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Factors Influencing Landuse Conversion in Ibadan Municipality, Nigeria

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Abstract
This paper examines the factors influencing landuse conversion in Ibadan Municipality, Nigeria with a view to providing information that could inform policy on landuse planning. Primary and secondary data source were adopted for the study. The study adopted systematic sampling technique in the selection of 531 buildings (5%) of the existing 10,620 buildings in the study area. Data were analysed using factor analysis and multiple regression analysis. Six factors were identified as the major factors influencing landuse conversion in the study area, these include physical, environmental, economic, institutional, social and cultural factors. The study further revealed that among the six factors, economic factor has the highest influence on landuse conversion in Ibadan Municipality. Majority of decisions on landuse conversion were made for economic purpose; starting from on-street trading to the legalized economic activities. All the factors were statistically significant except institutional factors. This study concluded that landuse conversion in Ibadan Municipality is at alarming rate and tending to succession of residential landuse by other landuses (most especially commercial landuse).

Keywords: Conversion, Influencing Factors, Landuse and Municipality

1. Introduction

Land is a free gift of nature and the most basic natural resources to mankind. It is fixed and limited in supply, it can be improved on and can be used for different purposes depending on the needs of services man at a point in time. Landuse is the term used for the human employment of the land and its various resources for different purposes (Assede *et al*, 2023). Earlier on, it has been defined by Marklund and Batello (2008) as the arrangements, inputs and activities that people undertake on land.

According to these definitions, landuse can be classified based on the types of human activities carried out on it. These activities include residential, commercial, industrial, institutional, recreational, agricultural, transportation landuses among others. Every activity of man as of necessity takes place on land and as a result of the variations in pattern and magnitude of man's activities on land overtime; landuse has also been experiencing various changes. Landuse change refers to any development or use which is different from the last use of the land or building

either approved by the planning authority or not (Oluleye, 2006 cited in Ogungbemi, 2012). It is the use of land for a purpose which is different from that which the land was originally zoned for (Pauleit, Ennos & Golding, 2005). According to Ruel (2017) and Adeyinka *et al*. (2017), landuse change comes in two patterns; landuse conversion and landuse modification.

Landuse conversion is the change of one landuse to the other through the changes in mix and pattern of land uses in an area; while landuse modification is the changing in the intensity of use or alterations in its characteristics, qualities or attributes of a certain type of landuse (Ruel, 2017). The latter is out of the scope of this study, as this study is concerned with the changing in one landuse type to another.

2. Literature Review

Landuse change has been identified to be influenced by several factors. Identifying the factors influencing landuse change therefore require an understanding of how individuals make landuse change decisions and how various factors interact in specific contexts to influence decision making on landuse (Wu *et al*.,2021). According to Eric *et al.,* (2003), the fundamental factors influencing landuse change can be classified under two major categories of direct/proximate and indirect/underlying factors.

Direct factors constitute human activities that originate from intended landuse and directly affect its use. They involve a physical action on land or landed property and operate at the local level such as individual farms, households, or communities (Ukpere *et al.*, 2021). However, indirect factors are fundamental forces that underpin the direct factors of landuse change and operate more diffusely (i.e. from a distance) (Arowolo & Deng, 2018). These forces include demographic, economic, institutional, environmental, physical, social and cultural factors.

a) **Demographic Factors:** The development of each household (either through the breaking down of extended family into smaller families or migration) and features of their life cycle contributes a lot to demographic changes (Alabi & Olonade, 2022). It is also associated with the shift from low to high rate of fertility or mortality level (Addah & Ikobho, 2022). Makele (2023) explained that migration in its various forms is one of the most important demographic factor that causes landuse change over a period of time; as it operates with other non-demographic factors (such as economic integration, government policies, change in consumption pattern, among others) in influencing land use change.

b) **Economic and Technological Factors:** Landuse change majorly results from individual and social responses to changing economic conditions (Lambin, Geist & Lepers 2003). The differences in the living standard among different households, countries, and regions determine geographic differences in economic opportunities and constraints (Indian National Science Academy, 2001). Innovation of new technology enhances economic standard of a region while, landuse change is one of the end results of improvement in economic standard as individual tends to change their landuse to the use that suit the economies of that location (Dami *et al*., 2011).

Literature has revealed some variables that come to play when dealing with economic factors of landuse conversion to include; cost of land acquisition, transportation cost (raw materials and labour) and cost of development (Eshetu *et al.,* 2024); unemployment, increase demand for land,

increase in sales, rent payment schedule and fee (Gbadamosi & Ibrahim, 2013). Others are increase in land value, increase in income generated, occupational characteristics, increase in market size, low standard of living, scarcity of land and increase in market size (Van Donk, 2008 cited in Tizora, Le Roux, Mans, & Cooper, 2016); increase in commercial activities and optimizing investment return (Ogungbemi, 2012).

c) **Institutional Factors:** Institutional factors entail the collaboration of political, legal, economic, and traditional interactions with individual decision making (Ostrom, Burger, Field, Noorgaard & Policansky, 1999). Access to land, labour, capital, technology and information is structured by local and national policies and institutions (Lawal & Adekunle, 2018). Examples include planning regulations, government policies, planning standard and urban renewal exercise (Anwar, 2002); land tenure system, taxation, political intervention and master plan (Petronella, 2018). Others are landuse policy, zoning regulation and the effectiveness of town planning activities in the controlling and monitoring of various landuse development (development control activities) (Adegunle *et al*., 2016)

d) **Environmental Factors:** These are the environmental conditions that influence landuse change in an area. They include characteristics of the neighbourhood, location of the neighbourhood, predominant landuse type, accessibility within the neighbourhood, among others (Assede *et al.*, 2023). In considering accessibility factors of landuse conversion within a neighbourhood, two aspects are to be considered; public accessibility and special accessibility. According to Yuri (2005), public accessibility deals with profit from certain location when avoiding movement cost (in term of time, money and easiness). For example, executive activities need public accessibility to get production factor (labour) and easiness to the market. Meanwhile households need public accessibility for easiness to work place, market and recreation facility.

