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ECONOMIC EFFECT OF TRAFFIC SAFETY MEASURES ON ROAD CRASHES IN DEVELOPING CITY IN SOUTHWESTERN NIGERIA

Dosunmu Victor Ayodele (Ph.D.) [1], Gegeleso Omolola Madoh (Ph.D.) [2], Ige Leah [3]

[1] Reader, Department of Transport Management, Ladoke Akintola University of Technology, ogbomoso, Nigeria
[2] Assistant Lecturer, Department of Transport Management, Ladoke Akintola University of Technology, Ogbomoso, Nigeria
[3] Graduate, Department Transport Management, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

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Corresponding Author

Dosunmu Victor Ayodele,
vadosunmu@lautech.edu.ng

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ABSTRACT

Accidents have long been a common occurrence in vehicle traffic. However, rather than being a natural occurrence, this catastrophe occurs as a direct or indirect outcome of human activity. The impact of traffic safety measures on road crashes in southwestern Nigeria was investigated in this study. Ogbomoso was the study area of the research, Oyo State. In Ogbomoso North Local Government, the study's population consists of 250 registered commercial motorists and 150 commercial motorcycle riders, as well as civil servants. The sample size was purposefully determined based on the respondents' degree of expertise and educational background. Based on the specified parameters, a sample size of 130 was chosen. The questionnaire was constructed scientifically to depict the mind of the respondents. Pearson Product Moment Correlation and percentages were used to analyze the data. At the 0.05 level of significance, the Pearson product moment correlation coefficient (PPMCC) was used to establish a relationship between the level of safety compliance and the level of crashes. The findings revealed that traffic safety measures in the studied area are insufficient. As a result, the study suggests that enough money in the transportation sector be provided, and that the government's supply of traffic safety measures be considered a primary obligation.

Keywords: Road, Crashes, Transportation, Economy, Traffic Safety Measures, Compliance

1. INTRODUCTION

When vehicles are used to transport people or goods from one location to another, transportation systems are referred to as a basic aspect of logistics and planning. All modes of transportation, from cars and buses to boats, planes, and even space travel, are typically used to move people. Transportation systems are being

developed in a wide range of sizes. Local transportation networks that cover a city's bus network and its suburbs, as well as country-wide delivery networks for haulage companies, are prevalent. When using a transportation system, the longer the distance to be travelled, the more efficient the usage of cars. Kohl (2017). The goal of a transportation system is to coordinate the movement of people, products, and vehicles in order to make the best use of available routes. When a new transportation system is created, it aims to lower transportation costs while also improving delivery times through better scheduling and route management. Periodic analyses and the construction of alternative routes allow for timely transportation system improvements in order to preserve efficiency. Kohl (2017) Furthermore, Anderson et al. (1996) discovered that pedestrians have a nearly 100% chance of survival at impact speeds of 30 km/h or less, whereas it is expected to be zero at 60 km/h or more. This obviously means that any safety measure aimed at separating vulnerable road users from vehicles, such as pedestrians when vehicle speeds surpass 30 km/h, will be extremely beneficial to their survival rate Vaa (2001) Designers are supposed to employ geometric criteria in the design of a road and its appurtenances, to account for all circumstances, and to minimise and analyse the potential impact of external elements on road safety Ghaffari and Zoghi (2016). The first stage of a road safety impact assessment is to determine where road safety measures will be deployed and how many accidents each measure is expected to reduce. Accidents have been broadly described as a brief, unexpected, and unfavourable event or occurrence that occurs as a direct or indirect result of human activity rather than a natural occurrence and results in an unwanted and undesirable outcome Hollnagel (2004). As things stand, crashes have a huge impact on society's economy, and traffic costs have an overall impact on the country's economy. The strategies and measures employed to protect road users from being killed or seriously injured are referred to as road traffic safety. Road traffic collisions have become one of the world's most serious health and injury issues. The problem is exacerbated by the fact that the victims were often healthy prior to their accidents. Each year, more than one million people died on the world's roads, according to the World Health Organization (WHO). The concept of Traffic Safety Measures is not new in transportation system. However, the level of compliance to the measures by road users varies across countries. The difference in compliance is mostly responsible for difference in accident rate. In developing countries such as Nigeria, tepid attitude of government to enforce compliance and implement safety measures have also contributed to many accidents. The prevention of accidents stands to be the most basic of all safety management paradigms. Accidents would be rare or non-existent if there was an effective management system in place. On the other hand, the occurrence of accidents indicates a lack of efficient safety management. As a result, understanding and having quick information of how accidents happen is critical to developing solutions to prevent them. It may appear to be a simple nexus, but accidents are complicated events that rarely emerge from a single failure, and this complexity has made understanding how accidents occur difficult since the birth of the industrial revolution Toft et al. (2012). This paper therefore attempts to find out and examine the economic effect of traffic safety measure on road crashes in developing city in southwestern Nigeria and the hypothesis to be tested is:

Hypothesis: There is no correlation between the amount of safety compliance and the rate of accidents.

1.1. LITERATURE REVIEW AND CONCEPTUAL UNDERPINNING

1.1.1. TRAFFIC SAFETY MEASURES

When it comes to traffic safety measures that may or may not be relevant to less motorized countries, there is one basic principle that applies to all traffic cultures around the world: The amount of violence that the human body can accept, i.e. the physical forces that operate on the human body in automobile crashes, car against car, or car versus vulnerable road users, the "delta's" that the human body can withstand in accidents involving speed and sudden speed changes Toft et al. (2012). Road crashes have a huge economic impact on society as a whole, particularly on road users. Accidents on the road entail physical, social, emotional, and financial consequences. When it comes to traffic safety measures that may or may not be relevant to less motorized countries, there is one basic principle that applies to all traffic cultures around the world: The amount of violence that the human body can accept, i.e. the physical forces that operate on the human body in automobile crashes, car against car, or car versus vulnerable road users, the "delta's" that the human body can withstand in accidents involving speed and sudden speed changes. Road crashes have a huge economic impact on society as a whole, particularly on road users. Accidents on the road entail physical, social, emotional, and financial consequences. In 2003, the global economic cost of road accidents was estimated to be $518 billion per year, with $100 billion of the burden falling on poorer countries (WHO, 2009) These factors could be taken into account by looking at the costs of putting these safeguards in place to protect people and property. Road traffic accidents (RTA) have been a major public health concern in recent decades, and they are now one of the leading causes of death and disability around the world. World Health Organization (WHO) discovered that road traffic accidents would become the sixth greatest cause of death globally by 2030. Mirmohammadi et al. (2013). Examining the various factors that influences the causes of accident in transport system is herculean task. Accident could occur in different nature due to the fact that there are different modes at which transport system operate. The four major factors which are vector (vehicle), host (Human being), agent (Energy- speed), environment (weather, road condition). Pikunas et al. (2004). In addition, causes of road accidents includes Over speeding, alcoholic driving, driver distraction, red light jumping, ignoring safety equipment such as seat belts and helmets, noncompliance with lane driving, and improper overtaking. According to Henrich's Many Causations Theory, multiple causes mix in a random sequence (any given order) at the junction point to cause an accident. Man, Media (Environment), Machine, and Management are all examples of multiple causation. The breakdown of these components is utilized to determine which combinations are most likely to act as a catalyst for injuries to occur. It's worth noting that this theory is one of the first to acknowledge the importance of management in providing the necessary leadership and support to carry out the safety objective. Road transportation of people and products is a necessary part of modern life. At the same time, such transportation poses the greatest danger of accidents, resulting in human and resource losses. As a result, road transportation planning must prioritize safety. Not only for users, but also for engineers, planners, and decision makers involved in the operation, improvement, and development of transportation systems, safety is paramount Papageorgiou et al. (2004). Planning road safety measures is a difficult task because results and projections vary widely, and it has an impact on costs and economic growth. Although identification of such persons by demonstration of an injury repetition pattern should only be used for identification of those who need greater attention and guidance rather than for a 'victim blaming' mindset, empirical

