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Managing Road Traffic Accidents Using a Systems Approach: Case of Botswana - Empirical Review.

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Abstract

Road traffic accidents are a menace to human deaths and a single life lost on Botswana roads is one too many. The road traffic injuries have long been considered to be inevitable and caused by random, unpredictable events; documented success stories in road safety are needed to demonstrate that road traffic accidents need not be inevitable and unpredictable, but are avoidable. The systems approach to road traffic accidents (RTAs) acknowledges that there are three factors that contribute to road accidents and these are; road users, vehicles and road system. Specifically, the C-3 systems approach with three phases (creation, cultivation, and conduct) was adopted as a theoretical framework underpinning the study. The major findings from this study indicates that most RTAs are caused by road users through speeding, unlicensed driving, using cell phones whilst driving, alcohol and drug abuse, bad state of mind and healthy, non-use of safety belts and deliberate failure to observe road regulations amongst others. The findings also indicate that mechanically faulty vehicles, unmaintained vehicles, old vehicles, and tyre blowouts are vehicle related factors causing RTAs. Road system conditions involve potholes, stray livestock and road design attributes amongst others. The study employed the desktop research approach. The study came up with a number of recommendations which are important to reduce RTAs and these include educating the public on safe driving habits at both basic education and tertiary education levels as well as punitive policies on road users breaking road traffic laws and regulations has been identified as another recommendation. Stringent measures must be taken against livestock owners who leave stock straying in highways and public roads. In addition, regular road maintenance and vehicle maintenance were found to be of paramount importance in reducing RTAs in Botswana.

Key words: Road traffic accident, Casualty, Traffic safety, Botswana, Drunken driving, Systems approach

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1.0 . Background of the Study

Motor vehicles have undoubtedly added to the convenience of modern life. They make it possible for people to travel faster and further than our ancestors ever imagined. Motoring is now a way of life; unfortunately, it is also a way of easy death (Sowetan, 2004). Approximately 3,700 people lose their lives every day on the roads (WHO,2018). An additional 20-50 million suffer non-fatal injuries, often resulting in long-term disabilities. More than half of all road traffic deaths occur among vulnerable road users—pedestrians, cyclists, and motorcyclists. Road traffic crashes are a major cause of death among all age groups and the leading cause of death for productive and young adults aged 15–44 years. This group accounts for more than half of global road deaths. More than 90% of all road fatalities occur in low- and middle-income countries, even though these countries have approximately 60% of the world's vehicles. On average, road crashes cost countries 3% of their gross domestic product, (WHO), 2018).

India ranks 1st in the number of road accident deaths across the 199 countries reported in the World Road Statistics, 2018 followed by China and the United States (U.S). The WHO Global Report on Road Safety (2018) states that India accounts for almost 11% of the accident related deaths in the World. On the contrary, more than 38,000 people die every year in crashes on U.S. roadways. The U.S. traffic fatality rate is 12.4 deaths per 100,000 inhabitants. In addition, 4.4 million are injured seriously enough to require medical attention. Road crashes are the leading cause of death in the U.S. for people aged 1-54. The economic and societal impact of road crashes costs U.S. citizens $871 billion. Road crashes cost the U.S. more than $380 million in direct medical costs. The U.S.

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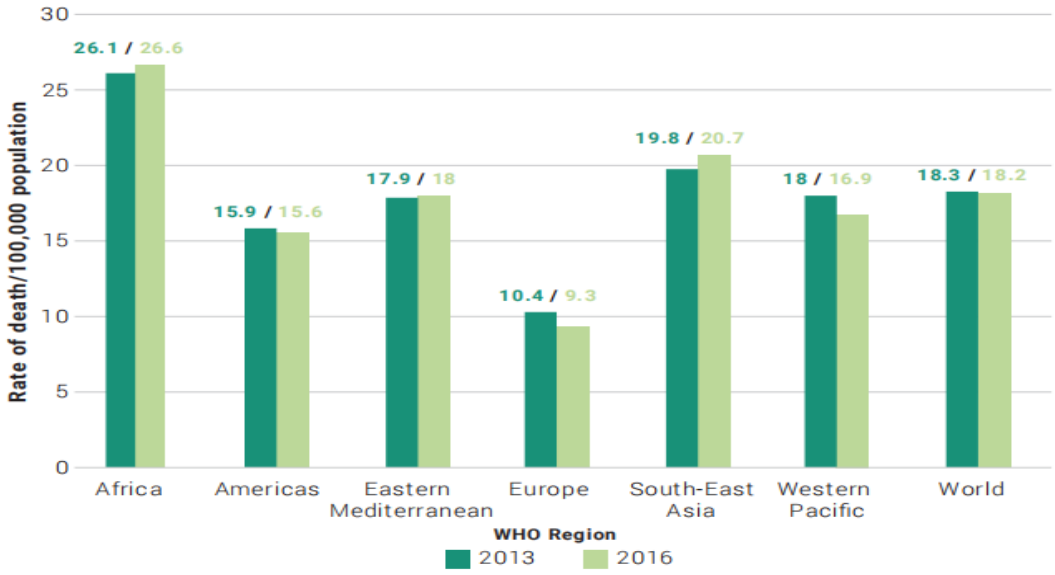
suffers the most road crash deaths of any high-income country, about 50% higher than similar countries in Western Europe, Canada, Australia and Japan, (WHO, 2018).

