ISSN 2348-3156 (Print)
International Journal of Social Science and Humanities Research ISSN 2348-3164 (online)
Vol. 7, Issue 4, pp: (759-773), Month: October - December 2019, Available at: www.researchpublish.com

COUNTERACTIVE TRAFFIC CONTROL STRATEGIES AND ROAD SAFETY IN RURAL KISUMU, SOUTH WESTERN KENYA

Silas Oloo Mc'opiyo

PhD, EBS, OGW

Graduate, Doctor of Philosophy in Management Science (Public Administration and Management

Kampala International University, Uganda

Abstract: **Road safety in rural areas of Kisumu County had attracted a lot of public opinion and scholarly debate despite a potentially enabling road safety strategy mirrored in Kenya's Integrated National Transport Policy (INTP). This was due to lack of specific attention in previous policy and scholarly research, yet there were perceived high levels of road fatality. Aware of the relevance of road traffic control as a conduit of policy implementation, this study sought to investigate and explain road safety concerns in that part of the county. The study particularly examined the influence of counteractive traffic control strategies on road safety. For this purpose, attention was specifically given to the effects of anti DMC[1] vehicle operations, reactionary safety mechanisms against reckless driving, and penalty of traffic offences on road safety. The study adopted an exploratory and descriptive correlational research design based on the quantitative and qualitative approach. A sample of 365 respondents was selected from the study population of 1919 subjects using purposive and stratified random sampling techniques. The study findings indicate that road safety was generally low in rural Kisumu County. This was according to findings attributed to DMC vehicles, reckless driving and discrepant traffic offence penalty. Particularly, operations against DMC vehicles were inadequate, mechanisms fighting reckless driving were less effectively used and traffic offences were barely penalized in most of rural Kisumu. It was specifically found out that failure to combat DMC vehicles predicted 25.5%, reckless driving predicted 38.5% and poor traffic offence penalties predicted 33.7% of road safety threats. Generally, counteractive traffic controls predicted 44.9% of the road safety dilemma in such rural areas of the county. It was therefore recommended that Kenya's National Transport and Safety Authority (NTSA), Kisumu County Government (KCG), and the private sector should phase out vehicles in dangerous mechanical conditions, ensure and support stringent road safety penalties and vigorously fight corruption in the road transport sector. Proactive traffic control strategies should also be promoted i.e. community sensitization on road safety, improved quality of driving schools, use of intelligent vehicle safety gargets, and consistent road maintenance.**

Keywords: **Counteractive traffic control, dangerous mechanical condition, reckless driving, traffic offence penalty, road safety.**

1. INTRODUCTION

1.1 Background to the study

Road traffic control has since the ancient roads been a basic social obligation of public administration, and so has been the concern about road safety. However, contemporary public traffic controls evolved much later beginning with earliest formal road safety policies. One of these policies was the 17th century Britain's transport policy, to be exact of 1663 (Bellis, 2015; Wellings, 2002). The policy was introduced to transform road transport and make it safer following the

[1] DMC in full is dangerous mechanical condition

development of better roads. This was replicated in North America, and the rest of Europe among other developed societies then. Globally, such road safety policies have since been consistently made and revised due to progressively evolving modern roads and ensuing road safety risks. The policies were used to buttress traffic control expected to bolster road use efficiency and safety (Bellis, 2015; Hobbs, 2015; Leonard, 2004). In Africa, this has been the same reason although similar road safety policies and formal traffic control came much later. The policies were first introduced in the colonial era beginning from 1870's, and gained more momentum in the post-colonial (independence) Africa that started in the late 1950's. Policy guided traffic control was not tenable in the pre-colonial period because there had not been any modern roads (Emmenegger, 2012; Ndegwa, 2003; Njoh, 2005; Sunderland, 2012). In post-colonial Kenya, road traffic control has evolved through successive road safety policies in the past 50 years of its independence (MOR, 2012). Kenya became independent from colonialism in 1963 (Manyara, 2016).

According to Hu, Zhou, Zhao and Liu (2005), counteractive road traffic control involves regulating and re-directing road use to ensure compliance with set road use standards following any breaches of the same standards or traffic rules while soundly conducted traffic controls promote road safety. The International Transport Forum (ITF, 2008) defines road safety as the incidence of reduced risk of serious injury and fatality of road users. According to UNECA[2] (2018), the incidence involves better road use practices perceived as immediate outcomes, and reduced road fatality regarded as final outcomes both of which should be the aim of traffic control strategies, usually underscored in the road safety policy. What is not known about rural Kisumu County however, is whether such control strategies significantly affect the level of road safety. The study was limited to three strategies perceived to potentially underlie road safety needs in that part of the county; anti DMC vehicle operations, anti-reckless driving mechanisms, and traffic offense penalties.

Kenya's road safety policy is constitutionally revitalized and sure, if such traffic control strategies were based on best practice, the anxiety surrounding road use in rural Kisumu would be significantly minimal. The policy was according to the 2010 constitution, designed to propel road safety inducing practices such as corrective traffic controls, which under devolution dispensation would have been more closely enforced for the right outcomes (Othieno, 2011). Kenya was devolved into 47 county governments including Kisumu County, widely crisscrossed by a road network only second to Nairobi county breadth (ASIRT[3], 2014). This was however not enough to explain the road safety quandary broadly reported especially about rural Kisumu! Being a local government, all of Kisumu County should enjoy an opulent of a state underpinned institutional framework for close and consistent administration of the road safety policy (Infotrack East Africa, 2014; Othieno, 2011). Startlingly, Kisumu County is widely reported to have been threatened by objectionable road use perceived as a high risk to road safety. In fact, recent years saw a scary road fatality. In just five years (2014-2018), Kisumu as a county registered 974 victims in 808 fatal accidents; 783 victims in 434 serious accidents, and 893 victims 141 slight accidents. Generally, 2650 victims were regrettably recorded from 1383 accidents in that period (NTSA, 2018).

It was also reported that in the same period especially around end of 2017, Kisumu County dominated South Western Kenya by 50% of road fatalities recorded in the region (Aoya, 2017; NTSA, 2018). Besides Kisumu County, South Western Kenya comprises five counties, namely Siaya County, Homa Bay County, Kisii County, Migori County and Nyamira County (KCG[4], 2013; MDP[5], 2013). According to DRSEAI[6], road fatality in Kisumu County was due to poor road use that should have been corrected through effective counteractive traffic control. Whether there were such attempts, it was unclear due to lack of enough attention in previous related research on road safety in Kisumu County (Amulla, 2018; Kipkosgei, 2009; Manyara, 2014; Murimi, 2013; Ndug'u, Ratemo, Mwai, 2015; Nyachieo, 2015; Onyango, 2018; Othieno, 2011). Very little or none was about such reactionary traffic control. There was therefore the need for this study to conduct a more focused analysis particularly about rural Kisumu.