By contrast, spacial accessibility is a location placement decision that is influenced by external economy factors (Yuri, 2005). It comprises two aspects of complimentary and concentration/ agglomeration of activities. Other elements of environmental factors influencing landuse conversion are topography, water level, climatic condition and soil characteristics (Verburg, Schot, Dijst & Veldkamp, 2004); availability of necessary infrastructure and services (such as water, electricity, good roads, car park, fire services, police post, waste collector services, etc.), quality landscape and structural pattern of the environment (Asamoah, 2010; Petronella, 2018).

e) **Socio-Cultural Factors:** Socio-cultural factors also influence decision making on landuse; as land managers have various motivations, collective memories, and personal histories that dictate attitudes, values, beliefs, and individual perceptions on landuse change decision (Indian National Science Academy, 2001). Elements of social and cultural factors influencing landuse conversion in an area are length of stay of the residents, security condition within the environment, prestige and trend (Ogungbemi, 2012); high level of privacy, educational level, occupational characteristics and good relationship between the people of the neighbourhood (Gbadamosi & Ibrahim, 2013). Others are religion, culture, good family relationship, beliefs, public attitude and perception of land managers (Assede *et al.*, 2023); historical heritage, age group

of the residents, marital status of the residents, household size and land ownership dispute (Lambin & Geist, 2007; Isola, 2016).

f). **Physical Factors:** Physical factors of an environment mostly dictate how fast the rate at which landuse will change. They are mainly human inputs to the natural environment such as provision of water services, electricity, health care facilities, educational facilities (Wu *et al.*, 2021). Other are construction of new road, availability of transportation facilities, good accessibility provision (road), building structural condition and types of building (Lambin, Turner, Geist, Agbola, Angelsen, Bruce, Coomes, Dirzo, Fischer & Folke, 2001); building age, types and condition of building facilities, location of the building (closeness to the road, central business district and market) (Farinmade, 2010); surrounding landuse activities, building ownership, use of building and traffic volume (Udoekanem *et al.*, 2014).

3. Materials and Methods

The study area is Ibadan Municipality known as 'inner Ibadan' is a subset of Ibadan Metropolis, Ibadan is the chief and the capital of Oyo State, one of the 36 States and located in South-western part of Nigeria (Obembe *et al.*, 2018). Ibadan Metropolis is the largest City in Nigeria after Bauchi (Oyo State, 2021) and has eleven Local Government Areas (LGAs) comprises of five urban Local Government Areas in the inner part of the City (known as Ibadan Municipality) and six semi-urban Local Government Areas in the outer part of the city (Ibadan Land, 2021). The five Local Government Areas in Ibadan Municipality are Ibadan North, Ibadan Northeast, Ibadan Northwest, Ibadan Southeast and Ibadan Southwest Local Government Areas (Wahab & Popoola, 2018). Ibadan Municipality has total land coverage of 3,080 km^2 with a population of 3,649,000 (United Nation, 2021). It is the State's administrative, commercial and industrial nerve center (Wahab & Popoola, 2018). Geographically, Ibadan Municipality is located between coordinates $7^{o}32^{'}47^{''}N$, $3^{o}55^{'}0^{''}E$ (Oyo State, 2021) (Fig. 1).

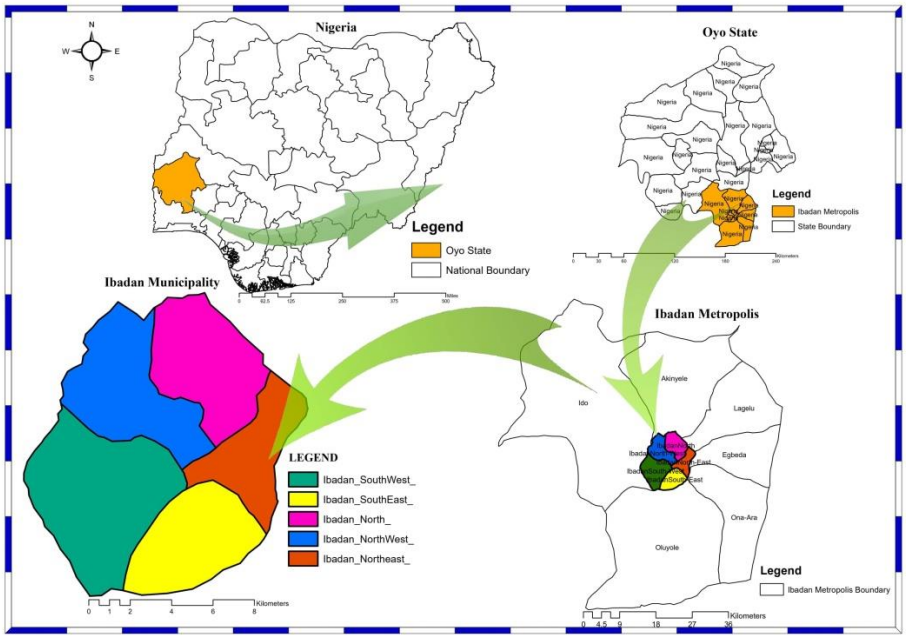

Figure 1: Location of the study area

Information was collected on physical, economic, environmental, social, cultural and institutional factors influencing landuse conversion in the study area. The study employed systematic sampling techniques for the survey of residents in each of the selected transportation routes of the five LGAs that make up the Municipality. Classifying roads based on ownership, there are three categories of road ownership in Ibadan Municipality: Federal, State and Local Government roads. Preliminary survey revealed that there were 3 Federal (Trunk A) roads, 34 States (Trunk B) roads and several Local Government (Trunk C) roads. This study selected 3 identified existing Federal roads, 1 State and 2 Local Government roads in each of the LGAs of Ibadan Municipality (see Table 1) using the information gathered from Oyo State Ministry of Physical Planning and Urban Development on roads where landuse conversion were more pronounced. Thus 3, 5 and 10 Federal, State and Local Government roads were respectively selected across the five LGAs of Ibadan Municipality. Through the use of Google Earth Software (2022), 10,620 buildings (both left and right) were identified along the selected roads; out of which 531 buildings were sampled using systematic sampling technique of an interval of 20 (5%) buildings after the random selection of the first building (Table 2). For questionnaire administration, residents along these three categories of roads were sampled.

