Adamawa State University Journal of Scientific Research
Volume 9 Issue 1, 2021; Article no. ADSUJSR 0901012
ISSN: 2705-1900 (Online); ISSN: 2251-0702 (Print)
http://www.adsujsr.com

Factor Analysis of the Spatial Pattern of Socio-economic Development in Adamawa State

Anjorin, Olufemi J[1], Galtima, M[2] & Ray, Helen. H[2]
[1]Department of Urban and Regional Planning, Federal Polytechnic, Mubi, Adamawa State.
[2] Geography Department, Modibbo Adama University of Technology, Yola, Adamawa State
Contact: *anjorinfemi2002@yahoo.com*

(Received in May 2021; Accepted in September 2021)

Abstract
This paper examined factors responsible for the spatial pattern of socio-economic development in Adamawa State. The objectives of the study include identifying factors responsible for the spatial pattern of socioeconomic development in Adamawa State, and examining effects of the spatial pattern on communities in the State. Both primary and secondary data were used for the study. While respondents' opinions on the spatial pattern of socio-economic indicators and development was sought from primary sources, the number of socio-economic facilities in each LGA and at the state level (secondary data) were provided by different units/departments including Works & Services, Education, Health, and Quality Assurance, etc, in each of the 21 LGAs in Adamawa State, and various supervising States' Ministries and Boards among other sources. Multistage sampling techniques were used to sample 386 household heads (309 male and 77 female) from the 12 purposefully selected LGAs for questionnaire administration. Subsequently, socio-economic data collected were coded into Statistical Package for Social Science (SPSS) Version 21, subjected to factor analysis and descriptive statistics. Findings from the study revealed the main drivers of the spatial pattern of socio-economic development in Adamawa State. Also, the uneven spatial pattern of development in the state is reported to have significant negative impacts on the development of the state and the people therein. Therefore, in other to eliminate, or at least reduce, spatial inequality in the level of development in Adamawa State, sufficient provision and equitable distribution of the identified drivers across the various geographic units in the State was suggested.

Keywords: Drivers of Spatial Pattern, Factor Analysis, Socio-economic Development, Spatial Pattern

Introduction

Development is conceptualized in diverse ways using parameters that include economic growth, development process, people's welfare, politics, and injustice. While Willie (2016) conceptualizes development as specific, intentional interventions to achieve improvement or progress in any country or region, Michael (2011) describes it as the process of improving on the communal quality of life through integrated approach to food production, physical, social and institutional infrastructural provisions with an ultimate goal of bringing about quantitative and qualitative change that will result in improved living standard of the populace of a given geographical area. On the other hand, Mabogunje (2015) described development as transformation of mode of production in a society or region. Such mode includes elements like infrastructures, and activities like distribution pattern that can be instrumental to real life. Mabogunje (2015) concluded that such transformation in socio-economic activities for the betterment of the society constitutes development. Hence, development can be viewed as advancement of integrated approach towards advancing the quality of life for people, economy and the society through improvement in socio-economic indicators.

Consequently, provision of socio-economic indicators such as education, health and commercial facilities, stable electricity, portable water and tarred roads, amongst others are important to development (community and regional). Besides the need for sufficient provision of socio-economic facilities, fairly balanced spatial pattern of such facilities among various geographic regions is equally significant. Apart from promoting community and/or regional development, balanced spatial distribution of socio-economic facilities enhances people's living standard. Although the relevance of socio-economic facilities to development of any society cannot be over emphasized, yet there are

evidences of inequality in the spatial pattern of socio-economic indicators, economic activities, incomes, and regional development from China to Russia, India, Mexico, South Africa and Nigeria (Obu et al, 2015; and John, 2016).

In Nigeria, studies such as Ita et al (2012), Ilesammi (2013), Ujoh & Kwaghsende (2014) and Balogun (2018) reported uneven spatial pattern of socio-economic facilities and development in Nassarawa, Cross River, Adamawa, Benue and Kogi States respectively. Also, evidence of inequalities, of different scales, in the spatial pattern of socio-economic indicators and development are reported by Fabiyi & Ogunyemi (2015); Fadahunsi et al (2017) and Dogo et al (2019).

In fact, previous findings on spatial inequalities prompted further studies on the reasons and effects of disparities on regional development. Some of the reasons advanced for disparities in the spatial pattern of socio-economic indicators and development in any region, especially among developing nations, include remoteness of communities from the city centre, colonization history, and natural endowment to economic processes (Wu & Gopinath, 2008; Sulyman, 2009 and Adefila, 2012). Also, according to Scott & Storper (2003) and Madu (2006), inequality in the spatial pattern of socio-economic development can be blamed on the general economic condition of a state, and the geographical location of communities. In addition, insufficiency of the provided socio-economic facilities in many communities, and poor implementation of government's development policies in various communities or regions are also blamed for inequality in the spatial pattern of socio-economic development (Ita et al, 2012; Ohlan, 2013 and Churski, 2014).

Although, some previous studies such as Gwary et al (2011), Girei & Dire (2014) and Adewusi (2015) examined socio-economic facilities in Adamawa State, however, drivers of the variability in the spatial pattern of socio-economic development remain unexplained. The inability of these previous studies to provide data and information on the drivers of the spatial pattern of socio-economic development in Adamawa State that could assist regional planners in effecting appropriate community and regional development policies continue to leave a gap to be filled. Therefore, it is pertinent to perform factor analysis of the spatial pattern of socio-economic development in Adamawa State using several socio-economic indicators. Such study would help to understand factors that promote spatial variation in regional development in other regions in Nigeria. Therefore, the aim of this study is to analysis the drivers of variation in the spatial pattern of socio-economic facilities and development in Adamawa State so as to understand the implications of the pattern on the development of the State. However, the objectives of the study are to: (i). identify factors responsible for the spatial pattern of socio-economic development in Adamawa State, and (ii). Examine the effects of the spatial pattern of socio-economic indicators on communities in Adamawa State.