1.2 Statement of the problem

Kenya's road safety policy presents a sound and devolved institutional framework for road traffic controls, supposed to enhance road use efficiency and safety (KIPPRA, 2017; Ministry of Roads, 2012). However, road safety in Kisumu

[2] UNECA is abbreviation for United Nations Economic Commission For Africa
[3] Association for Safe International Road Travel
[4] Kisumu County Government
[5] Ministry of Devolution and planning
[6] Directorate of Road Safety Enforcement and Investigation

County remains fragile, more especially in rural Kisumu. As of December 2017, the county was leading the rest of South Western Kenya with almost 50% of the 303 deaths (NTSA, 2018). In Kenya, Kisumu road fatality compares only with Nairobi County, the capital of Kenya (Aoya, 2017; NTA, 2018). The county was reported to record a road fatality rate of 31.3, higher than the national fatality rate of 28.2 per 100 000, annually (Aoya, 2017). DRSEAI blames road fatalities on wrong road use by careless vehicle drivers, *Boda boda* and *Tuk-tuk* riders (motorcyclists), cyclists and pedestrians (NTSA, 2018). Nonetheless, such a road safety situation, specifically about rural Kisumu, was previously never well explained, thus the need for the current research.

1.3 Purpose of the study

To assess the efficacy of counteractive traffic control strategies and their effects on road safety in rural Kisumu, South-western Kenya.

1.4 Objectives of the study

1. To examine the effect of field operations against dangerous mechanical condition (DMC) vehicles on road safety in rural Kisumu, South Western Kenya.

2. To assess the effect of reactionary safety mechanisms against reckless driving on road safety in rural Kisumu, South Western Kenya.

3. To find out the effect of traffic offence penalties on road safety in in rural Kisumu, South Western Kenya.

1.5 Research Hypotheses

1. There is no significant relationship between field operations against DMC vehicles and road safety in rural Kisumu, South Western Kenya.

2. There is no significant relationship between reactionary safety mechanisms against reckless driving and road safety in rural Kisumu, South Western Kenya.

3. There is no significant relationship between traffic offence penalties and road safety in in rural Kisumu, South Western Kenya.

2. LITERATURE REVIEW

The review of literature covered the theoretical review, conceptual framework and existing empirical literature. The theoretical review included the research theory and model.

2.1 The Total Safety Culture Theory

This study was underpinned by the Total Safety Culture Theory (TSCT) as the theoretical framework on which the research process was anchored. Largely developed by E. S. Geller in 1994, the theory integrates three theoretical bearings but more critical for this study were the behavioural values and classical principles (Geller, 1994; Guldenmund, 2010; Rakowska, and Szubielska, 2013). The behavioural perspective of total culture recommends for reactionary strategies against safety risks, and the classical approach roots for both reactionary and proactive actions (Cole, Stevens-Adams and Wenner, 2013; Marsh, 2014). TSCT was perceived to be applicable and preferred for the current study mainly because of its behavioural insights and partly due to the classical principles that recommends reactionary safety measures. This suits the counteractive road traffic control strategies this study sought to explain the research problem. The problem was about the level of road safety in rural Kisumu County that appeared to have long been in obscurity.

2.2 Research model

This section covers the existing and adopted research models respectively. The existing model reviewed and perceived as being the most related to this study was the Target Hierarchy Safety (THS) model while the adopted model (as the actual research model) was the extract of the THS model.

2.2.1 Target Hierarchy Safety Model

Review of the Target Hierarchy Model was made on the basis that it is consistent with the Total Safety Culture Theory. Through its idealization of the road safety policy procedure, it integrates the hypothetical insights of the theory related to

ISSN 2348-3156 (Print)
International Journal of Social Science and Humanities Research ISSN 2348-3164 (online)
Vol. 7, Issue 4, pp: (759-773), Month: October - December 2019, Available at: www.researchpublish.com

this study namely behaviourism and classicism. The procedure according to THS model takes a progression of policy input, implementation and outcome (Mosink *et al.*, 2005). The theoretical beliefs of behaviouralism, and classicals' shared responsibility can be used to define road safety policy and implementation. This can be in theory and practice and at any time and space not only for total but sustainable safety as well. Illustration of all this is the THS model which provides meaningfully spot on pyramidal breakdown of the road safety management system as presented in Figure 1.

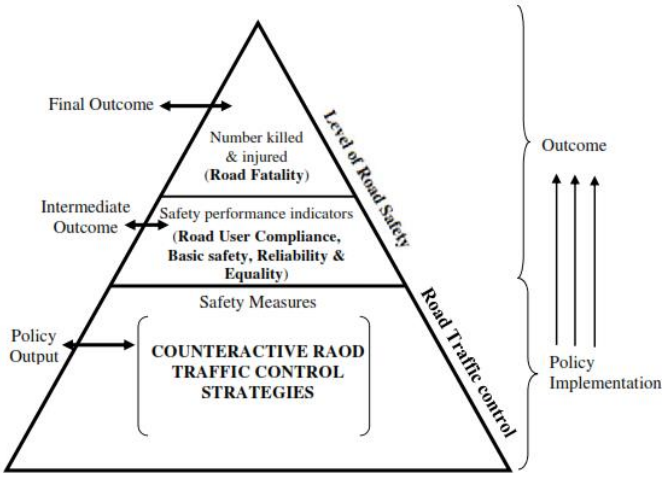
Source: Mosink et al. (2005)

Figure 1. The target hierarchy safety model

The model adopts a Maslow's pyramidal structure above only for a graphic presentation of the hierarchical importance of safety performance indicators in the road traffic management system. According to the pyramid, the structure of road safety performance analysis should start from the pyramidal base stating the necessary elements of the traffic management scheme such as the counteractive traffic controls (Luukkanen, 2003). Due to its generality, research based on the THS model could not yield a specific, realistic and in-depth analysis. With this in mind, a new model was generated and adopted as the actual research model.

2.2.2 Adopted research model

This model was the actual Research Model adopted to direct the research process. It was derived from the THS model above and was dubbed, "road traffic safety model" to resonate well with the research problem, which basically centered on road safety that for long had been a contentious public administration challenge mainly in rural areas of Kisumu County. The version of the new model was illustrated in Figure 2.