Data were analysed using factor analysis and multiple regression analysis. Factor analysis was used to extract the components of the factors influencing landuse conversion in the study area; while multiple regression analysis was used to analyze various factors influencing landuse conversion in the study area. It was also used to determine those factors that have positive effects on landuse conversion from those having negative effects on landuse conversion.

Table 1: Selected Roads Description

S/N	LGAs	Roads	Categories	Distance
1.	IBN	Old Oyo Road	Federal	5
2.	IBNE, IBN & IBSE	Iwo Road-Gate-Beere-Challenge (right side) Road	Federal	12.7
3.	IBSW	Challenge-Mobil Road	Federal	3.5
4.	IBN	Gate-Orita Aperin Road	State	3.2
5.	IBNE	Idi Ape-Basorun Road	State	1.8
6.	IBNW	Dugbe-Eleyele Road	State	3.5
7.	IBSE	Beere-Eleta-Orita Aperin Road	State	4.2
8.	IBSW	Oke Ado- ChallengeRoad	State	2.0
9.	IBN	Orita Mefa (Total Garden)-Oje Idi Ayunre Road	L.G.A.	2.1
10.	IBN	Oje-Aremo Road	L.G.A.	1.8
11.	IBNE	Oke Adu-Agugu Road	L.G.A.	1.2
12.	IBNE	Gate-Green Spring Hotel Road	L.G.A.	2.2
13.	IBNW	ICT-Eleyele Road	L.G.A.	1.8
14.	IBNW	Fanmilk-Eleyele Road	L.G.A.	2.3
15.	IBSE	Kobaomoje-Idi Arere Road	L.G.A.	2.5
16.	IBSE	Orita Aperin- Idi-Arere-Oja Oba Road	L.G.A	4.3
17.	IBSW	G. Allen-Challenge Road	L.G.A.	2.8
18.	IBSW	Oke Ado-Imalefalafia-Ring Road	L.G.A.	3.2
	TOTAL			**60.1**

Table 2: Building Selection Details

Selected Roads	Number of Buildings		Total No. of Buildings	No. of Buildings Selected
	Right	Left		
Old Oyo Road	215	322	537	27
Iwo Road-Gate-Beere-Challenge (right side) Road	724	1372	2,096	105
Challenge- Mobil Road	102	98	200	10
Gate-Orita Aperin Road	223	222	445	22
Idi Ape-Basorun Road	56	72	128	6
Dugbe-Eleyele Road	102	96	198	10
Beere-Eleta-Orita Aperin Road	905	917	1822	91
Oke Ado- Challenge Road	92	87	179	9
Orita Mefa (Total Garden)- Oje Idi Ayunre Road	338	354	692	35
Oje-Aremo Road	211	218	429	21
Oke Adu-Agugu Road	62	69	131	7
Gate-Green Spring Hotel Road	76	73	149	8
ICT-Eleyele Road	205	203	408	20
Fanmilk-Eleyele Road	86	88	174	9
Kobaomoje-Idi Arere Road	262	264	526	26
Orita Aperin- Idi Arere-Oja Oba Road	675	610	1,285	64
G. Allen-Challenge Road	82	86	168	8
Oke Ado-Imalefalafia-Ring Road	529	524	1,053	53
TOTAL	**4945**	**5675**	**10,620**	**531**

4. Results and Discussions

Underlying factors influencing landuse conversion were revealed through the use of factor analysis. The importance of factor analysis was to reduce observed factors of landuse conversion into easily explanatory factors. This was done by reducing a large data set to a more manageable size while retaining as much of the original information as possible.

4.1. Determining Factors of Landuse Conversion in Ibadan Municipality

Six factors influencing building use conversion in Ibadan Municipality were extracted with their various percentage of variance explained. These were physical, environmental, economic, institutional, social and cultural factors. For the interpretation of the result, this study adopted Stevens (2002) cited in Isola (2016) condition for interpreting substantive value in factor analysis. It was stated that only factors loadings with an absolute value greater than 0.4 (16% of the variance in the variable) should be interpreted. Hence, this study adopted 0.5 (20%) factor loadings for the interpretation; which is above 0.4 and considered being good. The adoption of 0.5 in this study correspond with Adeyinka (2005) and Olugbamila (2016) studies; whereby only factors loadings of 0.50 and above were considered.

Presented in Table 3 is the result of Kaiser-Meyer-Olkin (KMO) and Barlett's test of sphericity of the variables. The study's KMO test result (73%) was within the range of being good as stated by Field (2005). This indicates that patterns of variables correlations were relatively compacted and therefore, factor analysis was suitable to yield reliable factors influencing building use conversion. The Barlett's test also gave a confidence that factor analysis was adequate and appropriate for the data with a very strong significant level (P=0.000 at 5% level of significance).

