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INTEGRATING REMOTE SENSING DATA WITH QUESTIONNAIRE TO UNDERSTAND URBAN LANDSCAPE CHANGE

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ABSTRACT

The use of questionnaire in addition to remote sensing data could improve the understanding of Land Use/Land Cover (LULC) to enhance future planning and policy formulation. This study applied quantitative and qualitative statistical techniques to generate attribute data as an addendum for remote sensing data, with a view to statistically analyses some sensitive environmental and socio-economic components that can trigger changes in LULC of Nnewi North Local Government Area of Anambra state, Nigeria. The methodology used supervised satellite image classification, structural questionnaires, personal observations and oral interview. The GeoEye-1 High Resolution Satellite Image (HRSI) data was analyzed using ENVI where the Error Matrix and Kappa Coefficient results revealed that SVM overall accuracy is 98.07% and Kappa Coefficient is 0.97, hence, image classification result was acceptable. The sample size for the study area was determined by the use of a mathematical model developed by Taro Yemeni, the study area was then evaluated using 445 distributed questionnaires. A total of 417 (94%) were duly completed and returned. The Spearman's Correlation Coefficient (r) was used to test two hypotheses as follows (1) the relationship between population growth and land use/land cover change, (2) Population growth and Government involvement in Mapping/Planning and Monitoring. The coefficient of the correlation of the first hypothesis is 0.710 with a significance value of 0.007 and this means that there is a strong positive correlation between extent of population growth and land the rate of use/land cover change in Nnewi north LGA. The Correlation coefficient of the second hypothesis is 0.417 with a significance value of 0.039, indicating that there is weak positive correlation. The study reveals that respondent's views are vital addenda for generation of non-spatial attribute information for a clear understanding and interpretation of urban remote sensing results. The research recommends that it is vital to consider using questionnaire as a structured way of obtaining firsthand and reliable non-spatial attribute information about any given environment for rapid decision making.

Key words: *Population, Questionnaire, Remote Sensing, landuse/landcover, Planning.*

1. Introduction

The knowledge about land use and land cover has become increasingly important so to overcome the problems of haphazard, uncontrolled development, deteriorating environmental quality, loss of prime agricultural lands, destruction of important wetlands, and loss of fish and wildlife habitat. Anderson et al (1976) observed that a modern nation must have adequate information on many complex interrelated aspects of its activities in order to make decisions. In view of this, the application of quantitative and qualitative statistical techniques to generate attribute data for remote sensing of urban landscape is a necessity. The basic data type in a Geographical Information Systems (GIS) reflects traditional data found on a map. Accordingly, GIS technology utilizes two basic types of data known as spatial data and attribute data. Spatial data describes the absolute and relative location of geographic features, while attribute data describes characteristics of the spatial features which can be quantitative and/or qualitative in nature, often referred to as tabular data.

Recently, land-use change has been the main concern for worldwide environment change and is being used by city and regional planners to design sustainable cities, Mubea, and Menz 2012) and while the lack of knowledge relating to land cover and its dynamics especially in developing countries can be attributed to: (1) weak government support for mapping agencies and research institutions, (2) expensive software and hardware, (3) insufficient budget allocations for data purchases and (4) resistance to changes especially by the traditionalist in the field of mapping. The use of remote sensing and geographical information systems (GIS) has become an essential tool for land cover mapping, storage, analysis and modelling of future scenarios (Geneletti and Gorte, 2003). Landcover and landuse change process can be identified and recognized using satellite imageries. Remotely sensed data in conjunction with Geographic Information System can provide significant results of changes of the earth surface. Landuse has changed the ecosystem rapidly and extensively due to consequences of rapidly growing demand on natural resources (Watson and Zakri, 2003). It has resulted in degradation of the natural ecosystem.

Mirbagheri (2006), states that although the terms landcover and landuse are sometimes used interchangeably, they are actually different. Simply put, landcover is what covers the surface of the earth and landuse describes how the land is used. The impact of urban expansion can result in environmental and socio-economic effects. Varlyguin (2008) gives an overview of the environmental impact induced by urban sprawl characterized by loss of open space, reduced biodiversity and land fragmentation. Socio-economic impacts are often a direct consequence of the environmental impact (Ojigi, 2006).

Ojiako and Igbokwe, (2009) applied the use of remote sensing and multimedia geographic information system (GIS) in the administration of socio-economic activities in Nnewi urban area of Anambra state. The results show that Nnewi Urban area of Anambra State is faced with numerous problems as a result of ineffective management of this spatial information, therefore leading to loss of enormous revenues by the urban authority and that the only available maps are in analogue forms, thus, limited in its application. Ezeomedo (2019) carried out research on satellite image classification and mapping of

Urban Features of Nnewi using GeoEye-1 High Resolution Satellite Image (HRSI) of 2016, Support Vector Machine Classifier (SVMC) and Maximum Likelihood Classifier (MLC) with a view of producing urban land use and land cover map of the area. However, other important attribute information that cannot be captured using remote sensing operation could be obtained through the application of quantitative and qualitative statistical techniques (ground truthing, field observation, personal communication and questionnaire administration among others).

Thematic analysis is historically a conventional practice in qualitative research which involves searching through data to identify any recurrent patterns. There is no simple distinction between qualitative (naturalistic, contextual, idealist) and quantitative (experimental, positivist, realist) methodologies. Since analysts move back and forth between new concepts and the data, all research involves processes of induction and deduction, especially thematic analysis whereby induction creates themes and deduction verifies them, (Martyn, 2010).

