UNIVERSITY OF LUSAKA

SCHOOL OF POSTGRADUATE STUDIES

Effectiveness of the Implementation of Road Safety Quality Management Systems - Case of Lusaka Main Roads

BY

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Submitted to the School of Postgraduate Studies in partial fulfillment of the requirement for the Master of Science in Project Management of the University of Lusaka

DECLARATION

I, Brenda Namukoko, do hereby declare that this piece of work is my own and has not been submitted before for any academic purpose in this University or any other Institution. I have acknowledged where is not mine

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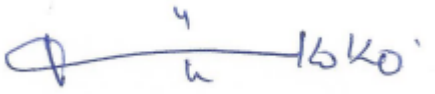
Signature: 

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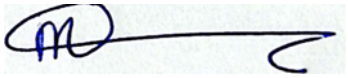
Signature: 

Date: 26/03/2023

DEDICATION

My beautiful family, who have unendingly loved, supported, and believed in me, are honored by this work.

ACKNOWLEDGEMENTS

First and foremost, I want to express my gratitude to the Almighty God for his mercy and grace in bestowing upon me the skills and knowledge necessary to complete this study project. A compilation of this nature would not have been viable without acknowledging the work of others. I owe a debt of gratitude to all the books and magazines I had to continuously read in order to complete this report. I also want to thank everyone who helped with the data collection that was necessary to create this study. I also want to express my deep gratitude to my superb supervisor, Dr. Eng. Michael Kalumbu Nsefu, for his guidance, mentoring, advice, and support throughout this project. I also value the opinions of my family more especially my husband Mr. Edwin Kaluba and close friends who shared my convictions and thought some parts need clarification or that some additions were necessary.

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ACRONYMS AND ABBREVIATION

BRFs	Behavioral risk factors
CBD	Central Business District
ERF	European Union Road Federation
GIS	Geographic Information System
GRZ	Government Republic of Zambia
GPS	Global Positioning System
GRSF	Global Road Safety Facility
GRSP	Global Road Safety Partnership
HEMP	Hazard and Effect Management Process
HICs	Hospital Incident Command System
ICT	Information and Communication Technology
IMS	Intelligence Mobility Solution
ITS	Intelligent Transport system
ISO	International Standard Organization
LDP	Lusaka Decongestion Project
LMICs	Low-and Middle-income Countries
MoF	Ministry of Finance
NRFA	National Road Agency
NRSS	National Railway Safety Services
OECD	Organization for Economic Cooperation and Development

PDRSMF	Process-Driven Road Safety Management Framework
PP	Process Protocol
PPP	Public Private Partnership
SDGs	Sustainable Development Goals
SPSS	Statistical Package for Social Science
RDA	Road Development Agency
RTAs	Road Traffic Accident
RTSA	Road Transport Safety Agency
TMS	Traffic Management System
UN	United Nation
SUV	Suburban Utility Vehicle
WHO	World Health Organization
ZRSCI	Zambia Road Safe Corridor Initiative
ZP	Zambia Police

ABSTRACT

Countries are concentrating on building sustainable systems for managing roads since road safety is a priority. In Zambia, the growth in traffic accidents that cause fatalities, injuries, and property damage has made road safety a challenge. Although Zambia's system for improving road safety is in place, there has not been a corresponding drop in the number of incidents that happen on the roads, especially in Lusaka. This research was aimed at analyzing the effectiveness of the implementation of the road safety quality management system in Lusaka. The study was on the Lusaka city main roads, engaging motorists and regulators of road transport in Zambia. That is, Ministry of Transport and Logistics, Road Transport and Safety Agency (RTSA), Ministry of Road Development Agency, Ministry of Finance and National Planning and Zambia Police (ZP)

This study adopted a mixed methods approach and applied a descriptive research design, employing interviews and questionnaires to collect data. Findings reveal that road safety was mainly acquired through available institutions (49%) and shared informally (60%) and experience (60%) and media (51%). Motorist have adequate road safety knowledge (63%). The important behavioral factors significant to road safety management were: not wearing seatbelts (94.5%); consuming illegal substances (76.4%); mobile phone usage (81.8%); ignoring signage (83.6%). The T2 was ranked most unsafe in Lusaka (47%). The respondents agreed there was a significant relationship between road safety management and the reduction of road accidents in Lusaka (76%). The study recommends a multi-institutional, coordinated framework for implementation of road safety management systems in Zambia with the aim to reduce road traffic accidents on the roads. The study demonstrates that there are workable approaches that can be undertaken to improve road safety in a growing city such as Lusaka.

Keywords: ***Road Safety Quality Management System, Road Accidents, Road User***

CHAPTER ONE

INTRODUCTION AND BACKGROUND

1.1. Introduction

There is recognition that road safety is a global challenge (Bliss & Breen, 2012), especially among developing countries with poor road safety management systems (Stern, et al. 2005). Since road safety is a major concern whereby RTAs account for over 1.5 million fatalities, apart from injuries and damages (Samsudin, 2020), it was conceived that the phenomenon is studied from the Zambian perspective. Lusaka was therefore chosen because it has 57% of all RTAs in the nation (Zambia Police, 2022). This chapter seeks to provide a thorough review of road safety quality management systems in the global, regional, and Zambian contexts. Also, explain how the Lusaka Township's main highways were constructed while considering quality management. This chapter also highlights the goals, research questions, significance of the study, definitions of key terminology, research variables, research outline, research scope, research area, and issue statement that forms the basis of the research.

1.2. Background of the Study

Urban regions have seen a large influx of residents, which has led to more vehicles on the road. Motor vehicles have facilitated mobility but also contributed significantly to traffic fatalities in cities, by 2030, they are expected to overtake smoking as the fifth major cause of death (Adriazola-Steil & Benoit, 2013; World Health Organization, 2020). It is common knowledge that road traffic accidents primarily affect underdeveloped countries, with pedestrians, motorized two-wheelers, cyclists, and roadside sellers suffering the highest rates of fatalities (Sawin et al., 2010). According to studies, low- and middle-income nations lack the necessary infrastructure and traffic control systems (Nantulya & Reich, 2003).

Low political will, insufficient safety standards, inefficient driver and pedestrian control systems, and ageing fleets are only a few of the problems that make safety management difficult (Makwenda, 2020; (Stewart, et al., 2012; Bishai & Hyder, 2006).

By 2030, it is expected that road traffic accident will account for the second most health losses and the fourth most healthy life years lost by the population of middle-income countries, respectively (Bliss, T. and Breen, 2012). Within the context of the sustainable development goals, it has been acknowledged that increasing road safety is a sustainable development issue that requires special attention (SDGs). Nations are committed to strengthening people's abilities to participate in economic activities in order to promote a good quality of living for all. Consequently, throughout this process, investing in public infrastructure is a top priority (Stern, et al. 2005).

To address the vulnerabilities that result in injury, property damage, and fatalities, middle-income nations must invest in their governance structures, infrastructure, road users' sanity, motor vehicle fleets, health, and citizen wellbeing. Significant social costs resulting from the absence of an effective system. Consequently, long-term cost savings result from investing in sustainable road safety systems as opposed to implementing small safety improvements or relying exclusively on crash avoidance techniques to lower fatalities and serious injuries (Ennajih et al., 2015). On a scale that is just now becoming obvious to be effective, investments in national road safety must be made consistently and integrated across a number of industries and related regulations (Bliss & Breen, 2012).

Governments and related organizations have implemented safety measures to make roads safer for all users. Accidents involving moving traffic are still the primary source of fatalities, property damage, and injuries. (Djahel et al, 2015) This phenomenon has attracted a level of research focusing on road traffic management systems (TMS). Efforts have not yielded the most reliable systems for handling traffic challenges in cities (Tonguz, et al., 2010; Case & Kamble, 2014); Feiri et al., 2012). In the case (Trojanová, 2014) road safety management systems arise from the concept of asset management through road management authorities.

A successful strategy to reduce the 1.35 million people wounded in traffic accidents each year is road safety management (Samsudin, 2020). Road safety management systems consider a variety of safety issues, including the behaviour of road users as well as improvements to infrastructure, vehicles, laws, and regulations (Ennajih et al.,

2015). Road safety programmes need to be strengthened at the national level through investments catered to ongoing and upcoming national concerns. This requires, not a rapid, but staged process that would consider the weaknesses and build appropriate capacity to achieve targeted outcomes (Global Road Safety Partnership, 2015). Recognizing the importance of road safety is necessary for long-term national development. A similar statement by the Argentina Road Project on Safe System projects is acceptable stand-alone, cross-sectoral initiatives focusing on high-risk corridors and metropolitan districts, with outcomes significant enough to be quantified. The lead agency's capacity to take on this role quickly and change in line with its management arrangements is crucial for guiding and upholding the production of results that result in road safety (Bliss & Breen, 2012).

Regarding the advancement of road safety, Africa is a specific source of concern. Road safety management is one of the most difficult problems on the continent. Africa Union (2015) claims that recent years have demonstrated that the continent's overall road safety situation is among the worst in the world. The assessment also states that: "Reliable data on traffic accidents are necessary for the development of evidence-based policy in Africa “. Basically, for the development of efficient prevention programs, governments need to better their information on traffic accidents (Segui Gomez et al., 2021).

The utility of current national statistics for cross-country comparison is limited by definitions for road safety indicators because these data are incomparable, which leads to underreporting of accident injuries and fatalities (Mukherji, 2005). For nations to gauge the severity of their traffic injury issue, develop targeted solutions and prevention efforts, monitor and evaluate the efficacy of intervention measures, gauge progress, and compare the magnitude of traffic fatalities concerning fatalities from other causes, reliable statistics on traffic fatalities must be available. The number of different sorts of injuries, how frequently they occur, and under what conditions must be known by nations. Such data will demonstrate the severity of the injury issue and the areas that most urgently require preventive efforts (African Union, 2015).

Road safety management in Africa is challenged in three main areas. The first area of concern is people. The amount of training that law enforcement agencies provide their officers may vary. Officers might not understand the meanings of the accident data elements or be unable to measure or interpret some of the data they are asked to report on. Some police officers find it uninteresting and would rather not record the transaction (Segui Gomez et al., 2021). Various law enforcement agencies may offer their officers different levels of training. Officers might be unable to measure or interpret some of the data they are requested to report on or understand the significance of the accident data elements. Some police officers find it boring and choose not to record the incident (Segui Gomez et al., 2021).

However, the implementation of road management technologies has resulted in brand-new safety issues that did not previously exist. There are increasing cases of drivers avoiding traffic control devices like speed cameras, equipment damage, mistakes in the management of data, communications issues, and so on (Mwenya, 2022; Sichembe et al., 2019). RTAs continue to be most severely impacted in Lusaka. Djahel et al. (2014) provide a sustainable traffic management system for highways and cities in response to Mwamba's (2014) argument that the current approach is insufficient to alleviate road carnage in Zambia. Despite Lusaka having the majority of the established traffic safety measures, RTAs continue to be the city's worst problem. According to data for the first quarter of 2022, out of the 7,255 RTAs in the entire country, 4,183 are located in Lusaka, representing a 57.7% share, greatly above the 12% share of Copperbelt, the province that came in second. This is true even though Lusaka has the best-developed roads in the nation and has installed road safety technologies in addition to traffic officers working to manage traffic within the city. 60% of all the country's automobiles are found in Lusaka (Zambia Police, 2022).

Management of road safety in Zambia is difficult. Road traffic accidents (RTAs), which frequently occur in Zambia and are the third leading cause of death, are frequent (Makwenda, 2020). Zambia has begun the procedures and projects necessary to establish an uniform system for managing traffic safety that complies with all applicable national, regional, and municipal laws. According to Mubanga (2021), the RTSA has put

into place the Zambia Road Safe Corridor Initiative (ZRSCI), a group long-term project to create a road safety management system in order to save lives, facilitate development, and enhance safer regional transportation and connectivity.

Biemba et al., (2014) claim that Zambia has the laws and rules required to establish a long-lasting system of road safety. The Road Traffic Act No. 11 of 2002 and the Transport Policy of 2002 are key governing documents. Working with the Zambia Police and line ministries, the three main organizations—Road Transport and Safety Agency (RTSA), Road Development Agency (RDA), and National Road Fund Agency (NRFA)—have the power and duty to take the initiative in improving road safety and assisting in reducing traffic accidents in Zambia.

With the help of the International Strategy for Disaster Reduction Partnership (GRSP) in Zambia, Zambia developed the National Road Safety Strategic Partnership Framework in order to implement the UN Global Plan for the decade of action for road safety 2011–2020. Strengthening/improving: The Partnership framework includes a number of key interventions, including advocacy and community involvement, funding and technical support, city enforcement, emergency rescue services, criminal prosecution, pedestrian safety, coordination and monitoring of road safety interventions, and corporate social responsibility (Biemba, 2014). The 2021–2030 Global Plan for the Decade of Action for Road Safety was launched in October of that year.

Despite their being a national strategic framework for road safety partnership, the RTSA, the organization in charge of carrying out road safety measures, lacks a strategic plan with a clear vision, goals, objectives, key outcomes areas, targets, and strategies (Chikamata, 2014). The existing solutions, according to Biemba (2014), have not been scaled up. Information and communication technology (ICT) applications for road safety, such as intelligent transport systems (ITS), appear to be in their infancy in Zambia, which is an interesting observation.

Musheke, (2014) submits that in 2002 the Government of the Republic of Zambia developed the first ever National Transport Policy; this was in recognition to the important role the transport sector plays in the national economy and the process of regional integration. The National Transport Policy led to the establishment of the

National Road Fund Agency (NRFA), which oversees resource mobilisation and disbursement, the Road Development Agency (RDA), which is in charge of road construction, maintenance, and rehabilitation, and the Road Transport and Safety Agency (RTSA), which deals with regulations and safety enforcement (Musheke, 2014). Zambia has a road safety strategy in place with a sophisticated structure to oversee it (GRZ, 2018). Since 2018, the Zambian government has worked harder to improve the country's system for managing road safety. A combination of law enforcement, traffic safety education, and intelligent traffic solutions will be employed to raise the country's safety profile (Mubanga, 2018).