Materials and Methods

Study Area

This study was conducted in Adamawa State which lies between latitudes 07º15′ and 10º58′N of the Equator and between longitudes 11º29′ and 13º47′E of the Prime Meridian covering a total land area of 37,852.33km^2 (Adebayo, 2020 and Zemba et al, 2020). The state has 21 LGA and shares boundaries with Borno, Gombe, Taraba States and the Republic of Cameroon to the North, West; South-west and East respectively (Fig 1). The North-South (Madagali to Toungo) and East- west (Fufore to Lamurde LGA) distance of Adamawa State is about 434.50Km and 165,58km long respectively (Zemba et al, 2020).

Adamawa State has both wet and dry seasons (April – October and November – March respectively), high daily and annual sunshine duration, humidity and annual mean monthly temperature range between 26.7ºC in the south to 29ºC in the central part of the state (Adebayo, 2020). Hence, Guinea and Sudan Savannah are the dominant vegetation in the state (Akosim et al, 2020). According to Tukur (2020), the landscape of Adamawa State is that of Valleys and Troughs, Upland & Lowland plains, and Hills & Mountain. Some of the prominent rivers in Adamawa State include River Benue, River Gongola, River Loko and River Yedzeram, etc (Adebayo et al, 2020). The state population as at year 2017 was projected to 4,470,434 (2,266,363 male and 2,204,071 female) (Anjorin, 2021).

In terms of socio-economic facilities and development, there are lots of socio-economic facilities located in different parts of the state. The socio-economic facilities in the state include

healthcare centers such as Federal Medical Center (FMC), Yola, Adamawa State Specialist Hospital Yola, German Hospital Yola, Virgwi Leprosy Hospital Garkida, and General Hospitals in each LGA Headquarters, and education institutions such as that include, Modibbo Adama University of Technology, Yola; Adamawa State University, Mubi; Adamawa State College of Technology, Michika, and Adamawa State Polytechnic, Yola & Numan. In addition, there are numerous commercial, agricultural, and micro finance banks, markets, telecommunication facilities and worship centers, among others in various parts of Adamawa State. All these facilities are known to enhance peoples' social life and contribute to socio-economic development across of communities (Balogun, 2018). However, the spatial pattern of these socio-economic facilities across the Adamawa State is uneven and biased towards some communities, LGAs and regions (Anjorin et al, 2021). But what remain unknown is the potential drivers of the unevenness in the spatial pattern socio-economic development in Adamawa State.

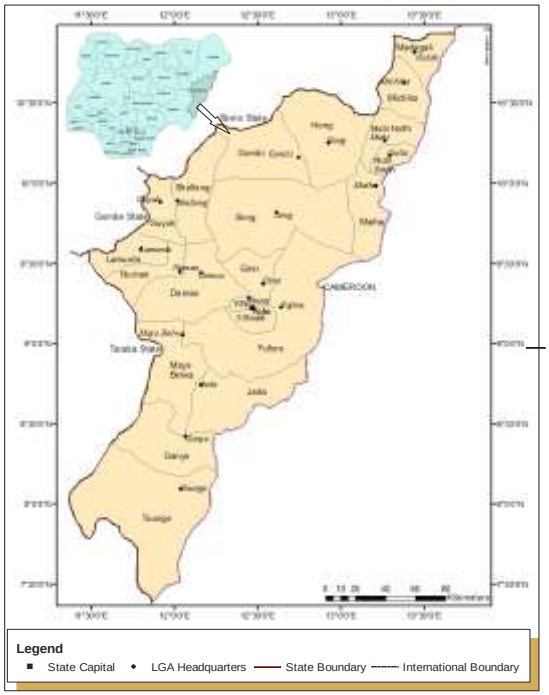

Figure 1: Nigeria showing Adamawa state with its LGAs
Source: Anjorin et al (2021).

Data collection and analysis

Primary and secondary types of data were sought for the study from primary and secondary sources. Data sought from the respondents (primary source) include, respondent's bio-data and opinions on the spatial pattern of socio-economic indicators and development provided in their communities. Secondary data sourced include the number of the public healthcare & education facilities, number of commercial facilities (banks and markets), sources of domestic water, minimum daily duration of electricity supply and coverage of telecommunication services, among others in each of the state's LGAs. Hence, the secondary data were sourced from different Local Government Area units/departments, such as Works & Services, Education, Health, and Quality Assurance, etc. In addition, secondary data were also sourced from the Business Unit offices of Yola Electricity Distribution Company (YEDC) in each LGA; various Adamawa State Ministries and Boards, including Ministries of Commerce & Industry, Education, Health, Information & Communication, State Universal Basic Education Board (SUBEB), the state's Post Primary School Management Board (PPSMB) and the State's Water Board (ADSWB), among others. Also, while the total mobile network subscriber in the state was provided by MTN Nigeria, Adamawa State Territory Yola office, Google Earth Pro was used to classify and digitized using the road networks in the state. The lengths of each classified road segment (tarred and paved

roads) and navigable waterways in each LGA were measured in square Kilometers using the length calculation module of ArcGIS 10.5. Other relevant information was also sought from other published literature including books and journals among others. Different sets of questionnaires were designed for LGCs, State Ministries & Boards, Mobile Network Providers and YEDC to capture relevant information on the spatial distribution of socio-economic variables under their supervision.