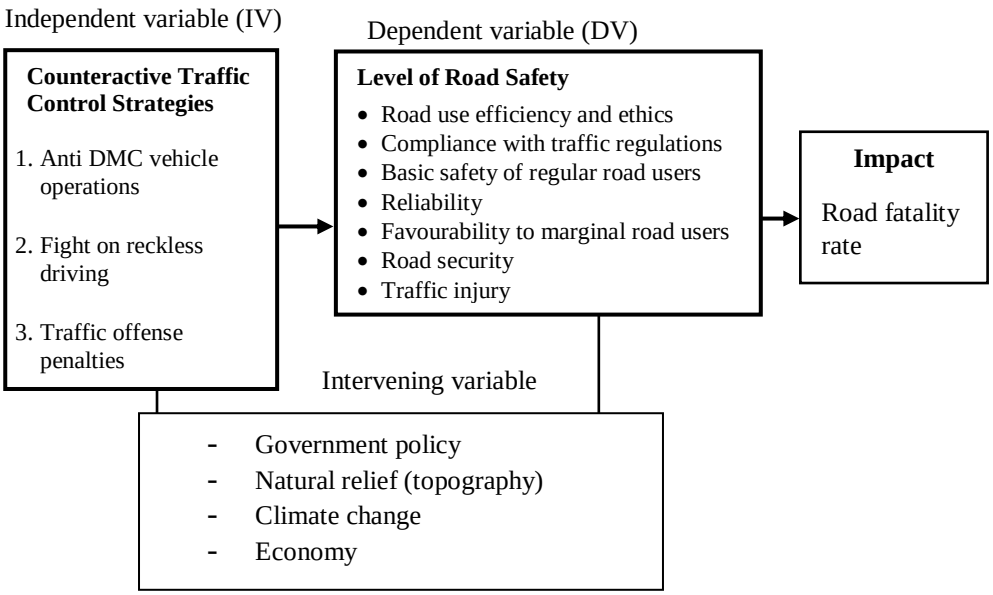
Source: Researcher (2018)

Figure 2. The Research Model

ISSN 2348-3156 (Print)
International Journal of Social Science and Humanities Research ISSN 2348-3164 (online)
Vol. 7, Issue 4, pp: (759-773), Month: October - December 2019, Available at: www.researchpublish.com

The adopted model (Fig. 2) was particularly useful as it closed the gaps detected in the existing Target Hierarchy Safety (THS) model. Specifically, while the THS model was generalized, the adopted model was directly addressed to road safety implications of counteractive traffic control strategies. As the primary research model, the new model was therefore used to operationalize the research conceptual scope. It helped fashion the cause-effect correlation between counteractive traffic control and road safety.

2.3 Conceptual Framework



Source: Adapted from the TSCT) (Geller 1994; Cole *et al*, 2013).

Figure 3. A conceptual framework about counteractive road traffic control on road safety

2.3 Review of empirical literature

This section presents literature closely related to the study and review in light of specific variable links consistent with the research objectives. The variable associations of review include effects of Anti DMC vehicle operations, Fight on reckless driving and Traffic offense penalties on road safety, respectively. In their qualitative study about urban traffic management in China, Hu, Zhou, Zhao and Liu (2005) specify government and other stakeholders at national and local levels gave due diligence to the implementation of the road traffic safety law enacted in May 2004. The law provided the basis for road transport policy reform, road transport institutionalization and traffic safety in the country. They note that this was reflected in the spirit of "human being-oriented" road transport management that pays due attention to the people and personal security. They found out that road traffic safety promoters emphasized the road traffic law for safety regulation and implementation of traffic controls with the ultimate objective to reduced road accidents. This study signified effective road traffic control at local government level but it was about urban not rural. It is old, was only qualitative and carried in another country, hence presenting locational, temporal, approach and contextual research gaps for the current study to fill.

In a study about traffic management problems in Lagos, Olaogbebikan, *et al.* (2013) found out several social and institutional causative factors of road safety risk. These include indiscriminate parking, loading and off-loading of goods and passengers on the road, and on-road trading (social) as well as over dependency on small occupancy vehicles, narrow road, inability of the traffic management agencies to evacuate crashed or broken down vehicles on time and ineffective traffic control measures (institutional). These are factors that well account for the road safety problem but the study never gave exhaustive attention to counteractive traffic controls which in rural Kisumu County were the underlying factors to such causes specified. There were depth and content research gaps to address. According to a study by Chiduo and Minja, (2005), the government of Tanzania made a commitment to tackle the road safety problem by adopting a comprehensive

road safety program. This program however yielded results after giving emphasis on the traffic legislation, institutional set up of road safety activities, law enforcement, and road traffic management. The study shades light on similar policy and institutional efforts that have been made in Kenya but it captures a broader spectrum of traffic management; it was not exhaustive about road traffic control thus leaving a depth gap.

UNECA's (2018) review of Uganda's recent road safety experiences revealed that lack of enough commitment to enforcement of traffic regulations could have also compounded the problems of road fatalities and injuries faced in the country. The review reports that although the country had a robust regulatory transport framework, several challenges compromised implementation of such policies and regulations. The entire country and, particularly Kampala City, was reported to be served by an unregulated public transport system, with most of the vehicles in poor mechanical conditions, coupled with poor driving skills that contribute to road crashes. Most vehicles operated largely outside the transport regulatory framework. It was established that Uganda did not have an up-to-date framework for monitoring and evaluating road safety on a regular basis as required by the African Action Plan for the Decade of Action for Road Safety (AAPDARS), nor a practice of working towards a national road safety strategy. It was further found out that traffic police also faced severe logistic challenges including lack of speed guns and patrol vehicles. It was observed that given its high road-crash rate, Uganda required a robust emergency response and care system to address the high number of road injury cases. However, post-crash response and care in the country was poor, particularly on up-country roads (UNECA, 2018).This review presented a startling picture of what traffic control can appear and cause to road safety if proper interventions are not made. However, all this only served a lesson for research on rural Kisumu County because the context and macro scope of the review were different from that part of the county. Otherwise, there was need for the current study to fill the perceived contextual, scope and approach research gaps.

Mukabanah (2012), in his paper on Transport Reforms in Kenya, observes that the adoption of the Integrated National Transport Policy (Sessional Paper No. 2 of 2012) was a big stride but failure by government to create relevant institutions, to develop transport plans, human capacity and adopt Intelligent Transport Systems (ITS) has led to unsustainable road transport management regimes. This has also been the reason why so many studies done in the Ministry of Transport (MoT) have never been implemented. This paper provided a significant glance on the challenges to transport policy implementation in Kenya but did not specifically cover road traffic control at county level thus leaving content and contextual research gaps.

Similar to Chiduo and Minja's (2005) study, Mukabanah (2012) also found out that road transport in Kenya is characterized by many externalities such as accidents, pollution and congestion due to a poor road transport regulatory and management regime. The result has been the entrenchment of bad motoring attitude and a *Matatu* (Para Transit) culture cultivated by a corrupt regulatory and enforcement regiment. The study gives real facts but it was macro with no specificity, thus leaving a scope gap. A study by Olemo (2016) sought to explore the major causes of road traffic accidents in Nairobi County. The apparently prominent cause observed in the study was the laxity associated with enforcement of traffic rules. Driver and vehicle related offenses were widely identified as the leading causes of frequent accidents in the county. The most singled out offenses was associated with driver behaviour, vehicle over-speeding and safety violation. If this could happen in the only capital city of Kenya, Nairobi, how about rural Kisumu? Yet Nairobi was expected to be the epicenter of best traffic control! Besides, the Kisumu County is distinct from Nairobi geographically. The current research therefore sough to address this geographical research gap.

