du et al., 2020; Lim et al., 2020).

The accelerometer-based road monitoring systems can only be used by vehicles on which they are installed, and driving speeds must not exceed a certain threshold to obtain useable data. They are restricted in the type of road issues they can monitor and can measure faults mainly on paved road systems, such as potholes and bumps. It also cannot measure road-surface damage in areas other than the vehicle's wheel paths and cannot identify the size of the road-surface damage outside the wheel path of the vehicle (Li et al., 2016).

3.5 Image-based road monitoring

Image-based monitoring and reporting on road status involves the use of cameras to acquire road data, which is then processed. The camera can be a simple digital camera mounted either inside the vehicle or outside the vehicle, or the camera of a smartphone fixed to a stand on the windshield of the vehicle. Methods for implementing image-based monitoring and reporting are classified as traditional methods or machine learning. Image processing with machine learning involves the use of an acquired dataset for training a machine learning algorithm in the identification of road problems (Yan & Yuan, 2018). The traditional method consists of filters, morphological analysis, statistical methods, and percolation techniques. Analysis of captured image data and results is carried out by dedicated software and then sent via wireless networks to agencies responsible for road monitoring (Siriborvornratanakul, 2018).

Image processing is a complex computing problem, and this can cause the cost of implementing this type of system to be high. The development of machine learning has improved image processing and has caused it to be readily available in developed countries. The system is driver dependent and difficult to install. Image-

based reporting systems are prone to lightning issues and instability of cameras due to movement, which causes poor video images. It is not community-oriented, and can only be used to measure problems on paved roads. Also, efforts must be made to improve recognition rates by getting rid of things that get in the way of analysis, like changes in the color and brightness of the road surface in different weather conditions, shadows on the road, other cars driving by, and road signs (Lee et al., 2021).

4. Community-based monitoring and reporting

Mbile technologies offer the benefits of direct communication, empowerment, and crowdsourcing for collective problem solving (Kavanaugh, Sandoval-Almazan, and Ubacht, 2020). The growth of social media also means that citizens have become more technology-sensitive and therefore more capable of using social media technology, so expect their governments to be abreast with new technologies. This has caused governments and their agencies to adopt new technologies to satisfy citizens' expectations and devote resources to social media adoption so that they can meet citizens' needs and achieve legitimate engagement with citizens within a democratic sphere (Fashoro and Barnard, 2021).

Today, the built-in camera of smartphones has become the most prevalent method for visual information capture in our lives and the environment. This and other developments have created the potential for civic-oriented systems in which residents can support community betterment through acts of citizenship in the community, allowing local governments to conserve human and financial resources (Santos et al., 2013). Crowdsourcing is an example of an ICT-based method for community monitoring and civic-problem solving.

Jeff Howe coined the term crowdsourcing in a 2006 article in the wired magazine (Pedersen et al., 2013; Stol and Fitzgerald, 2014; Wazny 2017; Stanley, 2020; Yu et al. 2021). And he went on to define crowdsourcing as "the act of taking a job traditionally performed by a designated agent (usually an employee) and outsourcing it to an undefined, generally large group of people in an open call" (Howe, 2006). For Brabham (2013), crowdsourcing consists of a voluntary, collaborative relationship between a crowdsourcer (an organization or an individual) and a crowd (a large group of people) that uses the internet to provide solutions to problems for mutual benefit.

Due to its appeal as a civic engagement tool, crowdsourcing has emerged as a viable option for

ICT-based community monitoring and reporting. Crowdsourcing for community monitoring has been described as citizen-sourcing, a description of crowdsourcing activities by governments to tap into the collective intelligence of citizens (Van Ransbeeck, 2015). Studies (Prpic, Taeihagh, and Melton, 2015; Dutil, 2015; Clark et al., 2019) have shown that good crowdsourcing projects can reduce administrative costs, improve service efficiency, and improve the relationship between the government and the people.

Crowdsourcing can be mobile or web-based. Web-based crowdsourcing refers to crowdsourcing activities that take place on the internet, typically on the task presenters' websites, while mobile crowdsourcing (MCS) refers to crowdsourcing activities that are carried out on smartphones or other mobile devices. Mobile crowdsourcing has become the most popular way for the community to monitor infrastructure. This is because mobile devices have features like portability, location-based reporting, the ability to get multimedia data, and the ability to present information to a user in their desired format.

4.1 Mobile crowdsourcing (MCS) for road monitoring and reporting

Today, the predominant method for location-based crowdsourcing is MCS. MCS is crowdsourcing activities that are carried out on smartphones or other mobile devices. They are based on location and use GPS. This makes it possible to collect data in real time and gives the crowdsourcing project a wider reach and more visibility. Today, smartphones are ubiquitous and widely used around the world, with rich sensors (e.g., GPS, accelerometer, and camera) built into them, and multiple radios (e.g., Bluetooth, Wi-Fi, and cellular) provided (Wang et al., 2017). This lets people with smartphones sense, gather, process, and share data anywhere and at any time.

In MCS road monitoring, the facilities provided by mobile devices, especially smartphones, are used in monitoring road faults via installed MCS road monitoring apps. The camera of the smartphone is a means of providing picture evidence for the identified road segments in the report. The GPS of the device is used to provide location information that further ties the photos to the location using geotagging features. Also, in many instances, a smartphone's local mobile network is used to connect to the crowdsourcer database or agency systems where these reports are then sent. When local governments use mobile crowdsourcing to find out about the status of infrastructure, they can act quickly and effectively

because the information comes from many different people in the community.

The MCS used in road infrastructure monitoring are not only for drivers or vehicles like in the case of image-based and accelerometer based reporting. Rather the apps can be used by any member of the community who needs to report a road issue. This makes the MCS method community-oriented, allowing all willing members of a community to actively take part in reporting issues and thereby provide ample information for decision-makers. The MCS is also location-based. This helps to automate the identification of locations to agency staff, removing the problem of manual location identification present in the call-based systems. MCS systems can be used to report road problems of various dimensions. For instance, the GIS, accelerometer, and image-based systems can only identify certain road conditions, but the MCS systems can provide a lot more information about road issues, making them more flexible in application and broader in road information acquisition.

Many authors have researched and developed MCS systems for road monitoring. Santos et al. (2013) developed a web-based and MCS solution seeking to promote citizens' participation in reporting issues such as potholes, illegal waste dumps, etc. in their environments in Portugal using the Open 311 specification. It was integrated into an existing GIS portal in Portugal and allowed citizens to report observed problems using a web browser or mobile device in a location-based environment. Tests in Porto, Portugal, showed that the system was able to help people report environmental problems to local authorities.

In CommuniSense, Santani et al. (2015) created a model for documenting and reporting on Nairobi's road infrastructure conditions using an Android-based MCS platform that uses a smartphone's GPS to automatically determine the position of registered users when they take photos of road hazards. The user adds a description of the hazards and then uploads or saves the image to his device for later submission, depending on the condition of his mobile connection. Additionally, a user might use a map system to detect road problems; if a user selects a hazard term, the app automatically adds a marker near the user's location to identify it. The system was tested for two weeks with 30 randomly selected users from various districts of Nairobi. After verification by Amazon's Mechanical Turk (MTurk), a 92 percent accuracy ratio was obtained.

An android-based MCS system was developed

by Bamne and Shinde (2016) for the Municipal City Government of Mumbai, India, to monitor and report on road surface conditions. A citizen can snap photographs of bad roads that are then geotagged using their mobile phones' GPS and submitted to a server. The server gives the user a confirmation SMS and a complaint ID upon receipt of the report information and possible resolution date. The report is then sent to a contractor or resident city engineer at the government end who is responsible for road maintenance. The MCS also has a feature called "On the Go" that lets users use images from other users to find and follow potholes in their immediate area. This helps them plan their routes around the city.

In another Android-based MCS, Deshmukh and Rajput (2016) provided a system that includes other city problems. Their system categorizes complaint categories into five groups, including litter and waste; health and safety; road damage and illumination; and a category to cater to complaints that do not fit into any group. Their system is divided into two parts: a mobile crowdsourcing platform and a web-based admin platform. A user submits complaints in the form of geotagged photographs and a description of the issue. The system transmits filed complaints to the server, where an administrator can read them and forward them to the appropriate authority, who then sends the system a report to the citizen indicating whether the issue has been handled or not. Users could also check on the status of complaints they had already made and complaints made by other users in their area.

5. Challenges of Mobile Crowdsourcing

Human users contribute data to the majority of MCS applications voluntarily through mobile sensing or human intelligent task activities via their smartphones. This engagement exposes them to potential privacy breaches and other security concerns associated with contributory mobile platforms. Additionally, the MCS's objective is to collect meaningful, high-quality data from crowd workers who may be dishonest, provide inaccurate data, or engage in malicious behavior. This section will discuss a variety of MCS-related issues, as well as potential solutions gleaned from research and studies.

5.1 Mobile device power and data limitations

Mobile devices frequently have limited power capacity, which affects the MCS's performance. The majority of smartphones use communication methods that consume an enormous amount of

power due to the disparate energy requirements of download and upload links (Chatzimilioudis et al., 2012). To overcome this obstacle, tasks must be scheduled efficiently and intelligently distributed among task workers to minimize network load (Kong et al., 2019). This ensures that the task execution process does not put a strain on task workers' device batteries and prevents them from accessing their usual functions, such as making a call, texting, or using the internet.

Primary applications in MCS, such as sensing via GPS, image geo-positioning, and data transmission, all consume a significant amount of energy on the smartphone. To address this issue, Conti et al. (2015) propose an adaptation scheme for determining the location of a phone that switches between precise but energy-inefficient GPS probing and energy-efficient but less precise Wi-Fi/cellular localization. The cost of data is another factor that affects MCS, especially in so-called public-oriented MCS. One way to encourage user participation is to offer an initial free data disbursement to users of the platform who take part in reporting. Another way to overcome the data issue is for the platform to use delayed transmission (Santani et al., 2015). This gives users the ability to save the photo of the location with its geolocation information and then send the report when they have data or there is free Wi-Fi available.

5.2 Privacy and security

The major characteristics that make MCS privacy- and security-critical and challenging are human involvement in data collection activities, crowdsourced task characteristics, and the dynamic topology of the users' circumstances (Yang et al., 2015). Furthermore, Wang et al. (2013) summarized the threats and vulnerabilities in MCS to include disclosure of user identity, disclosure of user location and activity, combining crowdsourced data with user data, lack of user privacy awareness, the vulnerability of mobile devices, reliance on information that may be inaccurate, and retaliation for reporting sensitive information. While MCS platforms prefer to use location and environmental information provided by task workers to make appropriate task recommendations, Gong et al. (2016) observed that this can result in privacy disclosure if the platform is attacked by threat actors.

Certain privacy protection mechanisms can be used in MCS to ensure its privacy and security. They include allowing users to choose which personal information to share, preserving user anonymity, and utilizing cryptography to protect both the crowdsourcer and the worker from

eavesdropping. increasing platform users' privacy awareness, informing them of the full risks of a privacy breach, detailed methods of protection, and providing them with the ability to freely opt in or opt-out. Also, there should be punishment for those who violate platform rules, which can serve as a deterrent to users engaging in security-lax behaviors.

5.3 Incentives

Incentives are a form of payment used to encourage user participation in mobile crowdsourcing applications. Jaimes, Vergara-Laurens, and Raij (2015) identify incentives as a critical component of the recruitment process because they influence user participation in MCS data collection activities. This is because tasks in an MCS are performed at the user's expense. These costs may include time spent performing tasks; data costs; transportation costs associated with data collection during crowdsourcing activities; and the risk associated with the disclosure of sensitive data on MCS platforms. The factors that motivate users or contributors to participate in crowdsourcing activities and communities have been extensively studied (Yang et al., 2015; Phuttharak and Loke 2019; Phuttharak and Loke 2020).

Incentives can be monetary, entertainment-related, service-related, or based on social responsibility. Monetary incentives are financial compensation for a crowd worker (Wang et al., 2017; Kong et al., 2019), while entertainment-based incentives involve gamification of the MCS process for a crowd worker using score points, leader boards, etc. (Morschheuser et al., 2016) to encourage workers. Additionally, service-based incentives provide personal benefits to crowd workers, such as knowledge gained from participating in MCS activities, the development of a new skill, etc. The social incentives are referred to as intrinsic incentives that provide a user with satisfaction from seeing how the activities benefit the larger society.

In summary, because each type of incentive has distinct benefits and drawbacks, MCS systems should seek to combine them to develop effective and practical ways of motivating individuals to participate in and provide high-quality solutions for MCS systems. For example, in MCS for public infrastructure monitoring, users can be motivated by an initial data subscription to contribute to the service. Then they can be awarded badges of participation that they can share with their social media friends. This will encourage public-spirited people to want to take part in the MCS activities and also serve as a digital word of mouth (WOM)

means of making the MCS app known to more users.

5.4 Task Design

Task design is another critical factor in MCS because it provides a description of the MCS task and, if not implemented properly, can result in low-quality input and, consequently, poor output. Three important components of task design are task definition, user interface (UI), and task granularity (Yufeng Wang et al., 2017). A task definition consists of a primary section that provides a concise description of the task, its nature, and time requirements, among other things. And a second section details the qualification requirements for the task worker. This also specifies the criteria for evaluating the contribution of a crowd worker. For example, if an MCS task asks for location-based data from a certain region, the MCS should tell users that their submissions will be rejected if they come from a different place.

The MCS user interface (UI) is the interaction point through which workers access and contribute to the task. A friendly user interface can increase the number of workers and the likelihood of high-quality outcomes, while a complicated user interface may discourage honest workers, resulting in low system utilization, low-quality results, and delays. The granularity of a task is a measure of its difficulty. According to research, the complexity of the task has a significant effect on the crowd's motivation to participate in crowdsourcing activities (Ghezzi et al. 2018; Lee et al. 2015; Zhao and Zhu 2014). In MCS, tasks are classified as simple or complex. Simple tasks are those that require little sophistication, for example, tagging or describing. These tasks are easy and quick to do, and you don't need any special knowledge or skills to do them. Complex tasks, on the other hand, are harder to do and may need special knowledge.

Complex tasks require additional time, resources, and expertise, so fewer people will be interested or qualified to perform them. One way to address this issue is to introduce modularity into MCS tasks. Modularity enables complex tasks to be broken down into smaller sub-tasks that are resolved by crowd workers and then combined to obtain the final solution. Generally, it is important that task designers properly evaluate the task's difficulty and the effort required to complete it during the task design phase (Liu et al., 2016) and use the information to provide adequate motivation (Phuttharak and Loke, 2019).

5.5 Trust

The lack of trust between crowdsourcers and crowd workers, particularly in MCS for

monitoring public infrastructure, is a critical issue. Citizens, who are typically the expected crowd workers, believe that civic engagement will not be productive because they perceive authorities as untrustworthy entities (Yfantis, Ntalianis, and Mastorakis, 2019). Additionally, some (mostly in developing countries) (may have participated in manual reporting in the past and received no feedback or follow-up actions indicating their report was considered. To address this and increase citizen trust in the MCS system, some authors have proposed a feedback system in which reported issues are logged and a message ID and acknowledgment are emailed to the citizens (Bamne & Shinde, 2016).

Additionally, several well-established public-oriented MCS, such as SeeClickFix, FixMyStreet, and Citizens Connect, offer discussion groups in which citizens who submit reports can discuss these issues and also view other members' posts (Santani et al., 2015). Another way to foster trust in an MCS for public infrastructure is to enable visible escalation to higher authorities other than local agencies while informing users via message or app updates. They can also provide a mechanism for broadcasting such reports to news outlets' news feeds when responsible local and state authorities are unavailable.