Table 3: KMO and Bartlett's Test for Factors Influencing Landuse Conversion

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.728
Bartlett's Test of Sphericity	Approx. Chi-Square	43698.128
	Df	3003
	Sig.	.000

Revealed in Table 4 were the proportions of common variance of the variables influencing building use conversion, known as communalities. This was done through the use of Principle Component Analysis (PCA) of Factor Analysis. PCA assumption is that all of the variable variance is common variance; as a result of this, all the identified seventy-eight (78) building use conversion indicators communalities were assigned a common initial value of 1.000 before extraction.

The communalities after extraction reflect the common variance in the data structure. At this stage, this study adopted Olajuyin (1980); Williams *et al.*, (2010) condition of variable extractions; where it was stated that when dealing with communalities after extraction, two categories of variables should be considered- high associated variables and low associated variables. High associated variables are variables that have high associated factors of 0.50 (50%) and above; while variables with communalities less than 0.50 (50%) were categorized under low associated variables.

After extraction, the variable with the lowest communality was 'urban renewal exercise' with 13.9% of variance. Moreover, the variable with the highest communality was 'population increase' with 86.3% of variance. It is to be noted that for a reasonable representation of the identified variables, it is expected that the communalities of the variables extracted should be high. This implies that the higher the communality, the more representative the variable.

Table 4: Communalities of Respondents' Responses in Ibadan Municipality

Landuse Conversion Indicators	Initial	Extraction
Increase in population	1.000	.863
Construction of new road	1.000	.827
High unemployment level	1.000	.817
Increase in commercial activities	1.000	.798
Good relationship among the respondents	1.000	.792
Age group of the residents	1.000	.783
Condition of housing facilities	1.000	.779
To generate more income	1.000	.779
Meeting up with current economic reality	1.000	.775
High building cost	1.000	.768
Lack of master plan	1.000	.748
Employment opportunities	1.000	.746
High traffic volume	1.000	.733
Use of building	1.000	.732
Concentration of many activities	1.000	.720
Closeness to the road	1.000	.716
Marital status	1.000	.714
Increase in land demand	1.000	.712
Increase in sales of goods	1.000	.712
Historical development	1.000	.700
Educational level	1.000	.698
Nearness to the market	1.000	.693
Soil type	1.000	.690
Needs of more space for development	1.000	.684
Availability of good roads	1.000	.683
Gender	1.000	.678
Technological advancement	1.000	.671
Optimizing investment return	1.000	.641
Values and belief	1.000	.637
Length of stay	1.000	.636
High cost of land	1.000	.625
Land scarcity	1.000	.625
Good climatic condition	1.000	.623
Easy access to place of work	1.000	.605
Prestige	1.000	.612
Building ownership decision	1.000	.593
Meeting up with current trend	1.000	.592
New building techniques	1.000	.578
To live close to the family	1.000	.570

Increase in market size	1.000	.569
Corruption among town planners	1.000	.568
Inappropriate allocation standard for various landuses	1.000	.565
Presence of complementary services	1.000	.565
Old buildings are more converted	1.000	.536
Poverty/poor living condition	1.000	.533
Ineffective town planning services	1.000	.513
Inadequate landuse policy	1.000	.510
Easy accessibility to other part of the town	1.000	.510
Lack of layout plan	1.000	.497
Types of housing facilities	1.000	.482
High level of privacy	1.000	.473
Regular water supply	1.000	.470
Presence of traffic congestion	1.000	.469
Aesthetic quality landscape of the environment	1.000	.465
Security within the neighbourhood	1.000	.458
High tax collection	1.000	.457
Religion	1.000	.452
Building arrangement	1.000	.450
Poor state of roads	1.000	.450
High cost of land in other landuse zones	1.000	.448
Good property maintenance habit	1.000	.444
Land disputes and competition between the residents	1.000	.439
Low rent payment	1.000	.436
Constant electricity supply	1.000	.430
Neatness of the neighbourhood (in terms of waste management)	1.000	.413
Increase in family size	1.000	.410
High crime rate	1.000	.402
Types of building	1.000	.389
Low traffic volume	1.000	.373
Low cost of land	1.000	.360
Good drainage	1.000	.327
Epileptic power supply	1.000	.321
Long tenancy period	1.000	.314
Topography and quite nature of the neighbourhood	1.000	.239
Political intervention	1.000	.228
Government policy	1.000	.200
Cost of transportation to other landuse zones	1.000	.197
Urban renewal exercise	1.000	.139

Extraction Method: Principal Component Analysis

Findings in Table 5 revealed the summary list of Eigen values associated with linear component before extraction, after extraction and after rotation. There were 78 components (same number as the total number of variables) before extraction. The extraction process as it has been done in Table 5 is important in order make each factor independent of each other. After extraction has been done, variables were reduced into six linear components (factors). These were components 1, 2, 3, 4, 5 and 6. Thus, before extraction and after extraction these components respectively accounted for 25.691%, 12.783%, 8.400%, 6.531%, 4.569% and 4.022% of variance. After rotation, the first factor (factor 1) accounted for 23.262% of variance; while factor 2,3,4,5 and 6 amounted to 10.001%, 9.595%, 6.829%, 6.262% and 6.047% of variance.

Table 5: Summary of the Total Variance Explained of Factors Influencing Landuse Conversion in the Study Area

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	12.239	25.691	25.691	12.239	25.691	25.691	10.344	23.262	23.262
2	9.971	12.783	38.475	9.971	12.783	38.475	7.801	10.001	33.263
3	6.552	8.400	46.875	6.552	8.400	46.875	7.484	9.595	42.858
4	5.094	6.531	53.406	5.094	6.531	53.406	5.327	6.829	49.687
5	3.564	4.569	57.975	3.564	4.569	57.975	4.885	6.263	55.950
6	3.137	4.022	61.997	3.137	4.022	61.997	4.717	6.047	61.997

Extraction Method: Principal Component Analysis.