Road safety has been designated as a national priority under the Link Zambia 8000 Project, and a public-private partnership (PPP) has been developed through RTSA with Intelligent Mobility Solutions (IMS), a partner from the commercial sector. By opening more than 30 new RTSA locations with automated motor vehicle inspection technology, the RTSA's footprint was intended to be increased. The system includes cross-border traffic management, overload control, secure vehicle registration, vehicle testing for compliance with safety regulations, law enforcement, and a traffic management center. The system was created to be centrally managed and controlled to ease traffic congestion, enhance traffic flow, manage vehicle testing and licensing, guide road safety law enforcement, lessen damage from overloaded cross-border vehicles, and expedite post-crash reaction (Mandyata and Ndhlovu, 2021).

1.3. Statement of the Problem

Developments in road safety system technologies have offered better methods for handling crash data and monitoring traffic (Haghani, 2020; Petrov, 2022). The ideal situation is one where large cities can manage traffic issues and address road safety by utilizing contemporary technologies, including satellites, and this has significantly improved road traffic management and prevented road traffic accidents (Chen, 2010). Road management techniques have not, however, totally reduced traffic accidents even in developed nations (Arzil et al 2012). Few African nations have mechanisms that effectively regulate road traffic (Haddad & Carnis, 2022; African Union, 2015). Different regulatory stakeholders perform competing responsibilities that are complicated by

bribery, high bureaucracy, and corruption. Law enforcement officers are not effective at implementing traffic laws, leading to higher RTAs (African Union, 2015; Chen, 2010).

Zambia experiences difficulties with road safety due to an increase in traffic accidents that result in death, injuries, and property damage (Simuyemba, 2018; Makwenda, 2020). Although Zambia has an operational road safety system, there has not been a corresponding decrease in the number of road accidents occurring within the country (Ndhlovu et al., 2021; Kopolo et al., 2017; Makwenda, 2020). It has not been established what particular factors lead to the persistent poor road safety compliance in Lusaka (Simuyemba, 2018). Therefore, the purpose of this study is to assess the effectiveness of the implementation of road safety and quality management systems in Lusaka, where the majority of the systems have been tested and implemented. The end product is a Lusaka-specific Framework for an efficient Road Safety Quality Management System.

1.4. Main Objective

To assess the relationship between the Road Safety Quality Management Systems and the reduction of road accidents in Lusaka

1.4.1 Specific Objectives

i. To explore the factors affecting the implementation of quality road safety systems within Lusaka.
ii. To examine the relationship between safety management systems and the reduction of road accidents in Lusaka.
iii. To develop a framework for assessing the effectiveness of the Road Safety Quality Management System in improving road safety in Lusaka

1.5. Research Questions

i. What factors affect the implementation of quality road safety systems in Lusaka?

ii. What is the relationship between safety management systems and the reduction of road accidents in Lusaka?

iii. What Frame can be developed for effectiveness of the Road Safety Quality Management System in matters of road safety within Lusaka?

1.6. Significance of the Study

The study's findings will show regulatory bodies in what ways the country's main roadways have seen an improvement in road safety, especially with the current quality management system. The study will be helpful to drivers, commuters, regulators, and the broader traveling public because the difficulties can be common to all the districts in the nation that are connected by trunk roads. The results will inform the responsible authorities of the current quality management system's shortcomings and offer recommendations on improvement of the quality of the system and quality management system and offer recommendations on how to improve the service's quality to lower traffic accidents.

1.7. Scope of the Study

The study was conducted on the Lusaka district city main roads, which includes the inter-city roads, Lumumba Road, great east road, great north road, Lusaka Kafue Road and ring road. These were purposively selected as some of the busiest roads in the district. These were deliberately picked because they are some of the busiest roadways in the region. During the data collection procedure, users and policymakers of Zambia's road transportation system were consulted. The RTSA, ZP, the Ministry of Transportation and Logistics, and the driver.

1.8. Research Variable

The present research study intends to assess the relationship that exists between safety management systems and the reduction of road accident. The Safety management will serve as independent variables that may have a relationship with reduction in the road accidents which is the dependent variable.

1.9. Definition of Key Terms and Concepts

Quality management system: A formal system for recording duties, processes, and procedures in order to improve quality and customer satisfaction

Road safety: techniques and precautions taken to reduce the possibility of a road user suffering a major injury or losing their life while using the road.

Road traffic accident: A collision involving at least one vehicle or another road user road user on a public road

Road transport: the movement of both people and products across public highways.

1.10. Organization of the Dissertation

This dissertation is organized into six complete chapters.

Chapter One: Introduction and Background-The first chapter outlines the background and offers a summary of the research topic. This chapter provides the study's history as well as an outline of the research problem, a definition of the problem, major and particular study objectives, research questions, the significance and scope of the investigation, and a description of the research variables.

Chapter Two: the review of the literature. Gives a summary of the research on the application of a quality management system for safety on the roadways. It highlights the theories related to the subject of the study.

Chapter three: Theoretical and Conceptual Framework- presents the conceptual and theoretical framework pertinent to the investigation.

Chapter Four: Research Methodology-It specifies the research methodology that will be used in the study and describes the method to be used in the research process. The study philosophy, epistemology, ontology, study population, sample size, data collection instruments, data analysis, reliability, validity, and ethical considerations are all heavily emphasised. Reliability, validity, and ethical concerns are also covered.

Chapter Five: Data Finding and Presentation-It presents the study's findings based on the questionnaires that will be gathered from qualified participants. The statistical software for the social sciences (SPSS) would be used to facilitate the response analysis, which would be based on the correlations of the identified variables

Chapter Six: Discussion and Analysis - gives a thorough analysis and interpretation of the study findings as well as a discussion of the significance of the research finding in light of the research problem being investigated. It also explains any new knowledge that has been gained about the research problem as a result of taking the research findings into account. Using the research questions and the examined literature, this chapter will link the introduction. In other words, the conversation focused on resolving the study's open-ended questions.

Chapter Seven: Conclusion and Recommendation-This chapter, the final one, contains the conclusion and recommendations based on the research findings.

1.11. Chapter Summary

This chapter gives a general overview of how road safety quality management systems are being implemented internationally, regionally, and in the Zambian context. Additionally, it emphasizes the study's goals, research questions, significance, and field of study, and issue statement, which forms the basis of the study. This chapter also discusses the dissertation's structure and defines some crucial terminology.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This literature review presented the most recent information, including, on the subject being studied. Secondary sources are necessary for literature reviews. A literature review is crucial because it offers a thorough understanding of the subject being studied. As a result, this chapter carried out a critical analysis and debate of earlier and later writings on the subject. The chapter discussed each variable under investigation, gave the results of the empirical research, and pointed out any gaps in the examined literature.

2.2 Overview of Road and Safety Management Systems

Bhalla (2013), states that road safety management in nations with the safest road networks exhibits several common traits and has established a variety of institutional structures that have been developed over many years, set goals for better safety results, and chosen a systematic approach to intervention. The main goal and justification for the management system are to decrease accidents that result in fatalities and serious injuries (results focus) (Larsson, and Corben, 2011). This is an expression of a country's or jurisdiction's desire to improve the outcomes of road safety through performance evaluation, analysis of the potential for initiatives to reduce crashes, setting long- and short-term goals for road safety strategies, programmes, and projects, and providing the resources and accountability required to meet them (Bergh, and, Petersson, 2010).

Although some countries have made progress in lowering the frequency and severity of traffic accidents, the situation is still worrying and getting worse in the majority of other nations. The death toll from traffic accidents and the associated costs to individuals and society are a burden on human civilization (Bliss, 2001). There have been various initiatives to intervene, but they frequently wind up being fragmented, ad hoc, and knowledge-based, which results in ineffective actions (Mendoza, and Pereyra, 2013). It is questionable whether generic programs are effective. Using meta-analysis, pure

mass media campaigns (TV, radio, newspapers) do not affect accidents. People have made mistakes and will continue to do so; awareness programs cannot stop this from happening. Accidents will therefore occur in a system designed so that errors can result in the analysis of the information's consequences found no discernible effect of pedestrian safety campaigns on accidents involving pedestrians (BITRE, 2012).

According to Dacota (2012), elements that affect traffic accidents include the road's gradient, kind of curve, width, lighting, road markings, and the existence or absence of hard shoulders and crash barriers. According to the Department of Transport, (2011) accidents caused by drivers falling asleep had a higher probability of deaths than other forms of traffic mishaps because they were impossible for the driver to actively control the vehicle prior to the impact. The number of fatalities in sleep-related traffic accidents is also 50% greater than the overall number of accidents, according to Durdin and Janssen's (2012) research. There were three times as many fatalities and twice as many seriously injured in accidents connected to sleeping as in accidents unrelated to sleeping. Sleep-related accidents are frequently more severe and have a high death toll because people involved, especially the driver, have no control.

Clarke et al. (2007), another element contributing to the fatalities of victims in traffic accidents is drunk driving. The cause is related to the inebriated driver's inability to control the car due to drowsiness along with drunk drivers, passengers, and other road users may also be unaware of potential dangers around them before, during, and after an accident, making it difficult for them to exercise caution and prevent major accidents and fatalities (Zomer et al, 2015).

2.3 Literature Based on Research Objectives

The relevant literature related to the research objectives is outlined below.

2.4 Factors Affecting the Implementation of Quality Systems

Traffic accidents are still the worst thing that can happen to a road user everywhere in the globe, despite the fact that they occur regularly afterward. The worst thing is that most drivers don't learn from their mistakes, and most individuals who use the roads are well aware of the general safety procedures and laws that must be followed; accidents

and collisions only occur as a result of carelessness on the part of other road users (Meyer, 2010). In most regions of the world, human error is the main cause of accidents and collisions (Roberts, 2006).

The most crucial factors are the conduct of the driver, the design, the state of the vehicle, and the infrastructure. Road safety is influenced by many things (Gan, and Brady, 2004). The most important variables are the conduct of the driver, the design, the state of the vehicle, and the infrastructure.

a) Vehicle Safety

Vehicle safety is an important factor in matters of road safety. Bhalla and Gleason, (2020) found that safety features installed on cars were responsible for the reduction in car crashes. These included antilock brakes, seatbelt usage, side impact optimization, front end design enhancements, enhanced vehicle design, front and side airbags, side door beams, and side structure and padding, all of which have the potential to reduce fatalities. Additionally, Lubbe (2018) discovered that automated vehicles significantly improved traffic safety. (2018) also found that automated vehicles greatly increased road traffic safety.

b) Driver Behavior

Driver behavior and performance are the largest obstacles to enhancing road safety (Cohen and Evans, 2003). Strong safety benefits for improved seat belt use and speed control are found in the research literature. On safety, driver education has a minimal effect. While enhanced enforcement of drunk driving laws and greater public awareness has improved safety (Ivan, 2011). Complex higher-level abilities that can only be learned via years of practice can help lower the chance of crashes and therefore, it is vital to address the driver, driver behavior, and driver abilities to analyze the aspects affecting road safety (Ramstedt, 2014).

c) The Change in the Quality of Infrastructure

The state of the roads is another essential aspect of driving safety. Automobile damage and other road user risk can result from poor or deteriorating road surfaces (Geisel, 2009). The kind of road also matters a lot; expressways with several lanes, which are

the fastest in Europe, also happen to be statistically the safest and at the same time, two-lane single-carriageways are frequently the most hazardous (Hakkert, 2007).

One of the studies done on Infrastructure and climate change: a study of impacts and adaptations in Malawi, Mozambique, and Zambia (2014) reviews how the weather is one of the challenging aspects concerning road and safety matters due to increased rainfall which potentially affects road infrastructure standard and eventually, cause of traffic accidents related to the weather (AUSTROADS,2004). According to a report from the meteorology department in 2022, increased rainfall is a factor in the high rate of traffic accidents because slick roads make it easy for drivers to lose control, which puts pedestrians and street vendors who spend most of their time on the sides of the road at a very high risk of being struck by cars (Bryceson, et al, 2006). Additionally, William et al. (2011) showed in Scotland that a road's gradient, curve, width, illumination, and road markings, as well as the existence or absence of hard shoulders and crash barriers, can all affect the likelihood that an accident would occur (Arndt,2012).

There have been numerous studies on road accidents in Zambia. Simuyemba (2018) found that, despite several highways having had their surfaces reemerged, a variety of factors contribute to RTAs in Zambia, including excessive speeding, poor driving judgments, inexperience, careless driving, wrongful overtaking, reckless driving, alcohol, overloaded vehicles, motor vehicle failure, poor lighting, stress, bad roadside behaviour, poor road surface or defects, obstructions, improper use of seat belts, and failure to use seat belts when necessary.

Makwenda (2021) stated that the number of traffic accidents increased, mostly because of over speeding. According to the study, the Great North Road, several sections of the Chirundu Road, and the Zimba-Livingstone stretch all experienced this event frequently. It was probable that the Kafue Mazabuka Road may offer a comparable situation once it was finished. The current poor condition of the roads can also be attributed to the high number of traffic accidents; for instance, if one is speeding, a pothole discovered on an unfamiliar road can result in a terrible accident (Ngoma, 2006). Poorly trained drivers, driver stress, insufficient highway road patrol, inadequate communication systems, bad highway signage, and other driver misconduct that escapes police discovery, such as

the use of phone registration marks, are some more recent causes of accidents in Zambia (Mwalusaka, 2012).