2.4 Conclusion

The most specifically relevant to study in the above review was empirical literature because it aligns with the traffic control strategies consistent with the research objectives. Empirical literature review was also prominently relevant as it was the basis of spotting existing research gaps in previous related literature, which warranted empirical testing. The most significant of the research gaps was the content specificity gap. Previous literature could not specifically explain the effects traffic controls on road safety. Other research gaps included the scope research gap, in-depth analysis gap, temporal gap, approach gap, contextual research gap, as well as the content gap, research accuracy gaps, role devolution analysis gap, locational gaps and content clarity gap. It was bound on these gaps that the current study claims originality and was deemed essential for policy and academic significance.

ISSN 2348-3156 (Print)
International Journal of Social Science and Humanities Research ISSN 2348-3164 (online)
Vol. 7, Issue 4, pp: (759-773), Month: October - December 2019, Available at: www.researchpublish.com

3. METHODOLOGY

This study adopted an exploratory descriptive correlational research design based on the quantitative approach. The exploratory facet of the design was useful for ascertaining an unfamiliar research problem (Van der Mescht, 2014). The descriptive design facet was adopted to answer questions of *what*, *where*, *who*, *when* and *how* (Creswell, 2007; Murphy, 2013) about each of the variables of counteractive traffic control and road safety in rural Kisumu. According to Zoëga (2008), the correlational facet was used to determine co-variance between such traffic control and roads safety variables. The study assumed a quantitative approach to enhance logic and comprehensive analysis (Harwell, 2010; Neuman, 2003). The study population targeted for research comprised several subgroups, each of which was represented by a category of the study sample adding to 365 subjects (Table 1). The sample was determined using the Sloven's formula (Adanza, 2006; Altares, 2003) as well as Krejcie and Morgan's (1970) sample scale. Purposive sampling and stratified random sampling strategies were adopted to select the sample as summarized Table 1.

Table 1: Summary of the sampling procedure

Sampling	Description	Population	Sample	Instrument
Purposive sampling	Lead Field Traffic Police Officers	102	18	Structured Questionnaire (248 Copies)
Stratified random sampling	Members of the CEC	12	02	
	Members of County Assembly	45	08	
	Members of Operator Associations	48	08	
	Members of Civil Society	14	02	
	Transport Business Operators	150	26	
	Grass root Community Leaders	1050	184	
Total		1421	248	

Source: Adapted by Researcher from records of field survey institutions (2016)

The questionnaire, based on a 5 - Likert Scale, was used as the instrument for collection of primary data. Responses to the 5 -Likert questions or items were scaled as 5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree, and1 = Strongly Disagree. At least 248 copies of structured questionnaire were administered among respondents as specified in Table 1. This was done with due diligence to respondents' informed consent and confidentiality. The collected raw data was presented, analyzed and interpreted using descriptive and inferential statistics based on the Scientific Package for Social Scientists (SPSS), version 16. The main descriptive statistical tools (packages) used included the arithmetic mean ($\bar{x}$), and standard deviation(S). Frequency distribution was also used in some respects. The inferential statistical tools adopted included Pearson's correlation coefficient and simple or multiple linear regression.

For accurate interpretation of variable descriptions and covariance, interpretive scales were adopted for each of the analysis tools. The variables included road safety, road maintenance, motorcyclist training, and vehicle safety gadgets. The "scale" for the arithmetic mean ($\bar{x}$) was adapted in such a way that 1 - 1.75 = 'Very low', 1.76 - 2.50 = 'Low', 2.51-3.25 = 'Moderate', 3.26 - 4 = 'High', 4.01- 4.75 = 'Very High' (Kostoulas, 2013). Scaling of the standard deviation included ≥ 1.5 = more spread from the mean and < 1.5 = closely clustered or less spread around the mean (Bland & Altman, 1996). For Pearson's correlation coefficient, the adapted scale included ≤ 0.35 = weak correlation; 0.36 - 0.67 = moderate correlation, 0.68 - 0.89 = strong correlations and ≥ 0.9 = very strong correlations (Asuero, Sayago, &Gonz´alez, 2006; Taylor, 1990).

4. FINDINGS

The findings of the study were at a response rate of 94% collected from 233 respondents out of the original study sample of 248 people. The findings were sufficient for addressing the research problem because the response rate was far higher than 70% minimum rate recommended for such a social science study (Fincham, 2008).

4.1 Description of the dependent variable: Level of Road safety

The dependent variable in this study was about the level of road safety in rural Kisumu. The explicit description of the variable seven indictors were analyzed as the relevant research constructs, namely transport operator efficiency and interpersonal respect, observance of traffic rules and regulations, safety of regular road users, road favourability of high-

ISSN 2348-3156 (Print)
International Journal of Social Science and Humanities Research ISSN 2348-3164 (online)
Vol. 7, Issue 4, pp: (759-773), Month: October - December 2019, Available at: www.researchpublish.com

risk road users, security on the roads and reduction in road use fatality. The results generated about each of the constructs were summarized in Table 2.

Table 2: Descriptive statistics on the level of road safety in urban areas of Kisumu County

Safety indicator	N	Mean ($\bar{x}$)	Std. Deviation (S)
1) Efficiency of transport operators (Reftops)	233	2.63	1.17
2) Inter transport operator respect (Itporspct)	233	2.30	1.02
3) Compliance with traffic rules ('Rdfrscomp')	233	2.50	1.01
4) Safety of regular road users (Saftrrusacds)	233	2.28	1.02
5) Roads Favorability to marginal users (Frhrrusrs)	233	2.44	1.13
6) No road use poses no security threats ('Rusthr')	233	2.47	1.16
7) Reduction in road use fatality ('Rdcrfatl')	231	2.57	1.23
Grand Indices	233	2.46	0.87

Source: Field research (2018)

With aid of the descriptive interpretation scales adapted (for both $\bar{x}$ & S), results in Table 2 indicate that road use fatality meagerly reduced ('Rdcrfatl') in much of rural Kisumu ($\bar{x}$ = 2.57; S = 1.23). Road fatality, as the final indicator of road safety, had poorly reduced in rural areas of Kisumu County. Such fatality rating could not have been any different from intermediate road safety indicators also specified in the table. The least rated of these intermediates was safety of regular road users ('Saftrrusacds'), which according to results was widely rated as being poor or low at $\bar{x}$ = 2.28; S = 1.02. This was followed in ascending order by inter transport operator respect ('itporspct'), also largely rated as poor ($\bar{x}$ = 2.30; s = 1.02); then roads favorability to marginal users (frhrrusrs), broadly rated as poor ($\bar{x}$ = 2.44; s = 1.13); road use security ('rusthr'), rated as poor as well among most of the respondents ($\bar{x}$ = 2.47; s = 1.16), and compliance with traffic rules ('rdfrscomp'), mostly rated as being just poor ($\bar{x}$ = 2.50; s = 1.01). The only indicator mostly rated as being moderate was the efficiency of transport operators (Reftops) at $\bar{x}$ = 2.63; S = 1.17. The average indices of $\bar{x}$ = 2.46; S = 0.87 recorded were not a surprise. Generally the level of road safety was mostly low in rural areas of Kisumu County. That noted, the study labored to explain the situation through verifying the null hypotheses using interferential statistical tools as detailed in the following themes.