5.6 Quality control

This assists in establishing the MCS system's output standard. Quality control is a concern throughout the crowdsourcing process and has received the most attention thus far due to the critical role that quality control plays in obtaining high-quality output (Niu et al., 2019). The output quality is determined by a variety of factors, including the behavior of crowd workers, the design of the MCS user interface, the incentive mechanism, the task design, and security and privacy concerns (Wang et al., 2017). Additionally, device resource availability and trust can affect quality. For instance, if users take photos and do not have data to immediately send the report, they may lose the report if procedures to ensure the report can be stored and sent at a later time when data is available are not built into the MCS. The design of tasks with an intuitive user interface, proper task decomposition, and task assignment (in task-oriented MCS) to qualified task workers all contribute to the output's quality. Another potential means of ensuring quality is to adhere to the rules of contribution management in the MCS.

6. Conclusion and future research

The growth of ICT has brought a great change in many aspects of human existence. One

such area observed has been in reporting on infrastructure developments and maintenance using mobile devices. In this paper, a review of ICT methods for road infrastructure reporting has been carried out, and a look at the disadvantages of the identified methods was also provided. The desire to have a system that can be used by members of the local community to report road issues, with the possibility of reducing the many unattended road faults in our communities, necessitated this review. It was also observed that the capabilities of the smartphone make them good candidates for use as a means to provide such reports to agencies.

The use of mobile crowdsourcing (MCS) in reporting road issues will allow the community to be involved in providing information about their environment to agencies responsible for taking care of these problems. However, further research is needed to understand how such systems can be effective in environments with no established open 311 platforms, and where control of activities is centered under the control of an individual, such as is the case of many local governments in Nigeria. Also, further research into MCS frameworks is needed as most observed MCS road reporting systems were implemented in developed countries with established routes for community-based reporting and feedback. It is therefore worth studying the many MCS frameworks to propose one that suits the environment of a developing country.

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Integration of Artificial Neural Network To A Web Based Students Information System For Tertiary Institutions

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Abstract

The development and economic growth of any nation solely depend on the human resources in the educational system. A lot of data about the students activities are involve in the education system, therefore there is need for managing, securing and accessing the data in real time. One of the main problems facing most of the university lecturers is the ability to use traditional paper-based operation to manage bulky quantities and different types of data they encountered in daily operation, starting from non-public data to numerous varieties of documents. Also students' records in most institutions have been held in low esteem, especially in the third world where most archival records on students are held in physical systems, giving rise to complications in recovering vital information and reduced access time. Some the university lacks a predicting system that will help student to predict their result, so as to enable know the area to put more effort to improve their academic performance. The aim of this study is to develop a web based student information system integrating artificial neural network. The methodology adopted in this paper is the Object-oriented analysis and design methodology (OOADM) and the application languages used was Hypertext Markup Language (HTML), Hypertext Preprocessor (PHP), MySQL, Cascaded Style Sheet (CSS), Java Script, Dream weaver, and Fireworks. The effective deployment and management of this system will improve greatly the speed and accuracy of student's information. The Artificial Neural Network used in the study was able to achieve 91% accuracy in predicting student's academic performance.

Keywords: student's information system, ANN, OOADM, LECTURER

Introduction

The development and economic growth of any nation solely depend on the human resources in the educational system. A lot of data about the students activities are involve in the education system, therefore there is need for managing, securing and accessing the data in real time. The student's data that form the important part of the education system are the student's personal and academic records.

One of the main problems facing most of the university lecturers is the ability to use traditional paper-based operation to manage bulky quantities and different

types of data they encountered in daily operation, starting from non-public data to numerous varieties of documents. The data have numerous access privileges and restrictions and will be entered by a whole lot of sources, starting from the present student to a faculty staff down to the administrator of the department. Automatically, the generated statistic concerning this data will be utilized by numerous stakeholders in the university. Therefore Traditional paper-based operation is not only pricey however additionally ineffective and time wastage. Therefore, since time is of essence in the digital age, there is need to develop

systems that are flexible, reliable and accurate for the purpose of delivering accurate information anytime needed. Meanwhile, availability of such information must not require physical presence except in exceptional cases when physical authentication is necessary. Today, the era of digital age has made possible for online registration, issuing of digital results and transcripts notification and application into the higher institutions through the web have come to be the norm (Uka and Ekwonwune, 2019).

The introduction of a web based students' management system in higher institutions will consequently enhance the efficiency, reliability, cost-effectiveness and management of students' academic transactions. The web based system offers human-computer interactive interface that makes it easy for maintenance and processing of students' data/information. Though, attaining these goals is tough when applying manual system in managing students' records, since the information needed is not well-organized, as a result it might give room for students' data redundancy and poor integrity, which will then led to poor services rendered to the students and staff by the university. Therefore the proposed system will guarantee to overwhelm these setbacks encountered in the existing (manual) way of managing student information, which include delays in the release of examination results, complaints from

Review of Literature

Uka and Ekwonwune (2019) proposed web automate the record generation process in the tertiary based students' record management system for institution. The methodology deployed in packaging Tertiary Institutions. Their paper was borne out due to their paper is the Object Oriented Analysis and the problems associated with student academic record Design Methodology (OOADM) while the management which include improper course programming languages used was Hypertext Markup registration, late release of students' result, Language (HTML), Hypertext Preprocessor (PHP), reconciliation of students' result, malpractices at Cascading Style sheet (CSS), Java Script (JS), and various students clearing units, inaccuracy due to My Structural Query Language (MySQL). The results manual and tedious calculation and record retrieval provided solution to inefficiency and at the same time difficulties in the institution. The objective of their maintain information accuracy and ease of access to paper is to develop a portal that would incorporate students, lecturers, parents and management in the online registration, profile creation, students' final tertiary institution. The paper failed to address the clearance and payment, transcript processing, issue of security as they recommended future works checking of admission status, verification of both to develop a school portal that could make use of face O'level /A'level and degree certificates and checking recognition as its security measures.

of results, thus it is expected to reduce paperwork and Maria et al. (2015) in their research titled "Mobile Web-Based Student Integrated Information System" describes a conducive and structured information exchange environment for the students of the College of Computer Studies in Manuel S. Enverga University Foundation in Lucena City, Philippines. The system

students about mistakes in their results, student and parents unable to get access to students' results, difficult experienced by the school management or department to get statistics over a period of time about students such as gender and age representation, students' GPA (Grade Point Average) and CGPA (Cumulative Grade Point Averages) not properly calculated etc.

Student academic performance is very vital in the educational system. The lack of qualify human resources in the building of a nation economic growth is as a result of poor academic result performance of the students. These can les to student's dropout, carry-over of courses etc. there is need for the institutional management to deliver a way of minimizing student's failure and improve their academic performance. Rao et al. (2017), classifying and predicting of student's performance is difficult to be done manually because the database is multidimensional. Therefore, using different classification algorithm will help to eradicate the issue of students' failure in courses (Costa et al., 2017). The Artificial Neural Network employed in this paper will be used to predict student's academic performance. This will help the parents and the teachers to be able to assist the students that performance poorly in some course, either but counseling them or organizing extra-moral classes for them to pick up

semester. The researchers applied Hill Climbing students' performance.

Algorithm search technique for the system particularly in creating self-enlistment and finding the best set of courses to the class schedule, and in projection of number of sections to be created for the next semester. Rapid Application Development (RAD) was utilized for the system development; PHP as the programming language, and MySQL as the database. The testing process of the system was done before deploying it on the internet. The process was done in different processors, operating systems and different mobile device platforms. The researchers made use of functionality, reliability, usability, efficiency, maintainability and portability for the testing of application. The results of the evaluation for prototype yielded a general weighted mean of 4.44 describes the respondents strongly agree that developed system was acceptable. Their work did not apply the technics for prediction of student results. The system is not a mobile application. The development did not focus on numerous courses.

Isijamovic et al. (2012) carried out a comparative study on several classification/prediction algorithms to predict student performance on selected courses in technology enhanced learning environment. They concluded that Artificial Neural Network (ANN) was among the best algorithms by several evaluation criteria. Costa et al. (2017), encounter the above study of Isijamovic by using four classification/prediction algorithms (Naïve Bayes, Neural Network, Decision Tree, and Support Vector machine) to predict student failure in programming courses. The sources of the two data used for applying these algorithms came from the campus and distance education in the University of Braze. The result from their study claims that support vector algorithm perform better than the other algorithms.

Further research was carried by Hikmat et al. (2019) using five data mining algorithms (Neural Network, Decision Tree, support vector machine, Naïve Bayes and K-Nearest Neighbor. They concluded that Neural Network performed better than others. From the result of their research, it was shown that the Neural Network had (98%) prediction accuracy; Decision Tree had (91%), Support Vector machine had (83%) and Naïve Bayes had (76%), which is the smallest prediction accuracy. Unlike the research study of Costa et al., (2017), that claims that Support Vector is better than other algorithms.

Moreover, other researchers such as (Thomas & Hass, 2001, Schumacher et al., 2010 and Wu et al., 2008) in their research study also claims that Neural Network is the best algorithm when it comes to predict

Methodology

Due to there are numerous approaches that can be used in designing a system, only one was adopted in this research which is the Object-oriented Analysis and Design Methodology (OOADM). OOADM is a set of standards for system analysis and application design. It uses a formal methodical approach to the analysis and design of information system. Object-Oriented Design (OOD) elaborates the analysis models to produce implementation specifications. OOADM was chosen for its functionalities, in that it allows object oriented abstractions for analysis and design of information-intensive web applications. Besides the modeling abstractions, it also provides a methodology which guides a developer through different activities in the web application development.

Analysis of the Proposed System

The proposed system is a web based student information system. The system automates all the activities in the tertiary institution making it accessible from any internet access point. The research develop a portal that would incorporate online registration, profile creation, students' final clearance and payment, transcript processing, checking of admission status, and checking of results. The new system provides features that are accessible by various categories of users including students, lecturers, support team, bursary, exams and records, and administrators. During the online registration, the student can register all his/her courses for the session. Therefore, the system maintains a centralized database for the student's bio data and course registrations. Students can edit their data and make necessary corrections within a stipulated time before the registration portal closes. The registration information submitted by student's are subject to approval by academic adviser and this done electronically. Once the registration information approved or rejected, the student gets an automatic SMS and E-mail notifying him/her of the registration status. In addition, on getting the approval, the student can no longer edit his/her registration information.

Lecturers at the end of every semester can upload student's scores in each of the courses to the online platform. Once the scores are uploaded, the system automatically computes student's grades in the courses and compile each student's result for the semester; and it is only accessible to individual students thou and administrator has access to all the results and departmental heads will equally access their

departmental results. During result checking, students equally use their registration number and the PIN code to check their result online.

With the integration of artificial neural student's performance in an exam over time. This made possible by the system-using student's previous scores in their examination to predict performance in coming exams. Students have access privileges to this prediction platform so that with the predicted performance the student can put more effort to perform better

In the system, there is provision for the bursary unit to manage students' payment information and financial status. With this, the institution authority can get electronic report on the revenue generated and the defaulting students.

Data Flow Diagram (DFD) of the Proposed System

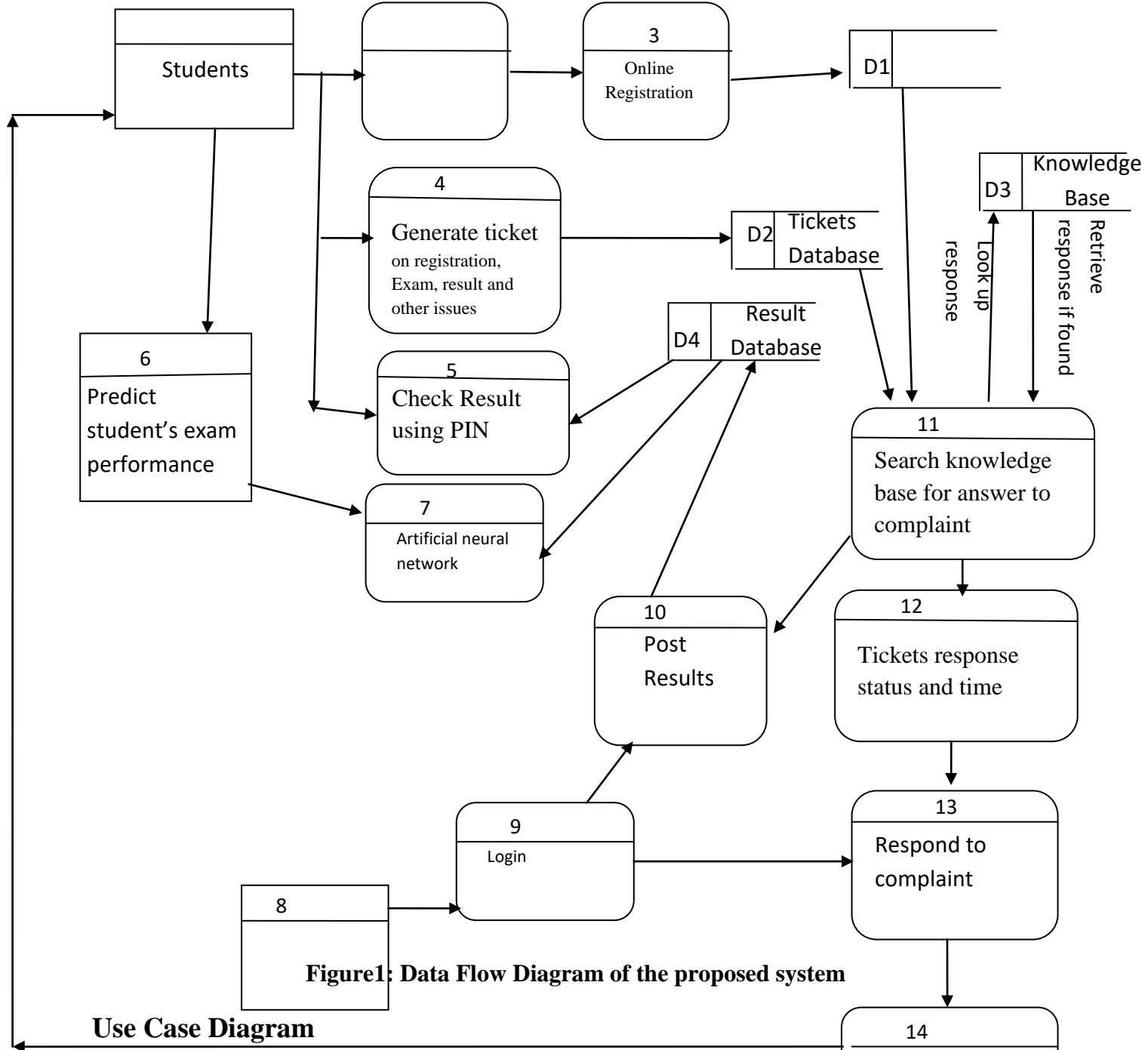


Figure 1: Data Flow Diagram of the proposed system

Use Case Diagram

The use case diagram of the various users of the proposed system is shown in figure below indicating privileges and duties of various users of the web based Student information system.

