International Journal of Science and Research Archive

eISSN: 2582-8185

Cross Ref DOI: 10.30574/ijsra

Journal homepage: https://ijsra.net/

(REVIEW ARTICLE)

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Critical analysis of factors affecting land use allocation in delta state, Nigeria 2012-2022

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International Journal of Science and Research Archive, 2023, 10(01), 941–950

Publication history: Received on 09 September 2023; revised on 16 October 2023; accepted on 19 October 2023

Article DOI: https://doi.org/10.30574/ijsra.2023.10.1.0846

Abstract

Critical analysis of factors affecting land use allocation in Delta state between 2012 and 2022 involves a comprehensive analysis of various elements that influence the distribution and utilization of land resources in the region. Land use allocation refers to the process of determining how different parcels of land are designated for specific purposes such as agriculture, residential, commercial, industrial, or conservation. The aim of the study is to analyze the various factors that influence the allocation of land for different purposes within the state. Sample size of 885 was obtained from the population using Taro Yamane's formula for sample size determination. This study adopted qualitative and quantitative research methods to analyze the opinion of the respondents in relation to the objectives of the study. Questionnaires were distributed to Estate Surveyors and Valuers in Delta State, members of Real Estate Developers Association of Nigeria in Delta State, Town planners in Delta State, Occupiers of Delta Development and Property Authority, Allottees of the Delta State Government and Delta State Land Use Allocation Committee to get their opinions. Data collected were presented using frequency table, percentage and analyzed using mean score analysis, PCA was used to analyze the four distinct factors affecting land use and allocation procedures to determine their individual contributions and understand their impact on land use allocation. The results found that the PC 1 which captures the most variation in the data is related to population density. The higher the population density, the more demand there is for Land in Delta state. The study recommends that Government should intensify efforts in protecting Land Use Allocation and ensure that citizens adhere to Land Use Allocation and avoid unnecessary Conversions or Change of Use.

Keywords: Analysis; Factors; Affecting; Land Use Allocation

1. Introduction

Land use allocation refers to the process of determining how different areas of land should be utilized for various purposes. It involves the allocation of land for residential, commercial, industrial, agricultural, recreational, and other purposes. The goal of land use allocation is to ensure efficient and sustainable use of land resources while meeting the needs of the population and promoting economic development.

Types of land use allocation

There are several types of land use allocation that are commonly practiced:

- **Residential Land Use**: Residential land is allocated for housing purposes. This includes single-family homes, multi-family buildings such as apartments and condominiums, and mobile home parks. Residential land use also includes the provision of infrastructure such as roads, utilities, and community facilities like schools, parks, and hospitals.

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- **Commercial Land Use**: Commercial land is allocated for business activities such as retail stores, offices, hotels, restaurants, and other commercial establishments. It is typically located in urban or suburban areas with good accessibility to transportation networks and a large customer base. Commercial land use aims to support economic growth by providing spaces for businesses to operate and generate employment opportunities.
- **Industrial Land Use**: Industrial land is allocated for manufacturing, processing, warehousing, and distribution activities. It includes factories, industrial parks, logistics centers, and other facilities necessary for industrial operations. Industrial land use requires adequate infrastructure for transportation and utilities to support the movement of goods and materials.
- **Agricultural Land Use**: Agricultural land is allocated for farming activities such as crop cultivation, livestock rearing, and forestry. It includes arable land for growing crops and pastureland for grazing animals. Agricultural land use is essential for food production and plays a crucial role in ensuring food security.
- **Recreational Land Use**: Recreational land is allocated for leisure activities such as parks, playgrounds, sports fields, golf courses, and nature reserves. It provides spaces for people to engage in outdoor activities, exercise, relax, and enjoy nature.
- **Open Space Land Use**: Open space land is allocated for preserving natural areas, protecting biodiversity, and maintaining ecological balance. It includes forests, wetlands, wildlife habitats, and other undeveloped areas. Open space land use helps to conserve natural resources, provide ecosystem services, and enhance the quality of life for communities.
- **Institutional Land Use**: Institutional land is allocated for public and community facilities such as schools, hospitals, government offices, religious institutions, and community centers. It supports the provision of essential services and infrastructure for the well-being of the population.
- **Transportation Land Use**: Transportation land is allocated for transportation infrastructure such as roads, highways, railways, airports, and ports. It facilitates the movement of people and goods within and between different areas.