Likert scales, frequently used in survey research, measure respondents' attitudes by asking how strongly they agree or disagree with a set of questions or statements. A typical scale might consist of the following response categories: strongly agree, agree, undecided, disagree, and strongly disagree. Numerical coding of the responses allows researchers to analyze Likert scale data with descriptive and inferential statistical methods, (Diker, Walters, Cunningham-Sabo, & Baker, 2011). Over the years, numerous methods have been used to measure character and personality traits (Likert, 1932). The difficulty of measuring attitudes, character, and personality traits lies in the procedure for transferring these qualities into a quantitative measure for data analysis purposes. The recent popularity of qualitative research techniques has relieved some of the burden associated with the dilemma; however, many social scientists still rely on quantitative measures of attitudes, character and personality traits, (Boone, and Boone, 2012). Clason and Dormody (1994) described the difference between Likert-type items and Likert scales. They identified Likert-type items as single questions that use some aspect of the original Likert response alternatives.

The development of the city of Nnewi needs thoughtful planning approach in order to avoid any urban environmental problem. Urban environmental problem can come in form of unplanned development, narrow roads/poor road network, poor traffic control, lack of open space and gardens among others; which obviously are the outcome of over population, urbanization, and industrialization. This research aims at Integrating Remote Sensing Data with Questionnaire to Understand Urban Landscape Change. To achieve this, supervised image classification and questionnaires was used and the focus is to identify some sensitive environmental and socio-economic factors that can trigger changes in land use and land cover of the study area for an improved urban planning, decision making and monitoring.

1.1 Study Area

The study area for this research is Nnewi North Local Government Area of Anambra state, South-Eastern region of Nigeria, created in 1996 from old Nnewi Local Government Area, spans over 1,076 square miles (2789km2), lying about 25km south of

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Onitsha in Anambra state, (Amanze, Ezeh and Okoronkwo, 2015). It is located between latitudes 5°59' 41.64"N and 6°03' 28.44"N and longitudes 6°03' 28.44"E and 6°52' 41.64"E (Figure 1), bounded in the north by Idemili South, South West by Ekwusigo, and South East by Nnewi South L.G. As of Anambra State. The study area is also known as Nnewi central or Nnewi urban and consists of four Quarters; Otolo, Umudim, Nnewichi and Uruagu.

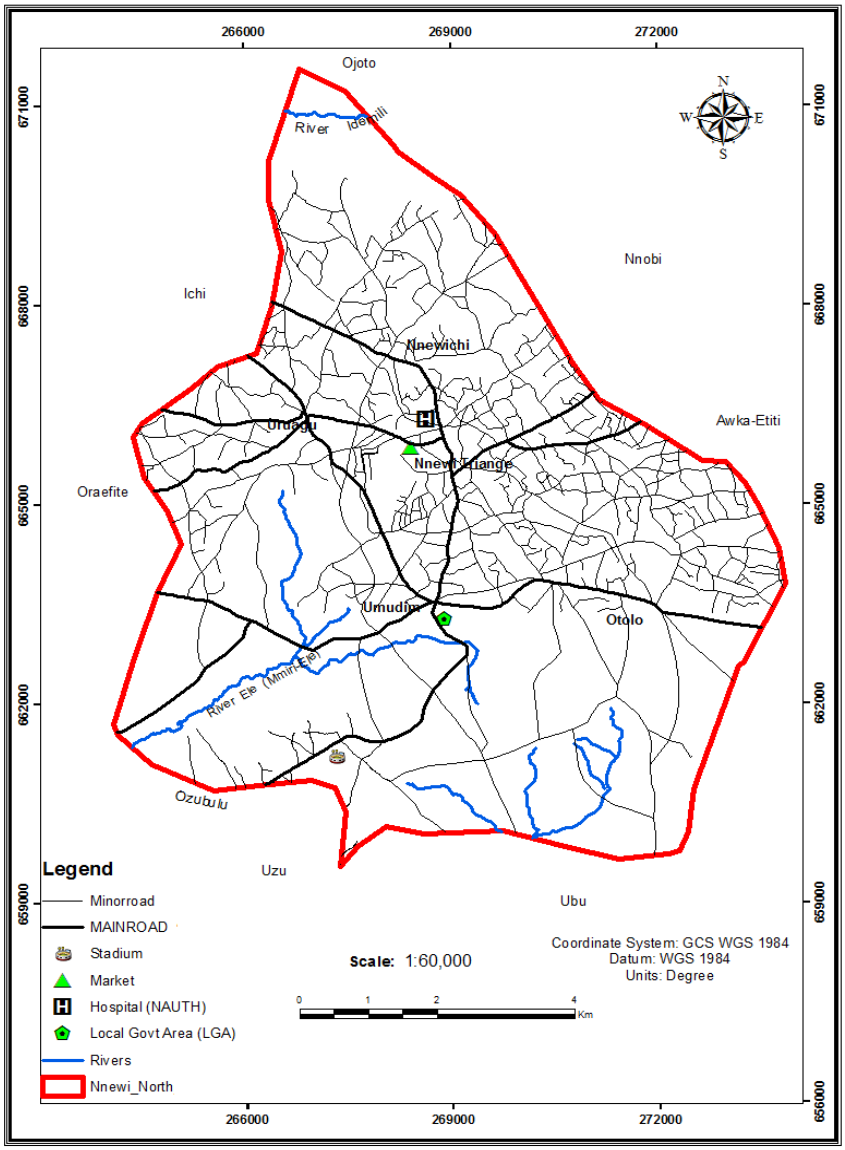

Figure 1: Map showing Nnewi North LGA of Anambra State Nigeria
Source: Ezeomedo, (2019)

