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Abstract

The study examined the effect of Road Traffic Accident Injuries on Productivity in Nigeria with a view towards reducing the incidence of Road Traffic crashes and improving road safety in Nigeria. The data used included number of passengers who sustained injuries in road traffic accidents in Nigeria for 2007. Data were also acquired on productivity in the labour sector of the economy through the assessment of seven variables, manpower in parastatals; manpower in ministries; employment in crop farming, registered teachers, policemen in service, national unemployment and private farmers. Z-score analysis was used to depict the pattern of productivity in the labour sector over the 36 states including the federal capital in the country while the fatality index was used to show the pattern of road traffic injuries in the country for the study period. Multiple regression analysis was then used to assess the relationship between road traffic accident injuries and productivity in the country. The results show that a clear relationship exists between road traffic accident injuries and productivity in Nigeria. The study finally made some recommendations to improve road safety in the country.

Keywords: Safety, Crashes, Risks, Environment, Patterns

Introduction

Road traffic injuries are increasing worldwide with developing countries bearing the brunt of this scourge. It has been projected that Road Traffic Injuries will be the second most common cause of disability – adjusted life year loss in developing countries by the year 2020 (Murray and Lopez, 1997; WHO, 1996). Road Traffic Accidents resulted in year 2002 alone in injury of more than 35 million people worldwide, out of them 5 million became permanently disabled and 1.2 million died (Nasar, 2003).

The economic cost of road crashes and injuries is also immense. Road Traffic Injuries is estimated to be 1% of Gross National Product (GNP) in low-income countries, 1.5% in middle-income countries and 2% in high-income countries. The global cost is estimated to be US $518 billion per year. Low-income and middle-income countries account for US $65 billion, more than they receive in development assistance (Safety-Net, 2006). Indeed, a World Bank study has shown that the economic development of regions and nations is associated with an increase in the number of injuries and deaths from road traffic crashes (Kopits, et al., 2005).

Road Traffic Injuries place a heavy burden not only on global and international economies but also on household finances. Many families are driven deeply into poverty by the loss of breadwinners and the added burden of caring for members disabled by road traffic injuries. Also, among males of the economically active age group, motor vehicle injuries are the third most important cause of death in developing countries (Soderland et al., 1995). However, the health and economic burden of Road Traffic Injuries have not been fully recognized (Zwi, 1993). Accurate epidemiological data from many of the developing countries are difficult to find in the literature (Van et al., 2006). Hospital logs or police records from which data on accident injuries could be sourced underestimate the total burden of the injuries (Balogun, 1992; Asogwa, 1992). Besides,

despite the importance of injury as a publics health problem, few studies have been concerned with the economic and social impacts. This is due to many factors most of which are related to availability of reliable data (Afakaar et al., 2003).

In Nigeria, road traffic crashes have become one of the leading causes of death in older children and economically active adults between the ages of 30 and 49 years (Murray et al. 1996; Jacobs et al., 2000). Despite this burgeoning problem, little attention has been paid to road traffic injury prevention and treatment in Nigeria and most developing countries. Pratte (1998) reported that gross underestimation of Road Traffic Accidents injuries and fatalities in Nigeria could be due to a lack of sufficient data collection by government agencies. The socio-economic cost of Road Traffic Accidents and Injuries in Nigeria are immense. The direct cost of traffic casualties can perhaps best be understood in terms of the labour lost to the nation's economy which consequently results in low productivity. Road Traffic Accidents and Injuries have significantly retorted Nigeria's socio-economic aspirations and development due to the premature loss of qualified and potential contributing professionals and able-bodied men and women in the labour force (Pratte, 1998).

The objective of this paper is to assess the effect of Road Traffic Injuries on productivity in Nigeria with a view to curbing the menace of Road Traffic Accidents, reducing injuries and improving safety efforts.