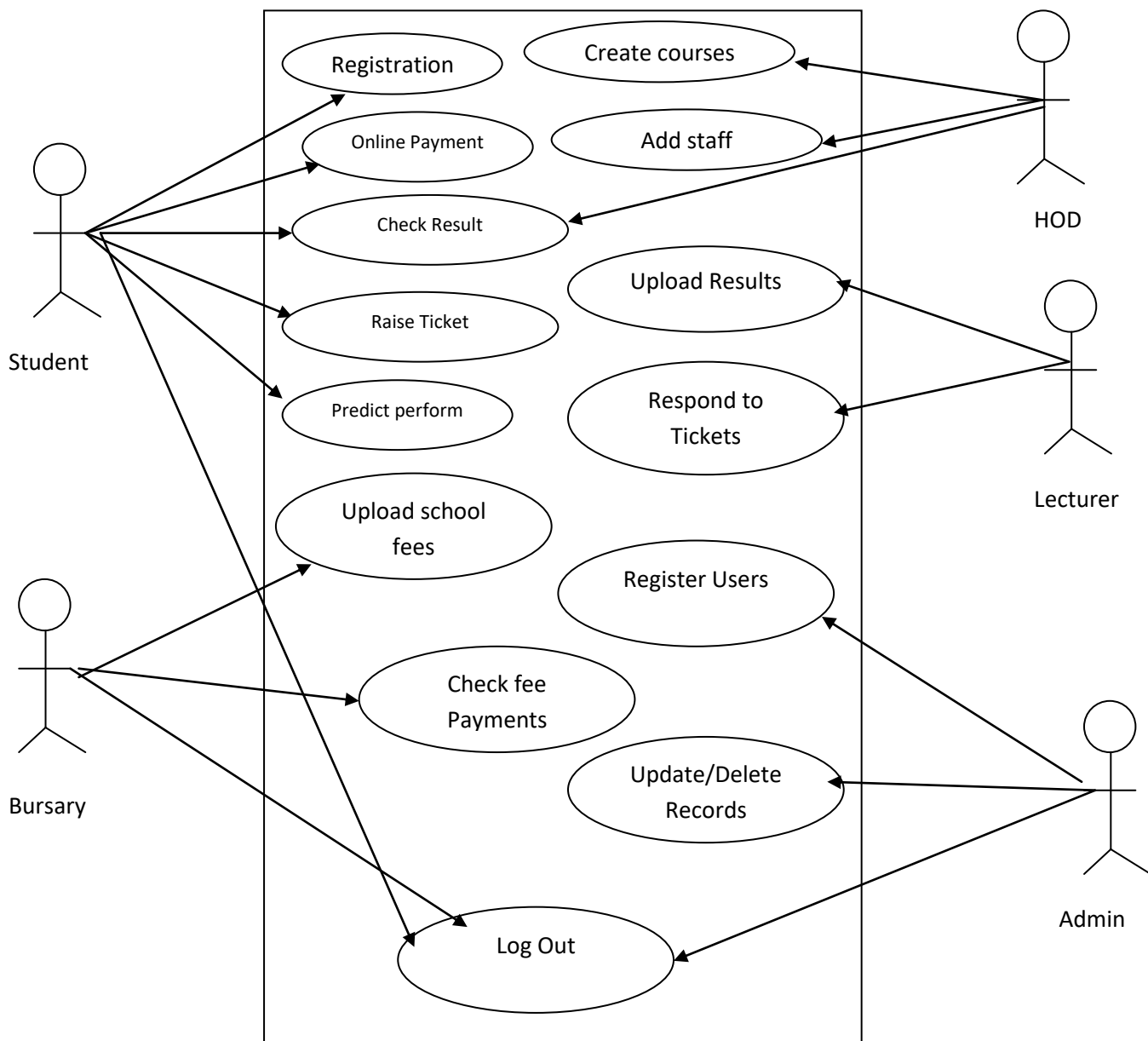


Figure 2: Use Case of the Proposed System

System Requirements

The system requirement divided into software and hardware requirement. Below is the detailed requirement for the proposed security mode.

Hardware Requirements

The list below describes the hardware components and software requirements needed for effective and efficient running of the system.

For the implementation of the proposed system, the following hardware is required:

- 2.4 GHZ of processor speed
- 4GB RAM
- 300 GB Hard disk
- Internet Modem

- Coloured Monitor
- Printer

Software Requirements

The following software installed on the computer system to run the new system developed.

- window 7, Window 8 or windows 10
- Microsoft Dream Weaver 8

- Wamp Server
- JQuery
- Fireworks
- Php-Mysql
- Java Virtual Machine

Control Centre/Main Menu

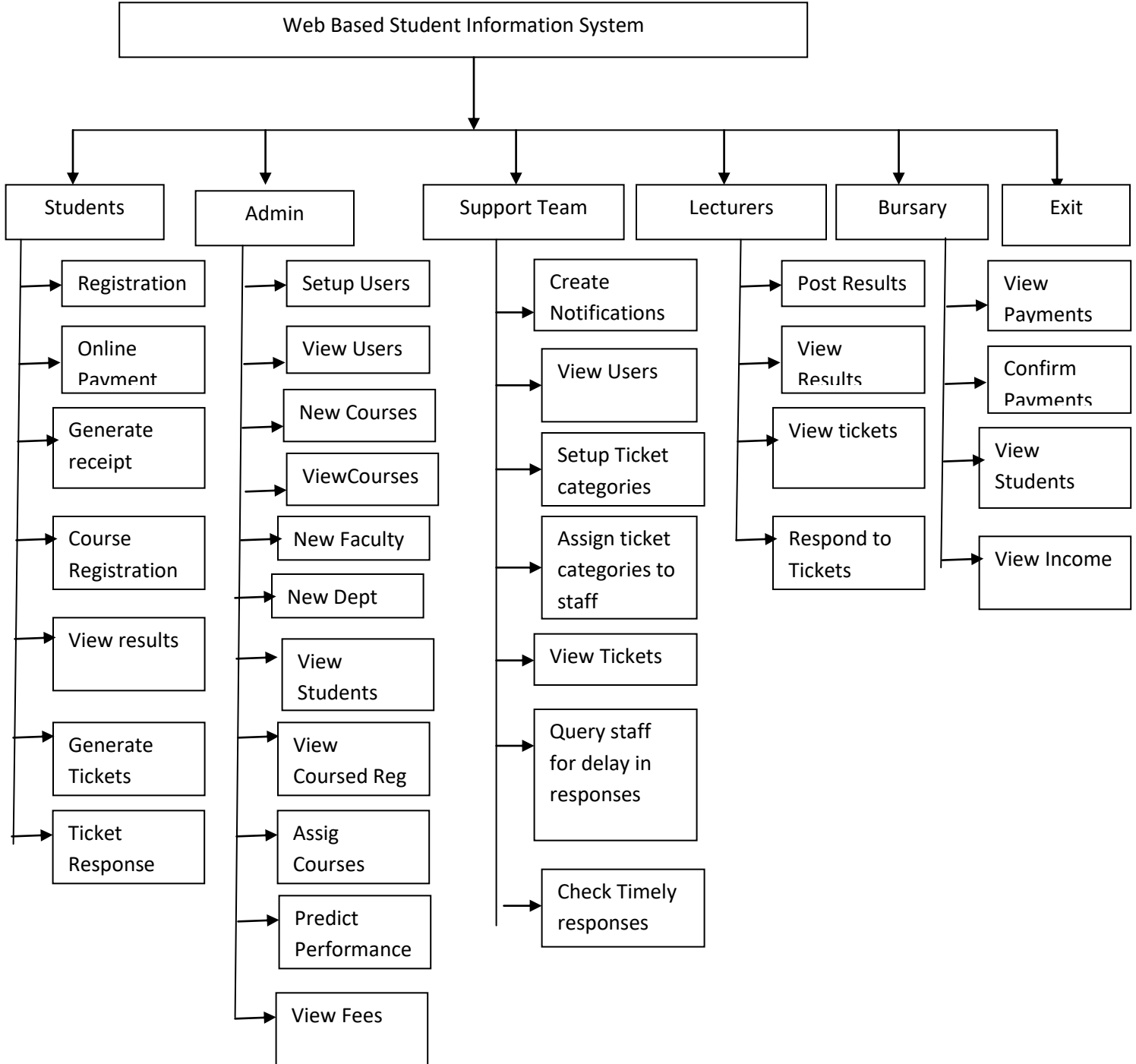


Figure 3: High-level Model of the Proposed System

Program Module Specificatio

The proposed web based student information system using artificial neural network and hidden markov model.is divided into several modules, which come

together to give the solution to the problem. The modules are as follows:

Login Module

The login module authenticates users on the

platform using username and password. Failure to authenticate all the criteria will lead to denial of access to the system.

The Main Menu

The main menu contains all the available commands and serves as a link to all other modules in the program. To access any of the menu command, click at the menu.

The Registration Menu

This menu contains the commands used for registering new students, new courses, and new departments.

Course Registration

The menu used mostly by students to register their courses. At the end of the registration, a printout

All of the courses registered appears on the screen.

Result Posting

It used to enter the student's scores and hence computation of Grade points and grade of the score takes place here.

Student RegistrationModule

The students use this module to register their details on the platform. The student submits his/her details including the username and password.

Users RegistrationModule

The admin uses this module to register users on the proposed systemplatform.

.Conclusion

Student's information management is a critical issue in most universities in developing countries. Timely access to information and security of the information is very crucial for effective implementation of electronic data management. This paper discussed on the development of a web based student information system, with the integration of artificial neural network technique for the prediction of student's performance in an exam over time. This made possible by the system-using student's previous scores in their examination to predict

View Users Module

The admin uses this module to display all users on the platform.

SMSModule

This module used to send SMS to students and support team staffs.

Ticket Module

The students use this module to generate ticket and submit to the database for response. This module once used will generate an SMS and send it to the support team staff assigned to the ticket category raise.

Ticket RespondModule

The platform allows support team staff to use this module to respond to tickets raised by students.

NotificationModule

The admin uses this module to send SMS notifications to students registered on thisplatform.

View TicketModule

This module used to display the dataset of the tickets generated.

Delete Module

The admin uses this module to delete unwanted record from the database.

View Result Module

This module displays student's examination results

performance in coming exams. Students have access privileges to this prediction platform so that with the predicted performance the student can put more effort to perform better or the courser adviser to call the student for counseling.

The effective deployment and management of this system will improve greatly the speed and accuracy of student's information.The Artificial Neural Network used in the study was able to achieve 91% accuracy in predicting student's academic performance

esign Output Results

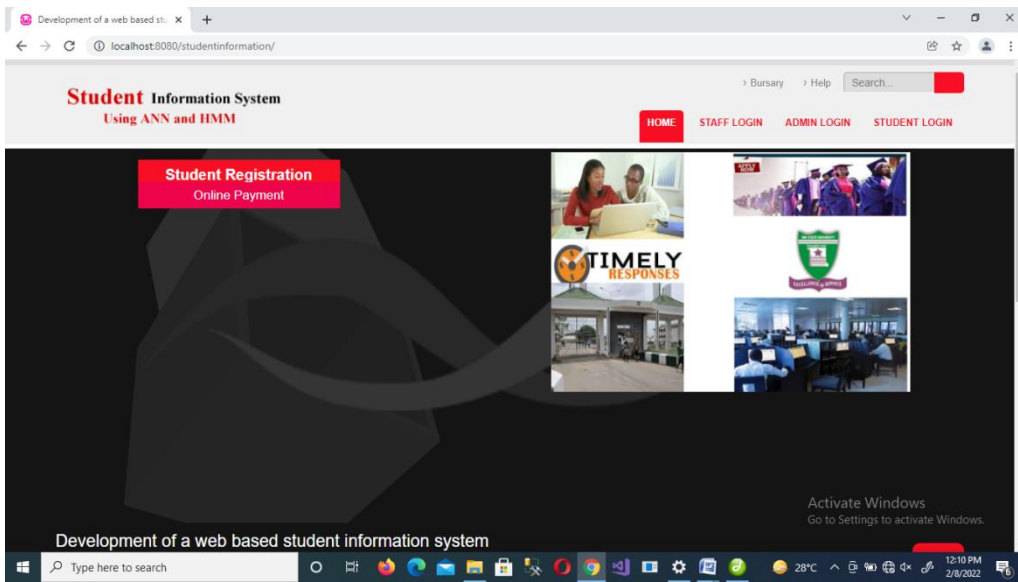


Figure 4: Home Page

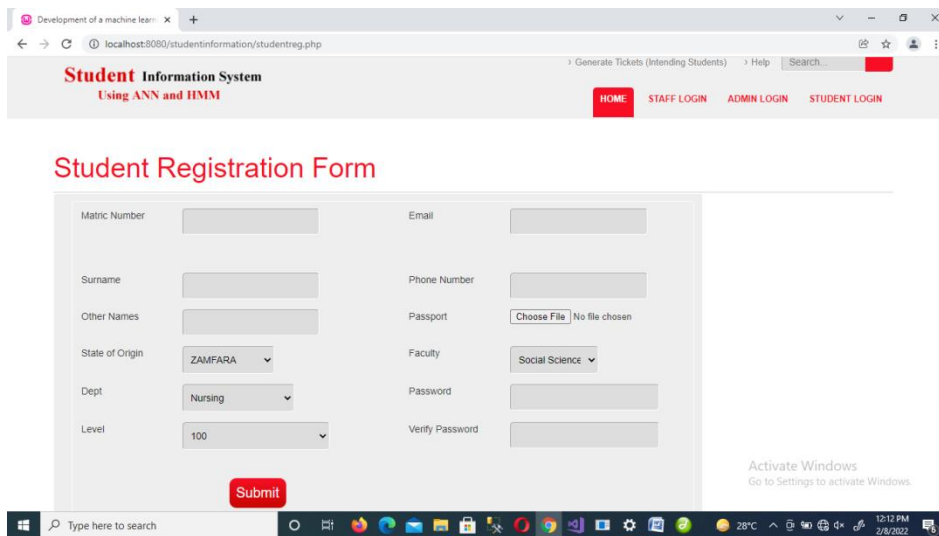


Figure 5: Student

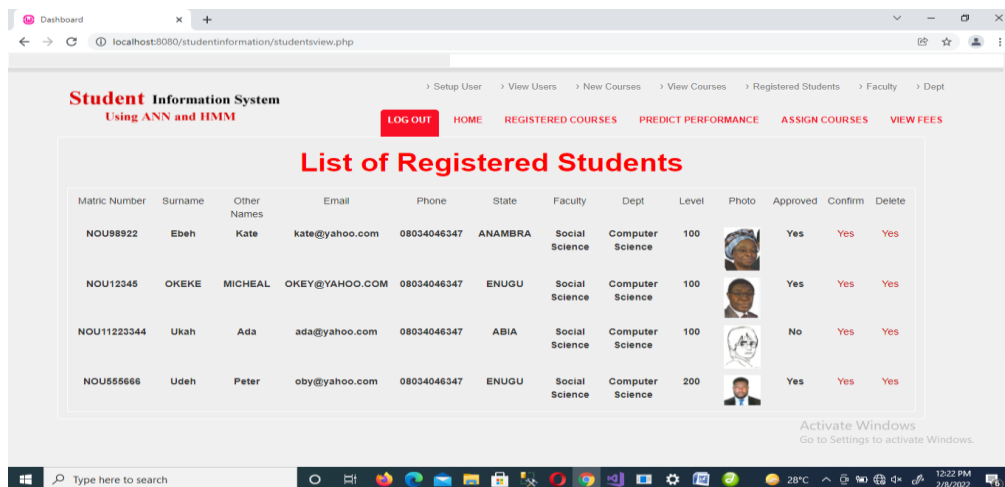


Figure 6: List of Registered Students

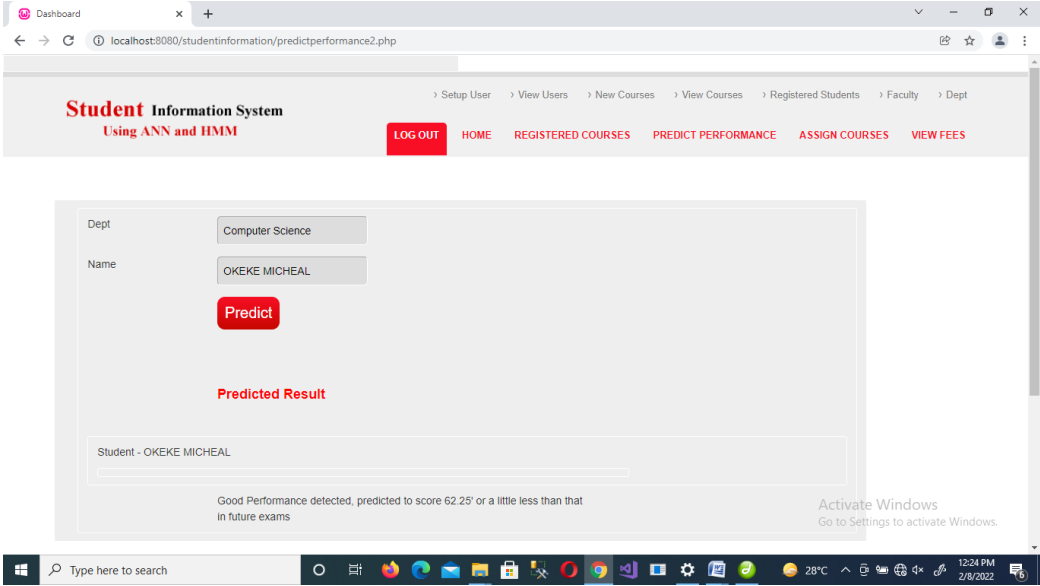


Figure 6: Predict Student’s performance

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Banking Innovation on Sustainable Development of Nigeria during the Pre and Post Covid Era

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Abstract

The research critically examined the nexus between Banking Innovation and Sustainable Development of Nigeria during the Pre and Post Covid Era between the year 2005 – 2020 respectively. The data employed for the study were basically obtained from CBN Statistical Bulletin 2020, in analyzing the data obtained; econometric techniques were used, such as Autoregressive Distributed Lag (ARDL), bounce test, granger causality, unit root and major diagnostic techniques were deployed to ascertain the impact of Banking Innovation on Sustainable Development in Pre and Post Covid Era in Nigeria. The result obtained shows positive and significant relationship between Banking Innovation (POS, ATM, MB) and Sustainable Development provided by human development Index. In the light of the above result, we recommend an immense and total improvement on the usage of banking innovative products.