2. Methodology

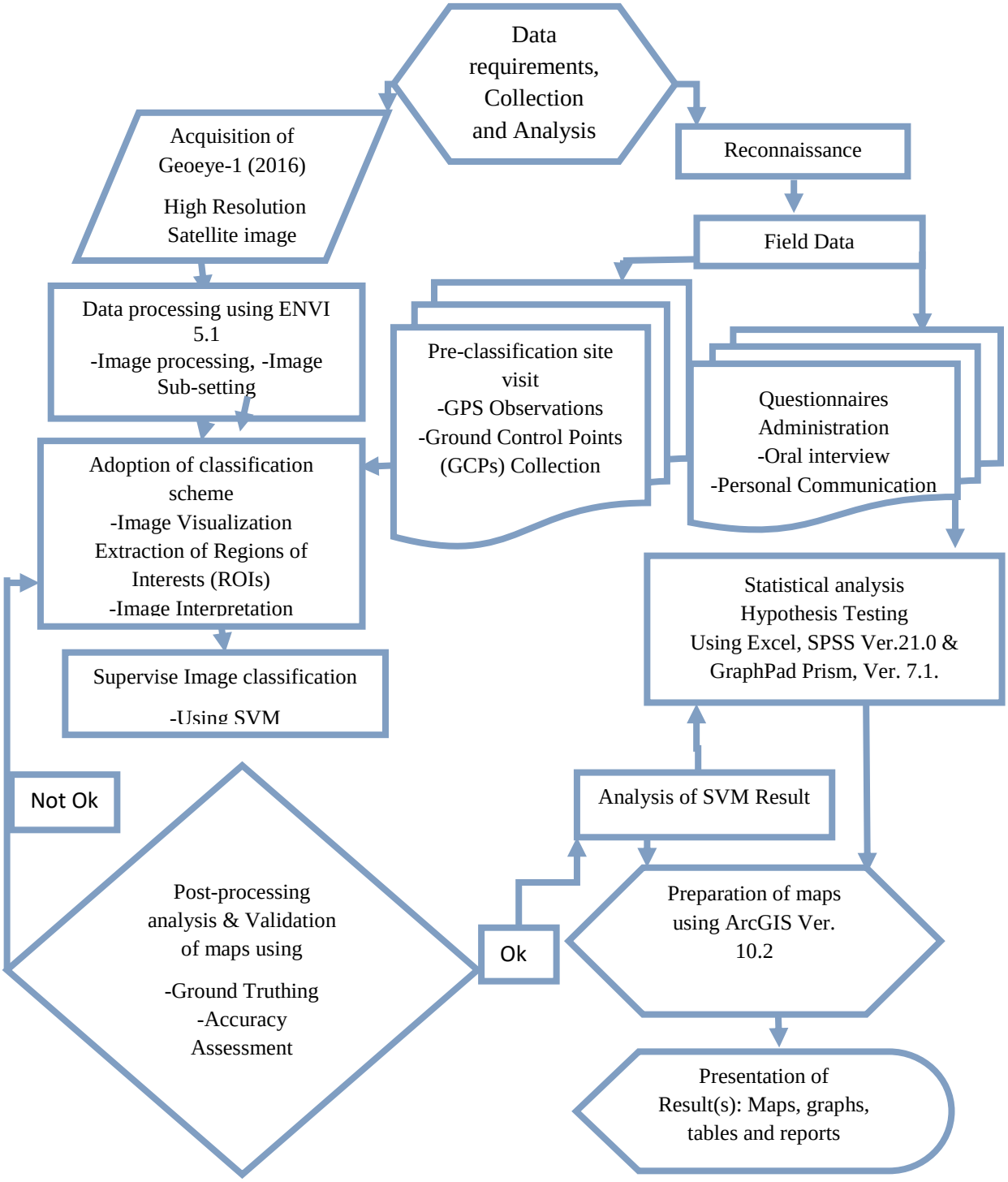

Figure 2: Flowchart of Methodology

The High Resolution Satellite image of Nnewi North LGA (GeoEye-1 Image of 2016) was obtained from DigitalGlobe online in ECW format (fig 2 and 3). The study used Environment for visualizing images (ENVI) software, version 5.1 for Image sub-setting, image processing, image enhancement, filtering and masking and image classification. More so, ArcGIS 10.2 was employed for production of thematic maps, Microsoft Excel, GraphPad Prism ver.7.0 and IBM SPSS ver.21 were used for statistical analysis and result presentation. Five features of interest/regions of interest (FOI/ROI) were extracted from High Resolution Satellite Image (HRSI) which includes the built-up areas; vegetation, water bodies, open/bare surfaces and farm. The selected FOI were then export to the n-D Visualizer to see their separability which aids in better image classification. Support Vector Machine (SVM) was used for supervised image classification and post-processing accuracy assessment (PAA) to produce a baseline landuse and landcover map of the study area.

Since the annual growth rate of population in Nigeria is estimated at 3.2%, the 2017 population of Nnewi and the sample size of the study was computed using of a mathematical model developed by Taro Yemeni (1964). The questionnaire contained 36 questions divided into four sections A-D. Section A= personal/household data. (Gender, age, level of education, occupation, marital status etc., B =population growth data, C, ownership of land, other resources and perception on the use of land and D government involvement in mapping, planning and monitoring of Nnewi-North. A total of 445 questionnaires were distributed, 417 were duly completed and returned. Typically, there are 5 categories of response, from (for example) 1 = strongly disagree to 5 = strongly agree. A Likert scale was applied in sections B to D. The responses from the entire sampled questionnaire were collected, as well as oral interviews and personal observations. The data and answers of the research questions were used to draw frequency tables, percentages and charts. Also, the hypothesis was tested using the spearman's correlations in Statistical Package for Social Sciences (SPSS).