Review of Related Literature

Various concepts and models have been used to explain traffic accidents. Of particular interest in the field of geography is the systems theory whose explanations are based on the concept of risks and man-environment adjustments and maladjustments (Muhlrad et al., 2005). The components of the theory are the environment, the means of transport and the behaviour of man (Krug et al. 2000). In furtherance of this theory, a model for traffic accident as inspired by the ecological model of a disease was developed by Jorgenser and Abane (1999). The model is characterised by three main components (See Komba, 2006). These are the vehicle, the environment and the behaviour of the population. The vehicle is described in terms of its composition, age, technical conditions and safety equipments like seat belts in a car. The environment comprises of the road system and the wider physical and built up environment. The physical environment splits further into different aspects such as daylight and climate; spatial conditions, settlement patterns, situation of areas of residence and working areas, principle of traffic separation, topography and road construction qualities. The behaviour of the population include the characteristics such as age and sex ratio as well as attitudes and general traffic behaviour. Also included are driving behaviour, driving experience, driving style, risk compensation and risk driving relating to influence of alcohol and drugs.

Superimposed on this model is a system of traffic 'laws, regulations and mode of enforcement designed to enforce' that the population adhere to the controls and regulations so as to maintain some level of road safety (Fig. 1). These include traffic rules, speed controls and convictions for various road offences (Jørgensen and Abane, 1999).

In an attempt to broaden our understanding of the role of risks in road traffic accidents, Klinke and Renn (2001) developed six main types of risks named after characters from Greek mythology. These include *Damocles* which are risks with high catastrophic potentials and probabilities widely known; *Cyclops* with no reliable estimate on probabilities but with high catastrophic potential at stake. *Pythia* with causal connection confirmed, damage potential and probabilities unknown. The fourth type is *Pandora* with causal connection unclear or challenged, high persistency risk and ubiquity (bio-accumulation) while the fifth type is *Cassandra* with an intolerable risk of high probability and great damage but long delay between causal stimulus and negative effect. The sixth type called *Medusa* represents perception of high risk among individuals and large potential for social mobilisation without clear scientific evidence for serious harm (see also Renn, 2002; Hood et al. 2001). Klinke and Renn concluded that risk management

strategies need be tailored to the main characteristics of the risk source in question. That means that in a security and crisis management regime, there should be a number of different means and strategies for dealing with the variety of risk types we face (Hovden, 2004).

Materials and Methods

The data used for this study included number of road traffic accident injuries for the 36 states in Nigeria including the federal capital, Abuja for 2007. Data were also collected on 7 variables considered to represent productivity measures in the country. These are Number of employees in federal parastatals per thousand population; Number of staff in ministries per thousand population; Number of registered teachers per thousand population; Number of policemen in service per thousand population; Number of national unemployed people per thousand population; Number of private farmers per thousand population (see Hautzinger et al. 2007). The choice of these variables was informed by the availability of reliable data on them for all the states in Nigeria and the federal capital Abuja. Besides, they all relate to the use of human labour for productive endeavours (see Schayer, 2004). These were collected for the year 2007.

The states for which the data were collected are Abia, Adamawa, Akwa Ibom, Anambra, Bauchi, Bayelsa, Benue, Borno, Cross River, Delta, Ebonyi, Edo, Ekiti, Enugu, Gombe, Imo, Jigawa, Kaduna, Kano, Katsina, Kebbi, Kogi, Kwara, Lagos, Nassarawa, Niger, Ogun, Ondo, Osun, Oyo, Plateau, Rivers, Sokoto, Taraba, Yobe, Zamfara and the federal capital, Abuja. The states and the federal capital are as shown in Figure 2.0.

Road Traffic Accident data were sourced from records of the Nigerian Police Force headquarters and the Federal Road Safety Commission. The two agencies have the statutory responsibility for collecting Road Traffic Accident data for the country. Data on people employed in the labour sector in the country were sourced from records of National Bureau of Statistics for 2008. Data on population of the country by states were collected from records of National Population Commission (NPC). These were obtained through the National Population Census conducted for the country in 2006.

The collected data were then collated and analysed using the Statistical Package for the Social Sciences (SPSS). Maps were also produced using Microsoft Excel. Multiple Regression method was then used to establish the relationship between Road Traffic Injuries and Productivity in the country.