Keyword: ARDL, Sustainable Development, Bounce Test, Banking Innovation.

Background to the Study

Financial innovation is the unanticipated improvement in the array of financial products and instruments that are stimulated by unexpected changes in customer needs and preferences, tax policy, technology and regulatory impulses (Tyavambiza, & Nyangara, 2015).

The debate on financial innovation and its effect on economic growth and development can be traced to the work of Schumpeter (1934). The author was the first to give us an idea of the connection between innovation and performance of an economy and the functioning of its credit and capital markets. A good understanding of the relationship between finance, innovation, and growth begins with understanding the character of innovation. (Mazzucato, 2013).

The development in the financial sector have not only led to the increase in the number of financial institutions, but also the development in the level of sophistication with new payment systems and asset alternatives to holding money. This has resulted mainly from technological advancement and increase in competition as the number of institutions increased. Developments in

payment systems have started to create close substitutes for hard currency, thus affecting a core part of banking.

Research studies on financial innovation in developing countries have so far focused mainly on welfare issues, particularly on its impact on financial inclusion (Adu-Asare Idun & Aboagye, 2014). Financial innovation has transformed and restructured banking services globally, and its impact on economies is becoming increasingly noteworthy. The available literature confirms that financial innovation drives economic growth (Sekhar, 2013). From a historical perspective, Laeven, Levine and Michalopoulos (2015) point out that financial innovation has been a driving force behind financial deepening and economic development over the past centuries. In turn, Štreimikien, (2014) contends that “leapfrog” (financial) innovation is a driving force for broad economic growth. Despite mixed evidence on causality, there is also a broad consensus that a well functioning banking system promotes economic growth (Owusu & Odhiambo, 2014).

Economic growth is defined as 'a rise in the total

output (goods or services) produced by). It is an increase in the capacity of an economy to produce goods and services, compared from one period of time to another. Economic growth occurs whenever people take resources and rearrange them in ways that are more valuable. Economic growth refers only to the quantity of goods and services produced; but say nothing about the way in which they are produced (Mackinnon, 1973).

The quest for profit forces companies, households and economic agents to look for new and improved products, services, processes and forms or structures of companies that decrease their production costs, satisfy in a great range, their customers' demand and bring higher

Statement of the Problem

The significance of financial innovation on economic development has led to various controversies among renowned scholars as to whether to adopt or reject the significance of financial innovation as a determinant to stimulating economic development. Various authors such as; Tunde, 2015; Levine et'al 2015; Adu-Asare, & Aboagye, 2014; Ajimobi et'al 2013 argued that financial innovation is grossly significant to economic development whereas Becky & Augustine, 2014 Owusu and Odhiamb2. (2014) in their separate studies, argued that financial innovation is grossly insignificant to economic development in Nigeria. These controversies had indeed created a vacuum in relationship with human development index in Nigeria academic stance on the impact of financial innovation on economic development in Nigeria.

However, in Nigeria and other less developing economics, the significance of financial innovation on economic development is yet to be optimized appropriately due to the inadequate use of automated teller machine, point of sale, mobile banking and internet banking by the banking public which has resulted into low growth in the economic development. To this end, the research study is centered on the effect of financial innovation on economic development in Nigeria where appropriate variables such as; automated teller machine, point of sale, mobile banking, internet banking(proxy of financial innovation) and aggregate output, human development index, per capital income, human poverty index and educational index as proxy of economic

profits. Sometimes this quest is made through official Research and Development (R&D) programmes or sectors of a company. Today, more than ever before, innovation, enterprise and intellectual assets drive economic growth and development a country (Laeven, Levine & Michalopoulos, 2015 and increase standards of living. Innovation is instrumental in creating new jobs, providing higher incomes, offering investment opportunities, solving social problems, curing diseases, safeguarding the environment, protecting our security and transparency in organizations and governments (Štreimikien, 2014).

development are used to study the empirical relationship existing between them.

Research Objective

The broad objective of the study centre on the effect of financial innovation on economic development in Nigeria; whereas, the specific objectives are to:

1. Investigate the relationship between automated teller machine and human development index
2. Examine the nexus between point of sale and human development index in Nigeria
3. Determine the relationship between mobile banking and human development index in Nigeria

Research Questions

The following research questions are formulated to guide this research work:

1. To what extent has automated teller machine affected human development index in Nigeria?
2. To what degree has point of sale affected human development index in Nigeria?
3. What is the relationship between mobile banking and human development index in Nigeria?

Research Hypotheses

The hypotheses are formulated in null form to aid in the empirical analysis in the research work:

- Ho₁: Automated teller machine has no significant relationship with human development index in Nigeria
- Ho₂: Point of sale has no significant relationship with human development index in Nigeria
- Ho₃: Mobile banking has no significant relationship with human development index in Nigeria

Significance of the Study

This study will benefit a broad range of people and institutions such as;

Policy Makers: The study will aid policy makers and monetary authorities, in formulating appropriate monetary policies that will enhance financial innovation and reforms and stimulate growth and development

Stakeholders in the Banking Sector: The study will benefit various stakeholders in the banking industry and aid bank borrowers in taking lending and borrowing decisions that will optimize their investment activities

Social and Financial Analysts: Financial innovation in the banking sector in Nigeria

Concept of Financial Innovation

Innovation in the financial sector is the act of creating and then popularizing new financial instruments as well as new financial technologies, institutions, and markets (Makur, 2014). It may be viewed as the design, development, and implementation of innovative financial instruments and processes, and the formulation of creative solutions to problems in finance. According to Korir (2014), financial innovations is one of the most important competitive weapons and generally seen as a firm's core value capability. It is considered as an effective way to improve firm's productivity due to the resource constraint issue facing a firm.

Ignazio (2007) groups financial innovations into; new products for example adjustable rate mortgages and exchange-traded index funds; new services for example on-line securities trading and Internet banking; new "production" processes for example electronic record keeping for securities and credit scoring and new organizational forms for example a new type of electronic exchange for trading securities and Internet-only banks.

According to Makur (2014), commercial banks in

Kenya have continuously been innovating new products, services and governance in order to improve their financial performance. The financial sector has over time developed

through electronic banking has been recognized to play an important role in financial sector development on the basis of its ability to create liquidity in the economy through financial intermediation. This will offer a platform where banks' products and services can be accessed and utilized with ease, thus encouraging banking culture and serving as a catalyst for economic growth and development

Researchers and Students: Academics, including students of finance, banking and other related fields and other researchers will find this study useful for further studies in this area

successfully with innovation products and services available in financial market. Some of these products are debit cards, credit cards, ATM cards, M-pesa and others which facilitate the use of electronic means of payment and sometimes substitute for the use of physical cash. Similarly these products gain a wider recognition in financial market leading to reduction of holding amount of money.

That latest service innovation will lead to furthering of financial inclusion and innovative service offerings for all Kenyans by presenting their financial services offering on to a single platform which will make banking services more accessible, flexible convenient and more affordable.

Financial innovation is the improvement in the array of financial products and instruments that are stimulated by unexpected change in customer needs and preferences, tax policy, technology and regulatory impulses (Venkatesh, & Davis, 2000). Innovation in the financial sector is the act of creating and then popularizing new financial instruments as well as new financial technologies, institutions, and markets (Waweru, 2012). It may be viewed as the design, development, and implementation of innovative financial instruments and processes, and the formulation of creative solutions to problems in finance. According to Makur (2014), financial innovations is one of the most important competitive weapons and generally seen as a firm's core value capability. It is considered as an effective way to improve firm's productivity due to the resource constraint issue facing a firm.

The developments in the financial sector have not

only led to the increase in the number of financial institutions, but also the development in level of sophistication with new payment systems and asset alternatives to holding money. This has resulted mainly from technological advancement and increase in competition as the number of institutions increase. Developments in payment systems have started to create close substitutes for hard currency, thus affecting a core part of banking. The quest for profit forces companies, households and economic agents to look for new and improved products, services, processes and forms or structures of companies that will decrease their production costs, will satisfy, in a great range, their customers'

demand and will bring higher profits. Sometimes this quest is made through official Research & Development (R&D) programs or sectors of a company. Other times, it is a hazardous result of control processes or of the trial and mistake method. Today, more than ever before, innovation, enterprise and intellectual assets drive economic growth and increase standards of living. Hence Innovation is instrumental in creating new jobs, providing higher incomes, offering investment opportunities, solving social problems, curing disease, safeguarding the environment, protecting our security and transparency in organization and governments

Concept of Sustainable Economic Development

Economic development encompasses progress in providing livelihood on a sustainable basis, access to education and basic healthcare for the majority of the population (Belshaw & Livingstone, 2002). 'Economic development' is a process in which a nation is being improved in the sector of economic, political, and social well being (Bates & Parkin, 2002). The term has been used frequently by economists, politicians, and others in the 20th and 21st centuries. The concept, however, has existed in the West for centuries. "Modernization and especially industrialization" are other terms often used while discussing economic development. Economic development has a relationship with the environment and environmental issues. Economic development is very often confused with industrial development, even in some academic sources. Whereas economic development is a policy intervention endeavor with aims of improving the economic and social well being of people, economic growth is a phenomenon of market productivity and rise in GDP. Consequently, economic growth is one aspect of the process of economic development.

Economic development is the overall development in the economy standard of living. The meaning of the term "development" becomes clearer with the understanding of the term "economic growth". By economic growth, economists generally mean the increase over time in a country's real output per capita. Though other measures can be used, output is most conveniently measured by the gross national product (GNP). This implies that economic growth is measured by the increase in a country's per capita GNP.

Economic growth is thus sustained expansion of production possibilities measured as an increase in the real GDP over a given period. Rapid economic growth sustained over a number of years can transform a poor nation into a rich one, as has been the experiences of Hong Kong, South Korea, Taiwan and other Asian economies (Bates & Parkin, 2002). According to Malizia and Feser (2006), growth and development is complementary, and one makes the other possible. They are also alternating processes that occur sequentially. Growth is an increase in output, development is a structural change, for example technological or legal. Growth expands the economy, while development must lead to more equal distribution of income and wealth. Overall, growth and development lead to a greater range of economic choices.

Economic development could also involve development in different sectors of the economy. It involves efficient economic management, good governance, sustainable development and poverty reduction; all of these are goals to which development stakeholders have to contribute (Sako, 2002). Ruttan (1997) explains that the basic needs approach represents a radical departure from conventional development strategy. In the basic human needs approach, poverty is defined not in terms of income, but rather as a lack of good nutrition, good health, educational opportunities and similar dimensions of welfare (Lewis, 2003).

According to this view, usually referred to as the basic (human) need approach, economic development is defined in terms of progress towards reducing the incidence of poverty, unemployment and income inequalities. Beneria (2003) advocates a vision of development based on an intuitive idea of life that is worthy of the dignity of human beings for

each and every person, a view that is in tune with the basic objectives of feminist economics. Meeting the basic needs of the vast majority of the population of a country is at the centre of this view. Ruttan (1997) further argues that growth objectives are replaced in this approach by consumption targets translated into specific programme goals, namely a life expectancy of 65 years, a literacy rate of at least 75 percent, an infant mortality rate of 50 or less per thousand births and a birth rate of 25 or less per thousand of the population. Sen (1999) asserts that “development has to be more concerned with enhancing the lives we

Theoretical Review

The Innovation Diffusion Theory

Diffusion Theory (IDT) that explains individuals' intention to adopt a technology as a modality to perform a traditional activity. The theory is developed by Rogers (1983). The critical factors that determine the adoption of an innovation at the general level are the following: relative advantage, compatibility, complexity, trialability and observability. (Rogers, 1995). Researchers such as Tan and Teo (2000), Gerrard and Cunningham (2003) and MdNor and Pearson (2008) had tested the theory on the e-banking adoption. The nominalized factors are complexity, triability and observability.

The underpinning theory employed in this work is a theory arising from the decomposed theory of planned behaviour. This theory considers that the use of technology is influenced by attitude, subjective norm and perceived behavioural control. The theory argues that the lesser the ratio of currency outside banks to broad money supply the higher the intermediation efficiency and vice-versa. This suffices that when the currency outside banks diminishes as a result of the increase in the use of electronic forms of payment, particularly ATM and other e-card products, as well as banking habits, the intermediation efficiency will be positive, otherwise it will be negative.

Empirical Review

Nzyuko and Jagongo, (2018) investigated financial innovations adopted by commercial banks in Kenya. The study is centered on the use of technology such as Automatic Teller Machines (ATMs), mobile phone banking internet banking and agency banking and its impact on financial performance of commercial

lead and the freedom we enjoy,” rather than economic growth being treated as an end in itself. In the same vein, Blignaut and De Wit (2004) explains that ignoring the impact of social capital or environmental preservation in the conventional growth models may be a problem when predicting the possibility of sustained growth. This suggests that the linkage and interactions between the economy and the environment are constrained, since growth does not automatically lead to increased welfare.

banks in Kenya .The study used time series data from central bank of Kenya (CBK) and Kenya Bankers' Association (KBA) annual bank supervisory reports (2010-2016). Through multiple regressions and correlation analysis the study found that there is a strong positive relationship between financial inclusion strategies and financial performance. Based on these results, the study recommends that financial inclusion innovations should be emphasized in the financial sector through regulatory and advisory bodies since it leads to improved financial efficiency. In addition, the study also recommends that financial institutions should embrace agency, internet banking and ATM banking to include the excluded people in financial services and products throughout the country since they proved significant in influencing financial performance.