2.4.1 Relationship between safety management systems and reduction of road accidents.

Preventing traffic accidents demands a thorough, well-thought-out response, led by competent government leadership with the required resources (Bliss, and Breen, 2009). A shift from crash prevention to death and serious injury prevention must be made in order to achieve the Safe System goal because everyone makes mistakes and gets into accidents (Breen, 2010). The countries with the safest road systems have demonstrated political will by enhancing their road safety goals, adopting and funding a rigorous, evidence-based intervention approach, and setting up critical organisational arrangements (Muhlrad, 2011). The effectiveness of the emergency medical system, speed regulation, intrinsic vehicle safety, and the road environment can all be improved to address this new Safe System priority (Yannis and Machata, 2014).

An effective system for managing road safety consists of three interconnected parts: institutional management functions, interventions, and results (WHO, 2013). Each component is frequently assessed against best practices from around the world in order to accomplish challenging and ambitious road safety goals (Breen, 2009). All nations should make sure that a successful road safety management system is in place in order to bring challenging levels of fatalities and serious injuries under control. When setting more challenging goals than LMICs, HICs should follow suit (Gitelman, and Buttler, 2011).

Wegman et al. (2010) examined the state of road safety in nine European nations representing three distinct areas with varying levels of development. Based on their findings, they made recommendations for each nation's road safety management systems. Some of the nations blatantly failed to perform some of the necessary components of an effective road safety management system, including

i. Establish a central agency for road safety with adequate funding to coordinate and manage road safety activities.

ii. Clearly define which ministry is primarily responsible for road safety. ii. Set quantified road safety targets.
iii. Increase funding for road safety improvement;
iv. Motivate stakeholders to participate in management of road safety;
v. Create a national independent road safety observatory to track progress;
vi. Gather information on risk exposure measured in terms of kilometers travelled and performance indicators for road safety; and
vii. Streamline processes and databases.

"It is extremely difficult to estimate the costs and benefits of organizational measures," the authors concluded (Larsson, 2017).

A few of the tools used included in-depth accident studies, behavioral observations of road users, traffic conflict studies, naturalistic driving studies, "Black-spot" identification and analysis, network screening, road safety impact assessments, road safety audits, road safety inspections, and road protection scoring. Numerous management tool applications were found (Jensen, 2013). Using an email survey, national highway authorities in 18 European nations were asked whether they used 10 formal instruments for great road safety management (Elvik, 2015). This was done to ascertain whether there was a correlation between the use of the tools and safety performance (Corben, 2003)

In 14 nations between 2010 and 2027, Wong et al. (2018) examined the success of quantitative road safety targets. The results demonstrated that, over the study period, road deaths decreased in the majority of countries having measurable road safety targets. "The establishing of measurable road safety targets serves to raise concerns about road safety in societies, stimulates policymakers to develop efficient road safety policies, and guarantees that sufficient resources are provided to road safety initiatives," they wrote in their conclusion.

Redundancy is emphasized by the Safe System Approach, and better roads necessitate the introduction of design elements that provide layers of protection to both prevent crashes and decrease the damage they do cause (Broughton. 2003). Through the NRSS, the department will give improved infrastructure design and operations top

priority, considerably enhancing road safety. This includes encouraging support for the adoption of Complete Streets laws in order to help transportation authorities across the United States in planning, developing, and running roads, streets, and networks. Complete Streets places a high priority on safety, comfort, and connectivity to destinations for all users, including drivers, pedestrians, bicyclists, people who use transit, people who use micro mobility, people who use shared services, people who deliver goods, and people who use wheelchairs and other mobility aids. Hyder and Mohan, 2007).

Roadway design cannot be standardized; context-sensitive designs must be the rule rather than the exception unfortunately, many of the highways in our country lack suitable infrastructure design components that promote the security of all road users (Larsson, Candappa, 2013). Since they are not enclosed in a motor vehicle, people who use public transportation, walk, bike, roll, or use a motorcycle need special consideration (Papadimitriou, 2015). 90 percent of the most dangerous intersections for pedestrians to die were found to have three or more lanes of traffic, and 70 percent had five or more lanes of traffic that they had to cross. 20 For those riding bicycles and walking, visibility is still a problem; 75% of fatal pedestrian collisions happen at night (Yanni, 2013). 21 More widely, the risk of injury varies depending on the type of road and how it is used, with arterial roads accounting for more than half of all traffic fatalities in 2020 although making up only around 10% of the country's total public road kilometers. 22 Context-sensitive designs give architects the flexibility to take into account varying road purposes and projected uses, as well as the surrounding land use and potential environmental implications. Roadway construction and maintenance zones must be safe for employees as new safety elements are added as roads are updated, maintained, and developed (European Transport Safety Council.2003).

2.4.2 Framework for the effectiveness of the road safety quality management system in matters of road safety.

According to Guasch (2004), nations with effective strategic planning frameworks are more likely to have successful road safety quality management systems than unsuccessful nations. For instance, plans for national road safety quality management systems that are supported by suitable legislation are frequently updated in France,

Italy, Japan, and Spain (Suseno, and Wibowo, 2015). On the other hand, different aspects of the current toll road programme in Indonesia and Mexico were developed independently and were not derived from a long-term strategic interregional road safety quality management system; as a result, they were poorly coordinated with plans for expanding the capacity of highways (Setiadji, 2015). To maximize benefits and reduce traffic accidents, a strategic planning framework that incorporates network analysis is crucial (George 2003). The strategic road network and the important links' best alignments should be refined as part of this planning, along with the best timing for each link's development based on corridor studies and a clear sense of its economic and financial viability (Dahdah, and Montufar, 2014).

Institutional management is the foundation of a successful national road safety management system. Key components of efficient institutional management have been identified and defined through a global study of management systems and leadership arrangements in nations and jurisdictions that have significantly reduced the number of fatalities and serious injuries (as well as those in nations without such arrangements and which have been less successful) (GRSF, and GRSF,2009). According to Muhlrad et al., (2011), the road safety management system is a complicated institutional architecture that entails agencies working together and interacting to support tasks and processes required for the prevention and reduction of road traffic injuries. Since (Bliss & Breen, 2012) contend that good road safety management can be performed through a range of structural and procedural forms, it is difficult to develop a strong practical model.

Depending on the availability of data, the majority of outcomes are utilized as outputs when evaluating road safety performance. All other levels function as system inputs for enhancing road safety. The following three levels should be developed by any nation looking to raise its performance level in terms of road safety (World Road Association, 2015).

Level I: Administrative duties in institutions

The cornerstones on which road safety management systems are built are seven institutional roles and these include planning, drafting legislation, allocating funds and

resources, promoting, observing, and assessing, doing research and development, and sharing knowledge (Salmon, 2009). These tasks are typically produced by government agencies that produce interventions, however, occasionally they are also carried out in collaboration with the business community and civil society (Mwebesa, 2018).

Interventions at Level II.

Interventions for achieving road safety goals include strategies, policies, programs, measures, activities, and projects. Interventions aim to lessen the likelihood of crashes, the severity of crash injuries, and the effects of crash injuries (Tingvall, and Haworth, 2010). They consist of information, promotion, enforcement, and incentives in addition to safety designs, standards, and laws. Interventions could be made in the development, maintenance, and management of the road system (Wang, 2016). Aside from the types of users on the road network and the entry and exit locations of vehicles, interventions might also address the recovery and rehabilitation of crash victims (Vedung, 2012).

Third Level: Results

Results for road safety are often intended to guarantee that long-term objectives and quantitative benchmarks are attained (Koornstra, 2011). These objectives include outputs from the transportation network, such as indicators of collisions, fatalities, and severe injuries. In order to achieve the targets and goals highlighted, cost-effectiveness must be taken into account in road safety management systems (Wegman, 2008)

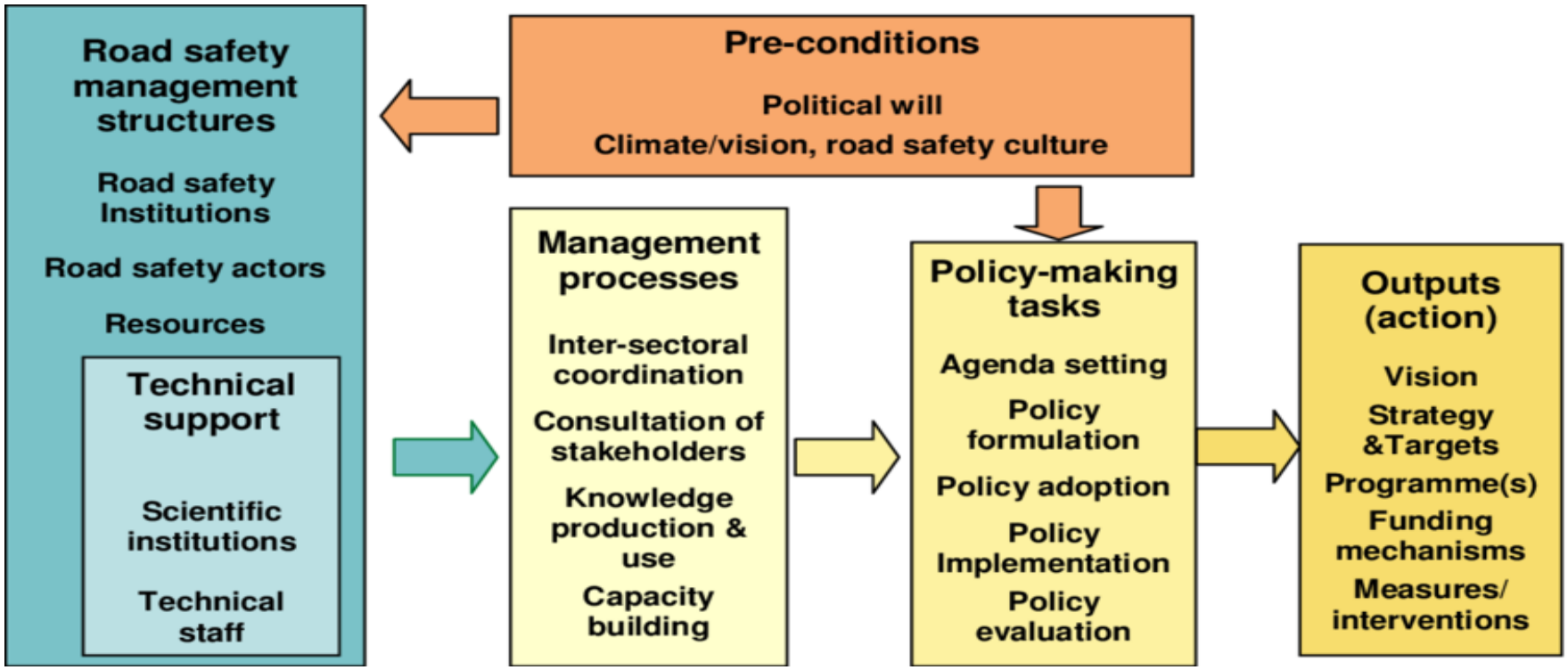


Figure 2 1 Framework for road safety

Source: Muhlrad, Gitelman and Buttler. (Ed) (2011)

In addition, Khan and Kamal (2017) noted that when stakeholders are poorly informed and communicated with, they will not successfully participate in the project, which would ultimately impair project quality because the demands and expectations of the clients are overlooked. It was concluded that the project's poor stakeholder engagement had an impact on the calibre of the results. Specifications were deemed to have had a major contributing influence from ineffective project stakeholder interaction. Project stakeholders were shown to be the source of all project uncertainty, hence ignoring them implies ignoring product quality since clients and designers mostly set product specifications (McLean, 2001). Integrated Road Safety Quality Management is a management strategy that encourages all significant players in a project to concentrate on the greatest project outcome at the best overall cost, as promoted by Silungwe et al. (2015). Every project begins with the formation of a team through the selection of several partners, who are primarily chosen depending on the project's requirements. The client, consultants, contractors, and suppliers make up the team. The group then collaborates to complete the best project for the client.

A qualitative mitigation paradigm for the transportation sector in developing nations was put forth by Wang, Dulaimi, and Aguria (2004). This was the case since the framework would offer in-depth management ideas and practices that multinational organizations might use. It is maintained that the suggested structure is workable and very simple to implement. According to the study, when risk mitigation measures are performed, they should be implemented in order of effectiveness for each mitigation measure for each element.

Ceric proposed the PDRSMF (Process-Driven Road Safety Management Framework), which was evaluated on the Croatian Sveta tri kralja Tunnel (2003). The suggested framework shall be employed in the execution of the road safety quality management process, which is carried out independently for each stage of the project in accordance with the Process Protocol (PP). After ensuring that the important safety in each phase had been identified, the experts employed the (PP) safety computer software to calculate safety likelihood and safety impact. They then suggested the best accident response plan based on safety exposure and road safety acceptability.

Before the project is implemented, applying the framework to the road safety quality management system in this manner has the disadvantage of erasing the cyclical character of the road management process (Montufar, 2014). New traffic accidents could emerge in the phase being analyzed or one of the following phases as a result of accident reaction during project execution. Road safety management is a cyclical process by nature since new road safety should be handled equally to the initial safety (Ibid) (Milligan, 2014). Furthermore, Zou, Wang, and Fang (2008) pointed out that if the framework is used to road safety quality management prior to the project's commencement, it may not be possible to account for potential fundamental changes in the relative values. Only when the proposed framework is used to execute a project, from stating the need to Operation and Maintenance, can its full potential be realized. This has a significant impact on how well roads are maintained, how often accidents occur, how acceptable accidents are, and how quickly accidents are responded to (Ceric 2003).

According to El-Amm (2003), a road safety management framework provides a data base for quantitative data, categorized by size, to assist judgments, such as e.g., the comparison between different alternatives or the decision between costs and adopting products. To accomplish this, however, trustworthy status information must always be available so that judgments may be made using accurate and comprehensive data (McMahon, and Dahdah, 2008).