Results and Discussion

The matrix of correlations (Table 1.0) shows that many of the variables are weakly correlated. Except for MPR (Manpower in federal parastatals) which has a correlation of 0.470 with RT (Registered teachers); and ECF (Employment in crop farming) which has a correlation of 0.505 with PF (Private farmers), all the other variables have low intercorrelations. Although RT (Registered teachers) has a correlation of -0.495 with PF (Private farmers), the value is negative and implies a reverse effect on each other. Overall, the correlation values imply that many of the variables are weakly intercorrelated. However, they depict a pattern that can be used to explain the relationship between the selected variables in the labour sector in the country.

Spatial Pattern of Productivity Measures

In order to discern the spatial pattern of productivity measures in the country the Z-score variate was used. Each productivity variable was linearly transformed, such that its mean becomes zero and its standard deviation becomes unity. Also, a composite score of productivity was derived by adding together the standard scores on the seven indices of productivity and again linearly transforming the total sum (Smith, 1973; Oyebanji, 1986).

Table 2.0 shows the spatial pattern of productivity in the country using the seven selected criteria. The pattern of employment in federal parastatals shows that Abia, Akwa Ibom, Edo, Imo, Kaduna, Kogi, Ogun, and Osun states rank high while Bayelsa, Jigawa, Kano, Katsina, Lagos, Rivers, Sokoto, Zamfara

States and the federal capital Abuja rank low. Also, the pattern of employment in ministries shows that Imo, Kogi, Niger and Ogun states have a fair share while Jigawa, Kano, Sokoto and Zamfara states are disadvantaged.

Crop farming is prominent in Abia, Akwa Ibom, Ebonyi, Enugu, Gombe, Imo, Jigawa, Kaduna and Katsina states while participation in this employment is relatively low in Bayelsa, Delta, Ekiti, Lagos, Ogun, Ondo, Oyo, Rivers, and the federal capital, Abuja.
The pattern of registered teachers in employment in the country shows that Abia, Bauchi, Borno, Ekiti, Enugu, Jigawa, Kaduna, Kano, Kebbi, Kogi, Kwara, Nassarawa, Ogun, Ondo, Osun, Oyo, Rivers, Sokoto, Yobe, Zamfara states and the federal capital, Abuja top the ladder while Adamawa, Anambra, Edo and Niger states are at the bottom of the ladder.

Employment in the Nigerian Police Force is dominated by Cross Rivers, Nassarawa and the federal capital, Abuja while Bayelsa, Jigawa, Kano, Ebonyi, and Katsina states rank low. Unemployment in the country is more prominent in Benue, Delta, and Yobe states while Edo, Kaduna, Ogun, Ondo, Rivers, and Taraba states are doing fairly well generally in employment.

Private farmers exhibit significant presence in Cross Rivers, Gombe, Imo, Kano, Katsina, Kebbi, Taraba, Yobe and Zamfara states while Adamawa, Bayelsa, Benue, Delta, Edo, Ekiti, Lagos, Ogun and Osun states have a low participation in private farming. Overall, the pattern of productivity in Nigeria determined using the seven criteria discussed above shows that Abia, Akwa Ibom, Benue, Cross River, Enugu, Imo, Kaduna, Kano, Kogi, Kwara, Nassarawa, Niger, Osun, Plateau, Yobe and the federal capital, Abuja are doing fairly well in their contribution to the productivity level in the country. Conversely, the contribution of Adamawa, Bayelsa, Lagos, Oyo and Rivers states is fairly low. The spatial pattern of productivity in Nigeria is as shown in Fig. 3.0.