Ibenta, and Anyanwu (2017)evaluated the relationship between financial innovation and bank efficiency as well as the impact of financial innovation on efficiency ratio of deposit money banks in Nigeria from 2006 to 2014. Secondary data covering the period of the study were sourced from the Central Bank of Nigeria Statistical Bulletin. The unit root test was performed to ensure that the variables were free from stationarity defect linked with almost all time series data due to the nature they were generated. A multiple regression model was used and estimated to evaluate the relationship among the variables concerned. The finding reveals that the value of transactions on Automated Teller Machine (ATM) and Point of Sale (POS) are negatively related with efficiency ratio while web/internet and mobile banking are positively related but only that of web/internet was significantly related. The granger impact

assessment depicts that financial innovation products reflected by value of transaction on ATMs, web/internet, POS and mobile banking has no significant impact on efficiency ratio of deposit money banks in Nigeria. The study found evidence that banks efficiency ratio exerted statistically significant impact on value of transactions on ATMs. The study recommends that, banks should invest more in ATMs and POS platforms as it reduces the operating expenses to net income ratio while ensuring effective utilization of existing web/internet and mobile banking infrastructure rather than acquiring new ones that will gulp a large fraction of their net operating income. Web/internet and mobile banking should be redesigned in such a way that customization will enable customers access all the banking services which would indeed reduce its transaction costs. This calls for dialogue and negotiation with mobile service providers operating in Nigeria.

Chukwunulu, (2019) investigated the effect of financial innovations on economic growth in Nigeria. Data on the e-payment system were used as financial innovation variables spanning 2008 to 2017. The Generalised Methods of Moments (GMM) employed for data analysed revealed that transactions through ATM, Mobile Banking, Internet Banking and Point of Sale terminals have significant positive effect on economic growth. Further results from the adjusted coefficient of determination (Adj R2) showed that about 79% of changes in economic growth can be explained by financial innovations. The study therefore concludes that financial innovation has high predictive power on economic growth of Nigeria and has impacted positively in determining Nigeria's economic growth. However, care should be taken to identify and eliminate the risk associated with these innovations before promoting them.

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Methodology

The research work is design to empirically examine the impact of financial innovation on sustainable economic development in a post covid era in Nigeria; sophisticated econometrics tools such Error correction model, Jarque-Bera normality, unit root, co-integration, impulse response analysis and Granger causality. Below are the specifications of the econometric tools;

Okafor, Ezeaku and Anyalechi (2017) employed quarterly data covering 2009:Q1-2014:Q4 to examine the effectiveness of financial innovation in driving growth in Nigeria. The Least Squares (Gauss-Newton/Marquardt steps) based on vector autoregressive (VAR) system was used to estimate the system model whereas Johansen co-integration test was utilized to test for long-run relationship among the series. The results showed a long-run relationship between growth and financial innovation. The findings indicate that financial innovations do not jointly have positive effect on growth as the responsiveness of growth to the individual innovation channels varied. ATM, mobile and internet transactions all have relative positive effect on growth, while transactions via POS channel had a negative influence on growth. The study therefore concluded that financial innovations have not had the desired effect on the Nigerian economy.

Ajide (2016) used bank competition to moderate the effect of financial innovation on sustainable development in eight West African countries covering the period between 2000 - 2013. Two variables of competition and two variables of financial innovation, with other control variables were regressed on a growth indicator. The dependent variable was adjusted net savings while the independent variables included bank competition, bank return, financial innovations, and banking sector development. The results from panel data estimations indicated that increase in banking efficiency driven by competition and financial innovation improved economic growth and development. It was also discovered that the effect of financial innovation on growth and development depends on the variable adopted, as one of the variables showed a negative relationship while the other had a positive relationship with development though the two were insignificant. However, the two proxies of competition were significant. The researcher concluded that a reduction in demand for money caused by financial innovations could deter economic growth and development.

Impulse Response Analysis

Impulse response traces out the responsiveness of the dependent variables in the vector error correction (VAR) model to a one standard deviation shock of each of the variables. So for each variable from each equation separately, a unit shock is applied to the error, and the effect upon the VAR system over time are noted. Thus, there are g variable in the system, a total of g^2 impulse

responses could be generated. The impulse response test $B_1 = \frac{E(u^3)}{(\sigma^2)^{3/2}}$ and $b_2 = \frac{E(u^4)}{(\sigma^2)^2}$ estimated from the bivariate VAR (1) equation; thus

$$Y_t = A_1 y_{t-1} + \mu t$$

Where $A_1 = [0.5 \ 0.3]$ & $[0.0 \ 0.2]$ respectively.

The Kurtosis of the normal distribution is 3 so its excess Kurtosis ($b_2 - 3$) is zero.

The Bera – Jargue test statistic is given

$$W = T \frac{(b_2 - 3)^2}{6 + 24}$$

Error correction model or equilibrium correction model

The equilibrium correction or error correction model is used to combine first differenced and lagged levels of cointegrated variables. The model measures the proportion of last period's equilibrium error that is corrected for and describes the speed of adjustment back to equilibrium.

$$y_t = \beta_1 x_t + \beta_2 (y_{t-1} - \gamma x_{t-1}) + u_t$$

Symbolically, the model $y_t = \beta_1 x_t + \beta_2 (y_{t-1} - \gamma x_{t-1}) + u_t$ is known as the error correction model or equilibrium correction model while $y_{t-1} - \gamma x_{t-1}$ is known as the correction model. Provided that y_t and x_t are cointegrated with cointegrating coefficient γ then $(y_{t-1} - \gamma x_{t-1})$ will be I(0) even though the constituents are I(1).

Where T is the sample size, the test statistics asymptotically follows a $\chi^2(2)$ under the null hypothesis that the distribution of the series is symmetric and mesokurtic.

Model specification

The impact of financial innovation on sustainable economic development in Nigeria is anchored on the econometric model below;

$$HDI = \beta_0 + \beta_1 ATM + \beta_2 POS + \beta_3 MB + \mu$$

Where: ATM = Automated teller machine

HDI = - Human development index

POS = Point of sale

MB = - Mobile banking

, σ_t = the error term at time interval T.

Bera and Jargue Normality

BJ uses the property of a normally distributed random variable that the entire distribution is characterized by the first two moments – the mean and the variance. The standardized third and fourth moments of a distribution are known as its skewness and kurtosis. Skewness measures the extent to which a distribution is not symmetric about its mean value and Kurtosis measures how fat the tails of the distribution are. A normal distribution is not skewed and is defined to have a coefficient of Kurtosis of 3. A normal distribution will thus have a coefficient of excess Kurtosis of zero. A normal distribution is symmetric and said to be meosokurtic.

4.0 Results and Discussion

This section of the research work present, analyze and report the result of the model estimation conducted: the table below shows Quarterly Data on financial innovation in billions proxied by automated teller machine (ATM), point of sale (POS), mobile banking (MB) and internet banking (ITB) serving as control variables and economic development proxied by human development index

Bera and Jargue (1981) formalize these ideas by testing whether the coefficient of Skewness and the coefficient of excess Kurtosis are jointly zero. Denoting the error by u and their variance by σ^2 , it can be proved that the coefficients of skewness and Kurtosis can be expressed respectively as:

Yr	ATM	POS	MB	HDI
2009				
Q1	548.6	11.03	1.27	8226.443
Q2	251.6612	36.7184	2.6185	8556.945
Q3	294.9517	44.9361	2.9962	9811.363
Q4	310.3243	44.0459	4.1506	10219.34
2010				
Q1	399.71	12.72	6.65	10050.67
Q2	321.8144	25.1297	63.85358	10102.82
Q3	319.1671	29.8247	75.76033	10336.11
Q4	341.2412	27.8778	74.59405	9830.344
2011				

Q1	1561.74	31.02	18.98	9446.946
Q2	376.7717	17.0436	43.25328	9957.95
Q3	420.2379	14.2152	46.81272	11110.74
Q4	400.1608	19.3586	49.23296	14183.59
2012				
Q1	1984.659	48.00831	31.50933	14119.89
Q2	538.1143	48.9505	727.4112	14701.06
Q3	586.2737	56.9129	714.9556	14754
Q4	599.0307	68.6625	722.3069	15151.76
2013				
Q1	2828.939	161.0163	142.7971	15261.94
Q2	4132.896	71.0286	563.713	15692.04
Q3	4122.578	80.1375	602.829	16279.27
Q4	4375.027	81.2041	615.1409	16191.47
2014				
Q1	3679.878	312.0717	346.4673	16452.3
Q2	4311.833	13.7841	494.9443	16927.98
Q3	4620.815	14.134	513.3734	17694.08
Q4	4990.504	12.8185	642.3882	18126.05
2015				
Q1	3970.252	448.5126	442.3538	18650.34
Q2	5381.59	71.0286	466.4944	18898.67
Q3	5511.069	80.1375	456.3068	18733.46
Q4	5322.282	81.2041	457.9778	18720.51
2016				
Q1	4988.133	758.9965	756.8975	18883.44
Q2	5811.744	26.5522	59.81573	21452.18
Q3	5125.3	27.4633	72.20069	22739.69
Q4	5586.178	29.1016	96.1665	21982.15
2017				
Q1	6437.592	1409.813	1101.999	22371.83
Q2	6332.073	1631.933	9365.598	21985.95
Q3	5884.873	1628.825	9181.208	22021.9
Q4	6053.095	1341.864	9155.799	22290.66
2018				
Q1	1568.949	474.7313	329.1158	22363.23
Q2	1603.166	543.6256	410.5659	22281.87
Q3	1591.014	650.4066	498.0817	22967.44
Q4	1716.957	714.3454	592.9377	22708.22
2019				
Q1	1539.26	633.81	100.69	23994.74
Q2	1699.16	749.82	1155.64	24758.24
Q3	1622.93	856.86	1428.12	25486.51
Q4	1651.25	964.27	1687.1	26636.61

4.2 Econometric Analysis

The model specified in chapter three is analyze using various econometric tools to determine the nexus between financial innovation and sustainable economic development in a post covid era in Nigeria, in analyzing the data, we therefore began the analysis with the use of lease squared estimates,

Lease Squared Estimates

The technique was introduced to determine the short run equilibrium relationship between the variables estimated in the model; the result is shown below;

ependent Variable: HDI
 ethod: Least Squares
 ate: 15/02/2021 Time: 08:42
 ample: 2009 2019
 luded observations: 44

variable	oefficient	id. Error	Statistic	rob.
	7.83878	593009	4.83978	0000
TM	008702	001961	436851	0044
OS	018850	018350	027238	0439
IB	004724	005439	868596	4185
TB	0.070254	084796	0.828510	4391
-squared	985959	Mean dependent var		37.6336
djusted R-squared	976599	S.D. dependent var		4.94579
E. of regression	345829	Akaike info criterion		493465
um squared resid	71.4673	Schwarz criterion		674327
og likelihood	0.71406	Hannan-Quinn criter.		379457
-statistic	05.3316	Durbin-Watson stat		505933
rob(F-statistic)	000011			

The result of adjusted R- squared estimates revealed that 97.6% variations in human development index is caused by changes in automated teller machine, point of sale, mobile banking and internet banking. Though, the result of Durbin-Watson shows the presence of serial correlation in the model which implies that the variables are inter-related and the F-statistics indicates that the model is a good

Individual coefficient in the relative results shows that automated teller machine and point of sale are positive and significant to human development index which implies that positive changes in those variables will lead to positive

outcome on economic development proxy by human development index while mobile banking and internet banking are positive, negative and insignificant to human development index which implies changes of the variables will impact insignificantly on human development index respectively.

Serial correlation LM test

The technique was introduced by Breusch – Godfrey to determine serial correlation among the estimated variables in the model; the result of serial LM test superseded that of Durbin –Watson statistics. The result below

reusch-Godfrey Serial Correlation LM Test:

-statistic	021610	Prob. F(2,4)	9787
bs*R-squared	117584	Prob. Chi-Square(2)	9429

est Equation:
ependent Variable: RESID
ethod: Least Squares
ate: 11/12/20 Time: 05:44
ample: 2009 2019
cluded observations: 11
resample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.005880	10.15476	0.099055	0.9259
ATM	-0.000401	0.003597	-0.111608	0.9165
POS	0.003861	0.030715	0.125702	0.9060
MB	-0.001723	0.010946	-0.157407	0.8826
ITB	-0.008509	0.112639	-0.075546	0.9434
RESID(-1)	0.164608	0.859524	0.191511	0.8575
RESID(-2)	-0.046715	0.669110	-0.069816	0.9477

The test technique is asymptotic test that relied heavily on the result of chi-squared test. The result shows that absence of serial correlation among the variables as evidence from the Chi-squared coefficient and probability result of 0.9787 and

0.9429. The result of LM supersede the result of Durbin –Watson statistics above. We therefore conclude that our variables exhibit the absence of ser

Heteroskedasticity Test

The test technique was introduced by Breusch Pagan – Godfrey to determine the constant variance of the variables in the model. It is diagnostic technique for constant variance determination; below is the econometric output; Heteroskedasticity Test: Breusch-Pagan-Godfrey

-statistic	.251157	Prob. F(4,6)	.8989
Obs*R-squared	.577656	Prob. Chi-Square(4)	.8128
caled explained SS	.431337	Prob. Chi-Square(4)	.9798

Est Equation:
 Dependent Variable: RESID^2
 Method: Least Squares
 Date: 15/12/20 Time: 08:58
 Sample: 2009 2019
 Included observations: 44

Variable	Coefficient	Std. Error	Statistic	Prob.
C	6.38233	2.66026	.807781	.4500
ATM	.004788	.009715	.492788	.6397
POS	.028961	.090904	.318588	.7608
MB	.020802	.026944	.772055	.4694
ITB	.002376	.420059	.005657	.9957
Adjusted R-squared	.723423	Mean dependent var	5.58794	
Adjusted R-squared	.627628	S.D. dependent var	2.16377	
S.E. of regression	6.48202	Akaike info criterion	.693764	
Sum squared resid	207.784	Schwarz criterion	.874626	
Log likelihood	8.31570	Hannan-Quinn criter.	.579756	
-2ln likelihood	.251157	Durbin-Watson stat	.225686	
Prob(F-statistic)	.898911			

The result of the Chi-squared probability figures indicates that variance of the variables are constant

Recommendation

Based on the findings, we recommend the following;

1. There is significant need for increased public education and awareness on the benefits of automated teller machine to enhance financial innovation in Nigeria.
2. The banks must improve service quality and customer responsiveness in cases of lost or stolen cards, frauds, and other customer complaints in relation to point of sale.
3. There is additional need for ensuring ease of use, and customer interactive features in mobile and on-line shopping systems in Nigeria.
4. Management of banks should from time to time train customers with regard to internet banking, its benefits, risk exposure, physical and internet security to avoid financial loss in the hands of hackers. This will enhance their technical
5. The study equally recommends that the monetary authorities in Nigeria should harmonize monetary policy rate to encourage banks in allocating credits to the different sectors of the economy.
6. The government should adopt policies that will alleviate poverty and increase the income per capita of citizenry in the country.
7. Educational promotional tools should be actively encouraged in the country because the level of education is another measure of economic development.
8. The government should give incentives to companies and entrepreneur to enable them increase their aggregate output which will lead to economic development

which conforms to the classical linear regression model

competence which will rob off positively on their operations with a positive spill-over effect on the entire economy.