1.1. Factors Influencing the Pattern of Land Use Allocation in Nigeria

The factors influencing the pattern of land use according to Nwanekezie (2009) can be described within two framework as follows:

1.2. The Physical Framework

This involves the law of nature, which can be categorized under geographical influence; the use to which land in a particular locality may be put is highly influenced by the regular pattern, of weather conditions, like temperature, amount of rain and its regularity of winds and others. Whether a place is in the desert region, forest or temperate region is often put into consideration before deciding on what the land is suitable for. Settlement pattern in the desert region differ considerably from that of temperate or forest region. The nature of soil is also put into consideration as in whether it is suitable for a particular use. For instance, solid firm land could be preferred to sandy, loamy or waterlogged area for residential use. With the development of modern technology, many things are achievable, but it is expensive and often not within the reach of everyone especially in the developing nations. Another element in the physical framework is the topography of the area. A hilly, rocky or undulating land area is not suitable for the construction of airport, industrial and commercial use.

1.3. The Institutional Framework

Customs, traditions, laws, organization and other institutions of human society are the practices that influence the use of land (Lichfield, 1969). These practices could be grouped into private individuals and public institutions. Private individual practices include social behaviors, customs and religious belief. Religiously, there are sacred lands, which cannot be used for any other purposes like residential, or commercial except for worshipping gods. Also, certain uses that contradict the religious belief of some people in a particular community are forbidden. For example, in the Muslim dominated communities, beer parlors, cinema houses, hotels and rearing of pigs are not allowed. Under traditions and customs, some groups of people live together in large numbers while others constitute scattered communities. Some private individuals, group of people or family property owners also dictate what, how and when their land can be put to use. Public institutions include town planning activities, other regulatory bodies, laws etc.

Town Planning Authority, Ministry of Lands, Works and Housing, Environmental Protection Agencies and Legislative Bodies respectively undertake regulatory measures that determine the uses of land. Government policies on development of land at Federal, State and Local Government levels have some far reaching effects on pattern of land use in the society. Those public institutions undertake necessary corrective, all preventive measures to counter the disastrous results of the activities of other forces in the usage of land. Apart from the zoning and other town planning

regulations, there are, according to Nwanekezie (2009) three other key laws in Nigeria viz, the Land Use Act Cap 2020 LFN, the Environmental Impact Assessment (EIA), Decree 86 of 1992, and the Nigerian urban and Regional Planning Decree 88 of 1992. The principles and policies of the affected public institutions are enshrined in the laws as a way forward for better environmental management strategies.

There are other factors which can affect Land use allocation, or Land use allocation are influenced by variety of factors that can have significant impacts on the way land is utilized and allocated. These factors can be broadly categorized into physical, economic, social, and political factors. Each of these factors plays a crucial role in shaping land use patterns and determining how land is allocated for different purposes.

1.3.1. Physical Factors

Physical factors include natural features such as topography, climate, soil fertility, and water availability. These factors influence the suitability of land for various uses. For example, flat and fertile land is often preferred for agricultural purposes, while hilly or mountainous areas may be more suitable for forestry or conservation purposes. Climate conditions also play a role in determining the types of crops that can be grown in a particular area. Additionally, the availability of water resources is a critical factor in determining the feasibility of certain land uses, such as irrigation-based agriculture or industrial activities.