Research shows that many developing countries have a serious road accident problem and that accident rates are higher than those of western industrial countries. In light of (Bener, et al., 2003) and (Maeletso, 2009), road traffic accidents are a significant but preventable, cause of death, disability and economic loss in developing countries.

In Africa, South Africa has one of the world's poorest road safety records with approximately 31.9 fatalities per 100 000 people while comparable developing countries have a much lower fatality rate (WHO, 2018).

For African countries, the average fatality rate is 24.1 fatalities per 100 000 people, whilst, globally, the average is 18 fatalities per 100 000 people, (WHO, 2018). In South Africa, approximately 1 million road accidents are reported per year. The majority of the accidents that occur are caused by human factors, with an average of over 40 people per day being fatally injured and at least 20 people being left permanently disabled (MVA-Fund, 2017) . Botswana has a recorded death rate of 20.1 per 100 000 populations against the global death rate of 17.4 per 100 000 population (Daily News, 19 May,2019).

Figure 1.1: Rates of road traffic death per 100,000 + population by WHO regions: 2013, 2016

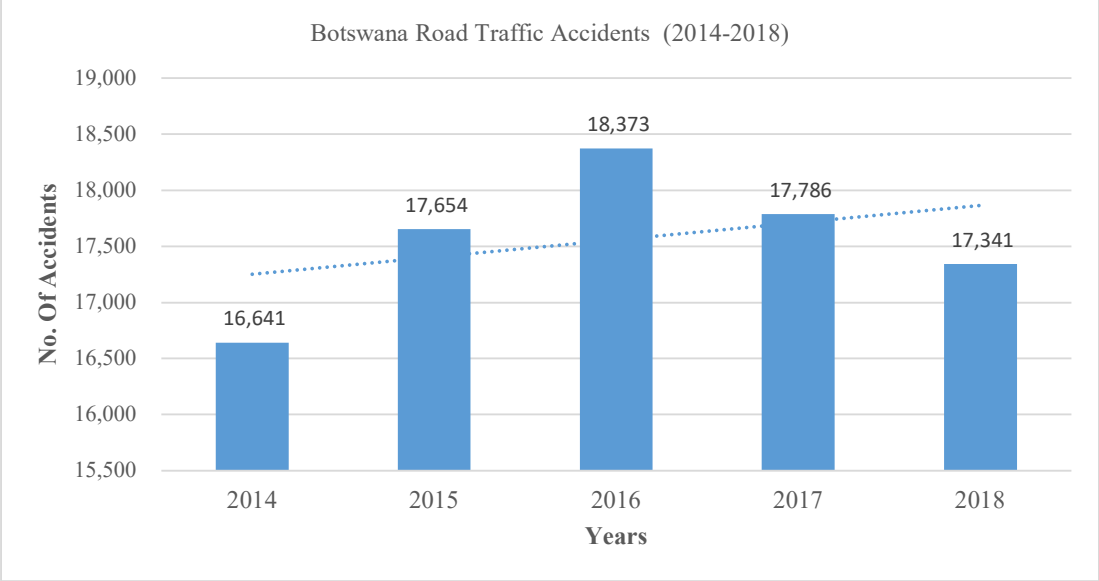


Source: (WHO, 2018)

As noted in figure 1.1, Africa recorded the highest number of deaths amongst all the continents of 26.6 road traffic deaths per 100 000 people in 2016.This figure has moved up from 26.1 per 100 000 people in 2013.This is surely worrisome statistics which calls for African countries including Botswana to move away from casual approach to a systems approach in reducing road traffic accidents and road carnage, (WHO, 2018).

According to Statistics Botswana (2018), Botswana experienced 16641, 17654, 18373.17786, and 17341 road traffic accidents for the past five years from 2014, 2015,2016,2017 and 2018 respectively (Figure 1.1). The linear trend from 2014 to 2018 is upward, which is worrisome as far as road transport safety is concerned.

Figure 1.2: Botswana Road Traffic Accidents



Source: Statistics Botswana, 2018

RTAs for the period under review have also resulted in an upward trend in fatalities or deaths as evidenced by statistics in Table 1.1. Table 1.1 shows a 22.5% increase in RTAs deaths from 2014 to 2018. Daily news (9 May 2019) expounded that there is no much progress towards reducing RTAs and fatalities in Botswana as indicated by Sustainable Development Goals , (Target 3.6) which states that road traffic deaths should reduce by 50% by 2020.