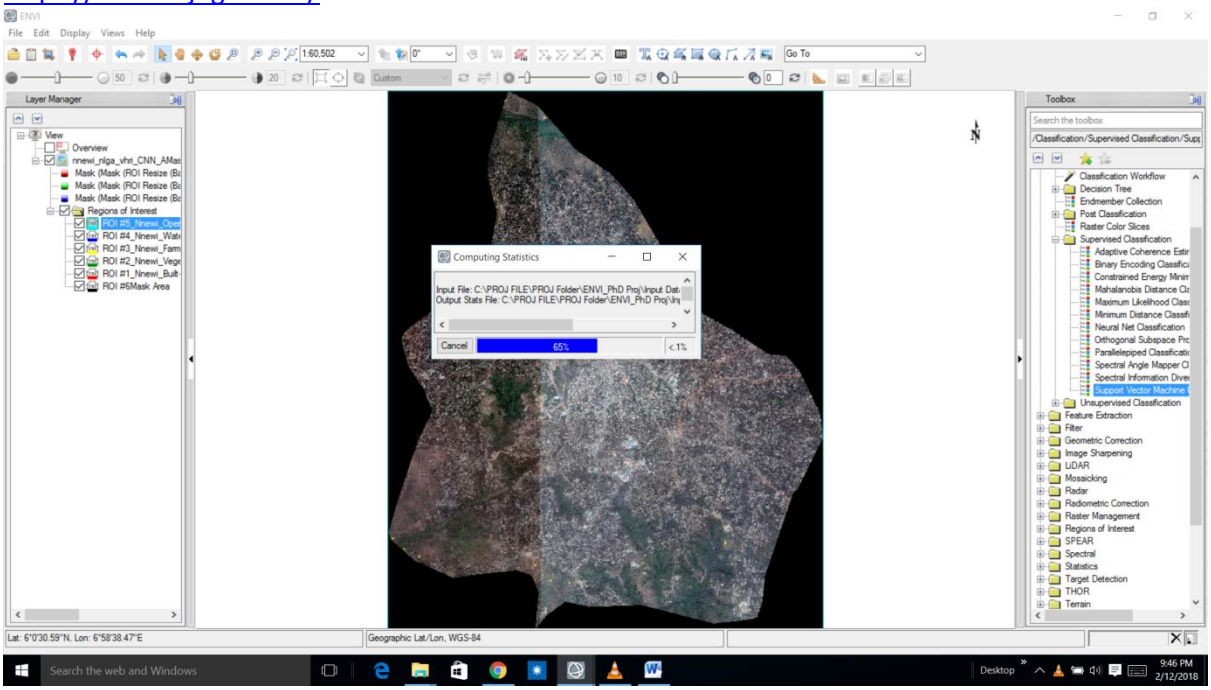

Figure 3: GeoEye-1 Satellite image of Nnewi North LGA

3. Results and Discussion

Radial Basis Function (RBF) kernel of support vector machine was used in supervised image classification. The analysis result is shown in (table 1 and fig. 4 to 9). Error Matrix and Kappa Coefficient results revealed that SVM overall accuracy is 98.07% and Kappa Coefficient is 0.97. The result showed that it is only the built-up areas and open/bare surfaces that were well classified without conflicting with the spectral signatures of other urban features. The percentage of land use and land cover in table 1 is baseline data of Nnewi North local government area and change detection in the nearest further will shows the rate of urban dynamism. Obviously, the urban Land Use and Land Cover (LULC) transformation will be indicating the rate by which a particular land class is transiting into another, this will help in forecasting and decision making.

Table 1: Support Vector Machine Image Classification Profile

S/N	Classes (ROIs)	Code	Colour Used	Points (PIXELS)	Percentage %	Area (km²)
1	Built-Up Area	#1	Mars Red	26,687,844	13.52	929.00
2	Vegetation	#2	Leaf Green	47,788,163	24.23	1,663.51
3	Water Bodies	#3	Lapis Lazuli	43,514,121	22.05	1,514.73
4	Farm Land	#4	Solar Yellow	77,742,135	39.40	2,706.20
5	Open/Bare	#5	Indicolite Green	1,602,180	0.80	55.77
		Total		197,334,443	100.00	6,869.21