4.2 Verification of Hypothesis One: Anti MDC vehicles operations and safety

This theme covers findings used to verify the related Null Hypothesis One. This was consistent with the related research objective. The hypothesis assumed that, "there was no significant relationship between field operations against DMC vehicles and road safety in rural Kisumu, South Western Kenya". Before this hypothesis could be verified, it was imperative that independent variable is described for an informed eventual inferential analysis. As the independent variable, the consistency of anti MDC vehicle field operations was described based on the statistics in Table 3.

Table 3: Descriptive statistics on field operations against DMC vehicles in rural Kisumu.

Descriptive Statistics		Indices (DgrswyfusRk)
Mean		2.23
	Upper	2.41
	Lower	2.05
Std. Deviation		1.28

Source: Field survey (2018)

The results in Table 2, indicate that anti DMC vehicle field operation was poorly rated in much of the rural Kisumu ($\bar{x}$ = 2.23; s = 1.28). That suggests that such operations were less consistent in most rural areas in the county.

ISSN 2348-3156 (Print)
International Journal of Social Science and Humanities Research ISSN 2348-3164 (online)
Vol. 7, Issue 4, pp: (759-773), Month: October - December 2019, Available at: www.researchpublish.com

Having described the level of road safety, Pearson's correlation coefficient and simple linear regression analyses were completed to determine how the consistency of these traffic operations affected road use safety in the areas of research. The related inferential results were presented in Table 4.

Table 4: Correlation and Regression (Model Summary) Coefficients

CORRELATIONS		
		Level of Road Safety
Field operations against DMC vehicles	Pearson Correlation (*r*)	.505**
	Sig. (2-tailed) (*p*)	.000
	N	231

**. Correlation is significant at the 0.01 level (2-tailed).

SIMPLE LINEAR REGRESSION			
Model	R	R Square	Adjusted R Square
1	.505[a]	.255	.252

a. Predictors: (Constant), Use of dangerous mechanical condition vehicles curtailed in Rural Kisumu

Source: Field survey (2018)

Correlation results ($r = 0.505^{**}$; $p < 0.001$) in Table 4 suggest that there was a linearly significant relationship (H_A) between field operations against DMC vehicles and level of road safety in the rural areas of study. According to simple regression results in the table $R^2 = 0.255$ such operations predicted 25.5% of road safety. The rest 74.5% (0.745) was predicted by other counteractive traffic control strategies. It was thus inferred that anti DMC vehicle operations significantly influenced road safety in rural areas of Kisumu County. Null Research Hypothesis One was rejected.

4.3 Verification of Hypothesis Two: Reactionary safety mechanisms against reckless driving and road safety

The study results in this theme were used to verify Null Hypothesis Two. The hypothesis stated that, "there was no significant relationship between reactionary safety mechanisms against reckless driving and road safety in rural Kisumu, Southwestern Kenya". The independent variable was also described before its effect on road safety could be determined. The descriptive findings captured the how effectively anti reckless driving mechanisms were used. The mechanisms in question included use of the speed gun and alcoblow. The statistics generated about such traffic control mechanisms were presented in Table 5.

Table 5: Descriptive statistics on the use of anti-reckless driving mechanisms in rural Kisumu

Descriptive Statistics		Indices (smus2rgvssduk)
Mean		2.29
	Upper	24.45
	Lower	2.14
Std. Deviation		1.35

Source: Field survey (2018)

Results in the table above show that a low arithmetic mean ($\bar{x} = 2.29$) and small standard deviation ($S = 1.05$) were computed. This indicates that anti-reckless driving mechanisms were poorly used in most of rural Kisumu to counter vehicle speed and unsafe driving. Control of vehicle speed and safe driving was less sufficient in rural areas of Kisumu County. This description was followed by Pearson's correlation and regression tests made to determine the effect of such safe control mechanisms on road safety as summarized in Table 6.

ISSN 2348-3156 (Print)
International Journal of Social Science and Humanities Research ISSN 2348-3164 (online)
Vol. 7, Issue 4, pp: (759-773), Month: October - December 2019, Available at: www.researchpublish.com

Table 6: Correlation and Regression (Model Summary) Coefficients

CORRELATIONS		
		Level of road safety
Use of anti-reckless driving mechanisms	Pearson Correlation	.621**
	Sig. (2-tailed)	.000
	N	231
	**. Correlation is significant at the 0.01 level (2-tailed).	

SIMPLE LINEAR REGRESSION			
Model	R	R Square	Adjusted R Square
1	.621[a]	.385	.383

a. Predictors: (Constant), Use of anti-reckless driving mechanisms

Source: Field survey (2018)

Results on variable correlations in the Table 6 indicate that at $r = 0.621^{**}$; $p < 0.001$ road safety in the areas of research was linearly significantly associated with the use of reactionary mechanisms against reckless driving. The regression statistic ($R^2 = 0.385$) shows that such counteractive traffic control mechanisms predicted 38.5% of road safety. The rest 61.5% (0.615) was predicted by other corrective traffic control strategies. It was thus inferred that adoption of anti-reckless driving mechanisms significantly affected road safety in the rural Kisumu County. As such Null Research Hypothesis Two was not valid.

4.4 Verification of Hypothesis Three: Traffic offences penalties and road safety

In this theme, results were used to verify Null Hypothesis Three, which presumed that, "there is no significant relationship between traffic offence penalties and road safety in rural Kisumu, South-western Kenya". The independent variable was also described before its effects on road safety could be determined. The descriptive findings cover how effectively automobile traffic offenses were penalized. The vehicles offenses included overloading, improper parking, unlicensed driving and reckless driving while motorcycle offenses investigated included overloading, unlicensed driving (riding) and reckless driving. . The statistics recorded about penalty of such offenses were summarized in Table 7.