Table 1.1: Botswana road traffic deaths by year

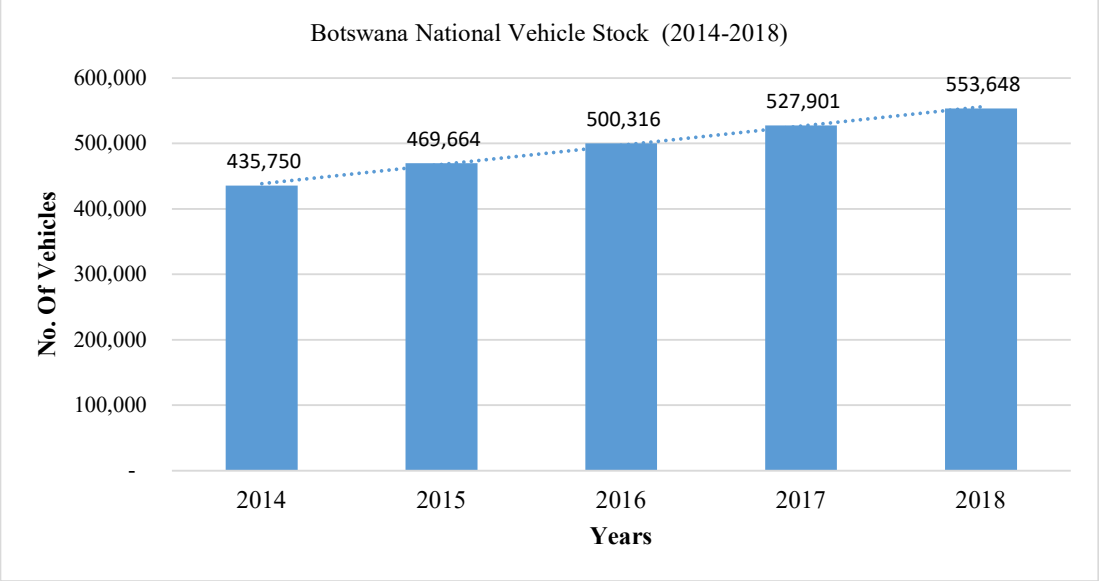
Botswana Road Traffic Deaths by year , 2014-2018

Year	Road Traffic Deaths
2014	377
2015	411
2016	450
2017	444
2018	462

Source : (Statistics Botswana, 2018)

The growth in the national vehicle stock is attributed to privately owned vehicles which constitute 97.7 percent of total vehicle population. The increase in vehicle stock has brought with it some major challenges, for example, an increase in road accidents as shown in Figure 1.1(Statistics Botswana, 2018). A total of 382 people died on Botswana's roads in the first 10 months this year, up nine percent year on year , ("382 die in Botswana roads", 2019). This is an indication that there is a lot that needs to be done by relevant authorities in Botswana to curb the ever growing number of RTAs and fatalities,(OECD Health Statistics, 2019).

Figure 1.3 : Botswana National Vehicle Stock



Source: Statistics Botswana, 2018

Against this background, this paper analyses road transport accidents in Botswana for the five-year period from 2014 to 2018. The purpose of this research is to answer the following questions:

- What are the causes of RTAs in Botswana?
- How does the systems approach help in identifying RTAs causes in Botswana?
- What recommendations are appropriate to reduce RTAs in Botswana

Section 2 deals with literature review on the C3 systems approach and RTAs control measures. Section 3 focuses on ways to reduce RTAs using the C3 Systems approach. Section 4 focuses on methodology. Section 5 looks at findings. The paper concludes with section 6 which gives recommendations and conclusions.