1.3.2. Economic Factors

Economic factors encompass market forces, financial considerations, and resource availability. Land values are influenced by supply and demand dynamics, as well as the potential profitability of different land uses. For instance, prime locations in urban areas may command higher prices due to their proximity to amenities and economic opportunities. Economic factors also influence the allocation of land for industrial or commercial purposes based on factors such as transportation infrastructure, access to markets, and availability of labor. Furthermore, resource availability, such as the presence of minerals or energy sources, can influence land use decisions.

1.3.3. Social Factors

Social factors encompass demographic characteristics, cultural preferences, and societal needs. Population growth and urbanization patterns play a significant role in shaping land use decisions. As populations expand, there is increased pressure on land for housing, infrastructure development, and public services. Cultural preferences also influence land use patterns; for example, certain areas may be designated for religious or recreational purposes based on societal norms and values. Additionally, social needs such as the provision of healthcare facilities, educational institutions, and recreational spaces can influence land allocation decisions.

1.3.4. Political Factors

Political factors include government policies, regulations, and decision-making processes. Land use planning and allocation are often guided by zoning regulations, land use plans, and environmental protection laws. Governments play a crucial role in determining the allocation of land for different purposes through policy interventions and regulatory frameworks. Political factors also encompass issues of governance, transparency, and stakeholder participation in decision-making processes. Political stability and the effectiveness of institutions can significantly impact land use allocation.

1.4. The Interplay of these Factors Affects Land use Allocation in Several ways

- **Spatial Distribution:** The combination of physical, economic, social, and political factors determines the spatial distribution of different land uses. For example, agricultural activities may be concentrated in areas with fertile soil and favorable climate conditions, while industrial zones may be located near transportation networks or resource-rich areas.
- **Competition for Land:** As population growth and urbanization continue to increase, there is often competition for limited land resources. This competition can lead to conflicts between different stakeholders with varying interests in land use. Balancing competing demands for housing, agriculture, industry, conservation, and infrastructure becomes a complex challenge for land use planners.

In conclusion, land use allocation are influenced by a wide range of factors including physical characteristics of the land, economic considerations, social needs and preferences, as well as political policies and regulations. The interplay of these factors shapes the spatial distribution of different land uses and creates competition for limited resources.

2. Methodology

For this study, qualitative and quantitative research method were adopted. The population of this study are professional members of Nigerian Institution of Estate Surveyors and Valuers Delta State, Real Estate Developers association of Nigeria Delta State, Nigerian Institute of Town Planner Delta State, Occupiers of Delta Development and property Authority (DDPA) Housing Estates, Allottees of Delta State Government ; Delta State Land Use Allocation Committee. The total population for the study is 4744. From this population a sample size of 885 was drawn with the use of Taro Yamane Formula. Questionnaires was distributed to the respondents to obtain their opinion. The data obtained from the respondents were presented with the use of tables and analyzed with PCA

2.1. Factors Affecting Land Use Allocation in Delta State

Table 1 Physical Factor

Questions	SA	A	UD	DA	SD	Total	
Land topography	650	160	33	25	17	885	4.58
Climate	560	213	67	30	15	885	4.44
Soil Type	501	198	100	78	8	885	40.5
Water Availability	584	97	115	18	91	885	4.62

Table 2 Economic Factor

Questions	SA	A	UD	DA	SD	Total	Mean
Market forces	717	115	5	21	27	885	4.67
Financial Considerations	690	81	8	71	35	885	4.49
Availability and Resources	646	186	6	35	12	885	4.6
Distance from nearby market	584	97	115	18	71	885	4.25

Table 3 Social Factors

Questions	SA	A	UD	DA	SD	Total	Mean
Population Density	662	127	58	30	8	885	4.58
Technological Capability	681	150	21	28	5	885	4.67
Culture and Tradition	675	101	98	6	5	885	4.62
Society Need	560	213	67	30	15	885	4.44

Table 4 Political Factor

Questions	SA	A	UD	DA	SD	Total	Mean
Government Polices on Expansion and Usage	650	160	33	25	17	885	4.58
Legislation	666	130	39	28	22	885	4.59
Regulation and Decision	681	150	21	28	5	885	4.57

From table 1 to 4, all the response has a mean score above 3.0 which means that they are accepted as factors affecting land use allocation in Delta State.