Table 7: Descriptive statistics on penalty of automobile offenses

Construct	N	Mean ($\bar{x}$)	Std. Deviation (S)
1) Penalty against vehicle traffic offenses ('Penasvetofs')	233	2.40	1.23
2) Penalizing motorcycle traffic offenses ('Penlmotofs')	233	2.13	1.32
Grand Indices ('Qltyrdtrfc')	233	2.31	1.02

Source: Field survey (2019)

Findings on construct 1, in the table above indicate that a low arithmetic mean ($\bar{x} = 2.40$) and small standard deviation ($S = 1.23$) were generated. This suggests that penalty of vehicle traffic offenses was less effective in most of rural areas of Kisumu County. Regarding construct 2, the findings show that also a low perception mean ($\bar{x} = 2.13$) and less spread standard deviation ($S = 1.19$) were computed. This implies that penalizing of motorcycle offenses investigated was less effective in much of rural Kisumu.

The grand average indices generated from the two constructs in the table show that generally a low arithmetic mean ($\bar{x} = 2.31$) and smaller standard deviation ($S = 1.02$) were generated. In that case, such traffic penalties against vehicle and motorcycle offenses were poorly rated by most respondents. By implication, administration of penalties against such automobile offenses was largely poor in rural areas of Kisumu County.

ISSN 2348-3156 (Print)
International Journal of Social Science and Humanities Research ISSN 2348-3164 (online)
Vol. 7, Issue 4, pp: (759-773), Month: October - December 2019, Available at: www.researchpublish.com

With this description, inferential analysis was made to determine the effect of the traffic offense penalties on road safety. The Pearson's correlation and Multiple Regression coefficients generated as a result were computed as summarized in Table 8.

Table 8: Correlation and Regression (Model Summary) Coefficients

CORRELATIONS			
		Road safety	
Penalties against automobile traffic offenses	Pearson Correlation	.579**	
	Sig. (2-tailed)	.000	
	N	231	
	**. Correlation is significant at the 0.01 level (2-tailed).		
MULTIPLE LINEAR REGRESSION			
Model	R	R Square	Adjusted R Square
1	.581[a]	.337	.331

a. Predictors: (Constant), Penalizing of motorcycle traffic offenses in Rural Kisumu, penalty of vehicle traffic offenses in Rural Kisumu

Source: Field survey (2018)

Results on variable correlations in Table 8 indicate that road safety in rural Kisumu was linearly significantly associated with automobile offense penalties at $r = 0.579^{**}$; $p < 0.001$. According to the multiple regression result ($R^2 = 0.337$), such penalties predicted 33.7% of road safety. The rest 66.3% (0.663) was predicted by other counteractive traffic controls. It was thus deduced that penalizing traffic offenses among vehicles and motorcycles significantly affected the road safety in rural areas of Kisumu County. In that case, Null Research Hypothesis Three overruled.

4.5 Grand Multivariate regression analysis: Counteractive traffic control strategies and road safety

To determine how counteractive traffic control as the general main independent variable predicted road safety, the dependent variable or area of interest, a grand multiple regression test was administered. The results recorded were summarized in Table 9.

Table 9: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.670[a]	.449	.442	.648

a. Predictors: (Constant), Curtailing the use of DMC vehicles Rural Kisumu, Use of anti-reckless driving mechanisms in rural Kisumu, Penalty against automobile offenses in rural Kisumu,

Source: Field survey (2018)

Results in Table 9 show that $R^2 = 0.449$. At this rate, counteractive traffic controls predicted 44.9% of road safety in rural areas of Kisumu County. The rest 55.1% (0.551) was predicted by other traffic control strategies. This was therefore inferred that increase in the consistency of counteractive traffic control strategies could thrust road safety performance in rural Kisumu County. The reverse was true.

4.6 Counteractive road traffic control model

Following the foregoing research results, this study proposes a road safety model called, "Counteractive Road Traffic Control Model (CTRCM)". This model builds on the research model adopted to direct the process of this very research. The research model was used to project how counteractive traffic control could determine intermediate and final road safety outcomes but CTRCM presents a more explicit, practical and spot on policy-outcome correlation that can be more valuable in assessing road safety policy performance starting with the rest of Kenya. The proposed orientation of the CTRCM was illustrated in Figure 4.

ISSN 2348-3156 (Print)
International Journal of Social Science and Humanities Research ISSN 2348-3164 (online)
Vol. 7, Issue 4, pp: (759-773), Month: October - December 2019, Available at: www.researchpublish.com

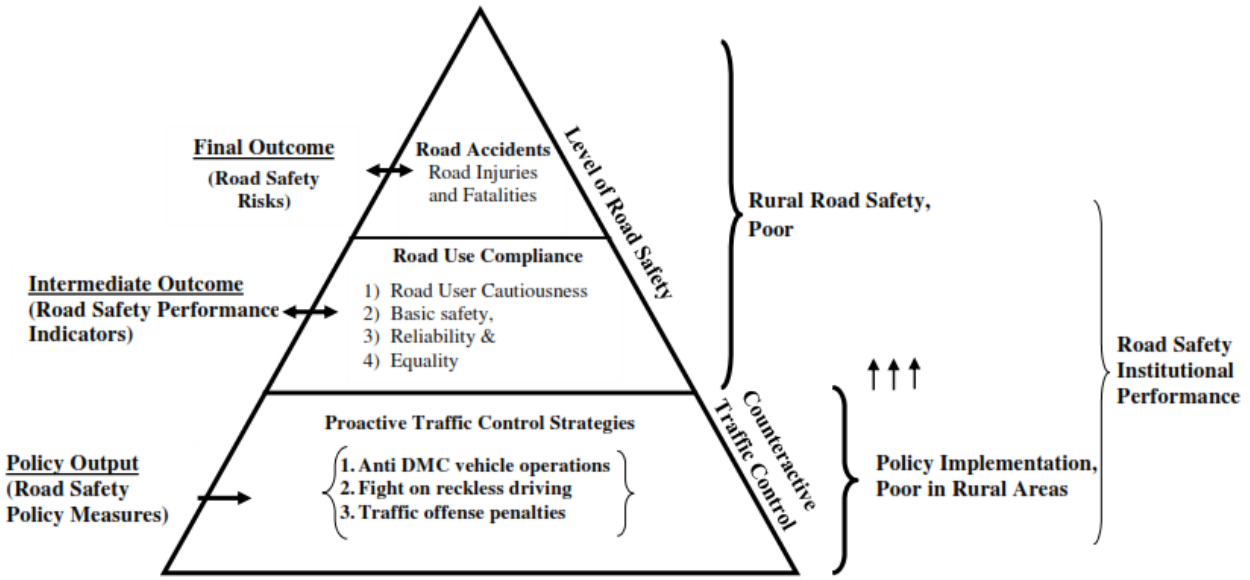


Figure 4. Counteractive Road Traffic Control Model

Source: Researcher (2019)

The proposed model in the figure above presents in an explicit counteractive version of road safety policy implementation that can be useful for efficacious road safety performance through traffic control strategies specified. The strategies were well specified, investigated and used to explain the level of road safety. They include field operations against DMC vehicles, consistent use of mechanisms against reckless driving, and pragmatic penalties of automobile traffic offenses. The model positions such traffic control strategies as dependable road safety policy measures that can be valuable for stamping out proscribed road use especially among vehicle and motorcycle operators.