2.5 Summary of the Literature

Worldwide, both the public and commercial sectors have expressed worry about the frequency of traffic accidents in the transportation business. The researched literature demonstrated that each of the elements examined has the ability to influence how well a road safety quality management system is implemented. Since the frequency of traffic accidents has grown more crucial to the success of transportation projects, researchers in the transport industry have been challenged to investigate, create, and build frameworks and procedures to address the issue of traffic accidents. There has been a lot of research on the elements influencing traffic accidents and the transportation sector as a whole, but little research has been done on the factors influencing how well road safety quality management systems are implemented. In a study of a similar

nature, investigated the relationship between road safety management and the decrease in traffic accidents (Unegbu et al., 2020). However, the study did not fully analyse the road safety quality management system. In light of this, the researcher was motivated to carry out this investigation in order to explore the factors affecting the effective implementation of the road safety quality management system relationships in Zambia.

Table 2. 1 : Knowledge Gap

NO	Author and Year of Publication	Research Topic	Methodology	Findings	Research Gap
1	Indhu and Ajai (2014)	Study of Road Safety Management in a Construction Project.	The promoters, consultants, and contractors' responses to the survey questionnaire and information gathered from them by mail or in-person meetings with staff served as the overall approach for this study.	According to the study's findings, inadequate building supplies, poor site management, ineffective management of qualified personnel, and the tendering of diagrams were the main factors.	The research primarily focuses on finding the variables that influence the implementation of road safety.
2	Silungwe et al (2015)	A Case Study of Kabwe Road Accidents Reduction on Infrastructure Projects in the Zambian Transport	The importance of the investigation and the nature of the research questions served as the study's key drivers for using a mixed methods approach. The researcher used surveys, questionnaires, and descriptive techniques to	The study indicated that the management of traffic accidents is substantially hampered by the excessive reliance on the conventional way of procurement. Therefore, the conventional approaches to minimizing road	The study was more concerned with the factors affecting the implementation process than it was with the entire Zambian transportation industry.

		Industry Through Integrated Road Safety Management Approach examines public service vehicle drivers' awareness of road safety issues and their behaviour on the road.	collect data.	accidents are inadequate because of the fragmentation of the parties involved.	
3	KAVUYI,(2017)	Study of Road Safety Management in a Construction Project.	PSV and regular drivers in Kabwe were the primary target groups; structured questionnaires were utilised for primary data collection, and semi-structured interviews were employed for secondary data collection from the key	The study found that governments are turning to the private sector to build and finance roads as a result of deteriorating road infrastructure and decreasing public funding. It also suggested that many accidents	The study examined a road's comprehensive management of road safety. The use of road management at each step of implementation was not thoroughly examined in the study.

			informants. Secondary data was gathered by doing literature research on RTAs across the nation. To put together the literature review, a number of sources, including RTSA reports, media, and other government records, were consulted.	may be avoided if private concessionaires adopted a comprehensive and useful road safety management programme with the assistance of the government.	
4	Zou, Wang & Fang (2008)	A life-cycle road safety management framework for infrastructure projects	This essay makes use of case study approaches in addition to considerable theoretical research and literature studies. First, a thorough analysis of the most recent research in the field was done. Then, three PPP infrastructure projects—two from Australia and one from China—are examined in order to identify the factors that contributed to	The study concluded that in order to successfully assess the financial, political, and public acceptance/rejection of PPP infrastructure projects, there must be a balance of interests between the government, public, and private partners as well as the final consumers of the products.	The study took a broad view of a road safety management framework within a project life cycle rather than explicitly assessing it based on the various project stages**.**

			their predicament and to communicate the important lessons learned about risk analysis and mitigation.		
5	Seboru (2015)	An Investigation into Factors Causing Accidents in Kenya	This study combined a questionnaire survey with an analysis of aggregated traffic accident data from police stations that kept track of incidents that happened along UCA-2. Accidents that happened along the Nairobi Southern Bypass between the years of 2016 and 2019 were included in the study period. The primary users of the Nairobi Southern Bypass, mainly the police, motorists, and pedestrians, filled out organised questionnaires to provide data.	Rain, sluggish decision-making, and poor planning and scheduling were the main contributors. It is advised that clients strengthen their management processes in order to reduce accidents.	The study examined all of the elements that contribute to traffic accidents.

2.6 Chapter Summary

The activities and studies on road safety quality management systems and common causes of traffic accidents that happen locally and globally are represented in the literature examined in this chapter. There are numerous authors and places mentioned in the citations, but every effort has been made to concentrate on the use of safety road management development. The numerous types of accident causes were discussed. The importance of a framework for managing the quality of road safety based on earlier research is also covered in this chapter, as is the link between effective accident reduction programmes and quality safety management systems. It highlighted the knowledge gap based on previously published literature on quality management systems for road safety in auto accidents, which is the last but not least.

The next chapter postulates the theoretical and conceptual frameworks; these will give an elaboration on the relationship between the dependent and independent variables.

CHAPTER THREE

CONCEPTUAL AND THEORETICAL FRAMEWORK

3.1 Introduction

This chapter's main emphasis is on the theoretical analysis and conceptual frameworks that will help the researcher with their research inquiries. Theoretical considerations included Tripod Beta, Swiss cheese, and systems theories. The independent and dependent variables, together with their related boundaries, will be represented and explained by the study's conceptual framework, which will be constructed in the Chapter. The chapter ends with a summary of the theories and ideas discussed.

3.2 Theoretical Framework

A theory is a group of related ideas, explanations, and assertions that provide a methodical interpretation of events by identifying relationships between factors in order to explain and forecast the phenomena (Kerlinger and Lee, 2015). A theory, according to Leedy & Ormrod (2016), is an organised collection of principles and ideas that seeks to explain a specific occurrence. Theories are made up of logical connections between concepts and sets of concepts that offer a basis for organizing what is known and a framework for critically analyzing phenomena (Kawulich, 2016). They are the logical instruments for comprehending, elucidating, and estimating a specific subject (Banda, 2019).

Acharyya (2017), the study’s theoretical framework is a framework that can support or explain the relationships between the many variables, which provides an explanation for the existence of the problem under study and acts as the foundation for doing research. Each study needs a theoretical foundation upon which to build, so for this thesis, various theories were considered to select the most relevant theory for developing the thesis's central idea of risk and its management. Thus, a theoretical framework can be described as a blueprint for understanding the links between the numerous components that have been recognized as being crucial to the solution of the current issue (Oluwatoyin and Oluseun, 2018). The Swiss cheese theory, the tripod beta theory, and the system theory will serve as the theoretical framework for this investigation.

3.2.1 Tripod Beta Theory

The Tripod Beta theory, which Reason developed in 1990, contends that accidents happen as a result of a confluence of mistakes and carelessness at many organizational levels (Katsakiori, and Sakellaropoulos, 2009). The three legs incidents/accidents, fundamental risk factors (BRFs), and risky acts are the source of the name Tripod. According to the Tripod technique, accidents happen because controls and barriers are either absent or ineffective (Khakzad, 2012). Unsafe activities (active failures) are brought on by hidden forces operating within organizations. These techniques, known as BRF, address issues relating to people, organizations, and technology (Kerlinger, 2015).

The Tripod Beta is a piece of software that combines the Tripod and the Hazard and Effects Management Process (HEMP), failures in human interactions at work, and other failures connected to management and organizational variables are some of these factors (Ahmadi, 2017). Organizational failures are the primary causes of accidents that persist as latent elements in the system for a long period. Technical and human errors (active errors), which also lead to accidents, always follow these latent causes (Hudson, 2013).

According to the tripod beta theory, multiple levels of the barrier are intended to reduce or eliminate an error. The layers of the system resemble this model's holes, which denote safety failures in each of the layers. Due to the other layers' protective role, a hole in one layer could result in an accident (Morrison, 2004). The absence of barriers to stop errors from happening is demonstrated by the emergence of an error if the holes in each layer are aligned (Rasmuss, 2010). This model classifies the four tiers of accident causation as follows: Organizational influences are listed first, followed by dangerous supervision, unsafe activities, unsafe acts themselves, and unsafe preconditions. By using this approach in the study, it was possible to divide the primary causes of accidents into two subcategories: dangerous behavior and unsafe surroundings. When looking at the immediate causes, risky situations rather than unsafe conduct were more important in the occurrence of accidents (AlAzemi, and Bhamra, 2014). Tripod Beta's accident causation theory is based mostly on human conduct; as a result, it emphasizes human behavior rather than harmful factors and precondition factors are the underlying causes used in the modified Tripod Beta approach. (Wiegmann, 2003). According to this study on the efficiency of implementing

road safety quality management systems of accident analysis, supervision factors have a greater impact on accident occurrence than individual components and operate as a chain connecting immediate causes to root causes (Hudson, 2013).

3.2.2 The Swiss cheese Model

The hypothesis, which focuses on obstacles to safeguards, holds that significant accidents are caused by system failures in which several, lesser failures combine to create an actual hazard (Cortes, 2011). Since additional defenses are in place to prevent an isolated failure, any weaknesses in one defense system theoretically won't necessarily allow specific threats to materialize. The theory has been applied in a number of academic disciplines (Vincent C, Taylor, 2007). A theoretical model used in risk analysis, risk management, and risk prevention is known as the Swiss cheese model and any elements of an organization are regarded as slices in this paradigm and an example of the slice is management

(Hudelson, 2009). A chunk of resource allocation. A slice of a safety program that works. One slice is operational assistance. However, if any of these "slices" of your business or agency have any shortcomings or weaknesses, you will have a hole in that slice. Swiss cheese follows (Rajablu et al., 2017). The Swiss Cheese Model demonstrates how failures cannot be attributed to a single root cause; instead, they are often the consequence of many independent elements working together (Haddon, 2003). It suggests that a method, device, or system's latent defects or failures are what cause the majority of mishaps (Schyve, 2008). Latent mistakes are active errors that happen when particular people engage in dangerous behaviour. Therefore, human mistake is not the only factor that leads to accidents. (2015) Lee and Kerlinger

By keeping in mind that all lines of defence inside an organization are interconnected, decision-makers may put policies and procedures in place that successfully minimise risk, as the study has done in order to guide decision-making that will ultimately prevent accidents from occurring (AlAzemi, and Bhamra, 2014). The Swiss Cheese Model emphasises the importance of removing latent errors since they can cause accidents when they are activated by active errors. Staying up to date with new standards and technology advancements is one way to achieve this (Hauge, 2004).

Because it shows accidents in a way that everyone, regardless of their area of expertise or degree within the sector, can simply picture and understand, applying this

model resulted in effective communication (Rosness, 2005). Although the details of risk analysis and accident prevention are intricate and may be challenging for many to understand, this model can be presented clearly, giving many individuals a fundamental understanding of these challenging subjects (Berlin, 2004).

3.2.3 Systems Theory

Rasmussen (2019) proposes this theory, which holds those three factors the host (human), the machine (machine agency), and the environment interact to generate an accident. According to the systems theory, which asserts that no single model or theory can completely explain all accidents, a person (referred to as the host), a machine (referred to as the agency), and the environment are all regarded to be systems with three components (Johnson, 2010). Lack of appropriate knowledge or training, risky working practices, faulty planning, unclear roles, and poor supervision are all factors that contribute to accidents (Smith, 2016). Additionally, these fundamental flaws are signs of management control failure, the main factor in the majority of mishaps.

The systems theory can be used to construct a road safety quality management system, which can assist management in comprehending the three major causes of human error: overload, improper behavior, and inappropriate responses (Greene, 2004). Management will be able to reduce accidents, especially on highway roads, by understanding these elements. When managers do not fully utilise quality management systems or do not know how to use them properly, they frequently fail (Smith, 2016).

3.3 Conceptual Framework

A conceptual framework is the comprehensive, logical orientation and associations of everything that underpins the assumptions, structures, strategies, methods, and execution of a complete research effort (Kivunja, 2018). It is a set of ideas, presumptions, expectations, hypotheses, and convictions that underpin and guide research (Robson, 2011; and Maxwell, 2012). A conceptual framework seeks to classify, define, and map links between concepts that are important to the investigation (Rocco and Plakhotnik, 2009)

Ideas that may have been developed from the researcher's own perception or with a few supporting references form the basis of a conceptual framework (Musau, 2020). The variables the researcher uses to achieve the given study objectives are listed in a conceptual framework. There are also the anticipated relationships between the

independent and dependent variables (Rajablu et al., 2017). This creates a connection between the independent and dependent variables. It provides as an illustration of the primary research variables and how they are believed to be related (Sakala, 2019).

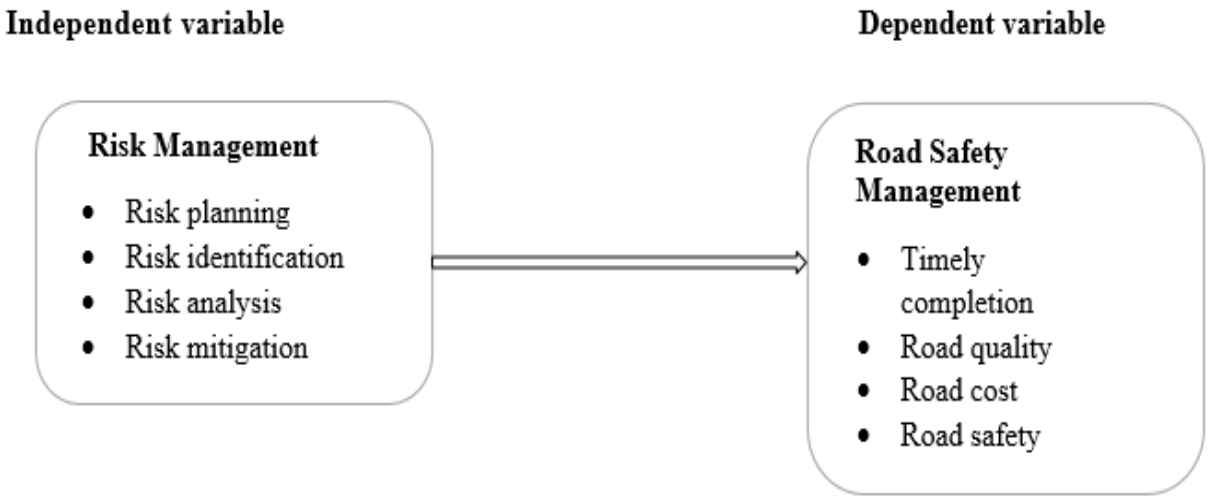


Figure 3.1: Conceptual framework for managing risks in road safety

Source: Adopted from Patil & Gaikwad (2015).