It was further revealed in Table 5 that 'factor 1' is the strongest factor among the six factors, as it accounted for the highest percentage of variance before and after rotation. However, the six factors (components) with total eigenvalue of 40.55 explained 61.99% of the total variance before and after rotation.

Using varimax rotation method, Table 6 shows the rotated component matrix of the factors loading for each variable. Rotation maximizes the loading of each variable on one of the extracted factors while minimizing the loading on all other factors. It also allows some variables to load highly on some factors and lowly on others, which leads to better interpretation of the result (Adeyinka, 2005). As regards the selected factor loading of 0.5, all variables with factor loadings of less than 0.5 were suppressed as they were considered not to be significant enough to influence building use conversion in the study area.

Table 6: Rotated Component Matrix[a] of Residents' Responses on Factors Influencing Landuse Conversion

Rotated Component Matrix	Components					
	1	2	3	4	5	6
Increase in commercial activities	.762					
High unemployment level	.735					
High building cost	-.735					
Increase in sales of goods	.729					
Meeting up with current economic reality	.723					
To generate more income	.713					
Increase in land demand	.713					
Land scarcity	.676					
Needs of more space for development	.674					
Optimizing investment return	.644					
Employment opportunities	.625					
Poverty/poor living condition	.596					
High cost of land	.538					
Increase in market size	.501					
Increase in population		.845				
Technological advancement		.693				
Lack of layout plan		-.690				
Inadequate landuse policy		-.664				
Ineffective town planning services		.612				
Inappropriate allocation standard for various landuses		.610				
Corruption among town planners		.581				
Lack of master plan		.576				
Building ownership decision		.570				
New building techniques		.513				
High tax collection		-.512				
Use of building			.731			
Availability of good roads			.685			
Types of building			-.671			
Construction of new road			.661			
Regular water supply			-.635			
Types of housing facilities			-.558			
Condition of housing facilities			.557			
Building arrangement			.555			
Epileptic power supply			-.537			
Building age (old buildings are more converted)			.505			

Nearness to the market				.756		
High traffic volume				.709		
Closeness to the road				.786		
Soil type				.687		
Concentration of many activities				.627		
Easy access to place of work				.584		
Good climatic condition				.564		
Presence of complementary services				.563		
Easy accessibility to other part of the town				.561		
Good relationship among the residents					.701	
Gender					.783	
Respondents length of stay					.699	
Age group of the residents					.690	
Educational level					.641	
Meeting up with current trend					.637	
Prestige					.561	
Marital status					.545	
Values and belief						.739
Religion						-.725
Historical development						.693
To live close to the family						.616
Eigen value	12.24	9.97	6.55	5.09	3.56	3.14
% of total variance	23.26	10.00	9.59	6.83	6.26	6.05

Extraction Method: Principal Component Analysis. Rotation converged in 21 iterations
Rotation Method: Varimax with Kaiser Normalization

Factor one has the highest loaded variables of 14 in number. It is obvious that all the variables are related to the welfare or economic issues of the resident. Hence, they can be termed as ***economic factors*** of landuse conversion. Factor two comprised eleven loaded variables and was described as ***institutional factors*** that influence landuse conversion in Ibadan Municipality. Variables in column three were related to the infrastructural or physical attributes of the study area, this factor is labeled ***'physical factors'*** influencing landse conversion. Factor four is the ***Environmental factors*** also known as locational factors. The fifth factor that determines landuse conversion in the study area was referred to as ***social factors***. This factor was made up of eight positive loaded variables. As further revealed in Table 6, the last factor of landuse conversion comprised four loading variables. These variables depict ***cultural factors*** influencing landuse conversion in the study area.

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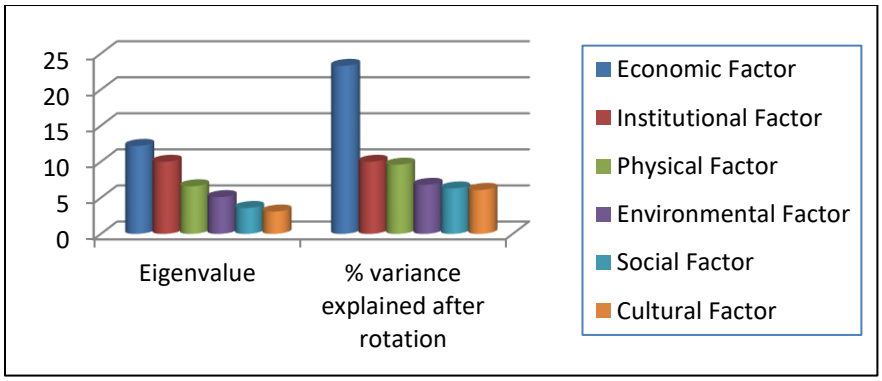

Figure 2: Factors influencing building use conversion in Ibadan Municipality

As presented in Figure 2, the extracted factors influencing building use conversion in Ibadan Municipality shows that economic factors explained 23.3% of variance, institutional factors explained 10.0%, physical factors explained 9.6% and environmental factor explained 6.8%. Other factors were social (6.3%) and cultural factors (6.0%). All these six factors collectively accounted for 61.99% of the variance of factors influencing building use conversion. In conclusion, this finding validates the study of Lambin *et al.*, (2003); Bosikun *et al.*, (2021) and Olabisi *et al*., (2023) that economic factor is the paramount factor influencing landuse conversion. Next to this were institutional, physical, environmental, social and the cultural factors. The least paramount factor influencing building use conversion in the study area was cultural factor.