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Crypto Currency Trading and The Impact On Global Digital Finance

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Abstract

The research work examined the impact of cryptocurrencies on the global financial market between 2005 to 2021 respectively. Global financial market was proxy by international liquidity whereas, cryptocurrencies was proxy by Bitcoin, Ethereum, Tither and Binance coin. Questionnaire were distributed to investors in cryptocurrencies and global financial market within the sample size of 1500. The raw data obtained were scaled using the linkel method to produce acceptable data for econometric analysis. In analyzing the data, the researcher employed econometric techniques such as Box Jenkin Q Statistic and EGARCH model to examine the linear dependency and volatility rate of cryptocurrencies in the global financial market. The test result revealed the absence of linear dependency and increase in exponential volatility rate in the currencies.

Keyword; Box Jenkin Q Statistic, EGARCH model, Cryptocurrencies, international liquidity

1.0 Background to the Study

According to Bartoletti, Carta, Cimoli, & Saia, (2017) the universal financial system is absolutely embracing the current evolution from physical currency to almost virtual currencies through the medium of technology. However, there have been many attempts at producing a digital currency during the 90s tech boom (Bech, 2017). Bitcoin was introduced in early 2009 by a group of programmers under the alias Satoshi Nakamoto. Cryptocurrency is described as a digital recordkeeping device that uses balances to keep track of trading obligations, which is publicly known to all traders. Some of the forms of crypto currencies include Ethereum, Bitcoin etc. However, since the introduction of Bitcoin in 2009, several private cryptocurrencies have been introduced, but Bitcoin has been generally adjudged as the most successful one. According to Gilbert &Loi (2018), cryptocurrencies are mainly designed to function without independent regulation and are protected from being exposed to government authorities for control. Moreover,

many central banks begin to discover the adoption of blockchain technologies and cryptocurrency for retail and large-value payments. (Bartoletti et al., 2017)

Admission of cryptocurrency into the Nigerian financial sector is gaining wide popularity but with fears and doubt about its functionality since no regulatory framework from the apex bank exists. But there is a broad call for Central Bank of Nigeria to begin a proper regulatory action. Nevertheless, it is appropriate to note that the Central Bank of Nigeria financial policy restrictions on foreign exchange have steered Nigerians to modernize bitcoin to access foreign exchange. Hence, eliminating the currency would be seen as unreasonable and unworthy of a country that seeks to promote domestic innovation. Thus, it may be found significant if they join several other countries to accept its operation in Nigeria. Therefore, the problem confronting this study is determining cryptocurrency's effect on the Nigerian economy.

1.2 Statement of Problem

Cryptocurrencies, and particularly Bitcoin, have been recently a subject of many studies and analyses mainly in terms of their economic

properties. The analyses, such as of Pattison (2011), Hamacher and Katzenbeisser (2011), Britto and Castillo (2013) or Combs and Mitsoff

(2014) are usually focused on very narrow range of functions of cryptocurrencies, and lack the broader context. The study shall focus on the impact of cryptocurrencies trading on the global digital finance using the event study to generate data and subsequently applying econometric tools to reach at a reliable conclusion.

1.3 Hypotheses

- Bitcoin trading does not impact on the global financial market
- Ethereum trading is not volatile in the global financial market.
- Tether trading does not impact positively and significantly on the global financial market.
- Binance Coin volatility trading does not impact significantly on the global financial market

1.4 Significant of the Study

The research study will be significant to financial investors who probably intend to invest in financial securities through the use of digital finance, this will further expose the relevancy of digital finance to policy holders in the economy. Digital finance can also be applied to other field in finance such as investing in portfolio of assets rooted in cryptocurrencies.

Conceptual Review

Cryptocurrencies is designed to serve as a medium of exchange. The "crypto" prefix comes from the fact that cryptocurrencies use cryptography to secure and verify transactions as well as create new currency units (coins). Cryptography makes it easy to encode something that is easy to decipher with a key and difficult to decipher without a key, which means that coins can be difficult to create, but transactions can be easy to verify.

At their core, cryptocurrencies are entries in an immutable and pseudo-anonymous database—known as a "[blockchain](#)"—that no one can change (except under extreme circumstances when direct edits are made). The blockchain is a public record that is verified by many different nodes, which makes counterfeiting coins extremely difficult or impossible. It also makes it easy to trace any specific transaction between anonymous individual accounts or wallets.

Cryptocurrencies offer an easy-to-use, digital alternative to fiat currencies. Consumers from the United States or European Union may view cryptocurrencies as a novelty, but there are many countries with mismanaged domestic currencies.

For example, Venezuela's authoritarian regime has become infamous for its [skyrocketing inflation](#), which has led to plummeting living conditions for millions of citizens without access to external currencies.

Other countries have strict capital controls in place to control the flow of money and/or charge high taxes. Cryptocurrencies can be used to circumvent these capital controls and taxes—legal or not—which has led to increased demand on the part of consumers and businesses. For this reason, many countries have started cracking down on the illegal uses of cryptocurrencies for tax evasion or illegal purchases or sales abroad.

The official response to cryptocurrencies has been lukewarm at best across [central banks](#) and financial institutions. While there are some organizations that have been supportive of them, many central banks remain cautious given the market's extreme volatility. Issues with tax evasion and capital controls also have led to some widespread concerns.

United States Federal Reserve: U.S. Federal Reserve Chairman Jerome Powell believes that technical issues remain, and governance and risk management will be crucial before cryptocurrencies become part of mainstream society.

European Central Bank: Former European Central Bank Vice President Vitor Constancio called Bitcoin a "tulip" in reference to the 17th-century bubble in the Netherlands, and many other governors have expressed similar skepticism.

People's Bank of China: The People's Bank of China believes that conditions are "ripe" to embrace cryptocurrencies, but the central bank wants full control, and authorities are cracking down on the cryptocurrency ecosystem in the country.

Bank of Japan: The Bank of Japan doesn't see a market for cryptocurrencies.

Bank of England: Former Bank of England Governor Mark Carney called cryptocurrencies part of a "revolution" in finance, making the central bank one of the few governmental proponents of the technology.

The Venezuelan government, facing capital restrictions of its own, launched its own cryptocurrency in 2018—called the "petro"—that's allegedly backed by barrels of crude oil.

While official sources indicate that the country raised billions of dollars, many analysts are skeptical of these figures and the United States has outlawed U.S. citizens from purchasing the cryptocurrency.

Impact on Global Investments

Cryptocurrencies have many benefits when it comes to frictionless transactions and inflation control, but many investors are adding these currencies as assets to their diversified portfolios. In particular, the noncorrelated nature of the market makes cryptocurrencies a potential hedge against risk, similar to precious metals like gold. Many cryptocurrency [exchange-traded products](#) (ETFs and ETNs) have arisen for this very reason.

On the other hand, some experts fear that a cryptocurrency crash could have an adverse impact on the wider market, similar to how [mortgage-backed securities](#) sparked a wider global financial crisis. It's worth noting that the total market capitalization of all cryptocurrencies, which is between one and two trillion dollars as of now, is still less than that of some large public companies, such as Meta (formerly Facebook) or Amazon.² Yet, cryptocurrencies as an asset class is a new and dynamic prospect that can go in either direction. In the end, many investors view cryptocurrencies as either a vehicle for speculation or a hedge against inflation, but the size of the market doesn't represent a systemic risk as of 2021.

Benefits of cryptocurrencies

Cryptocurrencies have the potential to enable social and economic growth throughout the world, including in developing countries, by offering easier access to capital and financial services.

1.A Beneficial Rise in Economic Activities

There is already an entire industry built around cryptocurrencies and it's held by institutions dedicated to supervising all the digital coin exchanges taking place throughout the world. The rate at which the cryptocurrency industry is growing is earth-shattering and this can be confirmed by early adopters that became rich overnight and found opportunities to grow financially. Bitcoin, the most famous of these cryptocurrencies, has already permitted many people and companies to develop and flourish, while many also rely on trading as their source of

income. The economy is slowly shifting to adapt to these needs and cryptocurrencies have a great potential in satisfying them.

2. Great Opportunities for Poorly Banked Countries

More than a third of the world population does not have access to basic banking services that can help them out in case of a personal financial crisis - loans, checking accounts and the list can go on. These people that in most cases are already financially disadvantaged typically resort to doubtful and dangerous lending practices. The interest rate of these practices is anything but fair, which consequently leads to more instability among the people who requested the loan. This is where cryptocurrencies come in with their high volatility and ease-of-use.

There are now many apps and programs that facilitate the use of cryptocurrencies and bring them closer to the wider audience. An added benefit of cryptocurrency use is that it's completely decentralized, so trading can be done freely across borders. The use of technology will facilitate a financial revolution that will leave everyone more financially connected, empowered and enabled.

3. Low Transaction Costs

Because cryptocurrencies and blockchain don't need an actual brick-and-mortar building to exist, the costs associated with their transacting are minimal. There is no need for employee wages, utility bills or rent to be paid, so these savings naturally morph into low transaction fees. This in turn encourages more and more people to trust these new financial tools and start transacting, allowing for the global economy to be more closely intertwined. And depending on the broker you choose, you can even trade with no minimum deposit requirements - as offered by CryptoRocket, for example.

4. Increased Transparency of Transactions

Since all blockchain and cryptocurrencies transactions are automated and digitized, they are all tracked in a distributed ledger. The best part about it is that it cannot be manipulated by either people or companies, which greatly diminishes the risk of fraud and corruption. This means that underdeveloped countries also have a greater chance of entering the financial transactions game and boost their own economy and social prospects. What's more, citizens will be able to keep track of

where state funds will be oriented and will thus have a say within their own political climate.

5. More Power to Entrepreneurs

There is never been a more prosperous time to do business than it is now, in the sense that blockchain technology and cryptocurrencies can help entrepreneurs receive payments in more currencies. BitPesa is one such company that helps business owners in Africa make financial transactions with European, American and Asian companies. The aim is to help small and medium business everywhere get better financial coverage and a liberated financial connection with the rest of the world. By using BitPesa and TenX's digital wallet, entrepreneurs are able to quickly convert altcoins into fiat currencies that they can later redirect to business investments, purchases and payments.

The world is changing and it's changing quickly. The speed at which cryptocurrencies are taking over is a clear indicator that traditional financial institutions can no longer hold the fort so well and that other financial needs are arising and need to be addressed. Similarly, the world is facing a growing need to tear down borders, in search of a complete social and financial inclusion - this blockchain technology has everything it needs to address such issues.

It will only be a matter of time until these cryptocurrencies definitively find a way into our lives, shaping them for the better, with economic growth and inclusion in mind. Millions of people will now have the opportunity to invest, send money across borders, save money and start a business thanks to the amazing possibilities that cryptocurrencies bring to the table.

2.0 Finance theories on Cryptocurrencies

Mises Regression Theorem

The regression theorem assumes that all money must ultimately derive their purchasing power from a historical tie to a commodity that was valued in a state of barter. The theory of the value of money is able to trace the objective exchange value of money only to that point where it is no longer the value of money but just the value of a commodity (Jeffrey, 2014). In this way one can continually go further and further back and must eventually get to a point where one can longer find any component in the objective exchange value of money which emanates from valuations based on the function of money as a medium of exchange.

At this point, the value of money is nothing other than the value of an object that is useful in some other way than as money. Mises solved this circularity through the regression theorem. Mises further identified that people expect future purchasing power based upon current and previously observed purchasing powers. For the regression theorem to work, a medium of exchange must already have the attributes necessary for a medium of exchange, having a price and be accepted on the market.

Charles Dow Theory

According to the Dow theory, the importance of these upward and downward movements is their position in relation to previous fluctuations. This method teaches investors to read a trading chart and to better understand what is happening with any asset at any given moment. With this simple analysis, even the most inexperienced can identify the context in which a financial instrument is evolving. Furthermore, Charles Dow supported the common belief among all traders and technical analysts that an asset price and its resulting movements on a trading chart already have all necessary information already available and forecasted in order to make accurate predictions.

Dow theory trading strategy

Most trading strategies used today hinge on one key concept, the "trend". This was a novel idea when Charles H. Dow published his writings at the end of the 19th century. However, more than a century later, the Dow Jones Industrial Average market index, created by the American journalist to illustrate his theory, is probably now the most followed index on the planet.

Methodology

The researcher seek to use the event study to capture the volatility of trades on the global financial market and that of cryptocurrencies trading. However, the study shall attempt also to introduce the expo facto design which depends on after the fact probability. The researcher use international liquidity as a proxy to global financial market while Bitcoin, Ethereum, tether and Binance coin are proxy of cryptocurrencies. Primary data is obtained from investors across the globe such as; investors in cryptocurrencies and international market within a sample size of 1500. The primary data obtained is scaled using the Linkel scaling method to arrive at acceptable data

use for econometric analysis. The econometric techniques apply on the data include, Box Jenkin Q Statistic BJ Statistic was postulated by Box and Pierce (1970), Ljung and Box (1978) as a test for linear

dependency and auto correlation in time series data, symbolically.

:

$$Q^* = T (T+2) \sum_{L=1}^N A^{JL} x^2 N T-L$$

Where:

Q^* = Computed statistic for the Box Jenkin

T= the sample size

N = maximum lag length

L= the lag operator

A^{JL} = Autocorrelation coefficient at a given length which is given as:

$$= \frac{\sum_{i=1}^{n-1} (X_i - E(X)) (X_{i+L} - E(X))}{\sum_{i=1}^N (X_i - E(X))^2}$$

Where:

X_i = the series under investigation

$E(X)$ = the expected value or mean of the series.

EGARCH Model.

EGARCH model was credited to Nelson (1991); the conditional equation is given by:

$$\ln(\sigma^2_t) = w + \beta \ln(\sigma^2_{t-1}) + \gamma \frac{u_{t-1}}{\sqrt{\sigma^2_{t-1}}} + \delta \left[\frac{|u_{t-1}| - \sqrt{2}}{\sqrt{\sigma^2_{t-1}}} \right]$$

Where:

$\ln(\sigma^2)$ is the conditional variance of volatility and return.

Test of Hypotheses

The hypotheses estimated above to test the impact of cryptocurrencies trading on the global financial market will be examine with the model designed by the researcher to capture the relative impact of each cryptocurrencies on the global financial market.

$$ITL = F [BC^2, ET^2, TER^{1/2}, BIC^{1/2}]$$

$$ITL = \sum A + BC^2 + ET^2 + TER^{1/2} + BIC^{1/2} + \beta$$

Where,

ITL = International Liquidity

$\sum A$ = Exponential Constant

BC^2 = BitCoin Trades

ET^2 = Ethereum Trades

$TER^{1/2}$ = Tether Trades

$BIC^{1/2}$ = Binance Trades.

$BC^2 + ET^2$ explains the rate of volatility resolving within such currencies while $TER^{1/2}$ and $BIC^{1/2}$ is half of its counterpart like Bitcoin and Ethereum.

shows the exponential sluggishness by investors in using them for trading, theses further relates to the speed and volatility resolving such currencies

Econometric Analysis

Testing for linear dependency

Linear dependency is a valid claim of serial-correlation and absence of random walk behaviour of currencies which can make prediction of future prices using past prices possible thereby allowing for inefficiency in the

market; we employed Box Jekin Q statistic (BJ) to determine serial correlation in the movement of currencies in global financial market. The output of the BJ test are produced in table 1.1 below;

Included observations: 20

Autocorrelation	Partial Correlatio	AC	PAC	Q-Stat	Prob	
. .	. .	1	0.023	0.023	0.0134	0.908
. .	. .	2	0.032	0.031	0.0400	0.980
. * .	. * .	3	-0.08	-0.08	0.2210	0.974
. * .	. * .	4	0.100	0.103	0.5128	0.972
. .	. .	5	-0.01	-0.01	0.5192	0.991
. .	. .	6	0.002	-0.01	0.5193	0.998
. .	. * .	7	0.068	0.088	0.6827	0.998
. .	. .	8	0.038	0.020	0.7365	0.999
. * .	. * .	9	-0.07	-0.08	0.9785	0.999
. * .	. * .	10	-0.13	-0.11	1.7582	0.998
. * .	. * * .	11	-0.20	-0.20	3.6949	0.978
. .	. .	12	-0.04	-0.05	3.7964	0.987

Note that as a rule of thumb, the upper and lower band is given as $\pm (1.96*1/T^{1/2})$ where T is the number of observation (20); in our case, the upper and lower band is +0.4 and -0.4, it is therefore considered to be significance if the first and second coefficient of the autocorrelation and partial autocorrelation falls outside the band.