Adamawa State population (3,168,101) with inter-LGAs variations was projected to 4,470,434 in year 2017. Thereafter, 386 household heads (309 male and 77 female individual respondents) were sampled from 12 LGAs for questionnaire administration. While, Krejcie & Morgan (1970) sample size determination Table and formula for finite population was used to determine the total number of respondents required for the study and their spread across LGAs, multistage sampling techniques (purposive, proportional, simple and systematic techniques) was used in selecting the sampled LGAs and households for questionnaire administration. Only household heads were sampled for QA because they were considered to be in position of providing reliable information about their respective family bills such as education, medical, water and electricity bills as well as the effect of socio-economic facilities on their respective communities. Primary and secondary data were collected on 35 selected socio-economic variables as shown in Table 1.

Table 1: Selected Socio-economic Variables

S/N	Variables	Code	S/N	Variables	Code
1	Total Land Area	v_1	19	Kilometers of Navigable Waters	v_{19}
2	No of Primary Schools	v_2	20	No of Airport	v_{20}
3	No of primary School Teachers	v_3	21	No of Post Office	v_{21}
4	No of Primary School Enrolment	v_4	22	No of GSM Service Providers	v_{22}
5	No of Secondary Schools	v_5	23	No of People using GSM	v_{23}
6	No of Secondary School Teachers	v_6	24	No of Local Radio Signal	v_{24}
7	Secondary School Enrolment	v_7	25	No of Local Television Signal	v_{25}
8	No of Post-Secondary Schools	v_8	26	No of Banks	v_{26}
9	Population with Tertiary Qualification	v_9	27	No of Markets	v_{27}
10	No of Health Centers	v_{10}	28	No of Active Mining/Quarrying Sites	v_{28}
11	No of Hospital Beds	v_{11}	29	No of Manufacturing Industries	v_{29}
12	No of Medical Doctors	v_{12}	30	No of Agro-Processing Industries	v_{30}
13	No of Nurses and Midwives	v_{13}	31	No of Prominent Local Craft	v_{31}
14	No of Pharmacists	v_{14}	32	Minimum Duration of Electricity Supply per Day	v_{32}
15	No of Community Health Workers	v_{15}	33	No of Functional Public Well	v_{33}
16	No of Functional Ambulances	v_{16}	34	No of Boreholes	v_{34}
17	Kilometers of Tarred Roads	v_{17}	35	Accessibility to Tap Water	v_{35}
18	Kilometers of Paved Roads	v_{18}			

Data collected were coded into Statistical package for Social Science (SPSS) Version 21 where data reduction (factor analysis) was performed. According to AnGie & Sean (2013), factor analysis method helps to summarize data for easy interpretation of the underpinning factors of development. Accordingly, to extract only underpinning factors, Principal Component Analysis (PCA) was applied to the variables in factor analysis to do extraction by Correlation Matrix. Therefore, as suggested by Balogun (2018), factors whose Eigen value was greater than one (1) were retained as significant underpinning factors to the spatial pattern of development in the state. Also, in order for various variables to load on each underpinning factors, and for the purpose of clarity, and consistency in the variation pattern, the extracted factors were further subjected to orthogonal rotation using Varimax method. The result from factor analysis show factors and variables that is responsible for the spatial pattern of socio-economic development in the Adamawa State. On the other hand descriptive statistics (frequency and percentages) was used to analyse data provided by the primary respondents on effects of the spatial pattern of socio-economic indicators on communities in Adamawa State.

Result and Discussion

Drivers of Spatial Pattern of socio-economic Development in Adamawa State

The Total Variance Explained result on underpinning factors of the socio-economic development spatial pattern in Adamawa State which was determined through Extraction Method of Principal Component Analysis (PCA) is presented in Table 2.

Table 2: Total Variance Explained of the Spatial Pattern of Socio-economic Development in Adamawa State

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.230	29.229	29.229	10.230	29.229	29.229	7.747	22.133	22.133
2	5.274	15.068	44.298	5.274	15.068	44.298	4.776	13.645	35.778
3	3.927	11.220	55.518	3.927	11.220	55.518	4.173	11.922	47.700
4	3.480	9.943	65.461	3.480	9.943	65.461	4.145	11.841	59.542
5	2.534	7.241	72.702	2.534	7.241	72.702	3.152	9.005	68.547
6	2.085	5.958	78.660	2.085	5.958	78.660	2.903	8.294	76.841
7	1.532	4.376	83.037	1.532	4.376	83.037	1.717	4.905	81.746
8	1.258	3.593	86.630	1.258	3.593	86.630	1.709	4.884	86.630

Extraction Method: Principal Component Analysis.
Source: Field Survey (2021).

Table 2 indicate that 8 out of the 35 socio-economic variables subjected to factor analysis were retained as significant to spatial pattern of socio-economic development in Adamawa State and upon which other variables loaded. The retained factors jointly account for approximately 87% of the cumulative variance in the sample. Factors 1, 2 and 3 accounted for 29.22%, 15.06% and 11.22% of the variance respectively. Factors 7 and 8 have the least account of 4.37% and 3.59% of the variance respectively.