Risk management, according to Patil & Gaikwad (2015), is foreseeing future events and averting them before anything goes wrong. In order to accomplish the goals of road safety in terms of time, cost, quality, and safety, managing risks is a critical process (Pauer, G. 2017). Risks associated with each activity and their potential impact on the amount of time and money needed to prepare the network are addressed by risk management in road management. It also addresses planning, identifying, and assessing hazards related to managing road safety, as well as their propensity to occur, impact, and severity (Mendoza et al., 2017).

Unaffected by the complexity of roads, one of the main goals of risk management is to create chances for the efficient application of quality systems for improving road safety (Sodikov and Silyanov 2015). For a full analysis and reaction planning, the identification of hazards within road safety management necessitates going through the entire risk management process (Lindunda 2019). To ensure fair risk distribution between the private authority and private firm, the necessary

frameworks (legal, institutional, policy regulatory, and technical) must be in place (Philip Wijers 2016). The success of the implementation process will be ensured by this procedure. The ultimate objective of managing traffic accidents is anticipated to result from the interaction of all these factors (AlAzemi, and Bhamra, 2014).

Risk Management in Road Safety Management

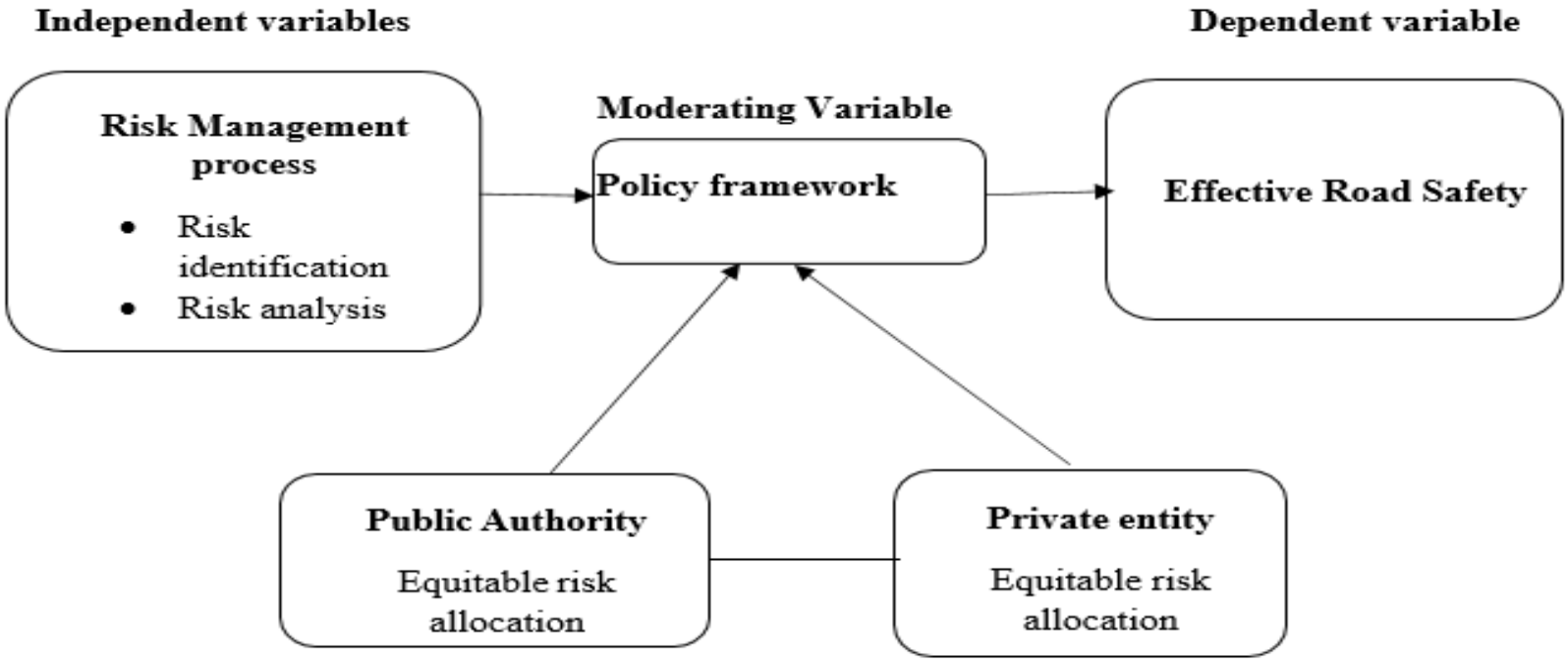


Figure 3.1 Conceptual Framework

Source: Lindunda (2019)

Risk Management in Road Safety Management

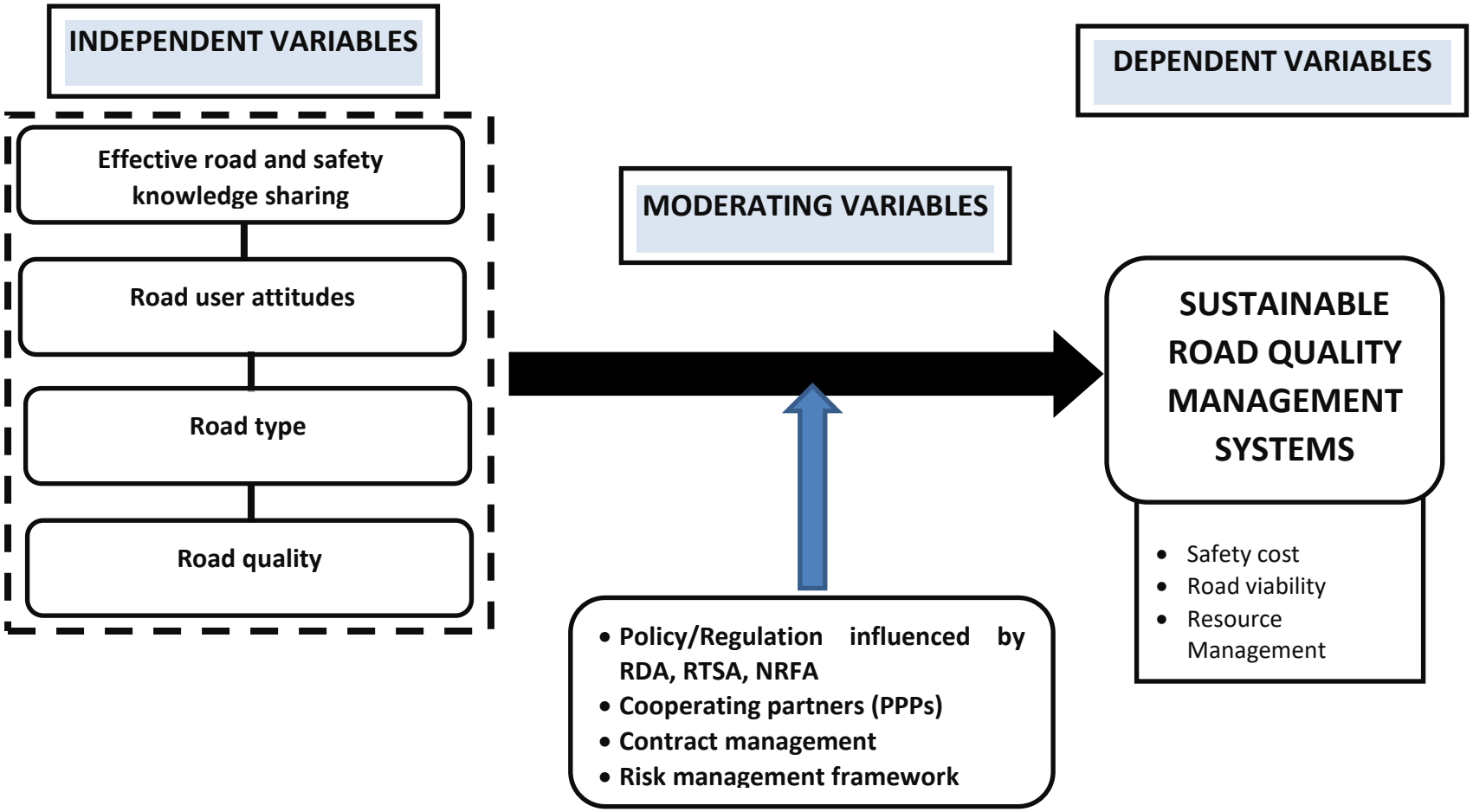


Figure 3.3. 1 Conceptual Framework

Source: Author (2022).

3.3.1 Explanation of variables

The proposed conceptual framework of this study shows how road accidents was conceptualised as the dependent variable whose main indicators were safety cost, road viability and resource management being influenced by effective road and safety knowledge sharing, road users' attitudes, road and moderated RDA, RTSA, NRFA, Cooperating partners (PPPs), Contract management and risk management framework. The framework sought to establish how road safety management systems have on the reduction of road accidents wanted to establish the level of influence that the Knowledge areas have on reduction of road accidents. The framework's variables were analysed in detail as follows:

3.3.1.1 Independent variables

The identification of inputs is the research's independent variable, which will be compared to latent variables like risk planning and feasibility. If the stakes are controlled from the perspective of the stages, effective risk management is achievable. This alone explains a full and accurate management of road dangers since they are managed in accordance with their likelihood of occurring during a specific phase. The planning and feasibility phases are among these crucial stages. According to research, addressing road dangers sooner rather than later can reduce the risks' adverse effects. It is important to recognize potential dangers and take proper precautions to manage them (Smith, 2016).

The management of risks through risk identification, planning, analysis, and stakeholder involvement goes hand in hand with the identification of inputs. This is crucial because managing the risks will increase the likelihood of managing traffic accidents only when they are consistently recognized and studied (AlAzemi, and Bhamra, 2014).

3.3.1.2 Moderating variable

The research study's moderating variable is the legal system. A road user legal framework entails the existence of well-defined laws, ordinances, and organizations that have an impact on how incidents are handled. In this regard, it follows that having a solid legal framework is necessary to guarantee successful risk

management. The framework will serve as an efficient manual for the primary project participants or stakeholders on how risks are to be managed at various phases. To put it another way, a legal framework offers a methodical approach to managing risks and assuring project viability and success through risk sharing. The Ministry of Finance, the Road Development Agency, the National Road Fund Agency, and the Road Transport are the main participants in this study's legal framework.

3.3.1.3 Dependent variables

Implementation of road safety is the research's dependent variable. The variable is made up of underlying factors that can be quantified, such as user happiness, resource management, road viability, and safety costs. Whether or not road safety is done within the budget without encountering overruns or shortfalls will depend on the safety cost. In order for the protection to be successful, it must be sustainable, therefore the road's viability will take this into account. In terms of managing road resources, this will concentrate on ensuring efficient resource allocation and usage for the road system. Finally, it will be necessary to determine whether the client's requirements were met or not. It will be satisfying if the road systems' safety meets the needs of the customers or end users.

3.4 Chapter Summary

This chapter presented the theoretical and conceptual frameworks for this study. The Swiss cheese model, the systems theory, and the tripod beta theory were three theories that were used in the chapter and explored within the context of the investigation. To ensure the successful implementation of adopted improvement interventions to lower road traffic fatalities and injuries on Zambian highways, Chapter 3 has developed a model for road safety in Zambia that suggests a comprehensive systems approach that is based on a dual linked data collection from the Zambia Police Traffic department and RTSA. The old theory of road safety, which emphasized human elements to lower road accident fatalities and injuries, is reviewed first, nevertheless, before moving on. On the basis of the theories employed in the study, a conceptual framework was subsequently created. Variables in the conceptual framework were further explained as independent and dependent variables.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 Introduction

This chapter provides a breakdown of the technique used to carry out this study. The research methodology, research design, study philosophy, study population, sample size, data collection methods, and data analysis are all described in detail in this chapter. The chapter also discusses the research's validity, dependability, and ethical issues.

4.2 Research Approach

Research approaches come in three varieties: mixed, qualitative, and quantitative. According to qualitative study, constructivist ideas are largely the basis for the knowledge claims being made. Quantitative research is a technique for testing objective hypotheses since it examines the relationship between variables. These variables can each be measured separately, frequently using instruments, so that the data can be assessed using statistical methods (Creswell, 2012). Both the qualitative and quantitative research paradigms are used while doing research utilizing a mixed method approach. This is being done to arrive at a convergence of findings. The importance of the investigation and the nature of the research questions served as the study's key drivers for using a mixed methods approach. The researcher's use of statistics in the problem analysis and arguments was also made easier by this method.

4.3 Research Design

As part of the research design process, data gathering and analysis methodologies are chosen. As a result, the study employed a descriptive research design. A descriptive research design, according to Hale (2018), summarises the characteristics of a population-based sample and extrapolates its results to the entire population. In order to give participants, the chance to reply to questionnaires and interviews, the survey method of descriptive research was used in this study. This descriptive research design technique is ideal for the study since it helped obtain data on following occurrences and

results in the arrangement, tabulation, and description of the data on the current effectiveness of the road safety quality management system in Lusaka.