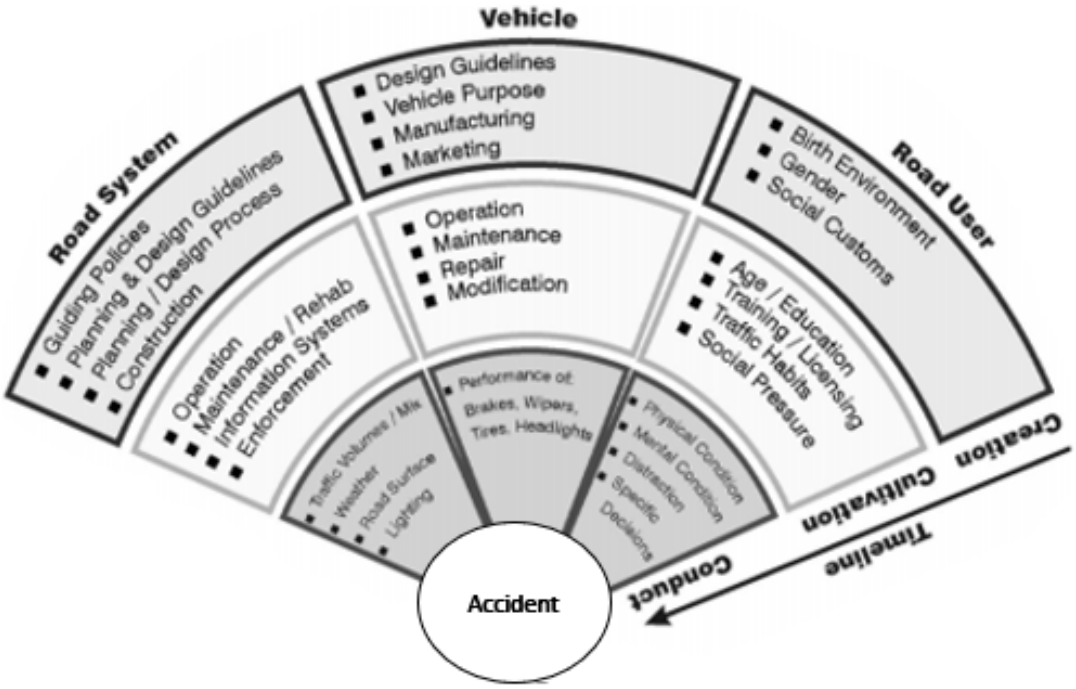
2.0 Theoretical Framework

2.1 The C3 Systems Approach in Road Traffic Accidents.

Zein and Navin (2003) elaborated an important guiding principle of modern RTAs analysis and prevention attempting to reduce the risks associated with traffic casualties and fatalities. The systems approach focuses on the relationships and dependencies between the various individual elements of the traffic system. The C3 Systems Approach to traffic safety refers to the three entities (the road user, the vehicle, and the road environment) and the three preventive timeline phases (creation, cultivation, and conduct) as shown in Figure 2.1. Creation is the phase when an entity or a system is “born” and its initial characteristics are set. Cultivation is the phase when an entity, system or individual develops and matures; operational characteristics and habits are formed. Conduct is the phase that represents the entity, system or individual actions and conditions favouring a RTA. The C3 approach provides this systematic framework to clearly identify the stages at which traffic safety professionals can intervene to reduce RTAs. The framework is in form of a graphical illustration, as presented in Figure 2.1; emphasising the convergence of situations that usually lead to RTAs which road users need to be aware of so that they can be able to manage accident favouring situations. The systems approach, unlike the casual approach, analyses in detail all circumstances leading to a RTA and gives awareness to road users on the best way to avoid accidents and incidents. The model mostly works to reduce RTAs by analysing the role of the road user, the vehicle and the road traffic system. Every combination of circumstances and timeline phase represents a cell in the C3 system; the contents of each cell represent the individual element that traffic safety professionals need to focus on and understand in order to reduce the risk of road traffic accidents. The systems approach in traffic safety acknowledges the more complex nature of motor vehicle accidents in which multiple factors interact to result in an accident. Compared with the traditional approach, systems thinking uses a multidisciplinary, multidimensional approach to promote the

perception of the "big picture". Thus, the systems approach considers a comprehensive set of variables and how they all interact toward a RTA.

Figure 2.1: C3 Systems Approach in Road Traffic Accidents Prevention



Source: Zein and Navin, 2003

3.0 Literature Review

Systems thinking is a discipline for seeing wholes. It is a framework for seeing interrelationships rather than things, for seeing patterns of change rather than static snapshots (Senge, 2006).

3.1 Causes of Road Traffic Accidents

3.1.1 Road User/ Human causes

Road user: representing drivers, passengers, pedestrians, cyclists, motorcyclists, and others who may use the road system;

3.1.1.1 Creation

A road user refers to a human being with a predefined ethnic background, and into a certain socioeconomic environment with established social customs (Zein and Navin 2003). For example, a person can be born into a cosmopolitan urban environment or into a rural agricultural environment. The economic condition of the family and the surrounding society could be thriving or less fortunate. These and other "birth" factors could affect future road safety behaviour. For example, drivers in rural agricultural environments tend to start operating motor vehicles at an earlier age. As well, they are less likely to wear seatbelts (Zein and Navin 2003). Data from the 1999 rural seatbelt survey indicated that the seatbelt wearing rate in rural southern areas of Alberta, Canada was 67.5%, compared with the overall (combined urban and rural) average of more than 90% (Hermans, et *al*, 2014). In small rural communities, there is also a relatively small choice of items such as car seats, driving schools, and vehicle models. Gender may also affect future traffic safety performance. Government agencies widely report collision rates by gender of driver, and this information is used to determine collision-related risks among male and female drivers. Particular emphasis has recently been placed on the behaviour of female drivers (Zein & Navin, 2003).

According to Statistics Botswana, (2018), out of the 6,243 casualties recorded in 2018, 4,018 were male (64.4 percent) and the remaining 2,225 were female (35.6 percent). During the same year 332 males lost their lives, which was 8.3 percent of total male casualties while 130 females lost their lives (5.8 percent of female casualties). Male casualties who suffered serious injuries accounted for 17.8 percent of male casualties while female serious injuries accounted for 17.2 percent of female casualties. Further to this, WHO (2018) explained that the society that is of high concern is Africa (26.6 deaths per 100 000 people) and specifically middle income regions which includes Botswana..

3.1.1.2 Cultivation

External factors and personal decisions throughout life influence a road user. According to OECD Health Statistics (2019), the following factors are likely to affect driving skill and behaviour:

- Level and quality of education,
- Driver training,
- Driving experience,
- Family responsibility,
- Peer pressure,
- Social responsibility,
- Work responsibility,
- Drug/alcohol use,
- Health/medical condition,
- Social status, and
- Self-awareness.