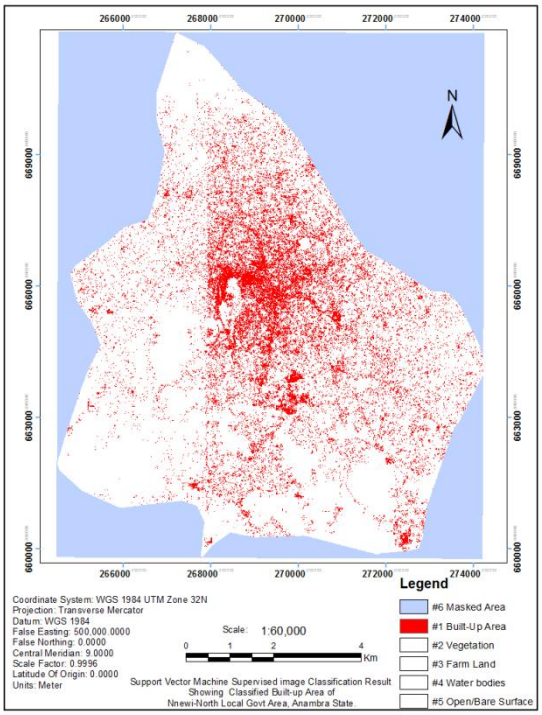

Figure 4: Built up Area

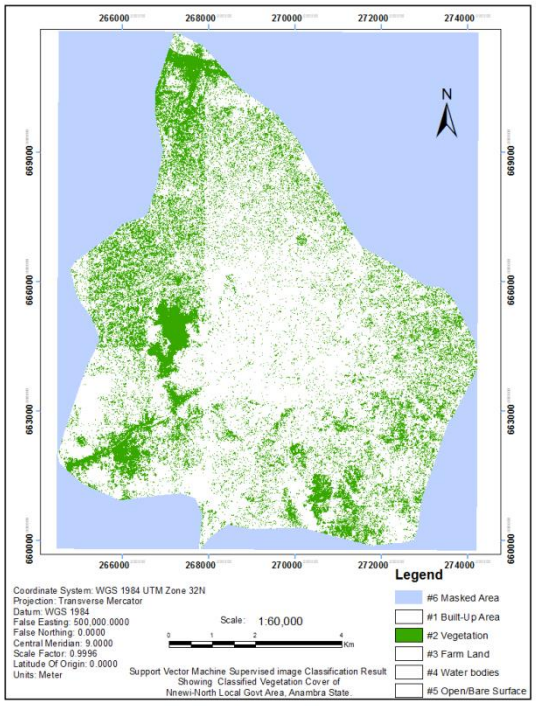

Figure 5: Vegetation

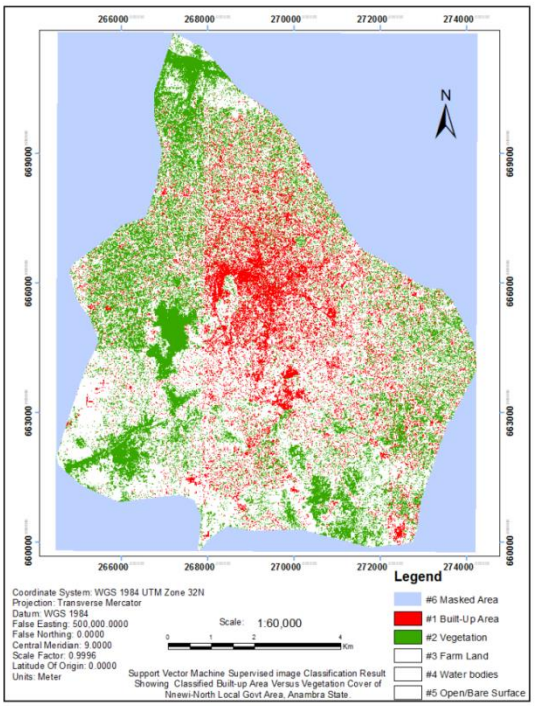

Figure 6: Built-up Area versus Vegetation

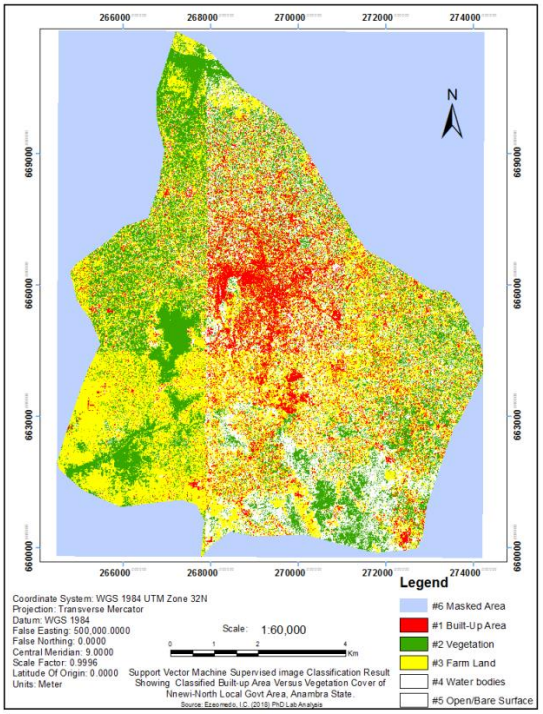

Figure 7: Built-up Area, farm land versus Vegetation

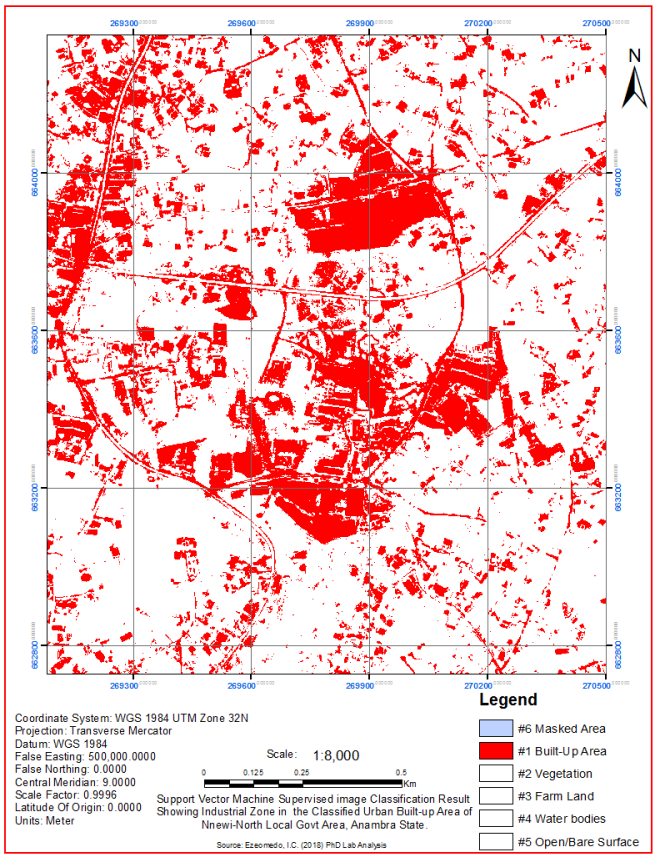

Figure 8: Nnewi industrial zone as part of the Built up Area

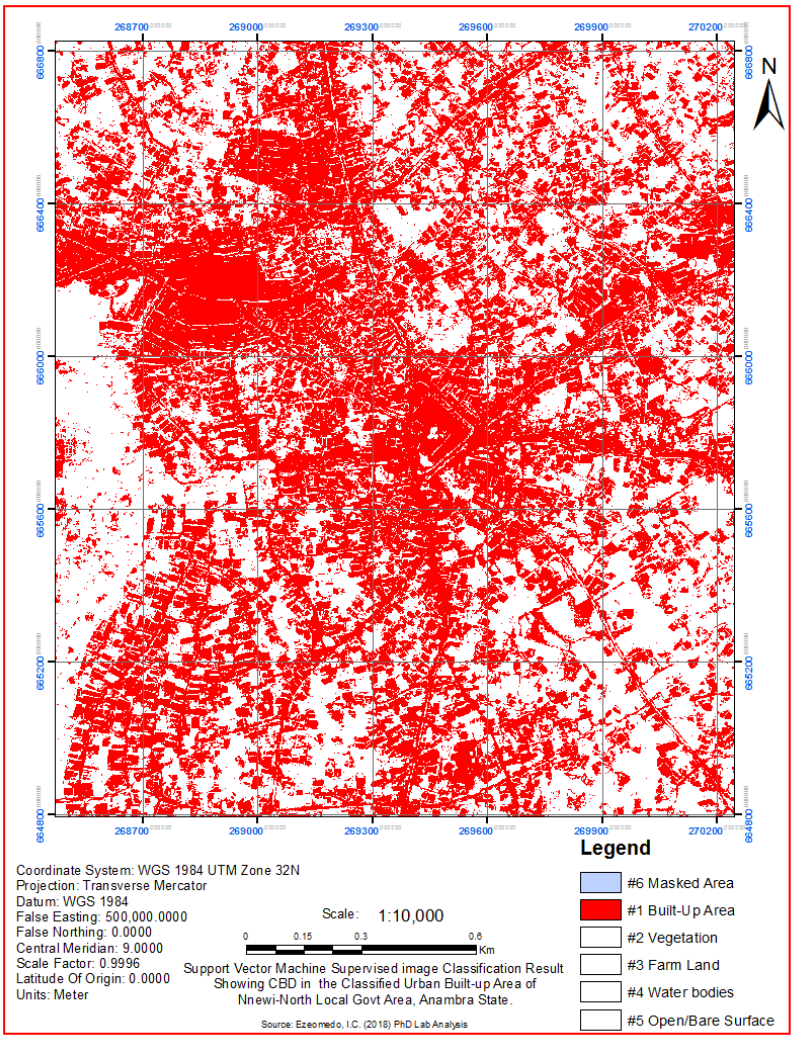

Figure 9: The CBD of Nnewi as part of the Built up Area

Plate 1: Nnewi triangular roundabout as heart of the town

Radial basis function kernel was used in the image classification which many researchers believed performs well in most cases. Classified satellite image of 2016 was used to produce the land use / land cover information of the study area, which revealed some salient question about the study area and also attempted answering them; for instance, there are questions like: (1). what is the settlement pattern of Nnewi-North LGA? 60% Nucleated settlement pattern was observed in the Central Business District Area (CBDA) while the remaining 40% were dispersed settlement pattern observed immediately after the CBDA, (plate 1, fig. 4, 8 and 9). (2). Does the city require urban renewal? Yes, because of the presence of some developments without wide access road within the CBDA, hence, urban renewal is inevitable and is required to create new roads and other basic infrastructure in the area. wider roads, well networked will help to accommodate the unprecedented population increase and urbanization. (3). Does the city have land for future development? Yes, in the sense that classified result says so. (4). However, the ownership of land determines what it is used for. The type of land ownership and title in Igbo land extremely affects the way the state is being developed. Land is owned by individuals as a customary inheritance from their great grandfathers; hence, may be difficult to acquire.