2.2. Principal Component Analysis

Principal Component Analysis (PCA) is a widely used statistical technique that plays a pivotal role in multivariate data analysis and dimensionality reduction. These components are linear combinations of the original variables, and they are ordered in such a way that the first component captures the most significant amount of variation in the data, the second component captures the second most significant variation, and so on. In this study, PCA is applied independently to four distinct factors: social factors, economic factors, physical factors, and political factors that effects land use allocation in Delta State. Each factor consists of multiple variables, and by analyzing them separately, we can gain deeper insights into the specific dimensions of variation within each factor.

Table 5 Social Factor

Population Density	Technology Capability	Culture or Tradition	Society Need
662	681	675	560
127	150	101	213
58	21	98	67
30	28	6	30
8	5	5	15

Principal Component Analysis for Social Factor

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.959	98.980	98.980	3.959	98.980	98.980
2	.033	.820	99.799			
3	.008	.199	99.998			
4	7.961E-5	.002	100.000			

Extraction Method: Principal Component Analysis.

From the above, it appears that the first principal component (PC1) explains the majority of the variance in the data (98.980%) with eigenvalue 3.959. Since it accounts for such a high percentage of variance, PC1 is likely a strong and meaningful combination of the original variables. This component could be used as a summary or representative of the data. This first principal component, which captures the most variation in the data, is related to population density. The higher the population density, the more demand there is for land in Delta state. The remaining principal components (PC2, PC3, and PC4) explain very little variance compared to PC1. Their eigenvalues are much smaller, indicating that they contribute less to the overall variance in the data. In this case, PC2 explains only 0.820%, PC3 explains 0.199%, and PC4 explains an even smaller percentage. The results suggest that the first principal component (PC1) is highly important and sufficient to represent the data, as it explains almost all of the variance.

Table 6 Component Matrixa

	Component
	1
Population Density	.999
Technology Capability	.998
Culture or Tradition	.993
Society Need	.990
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	

From table 6, the Component Matrix in Principal Component Analysis (PCA) shows the correlation coefficients (loadings) between the original variables and the extracted principal component(s). Population Density has a very high positive loading of approximately 0.999 on Component 1. This indicates a very strong positive correlation between Population Density and Component 1. When Component 1 increases, Population Density also tends to increase. Technology Capability also has a very high positive loading of approximately 0.998 on Component 1. This suggests a very strong positive correlation between Technology Capability and Component 1. Changes in Component 1 are associated with similar changes in Technology Capability. Culture or Tradition has a high positive loading of approximately 0.993 on Component 1. This indicates a strong positive correlation with Component 1. Culture or Tradition is positively related to Component 1. Society Need has a positive loading of approximately 0.990 on Component 1. This suggests a positive correlation with Component 1. Society Need is also positively related to Component 1.

The high positive loadings on Component 1 indicate that the variables (Population Density, Technology Capability, Culture or Tradition, and Society Need) are strongly associated with the first principal component. This means that these variables have a direct impact on how land is allocated in Delta State.

Table 7 Political Factors

Government Polies	**Legislations**	**Regulation**
650	666	681
160	130	150
33	39	21
25	28	28
17	22	5

Total Variance for Political Factors

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.998	99.924	99.924	2.998	99.924	99.924
2	.002	.065	99.990			
3	.000	.010	100.000			

Extraction Method: Principal Component Analysis.

Variance Explained: The "Total % of Variance" column shows the percentage of total variance explained by each principal component. In this case, the percentages are as follows:

Component 1: 99.924%, Component 2: 0.065%, Component 3: 0.010%

Component 1 explains almost all the variance in the data (99.924%), while Component 2 and Component 3 explain negligible proportions of the variance.