Unfortunately, there is no universal definition for the cause of accidents. Sebego, Naumann, Rudd, Voetsch, Dellinger, Ndlovu , (2014) explicated that these factors change over time, sometimes from day to day and sometimes over decades. In turn, these factors affect the choice of vehicle, and the likelihood that a road user will speed, drive while impaired, use a seat belt, use a proper child restraint, drive aggressively, yield to pedestrians, run red lights, and obtain the proper insurance coverage, among other behaviours. Largade (2007) is of the view that indeed RTAs are inevitable and changing the mindset of road users presents itself as a challenge, yet lives are at stake. The factors involved in the analysis of road-user cultivation are closely related to age, (MVA-Fund, 2017) The consideration of driver age in traffic safety has led to extensive studies on younger and older road users (state at least two of these extensive studies). These groups are more likely to be involved in certain types of collisions, and (in the case of young children and the elderly) to be more severely injured,(Hermans, *et al*, 2014) .Since the RTA could occur at any time and age during the cultivation phase, road safety research needs to explore the relationship of crash risk with all cultivation elements as they dynamically evolve (Zein & Navin, 2003).In 2018, Botswana, the age group that had more fatalities was the 31-35 accounting for 13.5 percent of total fatalities. The 01-05 age group followed with 10.3 percent of total fatalities. Age group 41-45 accounted for 9.5 percent while 26-30 and 36-40 accounted for 8.7 percent each. The age group which was most vulnerable to accidents in 2014 was the 26-40 accounting for 47.6 percent of total casualties. This same age group (26-40) has been the highest comparing years 2014 to 2018, (Statistics Botswana, 2014; 2015; 2016; 2017;2018).

3.1.1.3 Conduct

The physical and mental condition of the road user is also an important factor in traffic safety. Reduced mental capacity (for any reason) and physical tiredness are major contributors to driver error (Mupimpila, 2008). Reduced mental capacity is often related to alcohol consumption, although medication, stress, and fatigue also affect mental performance. Research into convenient methods of measuring mental capacity could offer significant traffic safety rewards,(Mupimpila, 2008; World Health Organization, 2018; Zein & Navin, 2003). Distractions, whether inside or outside the vehicle, reduce mental capacity on a time-limited basis. Eating, drinking, talking, dialling, applying make-up, changing radio channels, reading billboards, or admiring the scenery all take away from the mental capacity available for the driving task. Authors such as Bener, et al. (2003) have opined that road user behaviour is often reckless. They have alluded to that studies show that drivers habitually ignore traffic laws and pedestrians usually walk in the middle of streets and cross without checking for traffic. has reported that in general, driver's errors, often accompanied by law violations, are in the chain of events leading to more than 90% of all highway accidents. Nevertheless, it must be noted that the nature of behaviour differs between countries. While alcohol, for example, is found to be the most common causes of accidents in many developed countries, it is negligible effect in Islamic countries where the law prohibits alcohol drinking. The statistics also show that most of the road accidents in the highways are due to drunken driving only. According to Coetzee (2016) globally, close to 480,000 deaths and slightly over 20 million of people get injured by drunken driving every year. He goes further to argue

that in most high income countries such as South Africa, Australia and European countries, about 20% of fatally injured drivers have excess alcohol in their blood, that is, blood alcohol concentration (BAC) in excess of the legal limit. On other hand, Singh (2017), argues that in contrast, studies in low- and middle-income countries like India have shown that between 33% and 69% of fatally injured drivers and between 8% and 29% of non-fatally injured drivers had consumed alcohol before their crash.(Harbour 1997).

Kayembe (2017) argues that driver fatigue one of very dangerous conducts created when a person is suffering symptoms of fatigue while driving, often resulting from the hypnotic effect especially during night time driving either falling asleep at the wheel or so exhausted to make serious- and fatal-driving errors. The author goes further to expound that 20% of all the traffic accidents and up to one-quarter of fatal and serious accidents are due to drivers with a diminished vigilance level. Furthermore, accidents related to driver's hypo-vigilance are more serious than other types of accidents, since sleepy drivers often do not take correct action prior to a collision.

For pedestrians, distraction can result in inattention to the dangers of the road. Citing studies that identify driver distraction as a contributing factor in up to 20% of crashes, recently studied the effects of driver distraction on driver behaviour and vehicle control, (Sebego et al., 2014; Zein & Navin, 2003).Among other findings, the study found that, as drivers' cognitive load increased (such as while conducting a conversation requiring close attention), their visual search area narrowed and they had more incidents of harsh braking. In another related study on distraction, two thirds of those surveyed believed that cell phone use by drivers is a serious or extremely serious traffic safety problem. The conduct of road users at the time of crash occurrence is a function of road-user creation and cultivation characteristics. Drivers who are speeding or driving aggressively at the time of a crash may have developed these habits over several years,(Hermans et al., 2014; Rushton, A., Croucher, P. and Baker, 2014) Safety campaigns therefore may be more successful in targeting the underlying causes that result in these behaviours, rather than attempting to change the conduct itself. At the same time, road-user conduct may be strongly affected by the overall surrounding social and economic environment, (Sebego et al., 2014; World Health Organization, 2018)

3.1.2 Vehicle

Vehicle in this case represents cars, trucks, motorcycles, bicycles, and other machines that road users choose to deploy on the road system.