For the purpose of clarity and consistency in the variation pattern, Varimax method was used to further subject all the eight (8) extracted factors to orthogonal rotation in rotated component matrix so as to identify the significant factors that account for the variation in the spatial pattern of these variables and development. The result of the rotated component matrix is the loading of various variables on the eight (8) factors as shown in Table 3 – 10.

Factor Loadings

Factor I

Table, 3, revealed that seven variables positively loaded significantly on Factor I.

Table 3: Significant Variable Loading on Factor I

S/No	Variable code	Variable name	Loading	Commonality
1	V_{13}	Nurses and Midwives	.979	.977
2	V_{12}	Medical doctors	.979	.979
3	V_{26}	Banks	.957	.985
4	V_{14}	Pharmacists	.930	.940
5	V_{29}	Manufacturing industries	.919	.925
6	V_{11}	Hospital beds	.892	.923
7	V_{9}	Population with Tertiary Qualification	.786	.939

The seven variables that loaded positively on factor I have a total variance explained by 29.23% and 10.23 Eigen value (see Table, 2). Therefore, Factor I is considered to be medical services factor.

Although Table 3 shows that the total number of banks, manufacturing industries and people with tertiary qualifications loaded positively high on

Factor I, but the Factor is probably an indication of government's activities towards providing effective and efficient medical services in the 21 LGAs in Adamawa State. These variables might have loaded

highly on this factor since people's health status is a clear indicator of their level of poverty and/or well-being as suggested by the World Bank (2011). It is important for the population to be healthy because only healthy population can provide labour force needed to achieve development in the state.

Factor II

Table, 4, shows that seven variables significantly loaded on Factor resulting to an Eigen value of 5.27 and a total variance of 15.06% in the correlation analysis (see Table, 2).

Table 4: Significant variable loading on Factor II

S/No	Variable code	Variable name	Loading	Commonality
1	V_5	Secondary Schools	.939	.921
2	V_3	Primary School Teachers	.768	.901
3	V_7	Secondary School Enrolment (2016/2017session)	.745	.959
4	V_{15}	Community Health Workers	.674	.745
5	V_6	Secondary School Teachers	.589	.923
6	V_2	Primary schools	.564	.896
7	V_{23}	Percentage of people with GSM	.543	.916

Consequently, Factor II is considered to be education facilities factor. The loading pattern of variables on this factor show that index of total number of secondary school recorded the strongest positive effect and appears to be the most significant variable of factor II. This can be considered as an indication of government's effort at educating the citizens of the state. In the LGAs with high positive loading on secondary schools in Factor II, the population may probably make good use of all other provided socio-economic factors to boost the economic growth of the LGA. Factor II also shows positive loading for community health workers (CHOs, CHEWs and JCHEWs) and the total population using GSM. Since community health workers require minimum educational training, the high loading of secondary schools on this factor is considered an avenue to train youths for employment especially as junior health workers as suggested by Lehmann & Saunders, (2007). Therefore, Factor II is one of the drivers of spatial distribution pattern of socio-economic development in Adamawa State.

Factor III.

As shown in Table, 5, there are six (6) high positive loadings on Factor III with an Eigen value of 3.92 and total variance explained of 11.22% (see Table, 2).

Table 5: Significant Variable Loading on Factor III

S/No	Variable code	Variable name	Loading	Commonality
1	V_{20}	No. of Airport	.921	.935
2	V_8	No. of Post-Secondary Schools	.799	.886
3	V_{28}	No. of active mining/quarrying sites	.777	.814
4	V_{33}	No. of functional Public Well	.688	.872
5	V_4	Primary School Enrolment (2016/2017session)	.685	.823
6	V_{35}	No. of LGA with Tap Water	.524	.747

Variables that loaded highly positive on factor III are majorly urban-based. Hence, the reflection from factor III is that of residual infrastructure. Bashir (2012) described residual infrastructure factor as those factors that indicate "positive spread effects of the growth-center policy…" which government used to extend development from urban to rural areas. Hence, Factor III is named as residual infrastructure factor.

Factor IV.

There are five (5) variables on Factor IV with significant positive impact. These variables jointly have a total of 3.48 Eigen value and a total variance explained of 9.94% of the correlation analysis (see Table 2). The total variance of each variable ranges from 0.774 to 0.966 as in Table, 6.

Table 6: Significant Variable Loading on Factor IV

S/No	Variable code	Variable name	Loading	Commonality
1	V_{25}	No. of local TV signal	.898	.966
2	V_{24}	No. of local Radio signal	.853	.844
3	V_{22}	No. of GSM service providers	.830	.785
4	V_{32}	Minimum hours of electricity supply/day	.713	.803
5	V_{19}	Length of navigable waters (km)	.686	.774

On Factor IV, Local Television and Radio signals followed by the number of GSM service providers have the highest loadings. Hence, Factor IV can be conveniently interpreted as Information and Communication factor. High loading of Electricity on Factor IV is an indication that stability of electricity is germane to the spread of information, especially to the rural areas, about other socio-economic factors. Absence of stable electricity supply can make people to be unaware of government policies and efforts towards regional and/or community development. Previous studies such as Madon (2000), Gopalakrishna (2005), Obayelu & Ogunlade (2006) and Musingafi & Zebron (2014) have affirmed that Factor IV is an instrument that is useful in promoting awareness, eradicating poverty, and raising socio-economic development.

Factor V.

On the fifth Factor, three (3) variables are found to load significantly positive as shown in Table, 7.