On statistical analysis, the major occupation of the respondents showed that 55% of the sample are traders/business persons. This is followed by 19% and 16% who are civil servants and farmers respectively. Only 9.6% of the residents are uniformed persons, table 2. However, the ratio of distribution of respondents by community showed almost even distribution, indicating that Nnewi is a town that has similar culture and socio-economic heritage.

Table 2: Cross-tabulation Analyses of Major Occupation of the Respondents

			Community				Total
			Nnewichi	Umudim	Uruagu	Otolo	
Major occupation of the respondents	Farming	Count	2	18	20	28	68
		% within Community	15.4%	16.8%	12.0%	21.4%	16.3%
	Civil service	Count	2	22	29	28	81
		% within Community	15.4%	20.6%	17.5%	21.4%	19.4%
	Trader/Business	Count	8	57	100	63	228
		% within Community	61.5%	53.3%	60.2%	48.1%	54.7%
	Uniformed personnel	Count	1	10	17	12	40
		% within Community	7.7%	9.3%	10.2%	9.2%	9.6%
	Total	Count	13	107	166	131	417
		% within Community	100.0%	100.0%	100.0%	100.0%	100.0%

the result figure 10 showed the household size distribution of the residents of Nnewi. According to the result, the members of household that are between 3 to 4 and 4 to 5 are about 32% respectively. This is followed by those that are 6 and above members representing about 22% while about 14% of the households had 1 to 2 members.

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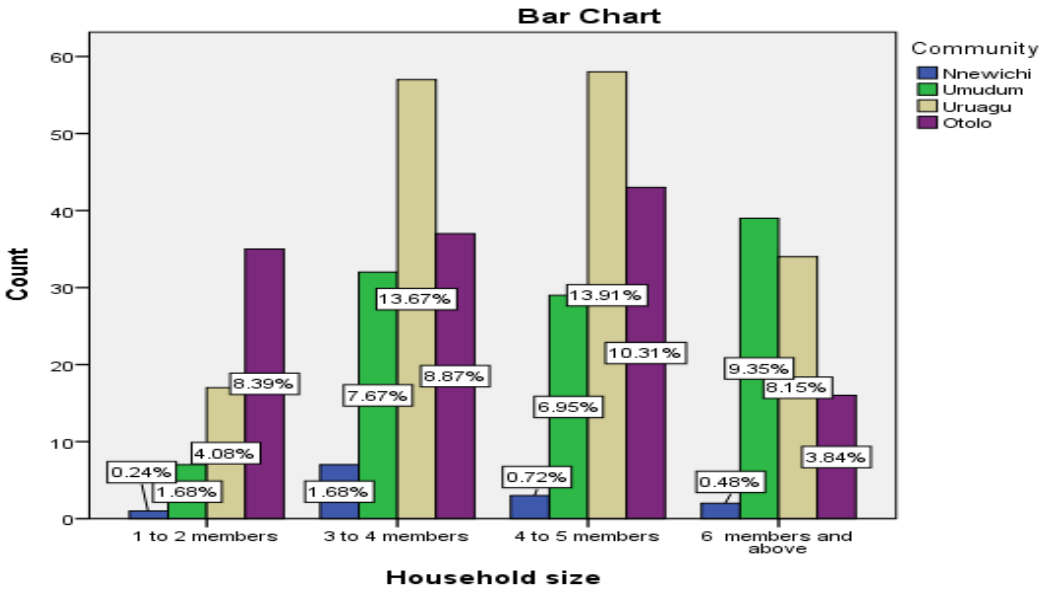