As noted by Clark (1970 cited in Olatubara 1994), changing in economic variable such as income has direct influence on landuse locational decision. Relating this with landuse conversion decision in Ibadan Municipality, it was established that majority of decisions on landuse conversion were made for economic purpose; starting from on-street trading (informal activities) to the legalized (approved commercial building use conversion) economic activities. This has resulted to the conversions of old buildings along the different road categories either through partial or full conversion. In replace of the old buildings, commercial sectors such as banks, petrol filling stations, entertainment/event hall, shopping malls, eateries, hotels among others were been put in place. This has extended to the use of building setbacks to the roads for economic purpose (majorly commercial use) either with temporary structure or without structure. It is therefore established that as a result of building use conversion, lands located along the roads were more or less for economic purpose (commercial building use) with little proportion being used for other purposes such as residential and public uses. This finding is contented with the work of Dami *et al*. (2011); Bosikun *et al.*, (2021) and Gbadamosi and Ibrahim (2013).

4.2. Multiple Regression Analysis of Factors Influencing Landuse Conversion in Ibadan Municipality

Discussed in this section is the regression analysis of the factors influencing landuse conversion in Ibadan Municipality. All the six factors influencing landuse conversion (physical, environmental, social, economic, cultural and institutional) that were revealed in the previous section were further used as independent variables in a stepwise multiple regression analysis. The results were as presented in Tables 7, 8 and 9. The dependent variables were the mean score indexes built from four measures of landuse conversion. They were agents, forms, types and stage of landuse conversion. A linear combination of the mean scores of these measures was used in computing the Landuse Conversion Index (LCI). Regression of both dependent and independent variables yielded six models (1 – 12) as follows:

❖ ***Model 1***

This model had the entry variable as cultural factor. Here, the effect of cultural factor on landuse conversion was determined. Cultural factor has a coefficient of multiple determinations 'R^2=0.066' which made it a less predictor of landuse conversion. This implies that 6.6% of landuse conversion was predicted by cultural factor. From this result (R^2 =0.066, $F_{(1,522)}$ = 36.857, P =0.000, α = 0.05), the change in coefficient of multiple determination remained the same and was also statistically significant. Being the only factor of landuse conversion considered at this stage, linear regression model was built (equation 1 & 2) using the standardized and unstandardized coefficient. The result (B = -0.215, β = -0.257, $F_{(1,522)}$= 36.857, P = 0.000, α = 0.05) revealed that cultural factor was a negative predictor of landuse conversion. This implies that increase in cultural activities of the people may not easily encourage landuse conversion in Ibadan Municipality.

Regression equation for unstandardized coefficients (B) is:

$$y_1 = 1.805 - 0.215x_1 + \varepsilon \quad (1)$$

Regression equation for standardized coefficients (β) is:

$$y_1 = -0.257x_1 \quad (2)$$

Where:

a = Constant y_1 = Landuse conversion x_1 = Cultural factor
ε = Error term

❖ ***Model 2***

The second model showed the effects of cultural and social factors on landuse conversion. Both factors had a coefficient of multiple determination 'R^2 =0.154'.This implies that 15.4% of landuse conversion was predicted by cultural and social factors. Thus, the introduction of the second factor of landuse conversion changed the coefficient of multiple determination to R^2= 0.154, $F_{(2,521)}$ = 47.313, P = 0.000 and α = 0.05. Multiple regression models were built using both cultural and social factors as shown in equation 3 and 4. This regression model was a multiple regression because factors considered were more than one. Both unstandardized and standardized coefficients were used in the equation to explain better the predictor with the highest coefficient. Therefore, while cultural factor is having negative effects; social factor had positive effects on landuse conversion and is statistically significant with the result β_1= 0.257, β_2= 0.296, $F_{(2,522)}$= 47.313, P =0.000 and α = 0.0. This implies that increase in social activities will enhance landuse conversion in Ibadan Municipality.

The regression equation for unstandardized coefficients (B) is:

$$y_1 = 1.805 + 0.215x_1 + 0.248x_2 + \varepsilon \quad (3)$$

Regression equation for standardized coefficients (β) is:

$$y_1 = 0.257x_1 + 0.296x_2 \quad (4)$$

Where:

a = Constant y_1 = Landuse conversion x_1 = Cultural factor
x_2 = Social factor ε = Error term

❖ ***Model 3***

The third model presented the effects of social, cultural and environmental factors influencing landuse conversion in the study area. The three factors had a coefficient of multiple determination '$R^2 = 0.404$' showing that 40.4% of landuse conversion was predicted by social, cultural and environmental factors. The inclusion of environmental factor in the model change the value of the coefficient of multiple determination to $R^2= 0.404$, $F_{(3,520)}= 117.317$, $P = 0.000$ and $\alpha = 0.05$. Considering these three factors of landuse conversion, multiple regression models were built as presented in equation 5 and 6. Two of these factors have positive impacts while one has negative impacts; but they were all statistically significant ($\beta_1= -0.257$, $\beta_2= 0.296$, $\beta_3 = 0.500$, $F_{(3,520)}= 117.317$, $P = 0.000$, $\alpha = 0.0$)

The regression equation for unstandardized coefficients (B) is:

$$y_1 = 1.805 - 0.215x_1 + 0.248x_2 + 0.\ 418x_3 + \varepsilon \quad (5)$$

Regression equation for standardized coefficients (β) is:

$$y_1 = -0.257x_1 + 0.296x_2 + 0.500x_3 \quad (6)$$

Where:

a = Constant; y_1 = Landuse conversion; x_1 = Cultural factor
x_2 = Social factor; x_2= Environmental factor; ε = Error term

❖ ***Model 4***

The fourth model accommodated physical factors of landuse conversion with the other three explained above factors. This resulted to a model explaining the effects of cultural, social, environmental and physical factors of landuse conversion. The four factors resulted to a coefficient of multiple determination '$R^2 = 0.580$'. This showed that 58% of landuse conversion was explained by cultural, social, environmental and physical factors. Therefore the coefficient of multiple determination model changed to $R^2 = 0.580$, $F_{(4,519)}= 178.824$, $P = 0.000$ and $\alpha = 0.05$. All these four factors were statistically significant ($\beta_1= -0.257$, $\beta_2= 0.296$, $\beta_3 = 0.500$, $\beta_4 = 0.419$, $F_{(4,519)}= 178.824$, $P = 0.000$, $\alpha = 0.05$). Presented in equation 7 and 8 were the multiple regression models built using cultural, social, environmental and physical factors of landuse conversion.