evidence reveals that intrinsic accident proneness may exist Petridou and Moustaki (2000). The first thing in assessing the impact of road safety is to identify the areas where safety measures will be implemented and to project the average number of accidents that each of the safety measures will reduce. It is well acknowledged that the effects of road safety measures will vary systematically based on the measure's qualities and the context in which it is implemented. According to the findings of Hoye et al. (2011), he opined than rather than single point estimates of effect, it is becoming increasingly important to summarize the effects of road safety measures in terms of accident modification functions. In metropolitan road networks, traffic lights at intersections are the primary control measure as a result of significant increase in traffic demands, it was therefore realized that, putting traffic lights in place, they may lead to more or less efficient network operations (under equally safe traffic conditions). As a result, an optimal control strategy must exist that minimizes the total time spent by all vehicles in the network. Although the relevant optimal control issue for any road network can be easily articulated, real-time solution and implementation in a control loop encounter a number of seemingly insurmountable challenges. • The introduction of discrete variables is required for red–green traffic light switching, making the optimization issue combinatorial. • The problem is very huge for a network as a whole. • A variety of unforeseen and difficult-to-measure disruptions (incidents, unlawful parking, pedestrian crossings, intersection blockage, and so on) can disrupt traffic flow. • Because of different factors, traffic measurements are primarily local (through inductive loop detectors) and highly noisy Papageorgiou et al. (2004). 1.1.2 Economic impact of traffic safety measures According to ADB 1997, economic view of road safety measures is very important since road traffic crashes constitute a tremendous cost on economies, particularly in the developing countries. According to the National Highway Authority, 2006, the economic impact of road crashes and injuries is projected to be around 2% of Pakistan's GDP. In his investigations in Pakistan in 2011, Gul observed that the expense of restoration and resource loss is steadily increasing over time. This is due to the rising cost of basic components, which makes restoration and rehabilitation more difficult. Accidents have severely eroded human capital. Even after small accidents, it is estimated that a person's effectiveness is diminished by 5–15 percent on average. In most developing cities, the high rate of traffic accidents caused by insufficient traffic safety measures has a negative impact on inhabitants' living standards, which in turn has a considerable impact on the economy.

2. MATERIALS AND METHODS

The city of Ogbomoso is located on the A1 Highway in Oyo State, Southwestern Nigeria, between latitudes 140N and 40N of the equator and longitudes 20E and 150E of Greenwich Meridian Time (GMT). It was established in the mid-seventeenth century. According to the 2006 National Population Census, the population was around 645,000 people. The city is one of Nigeria's greatest urban centres, with the Yoruba ethnic group accounting for the majority of the population. The region's main agricultural products are yams, cassava, maize, and tobacco. Ogbomoso North Local Government and Ogbomoso South Local Government are the two local government areas. The population of the study comprise of 250 registered Commercial motorist and 150 commercial Motorcyclists, Civil Servants in Ogbomoso North Local government. The sample size was purposively chosen using the criteria of level of knowledge and educational background of the respondents. 130 sample size were chosen based on the given criteria. The questionnaire was scientifically construed to evaluate attitudes and other phenomena of interest.

Pearson Product Moment Correlation and descriptive statistics (percentages) were used to analyse the data.

3. RESULTS AND DISCUSSIONS

3.1. SOCIO-ECONOMIC CHARACTERISTICS OF RESPONDENTS

Socio-economic characteristics of respondents presented in the table shows that 17.69% of the total respondents are below 20 years, 58.46% are between 21-40 years while 23.85% accounts for respondent above 40 years of age. This implies that safety issues must be embraced by the middle age class and more attention should be given to compliance. 53.85% of the respondent have higher education, 55.38% are married and 26.92% are commercial motorist. This finding indicates that road users are matured minds and can understand use of the traffic safety measures provided for smooth operations for all road users.