4.4 Philosophy of the Research

The coordination of ideologies and goals for knowledge development is said to be the essence of research philosophy. In general, it is what a researcher does when doing a study, which is learning new things about a particular subject (Saunders, 2016). The research technique to be utilized is also influenced by the hypotheses guiding study activity, particularly the conceptions of knowledge about the research (epistemology), the nature of reality and humans (ontology), and how knowledge would be acquired (methodology) (Saunders 2016).

4.4.1 Epistemology

The cornerstone of epistemology is knowing what can be known or what ought to be the accepted knowledge in a certain topic (Lindunda 2019). Easterby-Smith et al. created the epistemic positions of positivism and social constructivism (2017). The application of proper methodologies for the study of social reality in the natural sciences was believed to be made easier by positivism in epistemology. Social constructivism, on the other hand, emphasises the importance of researchers knowing their analysis based on their individual, ethnic, and historical experiences. Since both positivism and social constructionism are compatible with the requirements of the research, including the defined specific and primary purposes, this researcher chose both of them as the appropriate epistemological viewpoints.

4.4.2 Ontology

The process of understanding the social reality as it is perceived by numerous people while illuminating how those people's perceptions affect their conduct is known as ontology (Bracken 2014). The primary focus is on acquiring knowledge that inspires inquiry based on hypotheses regarding the nature of the universe. Relativism, realism, nominalism, and internal realism are the four approaches to ontology that are typically divided into categories. In this study, the realistic methodology was employed. This was

as a result of the method's capacity to create a neutral setting that is free from the attitudes and beliefs of people.

4.5 Study Population

The study population of a research is that cluster from which the researcher plans to draw deductions (Cresswell, 2014). It is a subdivision of the target population from which the sample is derived (A. S. Acharya et al., 2013). The research study was focused on a total population of 135 individuals, including drivers, employees of the Road Development Agency, National Road Fund Agency, Road Transport and Safety Agency, employees of the Ministry of Finance, and members of the Zambian police. Because they play a crucial role in creating and maintaining Zambia's road system, individuals from this institution were targeted.

Table 4. 1 : Study Population

S/N	STUDY POPUPLATION	RESPONDENTS
1	Motorist	55
2	Road Development Agency (Employees)	15
3	National Road Fund Agency (Employees)	10
4	Road Transport and Safety Agency (Employees)	15
5	Ministry of Finance (Employees)	10
6	Ministry of transport (Employees)	15
7	Zambia Police (Employees)	15
	Total target population	**135**

4.6 Sampling Techniques

Choosing elements of a predetermined sample size from a population is known as sampling methodology, according to Creswell (2014). In order to make the chosen groups representative of the entire population, it involves choosing individuals or groups of individuals from a population (Kombo, 2016). Simple random sampling, which is a statistical population subset with an objective selection process in which each participant has an equal chance of being chosen, was utilized in the study. Each driver had a chance to be selected in this case to participate and a purpose sampling was used to select employees from relevant institutions as this was a viable way to select officers who are directly linked to road safety and management systems to provide relevant information for the study.

4.7 Sample Size

A sample size is a small part selected from a study population for analysis and observation. A significant element is the fact that the objective is to draw conclusions about a population (Creswell, 2012). By examining the sample's characteristics, it is feasible to make certain inferences about the entire population from which the sample is typically drawn (Berg, 2009).

This study sample size was established by the use of Slovenes' formula

$$n=\frac{N}{[1+N\,(e)\,2]}$$

Where n =Sample size, N =Population size, e = Margin of error

In this study, the population (N) size is 135, Margin of error (e) 5%, with 95% confidence level. Therefore, the sample size of the research is calculated using Slovin's formula as shown below:

$$n=\frac{N}{[1+N\,(e)\,2]}$$

$$=\frac{135}{[1+135\,(e)\,2]}$$

$$= \frac{135}{[1 + 135\ (0.0025)]}$$

= 100

55 drivers in total were chosen at random from the main roadways in the Lusaka district, including the ring road, the inter-city roads, Lumumba Road, Great East Road, Great North Road, and Lusaka Kafue Road. They were specifically chosen since they were some of the busiest roads in the district. The following employees from institutions were purposely selected to offer pertinent data for the study: Zambia Police (7 workers), National Road Fund Agency (8 employees), Road Transport and Safety Agency (8 employees), Road Development Agency (8 employees), and Road Fund Agency (7 employees).

Table 4. 2 : Sample size

S/N	TYPE	Sample Size
1	Motorist	55
2	Road Development Agency (Employees)	8
3	National Road Fund Agency (Employees)	8
4	Road Transport and Safety Agency (Employees)	8
5	Ministry of Finance((Employees)	7
6	Ministry of transport (Employees)	7
7	Zambia Police (Employees)	7
	Total Sample Size	**100**

Source: Author (2022)

4.8 Data Collection Tools

The study included interviewing techniques and a standardized questionnaire to collect the data. The poll had both organized and unstructured questions. The questionnaire was created and put together to gather the information needed to address study problems. As a result, it only contained questions that were absolutely necessary to gather the information needed to answer the study questions. A five-point Likert scale questionnaire was used to allow respondents to give the best answer to the question. The lowest value is 55, where 1 denotes a very little amount or nothing at all and 5 denotes a very large amount. incredibly happy due to the way the questionnaire was designed, it had two subsections in order to acquire vital information for addressing research difficulties, personal information is gathered in Section A and particular questions are posed in Section B. Section B also contained subheadings developed from the three research objectives in order to collect data in accordance with study objectives. A self-administered questionnaire was utilised in the study to gather information from the participants.

4.9 Data Analysis

Data analysis entails modelling the data acquired in a certain research or study in order to discover pertinent information for the specified research challenge (Creswell, 2014). The researcher decided to use one sample test analysis and straightforward regression analysis with the help of Microsoft Excel and the Statistical Package for Social Sciences (SPSS) version 16.0 in order to streamline the study of feedback for quantitative data. The data were analysed using the descriptive analysis technique, which employs frequencies and percentages.

The Analytical Hierarchy Framework was used by the researcher to evaluate the qualitative data. Before starting data management, Ritchie and Lewis (2007) explain that this requires familiarizing oneself with the data by determining the initial key themes of the information obtained through interviews.

4.10 Research Validity and Reliability

4.10.1 Validity

According to Taherdoost (2016), validity is an explanation for how effectively the study actually covers the data. It speaks of how effectively research instruments capture the data they were intended to capture. This study achieved validity in three different ways: I by making sure the instruments were logical and comprehensive; (ii) by using a pilot study to conduct a validity test using 10 participants who completed the questionnaires and provided feedback on the clarity of some of them; and (iii) by using two instruments to enable triangulation with secondary data.

4.10.2 Reliability

To determine whether the questionnaire was appropriate for the entire sample, it had to go through some form of pre-test (Ghazali, 2016). The researcher tested the dependability of the questionnaires before distributing them to study participants. Following the delivery of a total of five (5) questionnaires to various study participants, this was done. To help assure the accuracy of the data acquired, the aforementioned questions were developed.

4.11 Ethical Consideration

The study made an ethical effort to ensure that respondents' opinions and desire to participate were respected. Additionally, the researcher ensured that no one would know that the respondents' private information was being used for the study. As a result, the analysis and conclusion did not link any specific respondents' personal information to any of the study topics. The moral considerations mentioned above allowed each respondent to provide truthful and comprehensive feedback.

4.12 Chapter Summary

Through the documenting of a suitable research approach, design, and philosophy that encompasses ontology and epistemology in light of the study's application domains, this chapter evaluated the methodology for doing the research. In addition, the research population was highlighted using an exact sample size established utilizing Slovins' approach. The chapter also looked at the sample plan and data gathering techniques

that would be used in the study. Last but not least, the ideal data analysis tool for the project was identified and listed under its application components.

CHAPTER FIVE

DATA FINDING PRESENTATION

5.1 Introduction

This Chapter presents the study's findings and explains the study's findings aiming at exploring the Effectiveness of Road Safety Management Systems in Lusaka, Zambia. The study targeted Motorists, RATSA, and supervisors.

5.2 Response Rate Analysis

The study issued a total of 55 questionnaires which were administered to motorists, The study targeted respondents who had been involved in utilizing public roads within Lusaka districts.55 questionnaires were distributed, and 55 were returned hence representing a 100 percent response rate.

5.2.1 Gender of Respondents: the researcher sought to investigate the gender representation of the study respondents; the outcomes of the investigation are shown in Table 5.1 below.

Table 5. 1:Gender of respondent

Detail		Frequency	Percent	Valid Percent	Cumulative Percent
	Male	39	70.9	70.9	70.9
	female	16	29.1	29.1	100.0
	Total	55	100.0	100.0	

Source: Author (2022)

From the results gotten, it was discovered that the majority of the study respondents were male 70.9% while female respondents were 29.1% 0f the study sample.

5.2.2 Respondents' years of experience

The researcher sought to find out the distribution of responded years of experience as indicated in table 5.2 below

Table 5. 2: Time frame for driving

Detail		Frequency	Percent	Valid Percent	Cumulative Percent
	Less than 1 year	4	7.3	7.3	7.3
	1-5 years	16	29.1	29.1	36.4
	More than 5 years	35	63.6	63.6	100.0
	Total	55	100.0	100.0	

Source: Author, 2022

From the finding in table 5.2 above it was discovered that 63.6% motorist have been driving for more than 5 years,29.1% have been driving for between 1-5 years and 7.3% have less than 1 year of driving experience.

5.2.3Type of vehicles driven by motorists

The researcher sought to find the vehicle type mostly driven by respondents on the road as shown in figure 5.1.

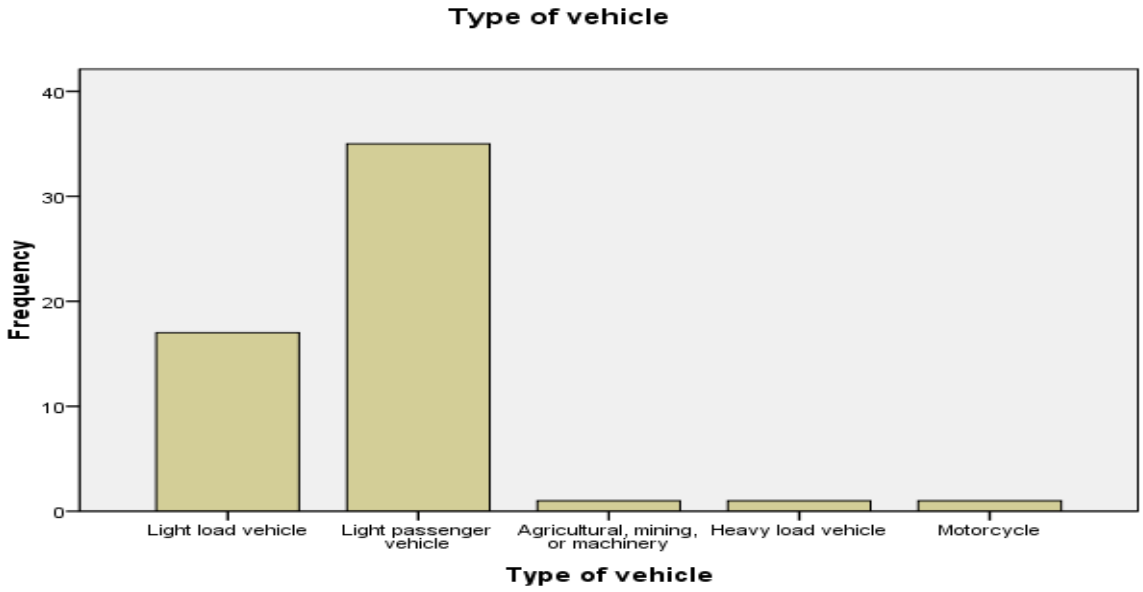


Figure 5.1: Types of vehicles used by motorists

Source: Author (2022).

From figure 5.1 the results indicated that motorists were using light passenger vehicles.

5.3 Descriptive Statistics Data Analysis for Quantitative Variables

Abdulsamad, (2011) asserts that the descriptive component of statistics enables researchers to condense enormous amounts of data into clearly comprehensible metrics. Descriptive analysis is thought to be a superior method for gathering data that illustrates the real world and describes relationships (Baha, 2016). As a result, the descriptive analysis of the research variables is the focus of this section of the study. Respondents were asked to rate their level of agreement or disagreement with the questionnaire's statements by selecting the appropriate response on a five-point Likert scale. According to the scale, the alternatives were (1-Agree, 2-Strongly agree, 3-Disagree 4-Strongly disagree, and 5-Neutral). In some cases, the ratings are 1, 2, and 3

5.3.1 To explore the factors affecting the implementation of quality road safety systems

The study determines factors affecting the implementation of quality road safety systems.