3.1.2.1 Creation

Vehicles are created to meet safety and operational criteria and are designed to meet market demands. Vehicle manufacturing occurs at plants that conform to quality and safety standards. Governments usually set the safety standards for vehicles, while the manufacturers are private sector companies headquartered in different countries, usually Asia, most governments tend to standardise safety based on the already designed vehicles,(Zein & Navin, 2003) .Vehicle manufacturing is a profit-oriented business that employs millions of people around the world. In most instances, safety features can be used as selling points, and to differentiate luxury models from economy models. For example, antilock braking systems and air bags, two features that are supposed to enhance safety, were first introduced on luxury models. As of 2002, side-impact air bags are still uncommon in non-luxury vehicles, and antilock braking systems are "options" on some base models, (Hermans, et al, 2014). Upcoming vehicle innovations that may positively affect safety include better headlights, external air bags, intelligent cruise control, collision warning systems, and vigilance control systems. At the same time, new driver distractions inside the cabin, including complex navigation and entertainment systems, may be detrimental to safety. Many vehicle marketing campaigns continue to promote speeding, aggressive driving, and power. The campaigns present ideal divisions of driving skill that are well beyond the capability of most car buyers. Marketing can also be used to negate safety features. For examples, antilock braking systems were promoted in marketing campaigns that appeared to encourage more speeding and aggressive driving. As an example of how vehicle creation affects safety, (Cigu, Agheorghiesei, Gavrilut,and Toader, 2018). Hermans, et al, (2014) expounded that a study conducted at University of California in 2001 depicted that the fatality risks of sport utility vehicles (SUVs), vans, and pickups are different. It was discovered that, given a crash, it is substantially safer for a driver to be in an SUV, van, or pickup (collectively considered "light trucks") than in a car. However, compared with cars, light trucks pose a substantially greater risk to other road users. In addition, light trucks are about 2.2 times more likely to get into a crash than are cars, thereby reducing the safety advantage that SUVs and vans provide to their drivers. The study

also showed that a light truck is between 3 and 6 times more likely to kill another driver in a two-car collision than is a car.

3.1.2.2 Cultivation

According to OECD Health Statistics report, (2019) a vehicle that is in use requires regular care and maintenance to operate safely and efficiently. Older vehicles require a higher level of attention. The component parts of a vehicle that most directly affect safety are also parts that are highly susceptible to wear and tear: brakes, tyres, windshield wipers, and lights (headlights and taillights). Worn brakes, worn tyres, worn wipers, and burnt-out lights make the driving task more challenging and reduce the margin of error available to avoid an accident. Original brakes, tyres, wipers, and lights are typically provided to the car makers by third-party original equipment manufacturers, which operate according to predefined quality standards. Hermans, Brijs and Wets, (2014) expanded that significant failures of quality in these components (other than wear and tear) are rare but could still happen, as evidenced by the recent alleged failure of firestone tyres on ford SUVs under certain heat and speed conditions. Other types of component failures in a vehicle are more major and dramatic, but also much less common. For example, a steering or transmission failure while driving could easily result in a crash, but these are comparatively rare. Vehicle maintenance is the responsibility of the vehicle owner and is sometimes entrusted to a third party (the vehicle mechanic).The relationship between the vehicle owner's creation and cultivation characteristics and vehicle operation and maintenance habits presents rich ground for traffic safety research. For example, the need for maintenance is a function of driving style and intensity; frequent speeding and hard braking require more frequent replacement of tyres and brakes. Drivers who exhibit this style of driving may well be less likely to properly maintain their vehicle, (Sebego et al., 2014).

3.1.2.3 Conduct

The performance of the vehicle immediately before an accident is typically a function of how well the vehicle has been maintained. Poorly maintained brakes, tyres, and windshield wipers are more likely to contribute to an incident. Vehicles that receive regular check-ups are also less likely to suffer a major failure of the steering, transmission, or electrical systems. Vehicle performance is typically identified as a primary or secondary collision cause in less than 10% of accidents, (Gouda & Saranga, 2018)

3.1.3 Road system

Road environment, representing the roads, sidewalks, and traffic control systems that physically and operationally define the road system, as well as environmental factors such as the weather and light conditions, (Hermans, et al, 2014).

3.1.3.1 Creation

The design of roads is progressing from a philosophy of "standards are safe" to a concept of an interactive design domain in which various design decisions will have different safety consequences that are predictable and sometimes quantifiable, (Gouda & Saranga, 2018).

The road environment is planned, designed, and constructed according to certain criteria, guidelines, and standards for example in Botswana its according to the Department of Roads. The road safety audit is a useful tool to ensure that design decisions and trade-offs that affect safety performance are properly assessed. Trade-offs that may compromise safety during the design process could occur for several reasons, including the need to accommodate environmental, social, geotechnical, political, and budget constraints. The planning, design, and construction of roads are the responsibility of the road owner (usually one of the three levels of government) and are sometimes conducted by third parties (planning and design consultants and road construction contractors) to the owner's specifications,(Karjalainen & Juhola, 2019).Sukhai, Jones and Haynes, (2009), argued that most roads are designed and constructed to the user's specifications hence they end up not meeting all safe design criteria due to cost issues and political reasons.

3.1.3.2 Cultivation

A road that is in service requires regular monitoring and maintenance to provide safe conditions. Over time, the pavement condition deteriorates, and traffic control systems (signs, signals) fail and need replacement. External conditions such as population growth, vehicle density, and land use could also change and render the initial road condition inappropriate, (Mupimpila, 2008). Proper road environment cultivation requires a complex system of continuous monitoring, record keeping, regular maintenance and upgrading, and response to unusual and unexpected conditions. This is normally the responsibility of the road owner, which has traditionally been a local municipality, provincial agency, or government. Recently, private sector companies have also started to assume the role of road owners through private–public partnership and concession projects. The greater focus of the private

sector on profitability raises interesting issues related to compromises in road ownership responsibilities that might affect safety,(Karjalainen & Juhola, 2019).