Table 7: Significant Variable Loading on Factor V

S/No	Variable code	Variable name	Loading	Commonality
1	V_{27}	No. of Markets	.896	.933
2	V_{34}	No. of Boreholes	.879	.875
3	V_{31}	No. of prominent Localcraft making	.602	.770

The three (3) variables: markets, boreholes and local craft making, that loaded highly positive on Factor V have Eigen value of 2.53 and account for over 7.24% of the total variance of the correlation analysis (see Table, 2). Since there are many rural-based markets in Adamawa State, the variable loading on factor V is a reflection of economic activities, especially in the rural areas of the State. Therefore Factor V is named as Rural Marketing. According to Varma (2010), rural market has immense contribution to welfare and well-being of the rural populace. Most of the rural dwellers in Adamawa State are either farmers or traders who earn their living from markets. Hence, rural market is an important factor that influences the spatial pattern of socio-economic development in the State.

Factor VI.

Three variables loaded positively high on Factor VI and these variables are the total land area (km^2), length of paved and tarred roads (km). The three variables account for 2.08 Eigen value and have 5.95% total variance explained of correlation analysis. The total variance of each variable on Factor VI ranges from 0.891 to 0.727 as in Table, 8.

Table 8: Significant Variable Loading on Factor VI

S/No	Variable code	Variable name	Loading	Commonality
1	V_1	Total land area (km^2)	.891	.891
2	V_{18}	Length of engineered roads (km)	.757	.891
3	V_{17}	Length of tarred roads (km)	.534	.727

Therefore, due to the positive linear relationship between the land area and the available roads, Factor VI is considered to be road transportation. The variable with the highest loading is the total land area. However, the total length of tarred and paved roads that loaded highly positive is considered an indication of government's efforts at creating easy means of road transportation within the state but yet; there are more paved roads to be tarred in the state. Increasing tarred road index would not only enhance easy movement of people, goods and services between urban and rural areas, but also provide ground for sustainable socio-economic development of the state, and enhance standard of living of the state residents.

Factor VII.

As revealed on Table, 9, only one (1) variable loaded positively high on Factor VII.

Table 9: Significant Variable Loading on Factor VII

S/No	Variable code	Variable name	Loading	Commonality
1	V_{16}	No. of ambulances	.876	.806

Factor VII was extracted with an Eigen value of 1.53 and a total variance explained of 4.37%. This implies that over 4% of the total variance in the correlation analysis is associated with Factor VII (see Table 2). This factor, which is Ambulance services, has to do with easy transportation of patients to the hospitals. Hence, Factor VII is suggestive of the significance and the need for easy movement of those seeking medical service across the State. Therefore, Factor VII is termed Ambulance Services. Findings in this study shows that public Ambulances are more functional in Urban based public healthcare centers. Hence, The Healthcare Delivery System (2003), suggested that Ambulance Services should be made more efficient in every region to save lives.

Factor VIII.

Factor eight loaded highly positive on two variables which are the number of Healthcare Centers and Agro-processing Industries as in Table, 10.

Table 10: Significant Variable Loading on Factor VIII

S/No	Variable code	Variable name	Loading	Commonality
1	V_{10}	No. of Healthcare Centers	0.849	.769
2	V_{30}	No. of agro-processing industries	0.517	.778

The Eigen value of factor VIII is 1.25 and it account for 3.59% of the total variance of the correlation analysis (as in Table, 2). The pattern of variable loading in Factor VIII shows a linear relationship between the number of public Healthcare Centers and that of Agro-processing Industries which are more Rural-based. This loading pattern simply indicates that provision of public Healthcare Centers is critical to the development of Agro-economy. Therefore, Factor VIII is considered as Rural Health Delivery Factor, and it is one of the factors that influences spatial pattern of socio-economic development in Adamawa State.

The above rotated Factor Analysis indicates that variation in the spatial pattern of socio-economic development in Adamawa State is a function of eight different factors. The factors are Medical Services, Education Facilities, Residual Infrastructure, Information & Communication, Rural Marketing, Road Transportation, Ambulance Services and Rural Healthcare Delivery. However, these eight factors can be grouped to six (6) as Medical and Education facilities, Residual Infrastructure, Information & Communication facilities, Market and Road Transportation. Adequate provision and balanced spatial distribution of these factors among the 21 LGA in Adamawa State would enhance socio-economic development of the State and ultimately lead to improvement in the standard of living of the State residents.

The findings of this study on factors responsible for the variations in the spatial pattern of socio-economic factors and development in Adamawa State is contrary to the findings of Sternberg & Tamasy (1999), Madu (2006) and Paul et al (2014) who in studies blamed bad government, poor institutional policies and remote geographical

location of communities for such variation. Furthermore, the findings of this study also contradict that of Ejaz and Imran (2015), Makinde, (2016) and Balogun et al (2019) who reported that implementation of ineffective policy at local levels; taking over of the nation's administrative mechanism by "plunderers"; natural environment, proximity to state headquarters and political powers be blamed for spatial variations in socio-economic development.

Effects of spatial pattern of socio-economic indicators in Adamawa State

Effects of the spatial pattern of the assessed socio-economic indicators on the development of Adamawa State were examined and the result presented in Table 11.