Spatial Pattern of Road Accident Injuries

Table 3.0 shows relevant statistics on population, area, Road Traffic Injuries per 100,000 population, population and standardised scorers of traffic injuries for the 36 states and the federal capital, Abuja for 2007.
The spatial pattern of Road Traffic Accident Injuries is as shown on Fig. 4.0. The pattern can be divided into four categories according to the severity of injuries. The first category comprise of states where the incidence of traffic injuries can be described as of low category and covers only Ekiti State. The second category of road traffic injuries described as of medium category covers Abia, Adamawa, Akwa Ibom, Anambra, Bauchi, Bayelsa, Borno, Delta, Ebonyi, Edo, Enugu, Jigawa, Kano, Katsina, Kebbi, Kwara, Lagos, Niger, Ondo, Oyo, Rivers, Sokoto, Taraba, Zamfara states and the federal capital, Abuja.

The third category which can be classed as of high level of Road Traffic Injuries in Nigeria covers Benue, Cross River, Imo, Kaduna, Kogi, Nassarawa, Ogun, Osun, Plateau, and Yobe states. The fourth category described here as of very high level of traffic injuries covers Gombe State alone. These are the four categories into which the spatial pattern of road traffic injuries in the country can be described.

Relationship between Road Traffic Accident Injuries and Productivity

In order to establish a relationship between Road Traffic Injuries (RTIs) and Productivity in Nigeria, Regression Analysis was used. (see Serpilkiliç et al., 2012).
The regression model developed takes the form

RTI = f(MPR, MMN, EMC, RT, PLS, UEM, PF) ---------- (1)

This can be operationalised in the form

$RTI = \beta_0 + \beta_1 MPR + \beta_2 MMN + \beta_3 EMC + \beta_4 RT + \beta_5 PLS + \beta_6 UEM + \beta_7 PF + e$ ---- (2)

where

RTI	=	Road Traffic Injuries
MPR	=	Manpower in Parastatals
MMN	=	Manpower in Ministries
ECF	=	Employment in Crop Farming
RT	=	Registered Teachers
PLS	=	Policemen in Service
NUE	=	National Unemployment
PF	=	Private Farmers
β_0	=	The intercept

$\beta_1 - \beta_7$ = regression coefficients

e = the error term

From equation (1) it can be stated that all the seven independent variables determine and influence Road Traffic Injuries in the country represented by RTI.

The outcome of the regression analysis gives the summary statistics in Tables 4.0

The regression results show that Road Traffic Accident Injuries (RTIs) has a positive relationship with Manpower in Parastatals (MPR), Employment in Crop Farming (ECF), Registered Teachers (RT), Policemen in Service (PLS) and Private Farmers (PF). On the other hand, Road Traffic Accident Injuries (RTIs) has a negative relationship with Manpower in Ministries (MMN) and National Unemployment (NUE).

The Coefficient of Determination, R^2 has a value of 25.1% meaning that the combined influence of the seven independent variables is only 25.1%. This shows that the remaining 74.9% are due to exogenous influences. These could be due to drivers' errors, road condition, vehicles' condition and inadequate safety measures on Nigerian roads. Further, only the t-value for Manpower in Parastatals (MPR) is significant at 0.05 significance level.

The analysis of variance shows that the regression is insignificant at 0.05 level since the table value is greater than the calculated value of 1.342 (Table 5.0). However, the regression results show that the model is good enough for the explanation of the effect of Road Traffic Accident Injuries on productivity in Nigeria using the seven selected independent variables. The regression model obtained is

RTI = -0.006 + 0.251 MPR – 0.198 MMN + 0.013 ECF + 0.131 RT + 0.083 PLS – 0.311 NUE + 0.254 PF.

Conclusion and Recommendations

The paper examined the effect of Road Traffic Accident Injuries on productivity in Nigeria. This has been done by assessing the causes, magnitude and factors responsible for the pattern of Road Traffic Accident Injuries in the country. The pattern examined over the 36 states and the federal capital, Abuja, shows variations in the incidence and severity of Road Traffic Accident Injuries in the country.

The pattern of productivity in the labour sector in the country has also been assessed in the paper. This has been done using seven selected variables, viz.: Manpower in parastatals, Manpower in Ministries, Employment in Crop Farming, Registered Teachers, Policemen in Service, National Unemployment and Workers in Private Farming. The assessment revealed that a relationship exists in the pattern of productivity in the labour sector in the country and road traffic accident injuries.