3.1.3.3 Conduct

The condition of the road immediately before a crash is usually a function of road creation and cultivation characteristics, as well as environmental factors that are more difficult to control. Many roads are designed and built with safety risks that become apparent at the time of the accident. These risks are often a result of conscious design trade-offs, such as the decision to build a tight radius horizontal curve to avoid purchasing the additional property that would allow a smoother curve. Other road environment risks develop over time and should be identified and corrected as part of the maintenance and upgrading, an example of this are road potholes and road deep cuts,(Sebego et al., 2014). Nyamukondiwa (2018), expounded that unenforced or non-existent road traffic laws contribute a lot to road traffic accidents in most sub-Saharan countries due to high levels of corruption within traffic police and those who are tasked to enforce. According to The Patriot, 8 May (2019), stray livestock are a menace in roads. Statistics indicate that in 2018 alone, 1 012 accident cases were reported and recorded in Botswana which involved collision with livestock resulting in 167 losses of lives. This really points to the relevant authorities to take appropriate action on stray livestock.

3.2 Managing road traffic accidents and reduction of accidents severity

Road deaths and injuries are preventable. A wide range of effective road safety interventions exist and a scientific system approach to road safety is essential to tackle the problem. This approach should address the traffic system as a whole and look into interactions between vehicle, road users, and road infrastructure to identify solution, (OECD Health Statistics, 2019).

3.2.1 Road Users

Sebego *et al*.,(2014) expounded that 94% of road traffic accidents are caused by road users or more specifically human errors in various ways. Managing RTAs therefore should focus much on engaging road users through a combination of education and punitive measures. The systems approach helps in understanding which combinations of road users require more education than punishment and which ones require tougher punitive measures for them to quickly comply and observe road safety regulations. Policymakers however must take a centre stage in engaging various road users starting with nationwide campaigns in educating everyone.

Foya, (2019) , notes that the influx of automobiles is not going back and soon every family will own a vehicle and travelling and driving will become part of everyone and every society. Education should be done at every stage of learning starting from kindergarten to tertiary levels, the idea being to create a culture and mind-set of road safety. This means policy makers will not invest much on road safety as the population will be conscientised well before they can start driving. Kayembe, (2017) goes further to say transport and logistics programmes at various levels should now give more emphasis on road safety and accident prevention. Commercial drivers should be engaged periodically on road safety and accident prevention. According to (Karjalainen & Juhola, 2019), understanding each of these factors and through planning, effective management and evidence-based interventions, road accidents can be predicted and prevented. Having access to accurate and updated information about the current road situation enables drivers, pedestrians and passengers to make informed road safety decisions

Policymakers and the police need to put strongest measures including long term jail to reduce the number of unlicensed drivers who are knowingly driving without proper competency required (Statistics Botswana, 2018). A report from Statistics Botswana ,(2018) showed that 293 accidents in 2018 were a result of unlicensed drivers, 22 deaths came out of these same accidents. This alone is an indication that the society needs to be conscientised, this time with deterrent fines or jail term to reduce such unlawful driving of vehicles.

Human error, rather than deliberate illegal behaviour, is an important contributor to fatal and serious crashes. Measures to reduce the prospect of human error need to be taken to guide use of the network. Clear consistent guidance and reasonable information processing demands upon the road users along a route is necessary to reduce uncertainty and indecision.

3.2.2 Vehicles

Use of sophisticated vehicles like accident detecting vehicles is one way that requires capital investment but goes a long way in reducing road traffic accidents. Edwards (2017) went further and advocated for driver less vehicles as a way of reducing driver error, these vehicles were already tested in US and proven that these vehicles can even

be commercial trucks sent for long distance deliveries. Edwards further explained that since driver error is more than 90% of all road accidents, this is a winning way in reducing it when vehicles are driver less.

Foya ,(2019), expounded that in order to reduce severity of accidents individuals and cooperates are encouraged to procure vehicles with high safety features. To encourage this the vehicle importation system must be favourable to all vehicles imported with high safety system, import duty must be so minimal or even exempted when an individual or organisation proves such safety features to the tax authorities. Such injury reduction features include front and side airbags that provide protection from severe injury, head-protecting side airbags, such as curtain airbags, which are highly effective in side impact and rollover crashes.

According to Gouda and Saranga, (2018),there is constant need to ensure that vehicles are mechanically well with good breaks, lighting, tyres and all other necessary checks. Motorists and organisations are encouraged to stick to the vehicle manufacturer's maintenance schedules and intervals. Edwards (2017) argues that this will go a long way in reducing road traffic accidents thereby saving lives and reducing accident insurance payments.

In this vein, US Library of Congress (2009) strongly believes that older vehicles and highly polluting vehicles should be phased out of the roads for good. This proposal is also supported by Yukoshima (2017) who is of the strong view that older vehicles should be phased out of the roads. However, this proposal does not go well with African governments which have no industry of their own which manufacture vehicles for their markets. It is necessary that all vehicles should be provided with seat belts and other necessary safety provisions (like airbags). In addition, it should be mandatory to wear seatbelts and the fine should be huge as a deterrent.