Table 1

Table 1 Socio Economic Characteristics		
Variables	**Frequency**	**Percent**
Age		
Less than 20	23	17.69%
21-40	76	58.46%
Above 40	31	23.85%
Level of education		
Primary	11	8.46%
Secondary	49	37.69%
Tertiary	70	53.85%
Marital Status		
Single	58	44.62%
Married	72	55.38%
Occupation		
Commercial Motorist	35	26.92%
Commercial Cyclist	25	19.23%
Civil Servant	15	11.54%
Student	25	19.23%
Trader	30	23.08%

Source: Field Survey, 2021

3.2. AVAILABLE TRAFFIC SAFETY MEASURE IN THE STUDY AREA

Table 2 shows the traffic safety measures that are available in the study area, it also shows that there is need for more effort in implementing the use of some these measures so as to secure life and property. More enforcement should be given to road users especially to the use of helmets by motorcyclist, there should be provision of by-pass roads in congested areas to ease traffic when necessary. In addition, there is need for lighting infrastructure at T-Junctions and round -about for ease of traffic.

Table 2

Table 2 Available Traffic Safety Measures Infrastructure Use of Helmets				
Use of Helmets				
	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	No	74	56.9	56.9	56.9
	Yes	56	43.1	43.1	100
	Total	130	100	100	
bypass roads					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	69	53.1	53.1	53.1
	Yes	61	46.9	46.9	100
	Total	130	100	100	
Road Safety treatment					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	57	43.8	43.8	43.8
	Yes	73	56.2	56.2	100
	Total	130	100	100	
Seat of Belt Enforcement					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	21	16.2	16.2	16.2
	yes	109	83.8	83.8	100
	Total	130	100	100	
Speed Enforcement					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	38	29.2		29.2
	yes	92	70.8	70.8	100
	Total	130	100	100	
Traffic Lighting					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	118	90.8	90.8	90.8
	yes	12	9.2	9.2	100
	Total	130	100	100	

Source: Field Survey, 2021

3.3. TEST OF HYPOTHESIS

There is no significant relationship between level of safety compliance and rate of accident

Table 3 shows that the probability value of 0.019 is less than the threshold of 0.05 at $p<0.05$ level. Hence the correlation test is statistically significant. A negative correlation co-efficient of -0.205 shows that there is an inverse relationship between the variables (that is, level of safety compliance and level of crashes) and the relationship is moderate. This therefore means that as the level of safety compliance increases, the level of crashes is reduced and vice-versa. This corroborates the work of Hollnagel (2004). Hence, the null hypothesis is rejected and the alternative hypothesis which states that 'there is a significant relationship between level of safety compliance and level of crashes is accepted.

Table 3

Table 3 correlation coefficient of level of compliance and level of crashes Correlations			
		level of compliance	level of crashes
level of safety compliance	Pearson Correlation	1	-.205*
	Sig. (2-tailed)		0.019
	N	130	130
level of crashes	Pearson Correlation	-.205*	1

	Sig. (2-tailed)	0.019	
	N	130	130
*. Correlation is significant at the 0.05 level (2-tailed).			

Source: Field Survey, 2021

4. CONCLUSION AND RECOMMENDATION

The findings revealed that the availability and implementation of traffic safety measures as well as the level of compliance of the road users to the use of this traffic safety measures will significantly influence the reduction of road accidents. It was established from the tests that a major solution to the reduction of road accidents is the availability of traffic safety measures. However, this study made us realize that there are inadequate and effective traffic safety measures in Ogbomosho north local government road axis. It is therefore recommended that the availability of traffic safety measures should be taken has a major responsibility by the government. There should be proper and adequate implementation of the necessary traffic safety measures. It also points out the necessity for more transport infrastructural facilities and improvement of the available ones as this will have a tremendous impact on the economy and development of the society.

CONFLICT OF INTERESTS

None.

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