In view of the gravity of Road Traffic crashes and injuries in Nigeria, experience of best practices from developed countries should be borrowed. Further, government should embark on the following recommendations:

- Police control of speed and drunk-driving must be intensified on the highways to stem the high incidence of traffic fatalities and injuries
- A national road safety strategy should be developed.
- Adequate financial and human resources should be allocated to road safety in the country.
- The effectiveness of safety belts and helmet in decreasing mortality and injury severity after motor vehicle crashes has been confirmed by many studies. Use of safety belts and helmets should be enforced in the country.
- Public education programme on road safety should be mounted and adopted in all states of the federation.
- The Federal Road Safety Commission should be staffed with trained professionals and be responsible for accident data surveillance and analysis.

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Table-1.0: The matrix of correlation between the productivity variables

	MPR	MMN	ECF	RT	PLS	NUE	PF
MPR	1.000						
MMN	0.332	1.000					
ECF	+0.032	-0.150	1.000				
RT	0.470	0.247	-0.228	1.000			
PLS	0.041	0.045	-0.240	0.188	1.000		
NUE	-0.052	0.088	0.003	0.025	-0.015	1.000	
PF	-0.292	-0.123	0.564	-0.495	-0.092	-0.097	1.000

MPR = Manpower in Parastatals
MMN = Manpower in Ministries
ECF = Employment in Crop Farmers
RT = Registered Teachers
PLS = Policemen in Service
NUE = Unemployed people
X = Private Farmers

Source: *The Author*

Table-2.0: Standard Scores on Productivity Indices in Nigeria

STATES	MPR	MMN	ECF	RT	PLS	NUE	PF	COMPOSITE
Abia	0.80	0.30	1.85	1.11	-0.08	-0.13	-0.54	3.31
Adamawa	-0.05	-0.21	-0.38	0.11	-0.15	-0.03	-0.64	-1.35
Akwa Ibom	1.44	0.38	2.02	0.36	-0.08	0.12	-0.11	4.13
Anambra	0.69	-0.08	-0.27	0.13	-0.34	-0.11	-0.20	-0.18
Bauchi	-0.66	-0.55	0.22	1.56	-0.55	-0.48	0.23	-0.23
Bayelsa	-1.38	-0.31	-1.04	0.48	-1.11	-0.52	-1.34	-5.22
Benue	-0.01	0.03	-0.11	0.49	-0.30	5.36	-1.00	4.46
Borno	0.22	-0.42	0.22	0.92	-0.30	-0.43	-0.30	-0.09
Cross River	0.18	0.03	-0.54	0.59	0.72	-0.04	0.74	1.68
Delta	0.02	0.28	-1.03	0.62	0.13	0.65	-0.64	0.03
Ebonyi	-0.77	-0.59	1.80	0.28	-0.68	-0.07	0.37	0.34
Edo	1.59	0.53	-0.43	0.07	0.23	-0.70	-0.93	0.36
Ekiti	0.59	0.13	-1.14	0.99	-0.23	0.32	-1.42	-0.45
Enugu	0.50	-0.10	1.09	1.17	-0.49	-0.07	-0.53	1.57
Gombe	-0.11	-0.39	0.82	0.40	-0.05	-0.17	1.03	-0.5
Imo	1.35	0.67	1.47	0.59	-0.56	-0.45	0.68	3.75
Jigawa	-1.28	-0.73	0.82	1.53	-0.71	0.50	0.11	0.24
Kaduna	0.79	-0.33	1.74	0.86	-0.10	-0.62	0.43	2.77
Kano	-1.18	-0.69	0.44	1.53	-0.98	0.04	2.65	1.81
Katsina	-1.06	-0.57	0.82	0.64	-0.68	-0.63	1.66	0.18
Kebbi	-0.93	-0.51	-0.60	1.23	-0.42	-0.04	0.93	-0.34
Kogi	2.34	0.60	-0.60	1.29	-0.51	0.41	-0.14	3.39
Kwara	0.67	0.22	-0.60	1.81	0.23	0.40	-0.30	2.43
Lagos	-1.35	-0.57	-1.56	0.65	-0.18	-0.20	-2.38	-5.59
Nassarawa	0.29	-0.06	0.49	1.09	2.68	-0.45	0.50	4.54
Niger	-0.17	5.39	-0.49	0.13	-0.13	0.46	0.30	8.49
Ogun	1.38	0.73	-1.36	0.89	0.42	-0.81	-1.46	-0.21
Ondo	0.59	0.14	-1.14	1.12	0.07	-0.63	-0.47	-0.32
Osun	1.37	0.09	-0.98	1.46	0.56	-0.58	-0.86	1.06
Oyo	0.05	-0.27	-1.03	1.58	-0.54	-0.56	-0.57	-1.34