The regression equation for unstandardized coefficients (B) is:

$$y_1 = 1.805 - 0.215x_1 + 0.248x_2 + 0.\ 418x_3 + 0.351x_4 + \varepsilon \quad (7)$$

Regression equation for standardized coefficients (β) is:

$$y_1 = -0.257x_1 + 0.296x_2 + 0.500x_3 + 0.419x_4 \quad (8)$$

Where:

a = Constant; y_1 = Landuse conversion; x_1 = Cultural factor
x_2 = Social factor; x_3= Environmental factor; x_4= Physical factor
ε = Error term

❖ ***Model 5***

Economic factor is a factor that has positive effects on landuse conversion in the study area. When economic factor of landuse conversion was included, there was a high increase in the coefficient of multiple determination (R^2 =0.880) compared to other factors contributions. This means that economic factor is the strongest predictor of landuse conversion in the study area. Hence, cultural, social, environmental, physical and economic factors explain 88% of the factors influencing landuse conversion in Ibadan Municipality. The coefficient of multiple determination model becameR^2 =0.880, $F_{(5,518)}$= 761.287, P = 0.000 and α = 0.05. All these five factors were statistically significant (β_1= -0.257, β_2= 0.296, β_3 = 0.500, β_4 = 0.419, β_5 = 0.548, $F_{(5,518)}$= 761.287, P =0.000, α = 0.05). Presented in equation 9 and 10 were the multiple regression models built with cultural, social, environmental, physical and economic factors of landuse conversion.

The regression equation for unstandardized coefficients (B) is:

$$y_1 = 1.805 - 0.215x_1 + 0.248x_2 + 0.\ 418x_3 + 0.35x_4 + 0.\ 459x_5 + \varepsilon \quad (9)$$

Regression equation for standardized coefficients (β) is:

$$y_1 = -0.257x_1 + 0.296x_2 + 0.500x_3 + 0.419x_4 + 0.548x_5 \quad (10)$$

Where:

a = Constant; y_1 = Landuse conversion; x_1 = Cultural factor
x_2 = Social factor; x_3= Environmental factor; x_4= Physical factor
x_5= Economic factor; ε = Error term

❖ ***Model 6***

The last model comprised all the factors by adding institutional factor of landuse conversion. Institutional factor of landuse conversion also has negative effects like cultural factors. That is, if the institutional framework functions well, there will be a reduction on landuse conversion. On the contrary, when landuse conversion increases, the significant of institutional framework in charge of landuse development control reduces. This resulted to a model explaining the impacts of cultural, social, environmental, physical, economic and institutional factors of landuse conversion in the study area. All these resulted to a coefficient of multiple determination 'R^2 = 0.880'. This revealed that 88% of landuse converted was explained by all these factors.

The overall coefficient of multiple determination models had one statistically significant negative determinant (cultural) factor, four statistically significant positive determinant (social, environmental, physical and economic) factors, and one not statistically significant negative determinant (institutional) factor. This resulted into coefficient of multiple determination model R^2 =0.880, $F_{(6,517)}$= 633.452, P = 0.659 and α = 0.05. It should be noted in this model (β_1= -0.257, β_2= 0.296, β_3 = 0.500, β_4 = 0.419, β_5 = 0.548, β_6 = -0.007, $F_{(6,517)}$= 633.452, P = 0.659, α = 0.05) that five factors were significant out of six. The last two equations (11 and 12) were the multiple regression models built using all factors (cultural, social, environmental, physical, economic and institutional) influencing landuse conversion in Ibadan Municipality.

The regression equation for unstandardized coefficients (B) is:

$$y_1 = 1.805 - 0.215x_1 + 0.248x_2 + 0.\ 418x_3 + 0.35x_4 + 0.\ 459x_5 - 0.006 + \varepsilon \quad (11)$$

Regression equation for standardized coefficients (β) is:

$$y_1 = -0.257x_1 + 0.296x_2 + 0.500x_3 + 0.419x_4 + 0.548x_5 - 0.007x_6 \quad (12)$$

Where:

a = Constant; y_1 = Landuse conversion; x_1 = Cultural factor

x_2 = Social factor x_3= Environmental factor x_4= Physical factor
x_5= Economic factor x_6= Institutional factor ε = Error term

Table 7: Stepwise Multiple Regression Models Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics R Square Change	F Change	Df1	Df2	Sig. F Change
1	.257[a]	.066	.064	.809	.066	36.857	1	522	.000
2	.392[b]	.154	.150	.771	.088	54.026	1	521	.000
3	.635[c]	.404	.400	.648	.250	217.926	1	520	.000
4	.761[d]	.580	.576	.545	.176	217.089	1	519	.000
5	.938[e]	.880	.879	.291	.301	1300.349	1	518	.000
6	.938[f]	.880	.879	.291	.000	.194	1	517	.659

a. Predictors: (Constant), Cultural Factor ***Significant level (α) equals 0.05**
b. Predictors: (Constant), Cultural Factor, Social Factor
c. Predictors: (Constant), Cultural Factor, Social Factor, Environmental Factor
d. Predictors: (Constant), Cultural, Social Factor, Environmental Factor, Physical Factor
e. Predictors: (Constant), Cultural Factor, Social Factor, Environmental Factor, Physical Factor, Economic Factor
f. Predictors: (Constant), Cultural Factor, Social Factor, Environmental Factor, Physical Factor, Economic Factor,
Institutional Factor