Figure10: Result of the household size

The result on Table 3 revealed that the respondents about 54.0% "agree" that Nnewi is densely population. Majority equally answered "agree" with percentage response of 42.0% that rapid population density brings about pressure on the land cover; of which they larger proportion of 69.5% "strongly agree" that the same population density has positive relationship with commercial/industrial activities. However, despite that majority of the respondents representing 50.4% of the sample "strongly agree" population causes overcrowding; greater proportion of the respondents indicated "disagree" urbanization relates with uncontrolled population growth. The cumulative response rate indicated that majority of the respondents representing 38.84% of the sample revealed that population density has effect on development rate of Nnewi North LGA, followed by 35.52% of "agree" making up about 74.36% (38.84 + 35.52%) are in agreement that population density has a correlation about pressure on the land cover in Nnewi.

Table 3: Assessment of the effect of high population on the land cover of Nnewi North LGA

SN	Question items	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Remark
1	Nnewi North is Densely Populated	89 (21.3%)	225 (54.0%)	43 (10.3%)	45 (10.8%)	15 (3.6%)	Agree
2	Population density causes pressure on land cover	121 (29.0%)	175 (42.0%)	5 (1.2%)	100 (24.0%)	16 (3.8%)	Agree
3	Population density relates with commercial/industrial activities	290 (69.5%)	112 (26.9%)	0 (0.0%)	11 (2.6%)	4 (1.0%)	Strongly Agree
4	Urbanisation relates with uncontrolled population growth	100 (24.0%)	115 (27.6%)	79 (18.9%)	150 (36.0%)	56 (13.4%)	Disagree
5	Population causes overcrowding	210 (50.4%)	113 (27.1%)	23 (5.5%)	40 (9.6%)	31 (7.4%)	Strongly agree
	Cumulative Average Response	38.84%	35.52%	7.18%	16.60%	5.84%	Strongly Agree

To statistically ascertain the level of ownership of land/other resources and perception on land use, twelve questions were used to find out this level by Nnewi residents as well as their perception on land use as it applies to Nnewi area. From the variables used, three of them received "strongly agree". This show that majority of the respondents aspire to become landlords (39.6%), as their income correlates with their land/house ownership. The opinion on strongly agree equally posit that farming problems include flooding, reduced agricultural land and poor soil (74.8%). From the outcomes, five variables received "agree" to the questionnaire items. These responses show that Nnewi is the business area and source of livelihood (51.1%) to majority of the respondents. Moreover, the also "agree" that land for agriculture is tempered by urbanization (55.4%), and that Urban agriculture can be practiced in backyard (51.1%). Also in their responses scale of "agree" it was shown that there is Land use abuse and unplanned building (57.6%), wherein industrialization results to deforestation (31.6%).

However, four items on Table 4 indicated "disagree" to variables including that development is spreading towards outskirt of Nnewi (50.8%); that urban agriculture brings about sustainable livelihood (42.0%); that non-agricultural land is mostly used for residential/ warehouse, recreation centre and stores; and that land use are mostly agric., residential, industrial and commercial (36.0%). These group of variables on which respondents have indicated "disagree" implies that development is clustered within a centre of Nnewi, with urban agriculture not contributing to sustainable development in

Nnewi wherein most land is used for residential, industrial and commercial purposes. The cumulative average response percentage score revealed that highest response rate of "agree" at 34.78% and "strongly agree" at 30.17% totaling 64.95% for agreement to the land ownership, use and perception on land and other resources in Nnewi North LGA.

Table 4: Ownership, use and perception on land and other resources in Nnewi North LGA

SN	Question items	Strongly Agree	Agree	Undecided	Degree	Strongly Disagree	Remark
1	Business area and source of livelihood	196 (47.0%)	213 (51.1%)	0 (0.0%)	8 (1.9%)	0 (0.0%)	Agree
2	Aspires to become landlords	165 (39.6%)	136 (32.6%)	102 (24.5%)	14 (3.4%)	0 (0.0%)	Strongly agree
3	Land for agriculture is tempered by urbanization	111 (26.6%)	231 (55.4%)	70 (16.8%)	0 (0.0%)	0 (0.0%)	Agree
4	Development is spreads towards outskirt of Nnewi	45 (10.8%)	66 (15.8%)	79 (18.9%)	212 (50.8%)	55 (13.2%)	Disagree
5	Income correlates land/house ownership	220 (52.8%)	123 (29.5%)	9 (2.2%)	40 (9.6%)	25 (6.0%)	Strongly agree
6	Urban agric. can be practiced in backyard	75 (18.0%)	213 (51.1%)	50 (12.0%)	65 (15.6%)	14 (3.4%)	Agree
7	Urban agric. brings about sustainable livelihood	46 (11.0%)	56 (13.4%)	88 (21.1%)	175 (42.0%)	52 (12.5%)	Disagree
8	Non-agric. land is mostly used for residential/ warehouse, recreation centre and stores	70 (16.8%)	115 (27.6%)	109 (26.1%)	150 (36.0%)	56 (13.4%)	Disagree
9	Farming problems include flooding, reduced agric. land and poor soil	312 (74.8%)	100 (24.0%)	0 (0.0%)	5 (1.2%)	0 (0.0%)	Strongly agree
10	There is land use abuse and Unplanned building	110 (26.4%)	240 (57.6%)	40 (9.6%)	16 (3.8%)	11 (2.6%)	Agree
11	Industrialization results to deforestation	69 (16.6%)	132 (31.6%)	103 (24.7%)	65 (15.9%)	48 (11.5%)	Agree
12	Land use are mostly agric., residential, industrial and commercial	90 (21.6%)	115 (27.6%)	79 (18.9%)	150 (36.0%)	66 (15.8%)	Disagree
	Cumulative Average Response	30.17%	34.78%	14.57%	17.86%	6.53	Agree

To statistically ascertain the level of government presence in mapping, planning and monitoring based on level of support on a 5-point Likert scale was used. However, the cumulative average response shows "high support". These results imply that the residents are obliged to give high support to the government on issues related to mapping, planning and monitoring of development activities in Nnewi North LGA, (Table 5).