Table 11: Respondent's opinion on the effect(s) of uneven spatial pattern of socio-economic factors on communities in Adamawa State

S/No	Item	Response	No	%
1	Does the current spatial distribution pattern of development negatively affect communities in the state	i. It causes health, education and other development outcome disparities between rural and urban population	201	52.89
		ii. There is high rate of unemployment and poverty	122	32.11
2	Transportation and communication	i. High cost of vehicle maintenance due to too many bad and unmotorable roads	193	50.79
		ii. Insecurity along some of the roads	78	20.53
3	Public education	i. Poor state of school buildings and other facilities therein	212	55.79
		ii. Problem of insecurity from the BHTs attacks	87	22.89
4	Commerce & Trade	i. Lack or inadequate infrastructural facilities in the markets	125	32.89
		ii. Inadequate banks and staff to serve the whole community	62	16.32
5	Public healthcare	i. Shortage of man power	105	27.63
		ii. Shortage of drugs	95	25.0
		iii. Time wastage before been attended to	84	22.11

As revealed, there are notable effects of the spatial pattern of socio-economic factors on the development of Adamawa State. According to most of the respondents (53%), uneven spatial pattern of socio-economic facilities in Adamawa Sate promote health, education and other development outcome disparities between rural and urban population; and high rate of unemployment and poverty (32.11%). In terms of transportation, high level of insecurity along many roads such as Yola – Mubi Road, Lafia – Ngurore Road, and Numan – Yola Road; as well as high cost of vehicle maintenance in the state was reported. While a little over 20% of the respondents blamed the concentration of tarred roads in just few LGAs and/or regions in Adamawa State for the high level of insecurity being experienced by motorist along the mentioned roads, more than half of the respondents (50.79%) linked the high cost of vehicle maintenance in the state to the fact that many LGAs and/or regions in the state lack tarred and motorable roads that is convenient for transportation.

Also, nearly 60% of the respondents explained that the uneven spatial pattern of public education facilities and personnel in Adamawa State causes insufficiency and poor state of, the few available, public school infrastructures in most of the disadvantaged LGAs such as Shelleng, Toungo, and Guyuk LGAs among others as shown in plate 1. The consequence of such spatial pattern on the disadvantaged communities and/or LGAs include the fact that many children, especially the less privileged ones, are denied access to affordable public education services and increase of illiteracy level in the affected communities, LGAs.

Plate 1: Dilapidated Classrooms in Ganye Town, Ganye LGA.
Source: Field Survey, (2018).

Basic socio-economic facilities such as electricity, potable water, education and medical facilities & personnel are either insufficiently provided, or are out rightly not available in many communities and/or LGAs in the state. Inadequacy and uneven spatial pattern of public facilities such as public education facilities (classroom blocks, teachers), and healthcare facilities and personnel (health centers, medical doctors, nurses and midwifes), among others, is blamed for high rate of unemployment & poverty among the residents of the state, underdevelopment of communities, LGAs and the State.

In addition, over concentration of the State's public healthcare facilities and personnel in few LGAs such as Yola North, Yola South and Mubi South and Numan LGAs, is also blamed for the shortage of medical personnel like doctors, nurses & midwives and pharmacists among others in public healthcare facilities that are located in the disadvantaged communities and LGAs in the State. Hence, public healthcare facilities in disadvantaged LGAs such as Demsa, Girei, Lamurde, Shelleng and Michika, among others are usually over-crowded, over-stretched, personnel over-laboured, and hospital patrons spend much time and money before accessing affordable public healthcare service(s).

The findings of this study agrees with Gilles & Franceschini (2006) and Mansour (2016) that stated that uneven spatial distribution of health facilities is often responsible for poor health outcomes for the residents of the disadvantaged localities, or between the rural and urban population; and high cost of accessing public healthcare in faraway locations. It also agrees with the findings of Inobeme & Ayanwole (2009) who blamed uneven spatial pattern of socio-economic indicators for the inaccessibility of a large part of Zaria population to western education system, deterioration of quality of education services rendered in the public secondary schools in Zaria, proliferation of expensive profit, rather than service, oriented private schools. According to Dhananjayan (2005), over concentration of facilities in few locations, especially urban areas often results in wastage and under-utilization of such facilities while the few provided facilities in other (rural) areas are rendered inefficient, ineffective and thereby resulting in underdevelopment of the neglected communities, LGAs, and/or regions; unattainment of socio-economic growth in the state.

However, Shafa (2017) warned that no nation can develop without adequate provision of infrastructures such as industries, electricity, health, and education facilities, among others, which are all essential towards poverty eradication, community and regional development. According to Churski (2014), socio-economic indicators that are evenly distributed across region can enhance equitable distribution of development benefits and opportunities, ensure economic, social, political satisfaction and improves quality of life. Therefore, imbalance spatial pattern of socio-economic facilities among various geographic units in a state promotes development disparities especially between rural and urban areas (Gilles and Franceschini (2006).

Conclusion

This study was conducted with the aim of providing quantitative empirical information on the drivers of the spatial pattern of socio-economic development in Adamawa State. Findings from the study show six categories of factors that are significant contributors to the spatial pattern of socio-economic

development in the State. The six identified contributors are medical personnel & facilities, education facilities, residual infrastructure, information & communication facilities, market and road transportation. These facilities are responsible for the uneven spatial pattern due to their insufficiency and indiscriminate distribution across the state. In terms of the effect the spatial pattern of socio-economic indicators has on communities, respondents unanimously agreed there are many negative implications of the uneven pattern of the assessed socio-economic factors on the state. Such negative impacts include poor state of the few provided facilities, over labour of personnel, less accessibility to affordable public education, health, domestic water and electricity facilities by a good numbers of Adamawa State residents. Hence, it was concluded that the current high level of variability in the spatial pattern in socio-economic development in Adamawa State would retard socio-economic development of the state and lower Adamawa State resident's standard of living.