Table 8: ANOVA[a] for Stepwise Multiple Regression Model

Model		Sum of Squares	Df	Mean Square	F	Sig
1	Regression	24.147	1	24.147	36.857	.000[b]
	Residual	341.998	522	.655		
	Total	366.145	523			
2	Regression	56.279	2	28.140	47.313	.000[c]
	Residual	309.866	521	.595		
	Total	366.145	523			
3	Regression	147.790	3	49.263	117.317	.000[d]
	Residual	218.355	520	.420		
	Total	366.145	523			
4	Regression	212.188	4	53.047	178.8	.000[e]
	Residual	153.958	519	.297		
	Total	366.145	523			
5	Regression	322.287	5	64.457	761.287	.000[f]
	Residual	43.858	518	.085		
	Total	366.145	523			
6	Regression	322.303	6	53.717	633.452	.000[g]

Residual	43.842	517	.085
Total	366.145	523	

a. Dependent Variable: Landuse Conversion Index (LCI) ***Significant level (α) equals 0.05**
b. Predictors: (Constant), Cultural Factor
c. Predictors: (Constant), Cultural Factor, Social Factor
d. Predictors: (Constant), Cultural Factor, Social Factor, Environmental Factor
e. Predictors: (Constant), Cultural Factor, Social Factor, Environmental Factor, Physical Factor
f. Predictors: (Constant), Cultural Factor, Social Factor, Environmental Factor, Physical Factor, Economic Factor
g. Predictors: (Constant), Cultural Factor, Social Factor, Environmental Factor, Physical Factor, Economic Factor, Institutional Factor

Table 9: Multiple Regression Coefficients and Significance

Model		Unstandardized Coefficients		Standardized Coefficients		Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta	T		Lower Bound	Upper Bound
1	(Constant)	1.805	.035		51.056	000	1.736	1.875
	Cultural Factor	-.215	.035	-.257	-6.071	.000	-.284	-.145
2	(Constant)	1.805	.034		53.587	.000	1.739	1.872
	Cultural Factor	-.215	.034	-.257	-6.372	.000	-.281	-.149
	Social Factor	.248	.034	.296	7.350	.000	.182	.314
3	(Constant)	1.805	.028		63.774	.000	1.750	1.861
	Cultural Factor	-.215	.028	-.257	-7.583	.000	-.271	-.159
	Social Factor	.248	.028	.296	8.748	.000	.192	.304
	Environmental Factor	.418	.028	.500	14.762	.000	.474	.363
4	(Constant)	1.805	.024		75.877	.000	1.759	1.852
	Cultural Factor	-.215	.024	-.257	-9.022	.000	-.262	-.168
	Social	.248	.024	.296	10.408	.000	.201	.295
	Environmental Factor	.418	.024	.500	-17.564	.000	.465	.372
	Physical Factor	.351	.024	.419	14.734	.000	.304	.398
5	(Constant)	1.805	.013		1 42.025	.000	1.780	1.830

	Cultural Factor	-.215	.013	-.257	-16.888	.000	-.240	-.190
	Social Factor	.248	.013	.296	19.481	.000	.223	.273
	Environmental Factor	.418	.013	.500	32.876	.000	.443	.393
	Physical Factor	.351	.013	.419	27.579	.000	.326	.376
	Economic Factor	.459	.013	.548	36.060	.000	.484	.434
6	(Constant)	1.805	.013		141.914	.000	1.780	1.830
	Cultural Factor	-.215	.013	-.257	-16.875	.000	-.240	-.190
	Social Factor	.248	.013	.296	19.466	.000	.223	.273
	Environmental	.418	.013	.500	32.850	.000	.443	.393
	Physical Factor	.351	.013	.419	27.557	.000	.326	.376
	Economic Factor	.459	.013	.548	36.032	.000	.484	.434
	Institutional Factor	-.006	.013	-.007	-.441	.659	-.019	-.031

a. Dependent Variable: Landuse Conversion Index (LCI) ***Significant level (α) equals 0.05**

In summary, for the factors that are significant and had positive determinant values (economic, physical, environmental and social factors), the increase in their activities will lead to more landuse conversions in Ibadan Municipality. On the other hand, for the factors with negative determinant values (cultural and institutional factors), increased in their activities might cause reduction in landuse conversion in Ibadan Municipality. These findings to an extent corroborates Ullman (1957, 1980) three independent conditions (complimentarity, transferability and intervening opportunities) for the existence of spatial interaction.

5. Conclusion

The study examined the factors influencing landuse conversion in Ibadan Municipality, Nigeria. This study established that landuse conversion was influenced by economic, institutional, physical, environmental, social and cultural factors in decreasing order of strength in Ibadan Municipality. The study further revealed that among the six factors, economic factor has the highest influence on landuse conversion in Ibadan Municipality. Majority of decisions on landuse conversion were made for economic purpose; starting from on-street trading to the legalized economic activities. All the factors were statistically significant except institutional factors. More so, the stage of landuse conversion in the study area has superseded penetration and invasion stages, as it is tending towards domination in some places and succession in other places. This study concluded that landuse conversion in Ibadan Municipality is at alarming rate and tending to succession of residential landuse by other landuses (most especially commercial landuse).

The study therefore recommends that Town Planners in the five Physical Planning Authorities of Ibadan Municipality should endeavor to prepare planning standards to guide all various forms and types of landuse conversion in Ibadan Municipality in order to ensure orderly and compatible landuse conversion in the study area. Also Poverty Alleviation Programmes should be initiated by the government to create more employment opportunities for the youths and young adults that were more involved in landuse conversion in Ibadan Municipality. This will go a long way in curtailing the incidence of informal sector activities (for example, on-street market) that contributed to landuse conversion in the study area.

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There is no conflict of interest in this study. The study was also not funded by any sponsor

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