5. DISCUSSION OF FINDINGS

5.1 Discussion of findings

The study findings were discussed hypothesis by hypothesis and in consistency with the research objectives. The findings well captured the effect of counteractive traffic control on road safety. Hypothesis one assumed that there was no significant relationship between anti DMC vehicle field operations and road safety in Kisumu County. On the contrary, there was a significant relationship despite being relative. According to study findings, operations against vehicles in DMCs were rare in most rural areas of Kisumu County. As such, statistical results indicate that operations significantly predicted 25.5% of road safety. The results on rural Kisumu corroborate the findings in Modley and Allopi (2008), which indicated that vehicle defects contributed to road misfortune as long as they were not restricted and/or inhibited by law enforcement.

Null hypothesis two was rejected because there was a very significant relationship between the anti-reckless driving control mechanisms and road safety in rural Kisumu. The relationship was however moderate though significant. According to the study reports, this was due to poor use of anti-reckless driving mechanisms including speed gun and alcoblow. Vehicle speed control in rural Kisumu County was never enough to guarantee safe road use. This validates Macharia's (2017) inference that control vehicle speeding in Kenya was not enough. The study results suggest that such counteractive reckless driving control was significant because it predicted 38.5% of road safety in rural Kisumu. This result corresponds to Mackey and Roodt's (2003) findings in a previous related research about South Africa.

According to findings related to hypothesis three, the null assumption proposed was not acceptable. There was instead a significant relation between automobile traffic offense penalty and road safety in rural Kisumu County. The findings indicate that there were not enough efforts made to discipline vehicle and motorcycle traffic offenders in rural areas in Kisumu County. Offenses captured in this study include unlicensed driving, reckless driving, overloading, and improper vehicle parking. This according to Zwerling et al. (2005) could be attributed to one thing; norm of negligent inspection and accountability of government traffic managers in rural areas. It was particularly reported that, some automobile offenses were penalized more than others. In the areas of research, only unlicensed driving was somewhat consistently

penalized, otherwise traffic authorities were less strict on the rest with least penalized being improper vehicle parking, followed by overloading, then reckless driving. The habit of fighting against certain vehicle offenses than others was not limited to rural Kisumu County but rather had formerly been reported in Lagos, Nigeria by Olaogbebikan, *et al.* (2013).

Inferential results indicate that penalty against such traffic offenses significantly predicted 33.7% of road safety. The inconsistency of anti-traffic offense penalty may not have been highest contributor to Kisumu road traffic tragedies but incidences of less tamed offenses were significantly a road safety hindrance like had been observed by Chiduo and Minja (2005) in Tanzania despite her devotion to tackle the road safety problem. The effect of poor traffic offense penalty also corroborates fears in Raynor (2014) about the laxity of traffic managers in regulating Boda boda cyclists in Uganda.

5.2 Conclusions

The study findings led to significant lessons about the effects of counteractive traffic control strategies on road safety in rural areas of Kisumu County. It is important that road safety, as a basic public administration responsibility and a key social cost shaper, should not be ignored. However, in rural Kisumu, the level of this safety was poor for both intermediate and final road use outcome. This could not be a coincidence but was rather attributed to corresponding performance of the three strategies of counteractive traffic control investigated, namely anti DMC field operations, reckless driving mechanisms, and automobile offense penalties. These strategies were poorly consistent and far discrepant. Anti MDC vehicle operations were the most discrepant or insufficient, followed by fighting reckless driving and the automobile offense penalty. All the strategies were poor though. Each of these strategies or practices contributed to road safety depending on its efficaciousness. The less efficacious strategy contributed less to road safety and vice versa. In the traffic control system therefore, such counteractive traffic control strategies will be more required when they are not enough and not because they are more important, after-all they are all vital for road safety promotion. No wonder anti MDC vehicle operations could be the most required in rural Kisumu County.

5.3 Recommendations

Basing on the research objectives and findings, the following recommendations were made:

5.3.1 Phasing out vehicles in dangerous mechanical conditions (DMCs). The National government and County government of Kisumu should put a total ban of any un-roadworthy vehicles including the very old and recent but mechanically unfit vehicles.

5.3.2 Proper and effective regulation vehicle speed. The NTSA and Traffic Police should consistently use the speed controls to ensure safe speed and driving among vehicle drivers in Kisumu County i.e. speed gun, and Alcoblow.

5.3.3 Consistency and transparency in the fight against vehicle and motorcycle traffic offences. The NTSA and Traffic Police should consistently and accordingly penalize any vehicle drivers and motorcyclists that commit any traffic offenses. Such offenses should be vehemently and transparently punished

5.3.4 Further research

The study also recommended that further research could be done in the following ways to address perceived knowledge gaps: a) other traffic control factors influencing road safety, b) a comparable study in other counties of Kenya or elsewhere in the world, c) conducting the same study over ten years to come, and d) other transport subsectors can be studied.

REFERENCES

[1] Adanza, E. G. (2006). Research methods: principles and applications. Sta. Mesa, Quezon City: Rex Bookstore.

[2] Altares, et. Al. (2003). Elementary statistics: a modern approach'. Manila: Rex Bookstore, Inc.

[3] Amulla, O. W. (2018). Observational survey of selected safety indicators among commercial motorcyclists in Kisumu city. Baraton Interdisciplinary Research Journal, Vol. 8 (1), p 1-9

[4] Aoya,C. (2017). Road fatalities on the rise, NTSA boss says. Nairobi: Hivisasa

[5] Association for Safe International Road Travel (2014). Road travel report: Kenya. Nairobi: ASIRT

[6] Asuero, A.G., Sayago, A. & Gonz´alez, A.G. (2006). The Correlation Coefficient: An Overview. Critical Reviews in Analytical Chemistry, 36:41–59

[7] Bellis, M. (2015).History of roads: inventions for traffic management. San Francisco: Inventors Expert.

[8] Bland J.M. & Altman D.G. (1996). Measurement error proportional to the mean. BMJ, Vol. 313, 106.

[9] Chiduo C.W. and Minja, P (2005).Road safety in Tanzania: what are the problems? Dodoma: Road Safety Unit, Ministry of Works, Tanzania.

[10] Cole, K. S., Stevens-Adams, S. M. and Wenner, A. C. (2013). A literature review of safety culture. New Mexico: Sandia National Laboratories Albuquerque

[11] Cole, K. S., Stevens-Adams, S. M. and Wenner, A. C. (2013). A literature review of safety culture. New Mexico: Sandia National Laboratories Albuquerque

[12] Creswell, J. W. (2007). Educational research (3rd ed.). Thousand Oaks, CA: Sage.