Recommendation

Based on the findings of this study, the following recommendations were made:

- Adamawa State government and her community development partners need to invest on sufficient provision of the identified drivers of spatial variability of socio-economic development which include medical facilities, education facilities, residual infrastructure, information & communication facilities, market and efficient road medium of transportation.
- Besides sufficient provision of the identified drivers of variability in the spatial pattern of socio-economic development, there is need to ensure equitable spatial distribution of such facilities amongst the various geographic units (communities, LGAs and regions) in the state so as to ameliorate the negative impact of uneven distribution of such facilities of the state residents.

References

Adebayo, A. A. (1997). Factor Analysis of forest floor variability in a Savanna wool land of south western Nigeria. *Global Journal of pure and applied sciences*, 3(2), 255 – 263.

Adebayo, A. A (2020). Introduction. In A. A. Adebayo, A. L. Tukur & A. A. Zemba (Eds.), *Adamawa State in Maps.* Yola, Paraclete.

Adebayo, A. A. and Zemba, A. A. (2020). Climate. In A. A. Adebayo, A. L. Tukur and A. A. Zemba (Eds.), *Adamawa State in Maps.* Yola, Paraclete.

Adefila, J. O. (2012). Regional inequalities in socioeconomic development in Nassarawa State of Nigeria: A spatial analysis for planning. *Journal of Asian Social Science*, 9(1):1-6.

Adewusi, O. A. (2015). Socio-economic analysis of pipe-born water supply in Mubi metropolis of Adamawa State, Nigeria. *International Journal of Business and Social Science*, 6(5), 194 - 98.

Akosim, C., Tella, I. O. and Jatau, D. F. (2020). Vegetation and Forest Resources. I*n* A. Adebayo, A. L. Tukur. and A. A Zemba (Eds.), *Adamawa State in Map.* Yola, Paraclete.

Anjorin, O. J. (2021). *Analysis of the spatial aspects of socio-economic development in Adamawa State, Nigeria*. PhD Thesis submitted to the Department of Geography, Modibbo Adama University, Yola, Nigeria.

Anjorin, O. J., Galtima, M. & Ray, H. H (2021). Analysis of the spatial pattern of public healthcare facilities and personnel in Adamawa State, Nigeria. *Gombe Journal of Geography and Environmental Studies, 2(1), 22 – 39.*

Balogun, G. F. (2018). *Spatial Inequalities in socioeconomic development in Kogi state, Nigeria*. Unpublished Doctoral dissertation, Ahmadu Bello University, Zaria.

Bashir, A. (2012). *Regional development and public policy in the Gongola region, Nigeria: An empirical study of spatial patterns and processes.* U.S.A. Lambert Academic Publishing.

Churski, P. (2014). Variations in the spatial distribution of areas of economic growth and stagnation in Poland: determinants and consequences. *Quaestiones Geographicae*, 33(2), 63-77.

Dogo, B., Ezeamaka, C. K., Ajibuah, J., Adepetu, A., Adewuyi, T. O. & Akinwumi, O. O. (2019). *Spatial distribution of educational facilities in Lere Local Government Area of Kaduna State, Nigeria*. Retrieved on 15th March, 2020 from www.aag.secureabstract.com

Fabiyi, O. O. & Ogunyemi, S. A. (2015). *Spatial distribution and accessibility to post-primary educational institutions in Ogun State, Southwestern Nigeria*: case study of Yewa South Local Government Area, Nigeria. Retrieved on 15th March 2020 from www.semanticsholar.org

Fadahunsi, J. T., Kufoniyi, O. & Babatimehin, O. I. (2017). Spatial analysis of distribution patterns of healthcare facilities in Osun State, Nigeria. *Universal Journal of Public Health, 5*(7), 331 - 344.

Gire, A. A. & Dire, B. (2014). Analysis of poverty and inequality among farmers in Yola North LGA of Adamawa State, Nigeria. *International Review of Social Sciences & Humanities*, 6(2), 126 - 132.

Gopalakrishnan, T. R. (2005). Exploring old terrains with new technologies: making ICT services and applications work for the poor. *Paper presented on Landscapes of ICT and Social Accountability*, University of Turku, Turku, Finland.

Gwary, M. M., Kwaghe, P. V., Ja'afar-Furo, M. R. & Dennis, A. (2011). Analysis of entrepreneurial agricultural activities ofyouths in Michika Local Government Area of AdamawaState, Nigeria. *Journal of Development and Agricultural Economics, 3(3)*, 91 - 97.

Hughes, D. W. & Holland, D. W. (1994). Core-periphery economic linkage: a measure of spread and possible backwash effects for the Washington economy. *Land Economics*, 70(3), 364 –377.

Ilesanmi, F. A. (2013). Regional development planning proposal for Adamawa state, Nigeria using the core – periphery model. *International Journal on Arts, Management and Humanities*, 2(2), 21-34.

Ita, A. E., Bisong, F.E., Eni, D. D. & Iwara, A.I. (2012). Development inequalities among geographic units in Cross River state, Nigeria. *Continental journal of sustainable development*, 3(3), 1-10.

John, T. (2016). *Regional Development*. In Oxford Bibliographies. DOI: 10.1093/obo/9780199874002 - 0134.

Kanagawa, M. & Nakata, T. (2008). Assessment of access to electricity and socioeconomic impacts in rural areas of developing countries. *Journal of energy policy*, 36, 2016-2029.