Plateau	0.49	-0.09	0.27	0.47	0.37	-0.35	0.16	1.32
Rivers	-1.24	-0.51	-1.03	0.82	0.06	-0.73	-0.34	-2.97
Sokoto	-1.01	-0.67	0.38	1.37	-0.53	-0.03	0.77	0.29
Taraba	-0.89	-0.34	0.11	0.58	0.14	-0.62	1.29	0.27
Yobe	-0.86	-0.51	0.60	1.18	-0.02	0.74	1.70	2.83
Zamfara	-1.20	-0.72	0.38	1.26	-0.51	0.05	0.90	0.16
FCT (Abuja)	-1.20	-0.29	-1.20	0.76	4.61	0.40	-0.30	2.78

Source*: The Author*

Table-3.0: Statistics on Road Traffic Accident Injuries Assessment in Nigeria

States	Area (sq km)	Population in Millions	Road Accident Injuries per 100,000 Population	Standardised values of Road Accident Injuries
Abia	4,900	2.81	1111.11	-0.40
Adamawa	38,700	3.18	1289.29	-0.02
Akwa Ibom	6,900	3.90	658.86	-0.13
Anambra	4,865	4.18	788.60	-0.87
Bauchi	49,119	4.65	1269.05	-0.76
Bayelsa	9,059	1.70	775	-0.48
Benue	30,800	4.25	122.35	0.71
Borno	72,600	4.17	1277.31	-0.65
Cross River	21,789	2.89	1185.59	0.38
Delta	17,108	4.11	647.41	-0.35
Ebonyi	6,400	2.18	970.87	-0.70
Edo	19,187	3.23	765.55	-0.71
Ekiti	5,435	2.40	1165.23	-5.43
Enugu	7,534	3.27	414.29	-0.28
Gombe	17,100	2.37	327.27	3.49
Imo	5,285	3.93	360.74	0.23
Jigawa	23,287	4.30	566.04	-1.02
Kaduna	42,481	6.11	2335.74	2.97
Kano	20,280	9.40	686.27	-0.85
Katsina	23,561	5.80	2048.23	-0.12
Kebbi	36,985	3.26	426.28	-0.77
Kogi	27,747	3.31	1017.20	0.73
Kwara	35,705	2.37	1179.78	-0.20
Lagos	3,671	9.11	331.72	-0.61
Nassarawa	28,735	1.87	1460.73	0.40
Niger	68,925	3.95	480.92	-0.96
Ogun	16,400	3.75	1166.92	2.09
Ondo	15,820	3.46	1159.15	-0.13
Osun	9,026	3.42	1410.64	0.50
Oyo	26,500	5.58	703.93	-0.30
Plateau	27,147	3.21	812.01	0.46
Rivers	10,575	5.20	521.57	-0.78
Sokoto	27,825	3.70	705.43	-0.30
Taraba	56,282	2.29	990.32	-0.50
Yobe	46,609	2.32	1357.14	0.62
Zamfara	37,931	3.28	550	-0.10
FCT (Abuja)		1.41	611.23	-0.05