[13] Emmenegger, R. (2012). The roads of decentralisation: the history of rural road construction in Ethiopia. Bern and Zurich: NCCR North-South, Switzerland

[14] Fincham, J. E (2008). Response Rates and Responsiveness for Surveys, Standards, and the Journal. American Journal of Pharmaceutical Education, 72(2), pp 43-46

[15] Geller, E. S. (1994).Ten principles for achieving a Total Safety Culture.Professional Safety 39 (9): 18–24

[16] Guldenmund, F.W. (2000). The nature of culture: a review of theory and research. Safety Science, Vol. 34(3), p. 215-257

[17] Harwell, M.R. (2010). Research design in qualitative, quantitative, mixed methods.Minnesota: SAGE Publications, Inc

[18] Hobbs, F.D. (2015). Traffic control. London: Encyclopedia Britannica, Inc.

[19] Hu, Q., Zhou, Z., Zhao Y. and Liu, Q. (2005).Study on theurban road traffic safety management.Proceedings of the Eastern Asia Society for Transportation Studies, 5: 2062 – 2074

[20] Infotrack East Africa (2014).Kenya Counties. Nairobi: IEA Ltd Kenya.

[21] International Transport Forum (2008). Towards Zero, Ambitious Road Safety Targets and the Safe System Approach. Washington, DC: OECD

[22] Kenya Council of Governors (2014).Nakuru County: promoting county transparency and accountability. Nakuru: Open Institute

[23] Kipkosgei, E. S. (2009). An assessment of the effects of the 'new' road safety regulations on passenger service vehicle operations in Nairobi, Kenya. Nairobi: Un published thesis MA Geography, Kenyatta University

[24] KIPPRA (2017). Taming the road safety challenge through effective policy response. Nairobi: KIPPRA

[25] Krejcie, R. V. and Morgan, D. W. (1970). Determining sample size for research activities. Educational and Psychological Measurement, 30: 607-610.

[26] Macharia, C. G. (2017). Regulation in the transport industry: a case of Matatu sector in Kenya. Nairobi: Unpublished MBA Thesis, United States International University (USIU) – Africa

[27] Mackey, T. C. And Roodt, L. (2003). Speed - is it relevant?eThekwini: Conference Planners

[28] Manyara C.G. (2015) Combating road traffic accidents in Kenya: a challenge for an emerging economy. In: Koster M.M., Kithinji M.M., Rotich J.P. (eds) Kenya after 50. african histories and modernities. New York: Palgrave Macmillan

[29] Marsh, T. (2014). Total safety culture: organizational risk literacy. Manchester: Ryder Marsh Safety Ltd

[30] Ministry of Devolution and planning. (2013). Counties of Kenya. Nairobi: MDP

[31] Ministry of Roads (2012). Draft policy on aligning the roads sub-sector with the constitution. Nairobi: MOR, Republic of Kenya

[32] Modley, S. & Allopi, D. (2008). Analytical study of vehicle defects and their contribution to road accident in South Africa. Durban: Durban University of Technology.

[33] Mukabanah E. (2012). Transport Reforms: Justification for a Road Transport Act 2013. Nairobi: Transport Sector Board Kenya Private Sector Alliance (KPSA)

[34] Murimi, L. (2013). Determinants of severity of road accidents involving buses along Kenyan roads: a case of Nairobi - Kisumu highway, Kenya. Unpolished Dissertation, Master of Arts in Project Planning and Management of the University Of Nairobi.

[35] Ndegwa, S.N. (2003). The politics of decentralization in Africa.A comparative analysis. Washington DC: World Bank

[36] Ndung'u, C. W., Ratemo, M.B., Mwai, L. K. (2015). Analysis of causes & response strategies of road traffic accidents in Kenya. IOSR Journal of Business and Management (IOSR-JBM), Vol. 17(4), p. 58-77

[37] Neuman, W. L. (2003). Social research methods. Boston: Allyn and Bacon.

[38] Nicolai, S. Prizzon, A. and Hine, S. (2014). Beyond Basic: The growth of post-primary

[39] Njoh, J. A. (2005). Implications of Africa's transportation systems for development in the era of globalization. Florida: University of South Florida, St. Petersburg

[40] NTSA (2018). Recent road fatality rates in South western Kenya and Kisumu County. Nairobi: DRSEAI, NTSA

[41] Nyachieo, G. M. M. (2015). Socio-cultural and economic determinants of boda boda motorcycle transport safety in Kisumu County, Kenya. Nairobi: Unpolished Dissertation, PhD in Sociology of Kenyatta University, Kenya

[42] Olaogbebikan, J. E. Ikpechukwu, N., Akinsulire, E. S. and Enosko, O. (2013).Traffic management problems in Lagos: a focus on Alaba International Market Road, Ojo, Lagos state Nigeria. Journal of Economics and Sustainable Development, Vol. 4(4), p.144-153

[43] Olemo, C., D. (2016). Exploring the major causes of road traffic accidents in Nairobi County. Nairobi: Unpublished Thesis for Master of Science In Social Statistics, University of Nairobi Kenya

[44] Onyango, G.M. (2018). Urban public transport in informal settlements: Experiences from Kisumu City, Kenya. Bulletin of Geography. Socio-economic Series, Vol. 40(40), p. 145–156.

[45] Othieno, N. (2011). Devolution in Kenya's new constitution. Nairobi: SID

[46] Rakowska, A. & Szubielska, J. (2013). Safety culture model and its dimensions on the of example of the coal mines in Poland. Lublin: Maria Curie-Skłodowska

[47] Raynor, B. (2014). Informal transportation in Uganda: a case study of the Boda boda.Vermont: Unpublished Paper, School for International Training (SIT), World Learning

[48] Taylor, R. (1990). Interpretation of the correlation coefficient: a basic review. JDM, Vo.1 35-39

[49] UNECA (2018). Road safety performance review Uganda. New York and Geneva: United Nations

[50] Van der Mescht, H. (2014). Phenomenology in education: A case study in educational leadership. Indo-Pacific Journal of Phenomenology, Vol. 4, No. 1, p 1-16

[51] Wellings, R. (2002). A brief history of British transport policy. London: Belhaven Press

[52] Zoëga, S. (2008). Symptoms and quality of life: a cross-sectional, descriptive, correlation study, evaluating the relationship between symptoms and quality of life in patients on opioids with advanced cancer. Reykjavik: Unpublished Thesis, MSc Nursin, University of Iceland.

[53] Zwerling, C. Peek-Asa, C., Whitten, P, S., Choi S. W., Sprince N. L., Jones, M. P. (2005). Fatal motor vehicle crashes in rural and urban areas: decomposing rates into contributing factors. Injury Prevention, Vol. 11 (11), p.24–28.