Table 8 Component Matrixa

	Component
	1
Government Polies	1.000
Legislations	.999
Regulation	1.000
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	

From table 8, Government Policies have a perfect positive loading of 1.000 on Component 1. This indicates a perfect positive correlation between Government Policies and Component 1. When Component 1 increases, Government Policies also increase proportionally. Legislations also have a very high positive loading of approximately 0.999 on Component 1. This suggests a very strong positive correlation between Legislations and Component 1. Changes in Component 1 are associated with similar changes in Legislations. Regulation also has a perfect positive loading of 1.000 on Component 1. This indicates a perfect positive correlation between Regulation and Component 1. Regulation is perfectly related to Component 1.

The perfect positive loadings on Component 1 indicate that the variables (Government Policies, Legislations, and Regulation) are perfectly and strongly associated with the first principal component. This means that these variables contribute significantly to the formation of Component 1 and share perfect positive patterns of variation. This implies that Government Policies, Legislations, and Regulation plays a crucial role in shaping the overall patterns of land use allocation in Delta State.

Table 9 Physical Factors

Land topology	**Climate**	**Soil Type**	**Water Availability**
650	560	501	584
160	213	198	97
33	67	100	115
25	30	78	18
17	15	8	91

From Table 9, Land Topology has a high positive loading of approximately 0.998 on Component 1. This suggests that Land Topology is strongly positively correlated with Component 1. When Component 1 increases, Land Topology tends to increase as well. Climate also has a high positive loading of approximately 0.994 on Component 1, indicating a strong positive correlation with Component 1. Changes in Component 1 are associated with similar changes in Climate. Soil Type has a high positive loading of approximately 0.989 on Component 1, indicating a strong positive correlation. Soil Type is positively related to Component 1. Water Availability has a positive loading of approximately 0.975 on Component 1, indicating a strong positive correlation. Water Availability is also positively related to Component 1. The high positive loadings on Component 1 suggest that the original variables (Land Topology, Climate, Soil Type, and Water Availability) have a strong positive relationship with the first principal component. This means that these variables contribute significantly to the formation of Component 1 and have a similar pattern of variation.

Table 10 Component Matrix[a]

	Component
	1
Land topology	.998
Climate	.994
Soil Type	.989
Water Availability	.975
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	

Table 11 Total Variance for Physical Factor

Total Variance Explained						
Component	**Initial Eigenvalues**			**Extraction Sums of Squared Loadings**		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	3.911	97.783	97.783	3.911	97.783	97.783
2	.077	1.924	99.708			
3	.008	.191	99.899			
4	.004	.101	100.000			
Extraction Method: Principal Component Analysis.						

Based on table 11, it appears that the first principal component (PC1) explains the majority of the variance in the data (98.980%) with eigenvalue 3.911. Since it accounts for such a high percentage of variance, PC1 is likely a strong and meaningful combination of the original variables. This component could be used as a summary or representative of the data. This first principal component, which captures the most variation in the data, is related to population density. The higher the population density, the more demand there is for land in Delta state. The remaining principal components (PC2, PC3, and PC4) explain very little variance compared to PC1. Their eigenvalues are much smaller, indicating that they contribute less to the overall variance in the data. In this case, PC2 explains only 1.924%, PC3 explains 0.191%, and PC4 explains an even smaller percentage.

Table 12 Economic Factor

Market Force	**Financial Consideration**	**Availability and Resources**	**Distance from nearby Market**
717	690	646	584
115	81	186	97
5	8	6	115
21	71	35	18
27	35	12	71

Table 13 Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.940	98.502	98.502	3.940	98.502	98.502
2	.041	1.033	99.534			
3	.018	.455	99.989			
4	.000	.011	100.000			
Extraction Method: Principal Component Analysis.						