Source*: The Author*

Table-4.0 Regression Summary of the Dependent and Independent Variables

Dependent Variable	Independent Variable	Standardised Coefficients	Standard Error	t-values	Level of Significance
RTI	Constant	-0.006	0.164	-0.036	0.971
(Road Traffic	MPR	0.251	0.203	1.243	0.224
Accident	MMN	-0.198	0.179	-1.103	0.279
Injuries)	ECF	0.013	0.227	0.061	0.952
	RT	0.131	0.212	0.626	0.536
	PLS	0.083	0.171	0.482	0.634
	NUE	-0.311	0.167	-1.860	0.073
	PF	0.254	0.234	1.086	0.287

R^2 = 25.1% R^2-Adj. = 6.4%

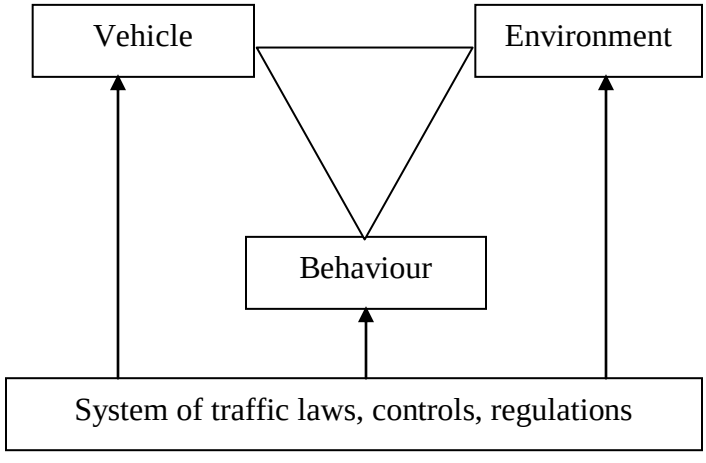
Source*: Computer Output*

Table 5.0 Analysis of Variance

Model	Sum of Squares	Df	Means Square	F-value	Sig.
Regression	8.996	7	1.285	1.342	0.268
Residual	26.815	28	0.958		
Total	35.811	35			

Source*: Computer Output*

Fig-1: A model for traffic accident



Source: (Jorgensen and Abane, 1999, Komba, 2000)