3.2.3 Road System

Road Traffic Accidents are caused by numerous causes and the nature of roads and general road environment is very critical for both vehicles and human beings. One major factor in reducing accidents is the continuous improvement of all major highways as well as putting visible signage in right places so as to warn the motorists and other road users. Nyamukondiwa (2018) notes that narrow roads, have a great tendency to expose vehicles to side swipe and in the event that a vehicle has broken down, it thus cannot be pulled off the road thereby it blocks such roads leading to further accidents. According to Traffic Safety Board of Zimbabwe (2017), Wide roads greatly reduce danger of accidents to both the people and vehicles. Tarmac reflectors on highway demarcate lanes markings clearly thereby making night driving very easy.

Sebego *et al.*, (2014), retorted that governments and local authorities should ensure that obstacles and distractions like livestock are kept away from the roads, this calls for policy makers to impose stringent measures to livestock owners who leave animals straying into roads. Edwards (2017) is of the strong view that there is need for removal of stray animals such as cattle, goats and donkeys and removal of encroachments on footpath and road margins will enable smooth flow of traffic

Regular road maintenance significantly reduce the level of accidents caused by bad roads and potholes, local authorities and roads department must constantly be checking on the condition s of the roads for any maintenance required.When designing roads the Roads Department of Botswana should engage users on the best way to have user friendly roads that minimise chances of accidents,(Sebego et al., 2014).Well-designed roundabouts are able to reduce deaths by up to 80% (BITRE, 2012) whilst grade separated pedestrian crossings reduce casualty crashes by 85% (Austroads, 2012). Larsson et al ,(2003), had the view that wire rope barriers (i.e., cable barrier systems) in the centre and edge of roads reduce fatal crashes by up to 90% . Proper transport planning, with many alternative roads in urban centres helps to avoid congestion, road rage and accidents as well. Transport and road engineering authorities should ensure that traffic robots are always working and all intersections are properly controlled. It is ideal that all urban roads be fitted with road cameras to detect violations whilst,(OECD Health Statistics, 2019)

The design of road infrastructure and the broader street environment should start with the needs of the most vulnerable users and then progress through to the safety needs of the least vulnerable.A road design and corridor planning exercise that progresses through the needs of pedestrians, cyclists, animal drawn carts, motorcycles, cars, trucks and buses will ensure that appropriate function, speed, road space allocation, and design features are incorporated to deliver the best safety outcomes,(Mupimpila, 2008). Nyamukondiwa,(2018) further retorted that this is not only a critical step for road authorities in planning new roads but it is a particularly challenging issue for safety review and retrofitting of existing networks over time.

4 Research Methodology

The study employed desktop research, reviewing both theoretical and empirical literature. Precisely, it involves reviewing relevant road traffic related literature at national and international level, Botswana government websites,

journals, academic literature, discussion papers, opinion papers, online sources, newspaper articles and data, among other critical transport and road safety documentation. The authors also reviewed literature from World Health Organisation Road Safety reports, OECD, as well as Government published circulars related to road transport accidents.

5 Findings and Recommendations

5.1 Findings

The findings do indicate the various views of different literature and authors. Major causes of accidents include the following:

- Human error
- Alcohol and drug abuse
- Over speeding
- Not abiding to road traffic regulations
- Driving without proper knowledge ie without drivers' license
- Fatigue
- Bad healthy and mental state
- Stray animals in highways especially at night
- Defective vehicles
- Tyre bursts-mostly for vehicles from Japan with mud and snow tyres
- Distracted driving ie use of cell phones, eating, reading, or applying make-up whilst driving
- Poor road design and maintenance
- Poor journey planning
- Bad weather
- Tailgating
- Vehicle design defects.

5.2 Recommendations

Recommendations and proposed ways to reduce road traffic accidents and severity of injuries include the following:

- Educating the public on safe driving habits
- Having road traffic prevention education in basic education as well as tertiary education
- Punitive policies for road users breaking road traffic laws and regulation
- Recraft vehicle importation policy based on vehicle safety specs
- The government should consider certain vehicle ages to be un road worthy and be deregistered
- There is need for regular road maintenance to avoid cuts and potholes
- Stringent measures must be taken against livestock owners who leave stock straying in highways and public roads
- The Department of Road Transport and Safety (DRTS) must enforce and seek evidence for regular vehicle maintenance before they issue licences for vehicles
- Periodical awareness campaigns should be done across the country with the theme "Road Traffic Accidents prevention".
- Engineering improvements to road safety
- Developing a research strategy for prevention which will reduce casualties and deaths on the road

6. Conclusion

Road safety is a shared responsibility. Reducing road traffic accidents requires commitment and informed decision-making by government, industry, non-governmental organizations and international agencies. It also requires the participation of people from many different disciplines, including road engineers, motor vehicle designers, law enforcement officers, health professionals, the media, educators, community groups and individual road users. Strong public awareness campaigns are essential to raise understanding of the issue and motivate individual and governments to take action, comply with existing laws and introduce or amend laws that do not exist or are ineffective.

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