Table 1.1 shows the result of the BJ test, it is discovered that the first and second coefficients of the autocorrelation and partial autocorrelation falls within the band. Therefore, in line with the rule of thumb, the coefficients of the

autocorrelation and partial autocorrelation are insignificance which indicates acceptance of the null hypothesis of no autocorrelation at 99% level of confidence. Therefore, the BJ test revealed the absence of linear dependency in the global financial market.

Volatility testing

We employed EGARCH model to examine the conditional variance of volatility and return. The presence of volatility clustering indicates absence of random walk hypothesis in currencies. The output is shown in table 1.2 below

EGARCH result of volatility and return

Variable	Coefficier	Std. Error	z-Statistic	Prob.
SECOND	2.119780	0.000188	11275.34	0.0000

THIRD	-1.073003	1.9E-104	-5.6E+103	0.0000
Variance Equation				
C(3)	2.547057	0.379199	6.716939	0.0000
C(4)	-2.226822	0.267618	-8.320907	0.0000
C(5)	-0.014369	0.227252	-0.063230	0.9496
C(6)	0.285477	0.141858	2.012409	0.0442

The result shows that the coefficient of the international liquidity while cryptocurrencies was conditional variance is not actually persistent and that proxy by Bitcoin, Ethereum, Tether and Binance coin. the negative coefficient indicates that volatility of the The result shows the international financial market present period cannot influence returns of the next depend on cryptocurrencies trading. period. Therefore, the result shows the absence of The researcher therefore recommend the followings; volatility clustering and concludes that random walk Cryptocurrencies trading in the financial global market hypothesis is actively presence in the behaviour of should be modify to suit different investor needs, as currencies in the financial global market which these will further improve the liquidity obtained from actively influence the market performance. the global financial market.

Conclusion and Recommendations

The research study examined the impact of to meet the need of the financial market. cryptocurrencies trading on the financial global market. Policies should be all inclusive where currencies can be market. Financial global market was proxy by traded within the world without limits.

2. Cryptocurrencies trading should be given a proper place in the financial market so that trades can be harmonize

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Presidential Amnesty Programme and Youth Militancy in the Niger-Delta: A Study of Southern Ijaw Local Government Area of Bayelsa State, Nigeria

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Abstract

This study investigates whether presidential amnesty programme initiated by the federal government of Nigeria has succeeded in reducing the high wave of youth militancy in the Niger-Delta region of Nigeria. With the aid of the study objectives, two hypotheses were formulated in the study. A target population of 200 inhabitants of the study area was adopted for the study. The simple random sampling and purposive sampling techniques were variously applied in the study at different stages. The summation of all the responses was presented using frequency distribution tables and simple percentages, while the chi-square statistical tool was employed to test the hypothesis formulated in the study. The test statistics reveals among others that, presidential amnesty programme in the form of educational training accrues to limiting youth piracy in Southern Ijaw Local Government Area. The study concludes and recommends among others that, Nigerian government in its magnanimity should uphold and continue to sustain its initiative on presidential amnesty programme in the form of educational training to the militant youths in the Niger-Delta as this would accrue to limiting the chances of the youths in indulging in militant activities such as youth piracy.

Keywords: Youth, Amnesty, Militancy, Programme, Presidential

Introduction

It is laudable to note that the calamity in the Niger-Delta region of Nigeria arising from the actions of the diverse militant groups operating in the region has ushered in some depressing consequences, not only on oil production and other economic activities but also on governance in general (Ejibunu, 2007). Kidnapping and hostage taking of oil expatriate workers in the multinational oil corporations has been the primary target of the militant groups in the Niger-Delta. The Nigerian economy has been affected due to the hostage taking of expatriate workers by the militants. In addition, security agencies cannot satisfactorily cover up the locations of different oil facilities due to the operations of the militants in the Niger-Delta (Wojuade, 2019).

Similarly, Ugor (2013) maintained that the oil income of the multinational oil corporations and the Nigerian government have been impacted due to the armed conflict by the militants. In spite of government's attempts by means of military options in handling the problem of youth militancy, it proved inadequate. Although a lot of ex-militants had surrendered their weapons in addition to government's investment of huge amount of money in the amnesty programme, situation of things remained the same for the militants.

Aaron (2010) maintained that, on the 25th June, 2009, late President Umaru Musa Yar'Adua, announced an amnesty programme for the militants who were eager to submit their

weapons. The amnesty programme was in three phases namely; disarmament, demobilization and reintegration. Ebo (2022) stressed that the armed struggle in the Niger-Delta resulting into bombing of oil pipelines and oil production facilities reduced drastically due to the introduction of the presidential amnesty programme. The programme assisted in putting to a stop, regular attacks and kidnapping of oil expatriate workers thereby improving oil productions and revenues. In their quest, Osah and Amakihe (2014) narrated that the presidential amnesty programme gave opportunity to those who have the interest of going back to school to do so. The amnesty programme has equally helped good number of ex-militants to be admitted into various disciplines in tertiary institutions around the world. While 2,922 beneficiaries graduated from offshore centres, 5,145 had previously concluded vocational training in Nigeria ranging from sea fairing, boat building, welding, electrical installation, information communication technology, oil drilling and marine related courses, safety management, carpentry and ocean diving etc. Aghedo (2013) argued that notwithstanding the absolute achievement actualized by the amnesty programme, crisis still persists in the region. In his own reaction, Atuloma (2018) maintained that, although the angry youths in the Niger-delta region have succumbed due to interventions from well meaning Nigerians and Nigerian government through the amnesty programme. However, the condition of things has not really changed for good for the teeming youths. There is increased rate of unemployment and poverty amongst the youths thereby prompting them in engaging into various antagonistic activities such as vandalizing oil pipelines for oil theft and kidnap of oil expatriate workers in order to make fortune for survival. Ikelegbe and Umukoro (2014) criticized the amnesty programme and the implementation arrangement for neglecting the aspirations of decisive stakeholders, including civil society actors. This limits the programme's ability towards reducing youth piracy and restore sustainable peace in the region. Ikelegbe and Umukoro further argued that, the efforts put in place in actualizing the aims of the presidential amnesty programme have not translated into effective accomplishment plan. Rather, the

programme was designed to mislead the militants and allow oil exploration without addressing the impoverished state of the region.

Statement of the Problem

Since the emergence of militant groups in the Niger-Delta region of Nigeria, the velocity of insecurity of lives and properties has escalated than before. The militant's activities which include kidnapping and oil bunkering, has kept the region at risk as well as a major peril to oil multinationals and source of revenue in Nigeria (Ajiye, 2015). Having introduced the presidential amnesty programme by the federal government of Nigeria for the militant youths in the form of educational training for the militant youths to acquire degrees in higher institutions, and vocational training on welding and fabrications as well as plumbing and woodworks for the militant youths to acquire relevant knowledge, skills and values however, it appears that youth militancy in the Niger-Delta in the form of youth piracy and oil pipeline vandalism are still on the increase. This study therefore, investigates whether presidential amnesty programme has succeeded in curbing down or reducing the high wave of youth militancy in the Niger-Delta using Southern Ijaw Local Government Area of Bayelsa State as the study locale.

Research Questions

- i. Does presidential amnesty programme in the form of educational training accrues to limiting youth piracy in Southern Ijaw Local Government Area?
- ii. Has presidential amnesty programme in the form of vocational training helps in reducing oil pipeline vandalism in Southern Ijaw Local Government Area?

Objective of the Study

The general objective of this study is to investigate the nexus between presidential amnesty programme and youth militancy in Southern Ijaw Local Government Area of Bayelsa State, Nigeria. While the specific objectives are:

- i. To ascertain whether presidential amnesty programme in the form of educational training accrues to limiting youth piracy in Southern Ijaw Local Government Area?
- ii. To determine whether presidential amnesty

programme in the form of vocational training helps in reducing oil pipeline vandalism in Southern Ijaw Local Government Area?

Research Hypothesis

- H₀₁:** Presidential amnesty programme in the form of educational training does not accrue to limiting youth piracy in Southern Ijaw Local Government Area?
- H₀₂:** Presidential amnesty programme in the form of vocational training does not help in reducing oil pipeline vandalism in Southern Ijaw Local Government Area?

Conceptual Clarifications

Conceptualizing Presidential Amnesty Programme

On the 25th of June, 2009, President Umaru Musa Yar'Adua announced an amnesty for militant groups in the Niger-Delta. The presidential amnesty programme was an initiative of Federal Government of Nigeria with the intension of eliminating youth's restiveness in the Niger-Delta region of Nigeria and refurbish revenue generation by means of oil exploration in the region (Ebiede, 2016). According to Ikelegbe and Umukoro (2014), the declaration of the amnesty was a chance given to the ex-militants in the Niger-Delta region to welcome amnesty and lay down their arms and ammunitions in switch over for presidential forgiveness. Likewise, the amnesty programme arouse due to different steps put in place by different bodies including the 'Legislative Retreat' put in place by the states in the South-South region of Nigeria. The communiqué was anchored on critical issues affecting the Southern part of the country which include granting amnesty for militants. Adebowole (2018) maintained that the amnesty programme taken to last for five years witnessed large number of militants laying down their weaponry within the 60 days time frame. Granting amnesty to the militants is subject to the lay down of weaponry and all documents related to militant actions and beneficial to militants who were sanctioned for actions related to confrontational activities.

The presidential amnesty programme was in phases: Disarmament, Demobilization and Reintegration (DDR) (Aaron, 2010). In their own reaction, Nwachukwu and Pepple (2011) buttressed that disarmament of militants brought about the physical deletion of the means of

fighting by the ex-militants. Demobilization entails the official and restricted functions of lively militants from armed groups and the provision of support packages to individual militants in momentary centres. While, reintegration entails the practice of reintegrating the ex-militants into civil society making sure that they do not engage in crisis with arms. Kuku (2012) averred that, it is remarkable that the amnesty was not an imposition by President Umaru Musa Yar'Adua rather, it was an initiative to be generously and personally selected by the militants within a time frame of barely two months. Also, the tendencies of full and unrestricted forgiveness were granted to the militants who welcomed the amnesty programme. Ebo (2022) narrated that the immediate outcome of the presidential amnesty programme was the stoppage of carrying weapons and youth restiveness in the Niger-Delta. Thousands of militants willingly welcomed the amnesty programme and put down their weapons. Also, the militant leaders in their entirety acknowledged the programme efficiently and discontinue youth restiveness in the Niger-Delta region.

Conceptualizing Youth Militancy

Militancy can be understood as the act of individuals, groups, or parties displaying or engaging in violence usually for a cause, whether religious, political, ideological, economic, or social. Nowadays, the term militant is synonymously used in the term "terrorist" (Quamruzzaman, 2010). In their own reaction, Chindah and Braide (2000) averred that militancy is a state or condition of being combative or disposed to fight for a cause or belief. It has also been seen as a violent response by an individual, group or sect in a region, community, state or nation due to claim of underdevelopment, political oppression, religious beliefs, and segregation. Youth militancy can be seen as an antagonistic and holistic activities by the youths mainly from the oil producing communities in order to showcase their grievances over issues of negligence at times by multinational oil corporations not performing their corporate social responsibilities to the host communities and inability of government to address tenaciously some of the challenges bedeviling the socio-economic development of the oil producing

communities in Nigeria. The holistic activities from the youth militants can come in the form of oil pipeline vandalism for oil theft, destruction of oil equipment and installations, kidnap of oil expatriate workers etc.

According to Ejibunu (2007), the history of militancy in Nigeria can be linked with Isaac Adaka Boro's led movement in 1966 for flaxen agreement with the Niger-Delta region through a revolution amid his Delta Volunteer Service (DVS) against the federal government. Despite the fact that government flattened the revolution however, the revolution rekindled the awareness in the mindset of the people on their prerogative to access their natural resources. Wojuade (2019) narrated that, later than ten years of Ken Sarowiwa's execution, the potential consequences of the Niger-Delta militancy and conflict have escalated in both human and economic terms. This gave rise to the emergence of various militant groups to undermine the activities of the oil companies using different strategies thereby daring the Nigerian State. Prominent among such groups are the Movement for the Emancipation of the Niger-Delta (MEND), the Joint Revolutionary Council (JRC), and the Niger-Delta People Volunteer Force (NDPVF). Wilson (2012) noted that the militant groups in the Niger-Delta region have been engaged in steady antagonism on the Nigerian state, multinational oil corporations, and prominent personalities for fortune and not mounting pressure for the overall advancement of the region. In order to actualize their objectives, the militants indulge in abducting expatriate workers and all sorts of unenthusiastic actions thereby causing harm to the entire citizenry.

Methodology

The survey research design was adopted in this study. The survey research design was adopted to investigate empirically, whether the presidential amnesty programme initiated by the federal government of Nigeria has helped in reducing the high wave of youth militancy prevalent in the Niger-Delta region of Nigeria using Southern Ijaw Local Government Area. Southern Ijaw Local Government Area was created in 1991 in accordance with the 1976 Local Government Reform that was officially established in the nation. Southern Ijaw Local Government Area is made up

Theoretical Framework

The human capital theory was adopted as the theory suitable to guide this work. The human capital theory emphasizes how manpower training and development programmes increment the efficiency and effectiveness of workers by expanding the level of cognitive stock of financial profitable human capacity, which could be an item of natural capacities and speculations in human creatures (Kessler & Lulfesmann, 2006). The implication and relevance of the human capital theory as it applies to this work is that, the theory accrues to developing the knowledge, skills, values, and behaviours of workers for the betterment of the workers and organizations at large. The human capital theory emphasizes the need for government, policy makers, civil society organizations, and philanthropists to initiate intervention programmes such as presidential amnesty programme and map out the necessary finance or resources needed for actualizing the benefits of the programmes as this would enable the militant youths in the Niger-Delta and Nigeria in general to be tenaciously empowered and acquire not only educational and vocational training but knowledge, skills, values, ideas, attitudes and aspirations. Also, the youths would be gainfully employed in different establishments as well as set up their own businesses which in turn uplifts their status and moral conducts and reduce or put to a stop the high wave of youth militancy such as youth piracy, oil pipeline vandalism, destruction of oil equipment and installations, and kidnap of oil expatriate workers that is prevalent in the Niger-Delta region of Nigeria.

of seventeen wards namely: Ammasoma 1, Ammasoma 2, Ammasomma 3, Apoi, Central Boma 1, Central Boma 2, East Boma 1, East Boma 2, Foropa, Koluama, Oladiama 1, Oladiama 2, Oporoma 1, Oporoma 2, Otuan, Ukubie, and West Boma (Wikipedia, 2022). The study adopted both the qualitative and quantitative research methods. The target population of this study consists of 200 inhabitants of Southern Ijaw Local Government Area. They consist of 100 youths who have benefited from the presidential amnesty programme and 100 persons who are residents in Southern Ijaw

Local Government Area. The reason for the target population is to generate tactful and relevant information based on the phenomena under study. Due to the fact that the target population of the study was deemed convenient for the study the sample size was not determined. In order to ensure effective coverage for the study, the simple random sampling technique was applied in this study to select ten wards out of seventeen wards in Southern Ijaw Local Government Area. Also, in order not to be bias the purposive sampling technique was adopted in this study in order to determine the number of respondents to be drawn from each of the selected wards because the population of all the communities/wards in 2006 census population in Nigeria has not been officially released. The primary and secondary sources of data collection were applied in this study. The primary sources consist of questionnaire while the secondary sources consist of information gathered from published

works. The indicators of the independent variable ‘Presidential Amnesty Programme’ are: educational training, and vocational training; while the indicators of the dependent variable ‘Youths Militancy’ are: youth piracy, and oil pipeline vandalism. The questionnaire was structured in Likert format with a four-point response scale. In the closed ended questionnaire, the respondents were given response options. These options served as the quantification of the respondent’s agreement or disagreement on a particular scale. The designated quantifications that were used in the questionnaire are: Strongly Agree - 4, Agree -3, Disagree -2, and Strongly Disagree 1. Out of 200 copies of questionnaire distributed, 193 copies were successfully retrieved. Data generated from the field were presented using frequency distribution tables and simple percentages, while the chi-square (χ^2) statistical tool was used to test the hypothesis formulated in the study.