5.3.1.1 The view regarding the factors of road safety and knowledge sharing within aspects as outlined below

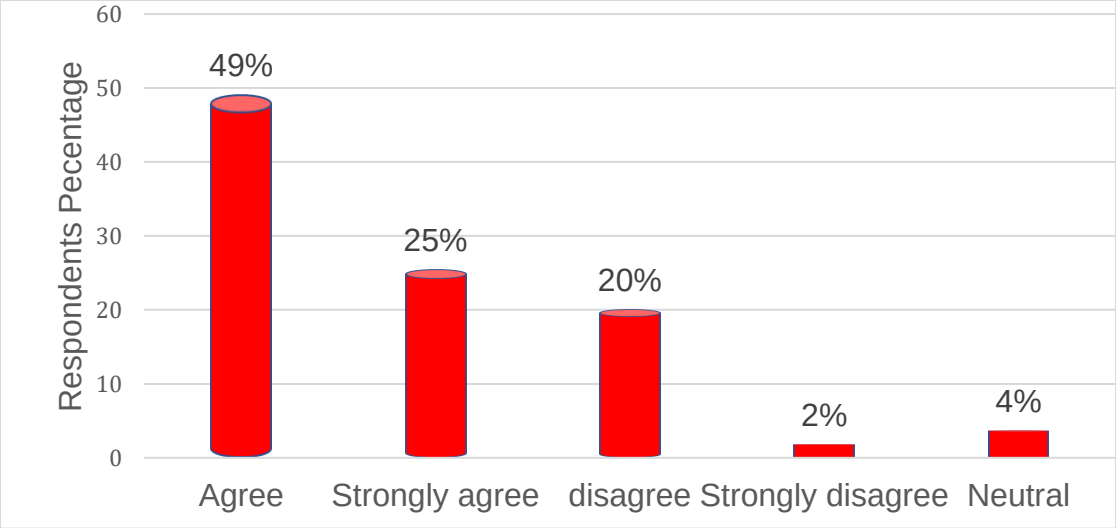


Figure 5.2: Road safety and knowledge sharing

Source: Author (2022)

From the finding from figure 5.2 above, 49% of the respondents agree that factors of road safety are learned through formal institutions concerned with driving and road safety, 25% strongly agreed, 20% disagree, 2% strongly disagree and 4% of the respondent could either disagree or agree. This implies that the majority of respondents agree that road safety issues are better learned through formal institutions which are concerned with driving and road safety

Table 5. 3: Safety knowledge shared through informal channels among motorists

Detail	Frequency	Percent	Valid Percent	Cumulative Percent
Agree	26	47.3	47.3	47.3
Strongly agree	7	12.7	12.7	60.0
disagree	17	30.9	30.9	90.9
Neutral	5	9.1	9.1	100.0
Total	55	100.0	100.0	

Source: Author (2022)

From the finding in table 5.3 above 47.3% of the respondents agreed that Safety knowledge was shared through informal channels among motorists, 12.7% strongly agreed, 30.9% disagree, 9.1% strongly disagree and 3.6% of the respondent could either disagree or agree. This implies that safety knowledge has been shared through informal channels among motorists.

Table 5. 4: Road safety is best learned by experience

Detail	Frequency	Percent	Valid Percent	Cumulative Percent
Agree	20	36.4	36.4	36.4
Strongly agree	13	23.6	23.6	60.0
disagree	18	32.7	32.7	92.7
Strongly disagree	2	3.6	3.6	96.4
Neutral	2	3.6	3.6	100.0
Total	55	100.0	100.0	

.

Source: Author (2022)

From the finding on table 5.4 ,36.4% of the respondents agreed that Road safety is best learned by experience, 23.6% strongly agreed, 32.7% disagree, 3.6% strongly disagree and6% of the respondent could either disagree or agree.

Table 5. 5: The media has been an effective channel for road safety education and sensitization.

Detail	Frequency	Percent	Valid Percent	Cumulative Percent
Agree	24	43.6	43.6	43.6
Strongly agree	19	34.5	34.5	78.2
Disagree	8	14.5	14.5	92.7
Strongly disagree	2	3.6	3.6	96.4
Neutral	2	3.6	3.6	100.0
Total	55	100.0	100.0	

Source: Author (2022).

The respondents indicated that the media has been an effective channel for road safety education and sensitization.43.6% of the respondent's agreed and 34.5% strongly agreed as shown in Table 5.5.

Table: 5.6. There is a comprehensive education and training program covering the core competencies of driving and road safety

Table 5. 6: Core competencies of driving and road safety

Detail	Frequency	Percent	Valid Percent	Cumulative Percent
Agree	20	36.4	36.4	36.4
Strongly agree	8	14.5	14.5	50.9
Disagree	19	34.5	34.5	85.5
Strongly disagree	5	9.1	9.1	94.5
Neutral	3	5.5	5.5	100.0
Total	55	100.0	100.0	

Source: Author (2022).

From the finding from table 5.6, 36.4% of the respondents agree that there is a comprehensive education and training program covering the core competencies of driving and road safety, 14.5 strongly agreed, 34.5% disagree, 9.1 strongly disagree and 5.5% of respondents could either disagree or agree.

Table: 5.7. Road safety knowledge systems in Zambia have effectively transitioned from actions based on intuition, judgment, and tradition to those based on structured institutional, empirical evidence, and technology

Table 5. 7: Road safety knowledge systems in Zambia

Detail	Frequency	Percent	Valid Percent	Cumulative Percent
Agree	26	47.3	47.3	47.3
Strongly agree	7	12.7	12.7	60.0
Disagree	20	36.4	36.4	96.4
Strongly disagree	1	1.8	1.8	98.2
Neutral	1	1.8	1.8	100.0
Total	55	100.0	100.0	

Source: Author (2022).

From the finding from table 5.7. above 47.3% of the respondents agree that road safety knowledge systems in Zambia have effectively transitioned from actions based on intuition, judgment, and tradition to those based on structured institutional, empirical evidence, and technology, 12.7% strongly agreed, 36.4% disagree, 1.8% strongly disagree and 1.8% of the respondent could either disagree or agree.

Table 5. 8: Motorists have appropriate knowledge and skills for effective implementation of the road safety management system

Detail	Frequency	Percent	Valid Percent	Cumulative Percent
Agree	22	40.0	40.0	40.0
Strongly agree	13	23.6	23.6	63.6
Disagree	18	32.7	32.7	96.4
Strongly disagree	2	3.6	3.6	100.0
Total	55	100.0	100.0	

Source: Author (2022)

From the finding from table 5.8 above, 40.0% of the respondents agree that Motorists have appropriate knowledge and skills for effective implementation of the road safety

management system, 23.6% strongly agreed, 32.7% disagreed, and 3.6% of the respondents strongly disagreed.

Table 5. 9:The digitally platform shares a best practice review of road safety risks for older road users

Detail	Frequency	Percent	Valid Percent	Cumulative Percent
Agree	14	25.5	25.5	25.5
Strongly agree	6	10.9	10.9	36.4
Disagree	25	45.5	45.5	81.8
Strongly disagree	5	9.1	9.1	90.9
Neutral	5	9.1	9.1	100.0
Total	55	100.0	100.0	

Source: Author (2022)

Table 5.9. above indicates that 25.5% of the respondents agree that digital platform shares a best practice review of road safety risks for older road users, 10.9% strongly agreed, 45.5% disagree, 9.1% strongly disagree and 9.1% of the respondent could either disagree or agree.

5.3.1.2 To what extent do you consider the following motorist behaviorally factors as important to road safety management

Table 5. 10: Not wearing seat belts and other seat belt

Detail	Frequency	Percent	Valid Percent	Cumulative Percent
Good	3	5.5	5.5	5.5
Bad	52	94.5	94.5	100.0
Total	55	100.0	100.0	

Source: Author (2022)

The respondents indicated that not wearing seat belts and other safety wears is important to road safety management. To this effect, the majority (94.5%) indicated that it is bad not to wear seat belts and other safety wear while 5.5% of the respondents said it is good as shown in Table 5.10

Table 5. 11: Consuming illegal drugs

Detail	Frequency	Percent	Valid Percent	Cumulative Percent
Good	8	14.5	14.5	14.5
Very Good	5	9.1	9.1	23.6
Bad	42	76.4	76.4	100.0
Total	55	100.0	100.0	

Source: Author (2022)

From the finding from table 5.11. Above, 14.5% of the respondents said consuming illegal drugs is good, 9.1% said is very good and 76.4% of the respondents said is a bad behavior to consume illegal drugs**.**

Table 5. 12: Using mobile phone

Detail	Frequency	Percent	Valid Percent	Cumulative Percent
Good	7	12.7	12.7	12.7
Very Good	3	5.5	5.5	18.2
Bad	45	81.8	81.8	100.0
Total	55	100.0	100.0	

Source: Author (2022)

The respondents indicated that using a mobile phone is important to road safety management. From table 5.12 above, 12.7% of the respondents indicated that it is not a good behavior to use a mobile phone on road, 5.5% indicated that is very good and 81.8% indicated that it is good behavior to use a mobile phone while driving.

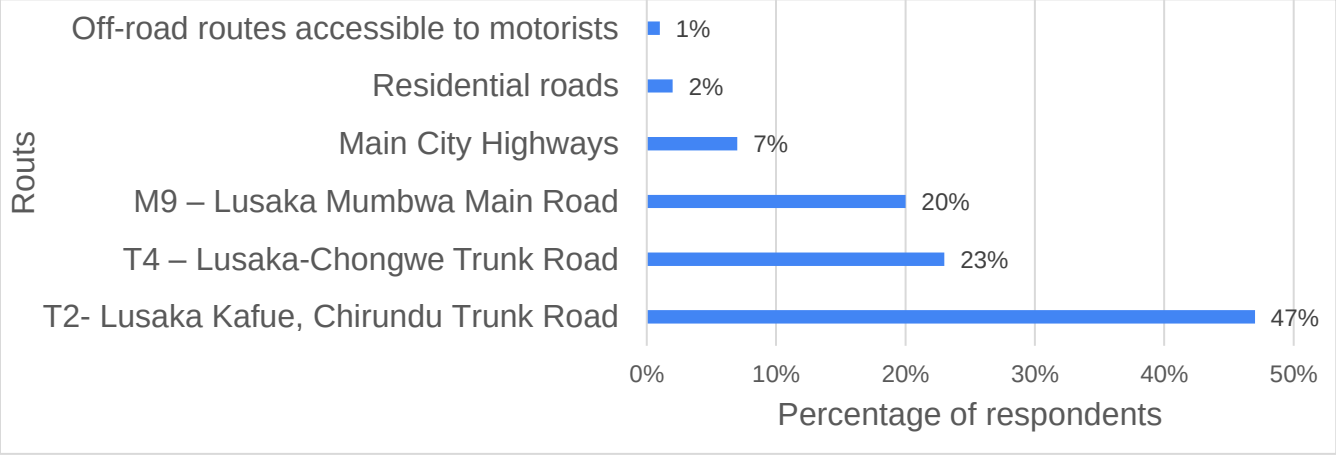
Table 5. 13: Not observing road signage

Detail	Frequency	Percent	Valid Percent	Cumulative Percent
Good	7	12.7	12.7	12.7
Very Good	2	3.6	3.6	16.4
Bad	46	83.6	83.6	100.0
Total	55	100.0	100.0	

Source: Author (2022)

From the finding from table 5.13. Above, 12.7% of the respondents indicated that it is a good behaviour not to observe road signs for road safety management, 3.6% said it is very good and 83.6 of the respondents indicated that it is a bad behaviour not to observe road signs.

5.3.1.3 Rank the levels of road safety on the following types of roads in Lusaka. 1 being most unsafe and 5 being safest



Figures 5.14 Level of road safety

Source: Author (2022)

The results in figure 5.14 indicate that 47% of respondents ranked T2- Lusaka Kafue, Chirundu Trunk Road as the most unsafe roads,23% ranked T4 – Lusaka-Chongwe Trunk Road,20% ranked M9 – Lusaka Mumbwa Main Road,7% main city highway,2% residential roads and only 1% Off-road routes accessible to motorists.

5.3.2 Relationship between safety management systems and the reduction of road accidents in Lusaka

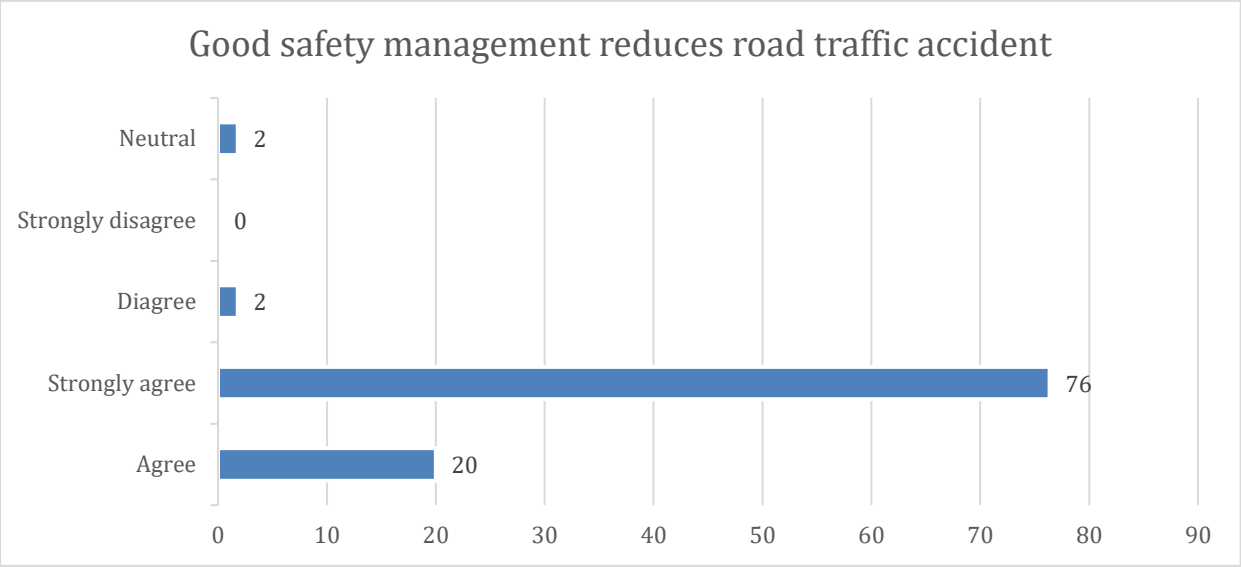


Figure 5.15 Good safety management reduces road traffic accident

Source: Author (2022)