Lehmann, U. & Sanders, D. (2007). *Community health workers: what do we know about them? World Health Organization* . retrieved on 12th July 2019 from www.researchdate.net

Mabogunje, A. L. (2015). *The development process: A spatial perspective*. Routledge

Madon, S. (2000). The internet and socioeconomic development: exploring the interaction. *Inf. Technol. People*, 13, 85-101.

Madu, I. A. (2006). Spatial inequality in Nigeria: the imperative of geographic perspectives in the development process. *Journal of social science and economic studies*, 8(2), 105-112 Retrieved on 14th April 2018 from www.Researchgate.net/publication/257199108

Makinde, O., Sule, A., Ayankogbe, O. and Boone, D. (2018). Distribution of health facilities in Nigeria: implications and options for universal health coverage. *International Journal of Health Planning and Management*, 33(4), 1179 -1192. doi: 10.1002/hpm.2603. Epub 2018 Aug 9. PMID: 30091473.

McDermott, R. E., Cornia, G. C. & Parsons, R. J. (1991). The impact of hospitals in rural communities. *Journal of rural health*, 7(2), 117–133. Retrieved on 20th July 2019 from www.ncbi.nlm.nih.gov/pubmed/10116773.

Micheal, M. (2011). Community participation in rural development. A case study of Vim-Tim Area. Unpublished national diploma project, Federal Polytechnic, Mubi, Adamawa State, Nigeria.

Musingafi, M. C. C. & Zebron, S. (2014). The role of information and communication technology in rural socioeconomic development in Africa. *International Journal of Public Policy and Administration Research*, 1(2), 38-46.

National Population Commission cited in National Bureau of Statistics Official Gazette (FGP 71/52007/2, 500(OL24), (2006): Legal notice on publication of the detailed of the breakdown of the national and state provisional totals 2006 census.

North, D.C. (1990). *Institutions, institutional change and economic performance*. New York. Cambridge University Press.

Obayelu, A. E. & Ogunlade, I. (2006). Analysis of the uses of information and communication technology for gender empowerment and sustainable poverty alleviation in Nigeria. *International journal of education and development using information and communication technology* (IJEDICT), 2(3), 45-69.

Obu, J. I., Obienusi, E. A., Ozoemene, M. L. & Iwu, E. O. (2015). Spatial inequality in development: a case study of Anambra state, Nigeria. *International journal of physical and human geography*, 3(4), 1 - 26.

Ohlan, R. (2013). Pattern of regional disparities in socioeconomic development in India: district level analysis. *Social indicator research, 114,841–873.*

Sadiq, Y., Balogun, G. and Anjorin, O. (2016). Spatial distribution of socioeconomic factors in Kogi state, Nigeria: development issues and implication(s). *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering*, 10(11), 3582-3589.

Scott A. J. and Storper M. (2003). Regions, globalization, development. *Regional Studies*, 37(6), 579-593.

Sternberg, R. and Tamasy, C. (1999). Munich as Germany's no. 1 high technology region, *Regional Studies*, 33(4), 367.

Sulyman, A. O. (2009). *Infrastructural facility provision and socioeconomic development in rural settlement of Niger State*, Nigeria. Unpublished doctoral dissertation, University of Ilorin, Kwara state.

Talpur, M. H., Ali, T. H., Chandio, I. A. & Shaikh, F. A. (2018). Transportation planning studies for socioeconomic development of depressed sub-regions: a review. *Mehran university research journal of engineering & technology*, 37(3), 603-614.

The health care delivery system." institute of medicine. (2003). *The future of the public's health in the 21st century*. Washington, DC: The National Academies Press. doi: 10.17226/10548.

Ujoh, F. and Kwaghsende, F. (2014). Analysis of the spatial distribution of health facilities in Benue state, Nigeria. *Public health research, 4*(5), 210-218.

Umoren, V. E. (2013). Socioeconomic Development inequalities among geographic units in Akwa Ibom state, Nigeria. *Ethiopian journal of environmental studies and management*, 6(3), 300-304.

UNESCO. (2005). *The impact of education quality on development goals*. EFA global monitoring report of united nation educational, scientific and cultural organization (UNESCO). Retrieved on 12th July 2019 from www.unesco.org

Varma, A. A. (2010). *Importance and development of rural marketing*. Retrieved on 22nd July 2019 from http://indianmba.com/Occasional_Papers/OP219/op219.

Willie, K. (2016). *Development theory*. *Oxford Bibliographies*. Retrieved on 27th August 2016 from www.oxfordbibliographies.com

World Bank (2011). *Nigeria socioeconomic assessment.* Washington, DC: World Bank. Retrieved on 12th July 2019 from www.document.worldbank.org

Wu, J. & Gopinath, M. (2008). What causes spatial variations in economic development in the United States. *American journal of agricultural economics, 90, 232 - 248.*

Yaro, C. A., Ezekiel, K., Onoja, A. E., Attah, T. C. & Zubairu, B. O. (2019). Challenges and spatial distribution of water infrastructures (boreholes) in Okene town, Kogi state, Nigeria. *Journal of applied science*, 19, 25-30.

Zemba, A. A; Tukur, A. L. and Ezra, A (2020). Basic geographic information on Local Government Areas. In A. A. Adebayo, A. L. Tukur and A. A. Zemba (Eds.), *Adamawa State in Maps.* Yola, Paraclete.

Acknowledgments

Data for this paper were extracted from the author's Ph.D thesis that was submitted to Geography Department, Modibbo Adamawa University, Yola, Nigeria. The PhD research (Rural Geography) was funded by the Nigeria Government through Tertiary Education Fund (TETFUND).