The formular for chi-square is shown below,

$$X^2 = \sum \frac{(O-E)^2}{E}$$

Where,

X^2 = Chi-square

Σ = Summation Sign

O = Observed Frequencies

E = Expected Frequencies

Given the above formular, to calculate the expected frequency of a cell the formular runs thus;

$$\Sigma F = \frac{\text{Row Total} \times \text{Column Total}}{\text{Grand Total}}$$

Accommodating the unforeseen chance factors, the researcher sets the level of significance at 5%. Also, the degree of freedom is determined in order to apply the chi-square (χ^2) text.

$$df = (r-1) (c-1)$$

r = Number of Rows

c = Number of Columns

Decision Rule

1. If the calculated value of chi-square (χ^2) is greater than the critical value of chi-square (χ^2), reject the null hypothesis.
2. If the calculated value of chi-square (χ^2) is less than the critical value of chi-square (χ^2), accept the null hypothesis.

Data Presentation

Research Question: Does presidential amnesty programme in the form of educational training accrues to limiting youth piracy in Southern Ijaw Local Government Area?

Table 1: Respondents perception on whether presidential amnesty programme in the form of educational training accrues to limiting youth piracy in Southern Ijaw Local Government Area?

No	Items	SA	A	D	SD	Total
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1.	Schooling in tertiary institutions as part of presidential amnesty programme has helped in reducing youth piracy in Southern Ijaw Local Government Area?	47 (24.3%)	84 (43.5%)	28 (14.5%)	34 (17.6%)	193 (100)
2.	Incidents of oil bunkering have reduced because youths acquire scholarships through presidential amnesty programme?	74 (38.3%)	57 (29.5%)	29 (15.0%)	33 (17.1%)	193 (100)
3.	No matter the introduction of presidential amnesty programme on education, youth piracy is highly experienced in Southern Ijaw Local Government Area?	41 (21.2%)	34 (17.6%)	52 (26.9%)	66 (34.2%)	193 (100)
Total		162	175	109	133	579

Source: Field Survey, 2022.

Table 1 shows the respondents perception on whether presidential amnesty programme in the form of educational training accrues to limiting youth piracy in Southern Ijaw Local Government Area. In question 1, out of 193 respondents, (24.3%) strongly agreed that schooling in tertiary institutions as part of presidential amnesty programme has helped in reducing youth piracy in Southern Ijaw Local Government Area, (43.5%) agreed, (14.5%) disagreed, while (17.6%) strongly disagreed. In question 2, out 193 respondents, (38.3%) strongly agreed that incidents of oil bunkering have reduced because youths acquire

scholarships through presidential amnesty programme, (29.5%) agreed, (15.0%) disagreed, while (17.1%) strongly disagreed. In question 3 out of 193 respondents, (21.2%) strongly agreed that no matter the introduction of presidential amnesty programme on education, youth piracy is highly experienced in Southern Ijaw Local Government Area, (17.6%) agreed, (26.9%) disagreed while (34.2%) strongly disagreed. From table 1 above, it indicates that the respondents responded greatly that presidential amnesty programme in the form of educational training accrues to limiting youth piracy in Southern Ijaw Local Government Area.

Research Question: Distribution of respondents on whether presidential amnesty programme in the form of vocational training accrues to limiting oil pipeline vandalism in Southern Ijaw Local Government Area?

Table 2: Distribution of respondents on whether presidential amnesty programme in the form of vocational training accrues to limiting oil pipeline vandalism in Southern Ijaw Local Government Area?

No	Items	SA	A	D	SD	Total
4.	Presidential amnesty programme on vocational training on welding and fabrication has helped in reducing oil pipeline vandalism in Southern Ijaw Local Government Area?	52 (26.9%)	78 (40.4%)	34 (17.6%)	29 (15.0%)	193 (100)

5.	Vocational training on plumbing and woodworks as part of presidential amnesty programme empowers the youths and reduces their vulnerability in engaging in oil pipeline vandalism?	70 (36.3%)	61 (31.6%)	25 (12.9%)	37 (19.2%)	193 (100)
6.	No matter the relevance of presidential amnesty programme on vocational training, oil pipeline vandalism is highly experienced in Southern Ijaw Local Government Area?	34 (17.6%)	31 (16.1%)	59 (30.6%)	69 (35.7%)	193 (100)
Total		156	170	118	135	579

Source: Field Survey, 2022.

Table 2 shows the respondents perception on whether presidential amnesty programme in the form of vocational training accrues to limiting oil pipeline vandalism in Southern Ijaw Local Government Area. In question 4, out of 193 respondents, (26.9%) strongly agreed that presidential amnesty programme on vocational training on welding and fabrication has helped in reducing oil pipeline vandalism in Southern Ijaw Local Government Area (40.4%) agreed, (17.6 %) disagreed, while (15.0%) strongly disagreed. In question 5, out of 193 respondents, (36.3%) strongly agreed that vocational training on plumbing and woodworks as part of presidential amnesty programme empowers the youths and reduces their vulnerability in engaging in oil pipeline vandalism, (31.6%) agreed, (12.9%) disagreed, while (19.2%) strongly disagreed. In question 6, out of 193 respondents, (17.6%) strongly agreed that no matter the relevance of presidential amnesty programme on vocational training, oil pipeline vandalism is highly

experienced in Southern Ijaw Local Government Area (16.1%) agreed, (30.6%) disagreed, while (35.7%) strongly disagreed. From table 2 above, it indicates that the respondents responded greatly that presidential amnesty programme in the form of vocational training accrues to limiting oil pipeline vandalism in Southern Ijaw Local Government Area.

Statistical Analysis and Test of Hypothesis

Test of Hypothesis One

H₀: Presidential amnesty programme in the form of educational training does not accrue to limiting youth piracy in Southern Ijaw Local Government Area?

H_i: Presidential amnesty programme in the form of educational training accrues to limiting youth piracy in Southern Ijaw Local Government Area?

Hypothesis one was tested using the values of responses in questions 1, 2 and 3 respectively in table 1.

Table 3: Contingency Table of Observed Frequencies

Table	SA	A	D	SD	Table
1	47 _a	84 _b	28 _c	34 _d	193 _{B1}
2	74 _e	57 _f	29 _g	33 _h	193 _{B2}
3	41 _i	34 _j	52 _k	66 _l	193 _{B3}
Total	162_{A1}	175_{A2}	109_{A3}	133_{A4}	579_N

Source: Field Survey, 2022.

Table 4: Calculation of Expected Frequencies

Source: Field		Cell	$\frac{162 \times 193}{579}$ = 54	Cell	$\frac{162 \times 193}{579}$ = 54	Cell	$\frac{162 \times 193}{579}$ = 54	Survey, 2022.
Table 5: Observed and Frequencies for One		Cell	$\frac{175 \times 193}{579}$ = 58	Cell	$\frac{175 \times 193}{579}$ = 58	Cell	$\frac{175 \times 193}{579}$ = 58	
		Cell	$\frac{109 \times 193}{579}$ = 36	Cell	$\frac{109 \times 193}{579}$ = 36	Cell	$\frac{109 \times 193}{579}$ = 36	
0	54	A ₃ B ₁	-7	A ₃ B ₂	$\frac{(O-E)^2}{E}$	A ₃ B ₃	$\frac{(O-E)^2}{E}$	
47	54	Cell	-7	Cell	100	Cell	2.273	
84	58	A ₄ B ₁	26	A ₄ B ₂	400	A ₄ B ₃	7.407	
28	36		-8		64		1.778	
34	44		-10		100		2.273	
74	54		20		400		7.407	
57	58		-1		1		0.017	
29	36		-7		49		1.361	
33	44		-11		121		2.75	
41	54		-13		169		3.130	
34	58		-24		576		9.931	
52	36		16		256		7.111	
66	44		22		484		11	
Total							59.32	

Source: Field Survey, 2022.

From the contingency table,

$$\begin{aligned}
 DF &= (r-1)(c-1) \\
 &= (3-1)(4-1) \\
 &= 2 \times 3 \\
 &= 6
 \end{aligned}$$

Thus, DF = 6

Decision Rule: At 0.5 level of significance with 6 degree of freedom, the table value of chi-square is **12.592** while the calculated value of chi-square is **59.32**. Since the calculated value of chi-square (χ^2_{cal}) is greater than the table value of chi-square (χ^2_{table}), we accept the alternative hypothesis (H_1) which states that, presidential amnesty programme in the form of educational training accrues to limiting youth piracy in Southern Ijaw Local Government Area.

Test of Hypothesis Two

H₀: Presidential amnesty programme in the form of vocational training does not help in reducing oil pipeline vandalism in Southern Ijaw Local Government Area.

H₁: Presidential amnesty programme in the form of vocational training helps in reducing oil pipeline vandalism in Southern Ijaw Local Government Area.

The hypothesis two was tested using the values of the response derived from questions 4, 5 and 6 respectively in table 2.

Table 6: Contingency Table of Observed Frequencies

Table	SA	A	D	SD	Total
4	52 _a	78 _b	34 _c	29 _d	193 _{B1}
5	70 _e	61 _f	25 _g	37 _h	193 _{B2}
6	34 _i	31 _j	59 _k	69 _l	193 _{B3}
Total	156_{A1}	170_{A2}	118_{A3}	135_{A4}	579_N

Source: Field Survey, 2022.

Table 7: Calculation of Expected Frequencies

Cell A ₁ B ₁	$\frac{156 \times 193}{579}$ = 52	Cell A ₁ B ₂	$\frac{156 \times 193}{579}$ = 52	Cell A ₁ B ₃	$\frac{156 \times 193}{579}$ = 52
Cell A ₂ B ₁	$\frac{170 \times 193}{579}$ = 57	Cell A ₂ B ₂	$\frac{170 \times 193}{579}$ = 57	Cell A ₂ B ₃	$\frac{170 \times 193}{579}$ = 57
Cell A ₃ B ₁	$\frac{118 \times 193}{579}$ = 39	Cell A ₃ B ₂	$\frac{118 \times 193}{579}$ = 39	Cell A ₃ B ₃	$\frac{119 \times 193}{579}$ = 39
Cell A ₄ B ₁	$\frac{135 \times 193}{579}$ = 45	Cell A ₄ B ₂	$\frac{135 \times 193}{579}$ = 45	Cell A ₄ B ₃	$\frac{135 \times 193}{579}$ = 45

Source: Field Survey, 2022.

Table 8: Placing the Observed and Expected Frequencies for Test of Hypothesis Two

O	E	O-E	(O-E) ²	(O-E) ² /E
52	52	0	0	0
78	57	21	441	7.737
34	39	-5	25	0.641
29	45	-16	256	5.689
70	52	18	324	6.231
61	57	4	16	0.281
25	39	-14	196	5.026
37	45	-8	64	1.422
34	52	-18	324	6.231
31	57	-26	676	11.860
59	39	20	400	10.256
69	45	24	576	12.8
Total				68.174

Source: Field Survey, 2022.

From the contingency table, the Degree of Freedom (DF) is

$$\begin{aligned}
 DF &= (r-1)(c-1) \\
 &= (3-1)(4-1) \\
 &= 2 \times 3 \\
 &= 6
 \end{aligned}$$

Thus DF = 6

Decision Rule: At 0.05 level of significance with 6 degree of freedom, the table value of chi-square is **12.592** while the calculated value of chi-square is **68.174**. Since the calculated value of chi-square (χ^2_{cal}) is greater than the table value of chi-square (χ^2_{table}), we accept the alternative hypothesis (H_1) which states that presidential amnesty programme in the form of vocational training helps in reducing oil pipe vandalism in Southern Ijaw Local Government Area.

Discussion of Findings

The result of the first hypothesis reveals that, presidential amnesty programme in the form of educational training accrues to limiting youth piracy in Southern Ijaw Local Government Area. This is not in line with the views of Ikelegbe and

Umukoro (2014) which criticized the amnesty programme and the implementation arrangement for neglecting the aspirations of decisive stakeholders, including civil society actors. This limits the programme's ability towards reducing youth piracy and restore sustainable peace in the region. They argued further that, the efforts put in place in actualizing the aims of the presidential amnesty programme have not translated into effective accomplishment plan. Rather, the programme was designed to mislead the militants and allow oil exploration without addressing the impoverished state of the region.

The result of the second hypothesis of this study reveals that, presidential amnesty programme in the form of vocational training has helped in reducing

oil pipeline vandalism in Southern Ijaw Local Government Area. This is not in consonance with the views of Atuloma (2018) which states that, although the angry youths in the Niger-delta region have succumbed due to interventions from well meaning Nigerians and Nigerian government through the amnesty programme. However, the condition of things has not really changed for good for the teeming youths. There is increased rate of unemployment and poverty amongst the youths thereby prompting them in engaging into various antagonistic activities such as vandalizing oil pipelines for oil theft and kidnap of oil expatriate workers in order to make fortune for survival.

Conclusion

Youth militancy is a social problem affecting the growth and socio-economic development of Nigeria as a nation. Many youths most especially in the Niger-Delta cannot meet the basic needs of life such as food, clothing, shelter, and education because they do not have the sources and finance needed to cater for their needs. As a result, they are faced with frustration, low self-esteem and poverty which consequently can make them to engage in militant activities in the form of youth piracy, oil pipeline vandalism, kidnap of oil expatriate workers, armed robbery and other restive behaviours. However, in order to reduce youth militancy in the Niger-Delta and give rise to national socio-economic development, Nigerian government should sustain and encourage the presidential amnesty programme as well as

formulate and implement good policies that would help to improve the economic and social well being of the youths in the Niger-Delta and Nigeria in general..

Recommendations

The study proffers the following recommendations apposite:

1. Nigerian government in its magnanimity should uphold and continue to sustain its initiative on presidential amnesty programme in the form of educational training to the militant youths in the Niger-Delta as this would accrue to limiting the chances of the youths in indulging in militant activities such as youth piracy.
2. Presidential amnesty programme in the form of vocational training by the Nigerian government should be sustained and encouraged in the sense that it would enable the militants youths in the Niger-Delta to acquire relevant knowledge, skills and values on different works and stay away from engaging in militant activities such as oil pipeline vandalism.
3. Nigerian government, civil society organizations, and philanthropists should as a matter of necessity, map out other thoughtful and eloquent strategies on how to eradicate entirely the prevalence of youth militancy in the Niger-Delta as this would help to create a cordial relationship between multinational oil corporations and the host communities in the Niger-Delta as well as increase the revenue generation of Nigeria as a nation.

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