Table 5: Analyses of the government efforts on mapping, planning and monitoring on development activities in Nnewi North LGA.

SN	Question items	Very High Support	High support	Moderate Support	Low support	Not in support	Remark
1	Use of basemap and master plan protects environment	67 (16.1%)	87 (20.9%)	208 (49.9%)	55 (13.2%)	0 (0.0%)	Moderate support
2	Nnewi should be planned for Business and resident	86 (20.6%)	165 (39.6%)	54 (12.9%)	68 (16.3%)	44 (10.6%)	High support
3	Mapping information enhances IGR	36 (8.6%)	89 (21.3%)	69 (16.6%)	113 (27.1%)	110 (26.4%)	Low support
4	Surveying and Geoinformatics enhances sustainable planning	45 (10.8%)	120 (28.8%)	198 (47.5%)	40 (9.6%)	14 (3.4%)	Moderate support
5	Proper monitoring enhances sustainable development	8 (1.9%)	44 (10.6%)	56 (13.4%)	231 (55.4%)	78 (18.7%)	Low support
6	Law enforcement is necessary for protection and conservation of the environment	88 (21.1%)	213 (51.1%)	54 (12.9%)	33 (7.9%)	29 (7.0%)	High support
7	Physical planning should consider topography and features to avoid erosion	95 (22.8%)	148 (35.5%)	120 (28.8%)	54 (12.9%)	0 (0.0%)	High support
8	Government enforces planning	114 (27.3%)	214 (51.3%)	34 (8.2%)	45 (10.8%)	10 (2.4%)	High support
9	Awareness for master plan of the area	45 (10.8%)	89 (21.3%)	176 (42.2%)	111 (26.6%)	36 (8.6%)	Moderate support
10	Land lease to Government	55 (13.2%)	45 (10.8%)	67 (16.1%)	231 (55.4%)	19 (4.6%)	Low support
11	Periodic update of base map of the area	88 (21.1%)	245 (58.8%)	40 (9.6%)	44 (10.6%)	0 (0.0%)	High support
12	ASUDEB Protection on land use and land cover	36 (8.6%)	90 (21.6%)	113 (27.1%)	158 (37.9%)	20 (4.8%)	Low support
	Cumulative Average Response	15.24%	30.97%	23.10%	23.64%	7.21%	High support

3.1.Testing of Hypothesis

Table 6: Correlation results for hypothesis one and two

		Socio-Economic Status	Population growth
Relationship between population growth and extent of LU/LC in Nnewi north LGA	Pearson Correlation		.710*
	Sig. (2-tailed)		.007
	N		417
Support for Government involvement in (mapping, planning and monitoring)	Pearson Correlation		.417**
	Sig. (2-tailed)		.039
	N		490
	N		417

*= Correlation is significant at the 0.01 level (2-tailed); ** =Correlation is significant at the 0.05 level (2-tailed).

Testing of hypothesis 1: There is no significant relationship between population growth and extent of land use and land cover in Nnewi north LGA.
Correlation between population growth and extent of land ownership and use in Nnewi north LGA was tested using hypothesis one and the coefficient of the correlation is .710 with a significance value of 0.007. This means that there is a strong positive correlation between extent of population growth and extent of land ownership and use in Nnewi north LGA. This implies that population growth influences the type of landuse and lancover use in Nnewi. This means that population growth is capable of enhancing land usage. Residents are more likely to make more effective use of land as population grows. The value of land seems to increase with level of population increase making resident to appreciate ownership of land more than in less populated areas. Since the significant value is below 5%, the study concludes that there is a significant relationship between population growth and extent of land ownership and use in Nnewi north LGA, (Table 6).

Testing of hypothesis 2: There is no significant relationship between population growth and extent of government efforts in land use mapping, planning and monitoring in Nnewi north LGA.
The correlation coefficient of the result between population growth and extent of support for government involvemen in land use in Nnewi north LGA is 0.417 with a significance value of 0.039. The coefficient of 0.417 indicates that there is weak positive correlation. This implies that the level of support or involvement of the government in management of Nnewi environment and urban planning may be weak, (Table 5 and 6). The result has significance value of 0.039 which is below the 5% level of significance. Apart from the questionnaire distribution and respondent's responses to them, about ten more residents were interviewed in 2017, responses show that the factors responsible for landuse and landcover change ranges from socioeconomic, political to even cultural factors.

4. Conclusion and Recommendations

Support Vector Machine (SVM) incorporated in ENVI software was use in classifying GeoEye-1, (2016) High Resolution Satellite Image (HRSI) of Nnewi Local Government Area to produce a baseline urban landuse/land cover map of the study area. From the existing information stored in the 1964 topographical map of Nnewi, the city was just a rural area with scattered family settlement pattern, population was less and amenities were little or none in existence. But today, Nnewi is a city, transformed from rural area to urban milieu; this is due to population growth, urbanization, and industrialization of the city. Therefore, there is a consistent land cover transition from one form to another. The drawback of this study is that urban land use and land cover transformation was not carried out due to inaccessibility of the relevant materials, however, the feedback form used shows that some environmental and human factors contributes to changes in landuse/ land cover of the study area.

The study reveals that respondent's view through statistical testing can generates information which can be integrated with the results of image interpretation. This will help the remote sensing analyst to understand the transition going on in the built-environment. By having firsthand and reliable information, mostly non-spatial attribute data of the environment for rapid decision making. There is serious need for periodic urban LULC analysis to guide stakeholders in Planning, Monitoring, and Management of Urban Areas. It is a great necessity to integrate developmental activities in Nnewi North into this base map and baseline plan of the study area. For these reasons, the urban renewal of the city for a sustainable urban and smart city development is a prerequisite.

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