From Table 13, the first principal component (PC1) has an initial eigenvalue of 3.940, which means that it explains 3.940 units of variance in the original data set. It also has an extraction sum of squared loading of 3.940, which means that it captures 3.940 units of variance from the original data set. The percentage of variance explained by PC1 is 98.502%, which means that it accounts for almost all of the variation in the data set. The cumulative percentage of variance explained by PC1 is also 98.502%, which means that adding more components will not increase the explained variance much. The second principal component (PC2) has an initial eigenvalue of 0.041, which means that it explains 0.041 units of variance in the original data set. It does not have an extraction sum of squared loading, which means that it is not selected as a principal component. The percentage of variance explained by PC2 is 1.033%, which means that it accounts for very little variation in the data set. The cumulative percentage of variance explained by PC2 is 99.534%, which means that adding PC2 to PC1 will increase the explained variance slightly. The third principal component (PC3) has an initial eigenvalue of 0.018, which means that it explains 0.018 units of variance in the original data set. It does not have an extraction sum of squared loading, which means that it is not selected as a principal component. The percentage of variance explained by PC3 is 0.455%, which means that it accounts for even less variation in the data set. The cumulative percentage of variance explained by PC3 is 99.989%, which means that adding PC3 to PC1 and PC2 will increase the explained variance marginally. The fourth principal component (PC4) has an initial eigenvalue of 0.000, which means that it explains no variance in the original data set. It does not have an extraction sum of squared loading, which means that it is not selected as a principal component. The percentage of variance explained by PC4 is 0.011%, which means that it accounts for almost no variation in the data set. The cumulative percentage of variance explained by PC4 is 100%, which means that adding PC4 to PC1, PC2, and PC3 will not increase the explained variance at all.

Table 14 Component Matrix[a]

	Component
	1
Market Force	1.000
Financial Consideration	.994
Availability and Resources	.989
Distance from nearby Market	.986
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	

Table 14, shows that market force has a loading of 1.000, which means that it is perfectly aligned with the component and has a strong positive relationship with it. Financial consideration has a loading of 0.994, which means that it is almost perfectly aligned with the component and has a very strong positive relationship with it. Availability and resources have a loading of 0.989, which means that it is also very strongly aligned with the component and has a strong positive relationship with it. Distance from nearby market has a loading of 0.986, which means that it is slightly less aligned with the component than the other variables, but still has a strong positive relationship with it. To summarize, the table shows that all the four variables are highly correlated with each other and with the first principal component, which captures all the variation in the data. This implies that market force, financial consideration, availability and

resource and distance from nearby market plays a crucial role as an economic factor affecting land use allocation in Delta State.

3. Summary of Findings

Principal Component Analysis (PCA) was applied independently to four distinct factors: social factors, economic factors, physical factors, and political factors that affect land use allocation in Delta State. Each factor consist of multiple variables and Was analyzed separately using PCA to gain a comprehensive understanding of how social, economic, physical, and political factors individually contribute to land use allocation in Delta State. This approach allows us to identify the key dimensions within each factor that significantly influence land use decisions. By understanding these dimensions, policymakers and planners can make informed decisions regarding land use allocation, taking into account the specific factors that are most relevant to their goals and objectives. PC1 is highly important and sufficient to represent the data as it explains all the variance. The results found that the PC 1 which captures the most variation in the data is related to population density. The higher the population density, the more demand there is for Land in Delta State.

4. Conclusion

In conclusion, land use allocation are influenced by a wide range of factors including physical characteristics of the land, economic considerations, social needs and preferences, as well as political policies and regulations. The interplay of these factors shapes the spatial distribution of different land uses and creates competition for limited resources.

Based on the identified factors of land use allocation in Delta State, the following recommendations are hereby proffered.

- Improvement of infrastructure: The government should invest in improving basic infrastructures such as roads, electricity, water supply, and drainage systems to attract more investors to invest in the state.
- Anti-corruption measures: The government should put in place anti-corruption in the land administration system. This will restore confidence in the system and encourage more investors to invest in the state.
- Government should intensify efforts in protecting Land Use Allocation and ensure that citizens adhere to Land Use Allocation and avoid unnecessary Conversions or Change of Use.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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