Fig-2: Map of Nigeria Showing States

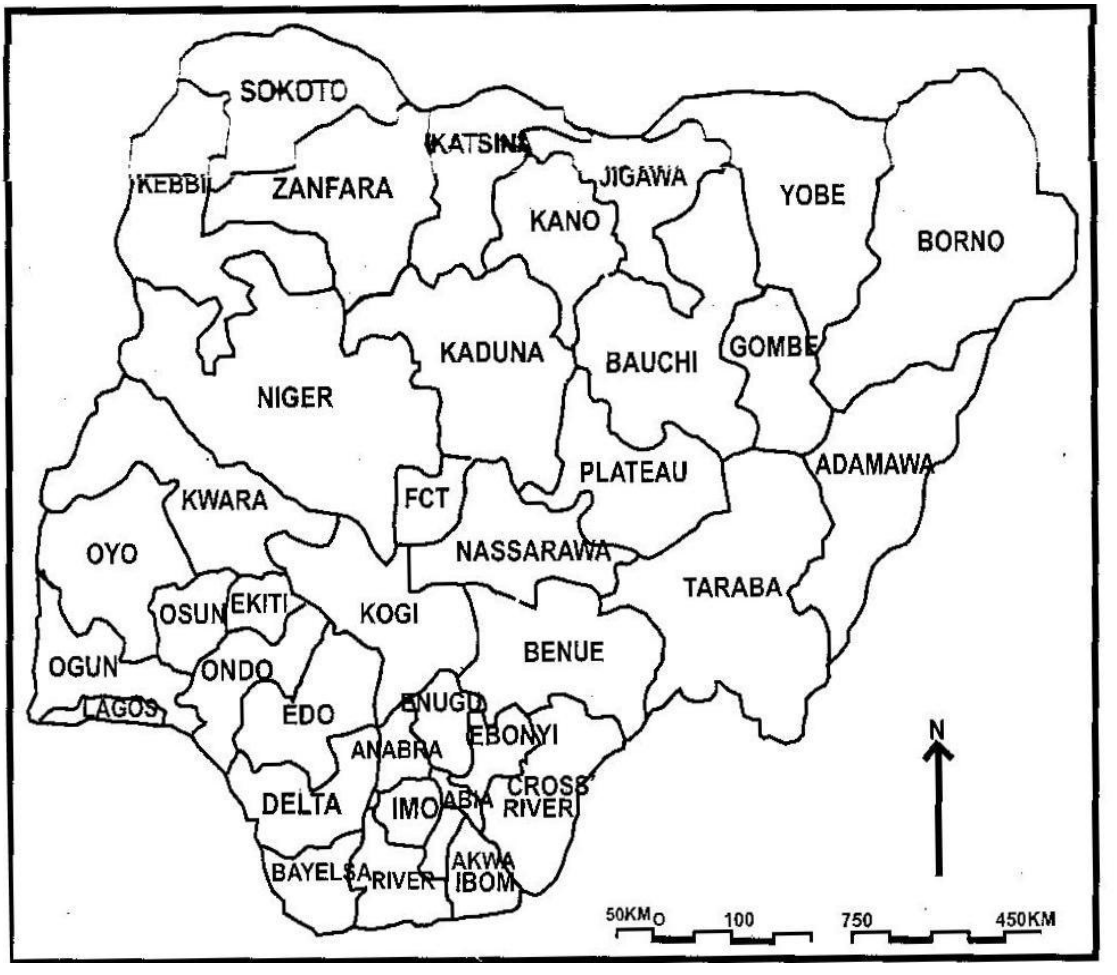


Fig-3.0: Spatial Pattern of Productivity in Nigeria

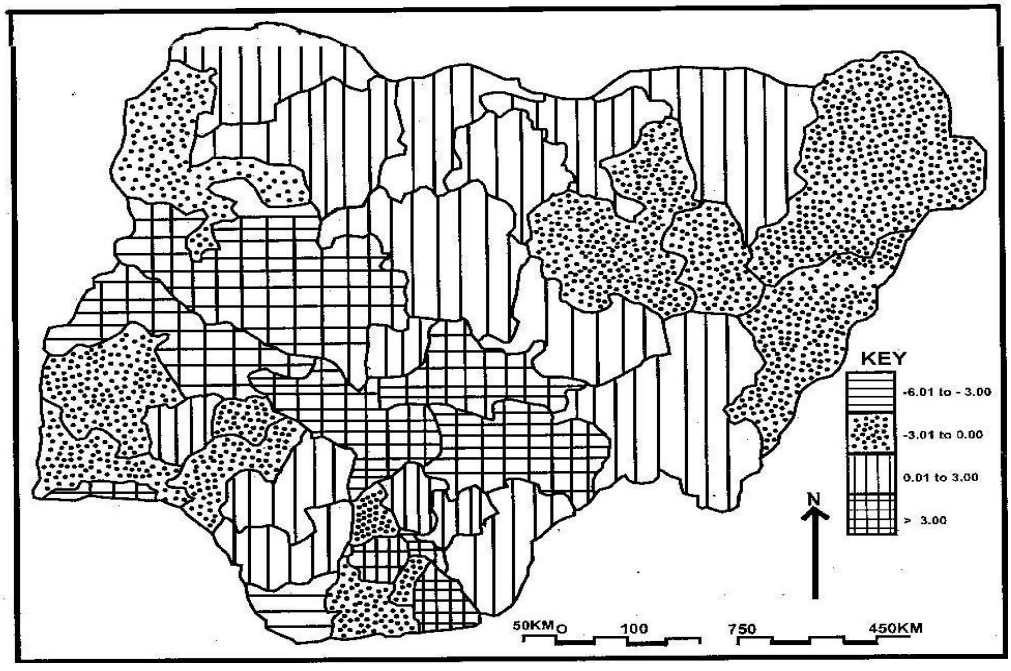


Fig-4.0: Spatial Pattern of Road Traffic Accident Injuries in Nigeria