From the finding from figure 5.15 above, most of the respondents strongly agreed that good safety management reduces road traffic accidents. 20% of the respondents agreed, 76% strongly agreed, 2% disagree and 2% of the respondent could either disagree or agree. This implies that majority of respondent strongly agree that good safety management reduces road traffic accidents**.**

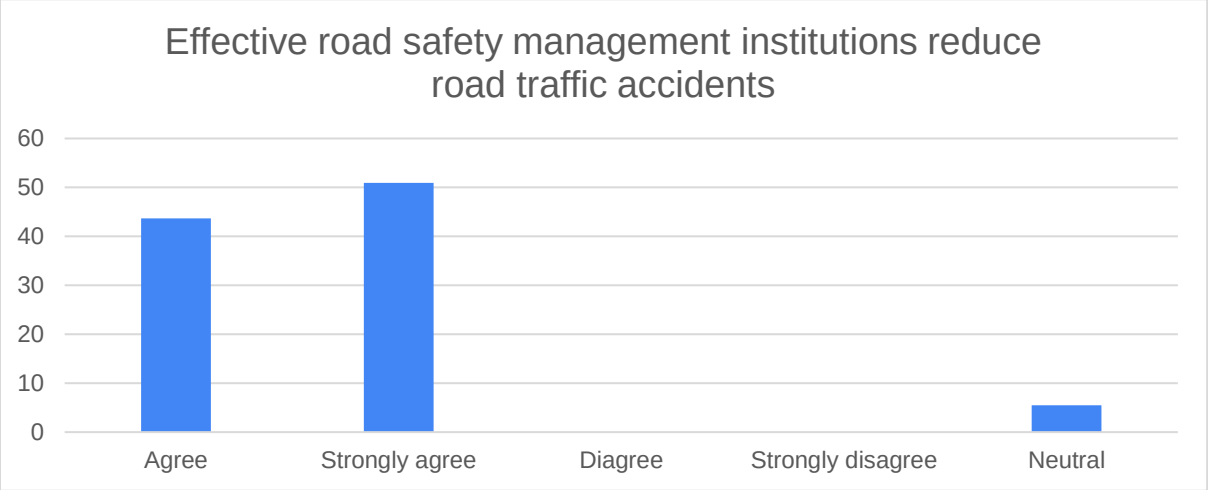


Figure 5.16 Effective road safety management institutions reduce road traffic accident

Source: Author (2022)

From the findings from figure 5.16 above, 45% of the respondents agreed that effective road safety management institutions reduce road traffic accidents, 50% strongly agreed and 5% of the respondent could either disagree or agree. This implies that majority of respondent strongly agree that effective road safety management institutions reduce road traffic accidents.

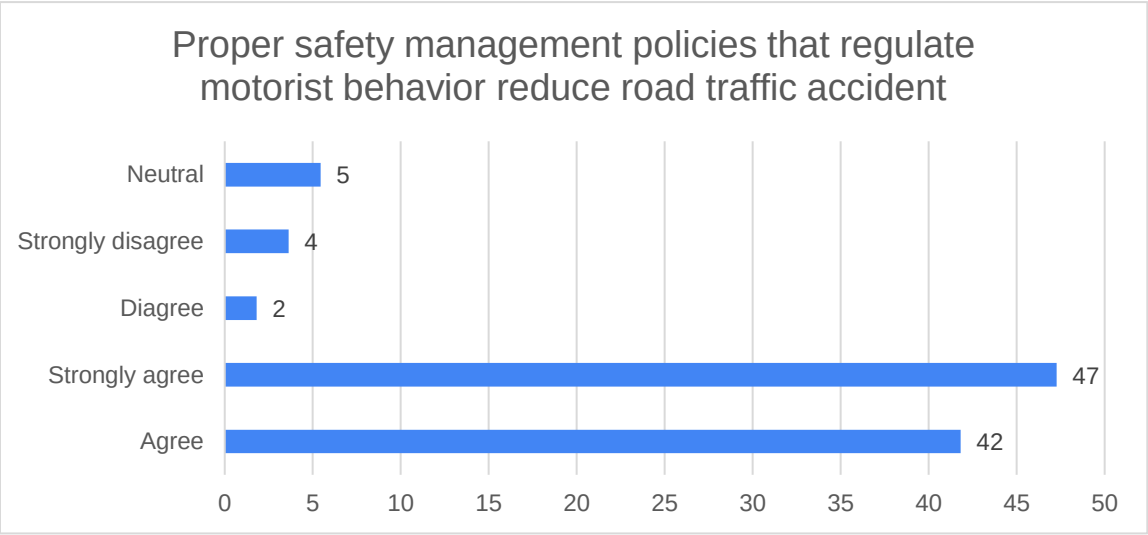


Figure 5.17 Proper safety management policies that regulate motorist behavior reduce road traffic accident

Source: Author (2022)

From the findings from figure 5.17 above, 42% of the respondents agree that proper safety management policies that regulate motorist behaviour reduce road traffic accidents, 47% strongly agreed, 2% disagree, 4% strongly disagree and 5% of the respondent could either disagree or agree. This implies that majority of respondent agree that proper safety management policies that regulate motorist behaviour reduce road traffic accidents.

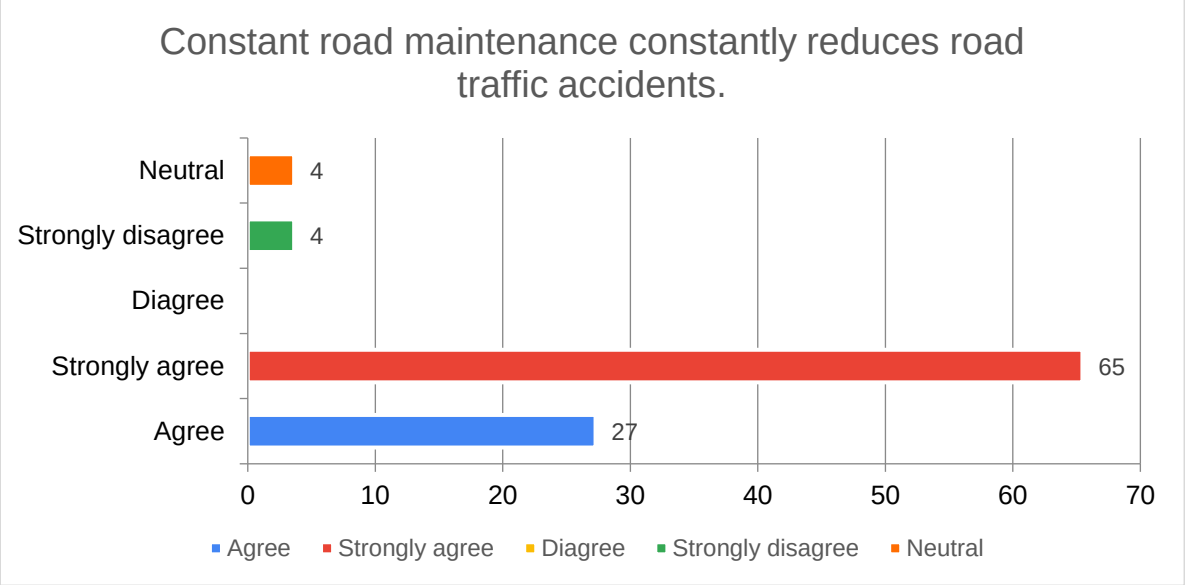


Figure 5.18 Constant Road maintenance constantly reduces road traffic accidents

Source: Author (2022)

From the findings from figure 5.18 above, 27% of the respondents agree that constant road maintenance constantly reduces road traffic accidents, 65% strongly agreed, 4% strongly disagree and 4% of the respondent could either disagree or agree. This implies that majority of respondent agree that constant road maintenance constantly reduces road traffic accidents.

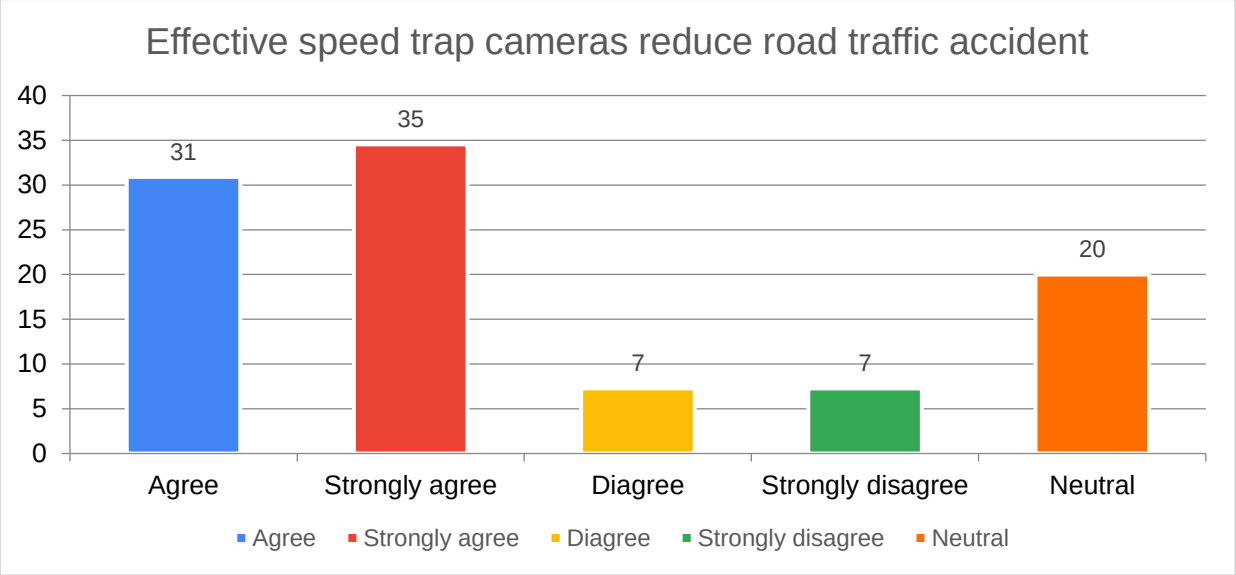


Figure 5.19 Effective speed trap cameras reduce road traffic accident

Source: Author (2022)

From the findings from figure 5.19 above, 31% of the respondents agree that effective speed trap cameras reduce traffic accidents, 35% strongly agreed, 7% disagree, 7% strongly disagree and 20% of the respondent could either disagree or agree. This implies that majority of respondent agree that effective speed trap cameras reduce traffic accidents

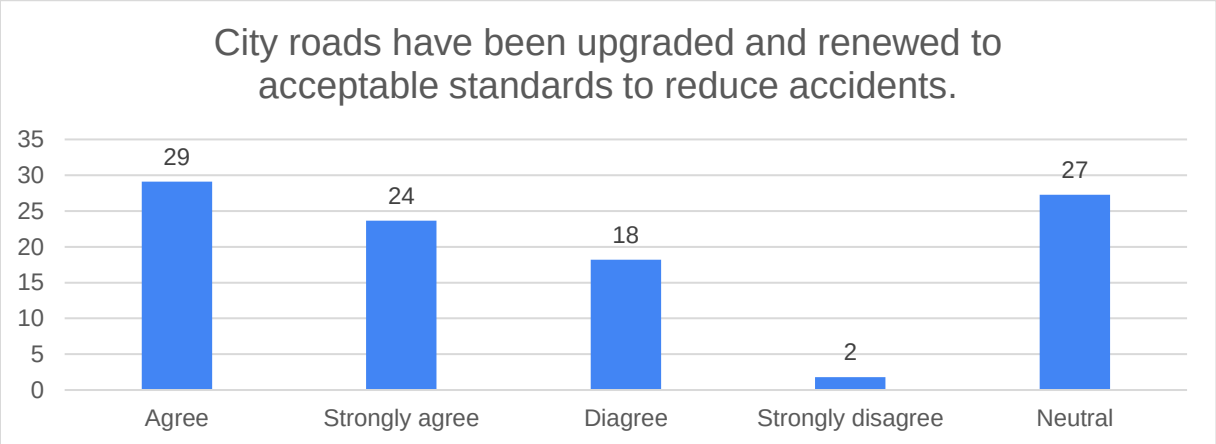


Figure 5.20: City roads have been upgraded and renewed to acceptable standards to reduce accidents

Source: (Author 2022)

Figure 5.20 above indicated that city roads have been upgraded and renewed to acceptable standards to reduce accidents. 29% of the respondents agree that city roads have been upgraded and renewed to acceptable standards to reduce accidents, 24% strongly agreed, 18% disagree, 2% strongly disagree and 27% of the respondent could either disagree or agree. This implies that majority of respondent agree that city roads have been upgraded and renewed to acceptable standards to reduce accidents.

5.4 Inferential Statistical Analysis

5.4.1 Analysis of Findings by Research Objectives

5.4.2 Factors affecting the implementation of quality road safety systems within Lusaka

The first research objective was to explore the factors affecting the implementation of quality road safety systems within Lusaka. Basing on the descriptive statistics, means were computed for the four measures affecting the implementation of quality road safety systems within Lusaka. In this section the analysis involves determining how the respondents answered the questions on the 5-Point Likert scale. This presents the means, interpreted using the following key (Table 4.X.) as one of the methods proposed by Amal, (2009).

Table 5.14: Interpretation of Means

	Interpretation of means			
	Range		Interval	Interpretation
5 point Likert Scale	From	To		
	1	1.8	0.8	Strongly Disagree
	1.81	2.6	0.8	Disagree
	2.61	3.4	0.8	Neutral
	3.41	4.2	0.8	Agree
	4.21	5	0.8	Strongly Agree

Table 5.15: Implementation of Quality Road Management Systems

		Road quality	Safety knowledge sharing	Road user attitude	Road type
N	Valid	55	55	55	55
	Missing	0	0	0	0
Mean		2.800	3.800	3.182	3.618
Std. Deviation		.8903	.4037	1.0902	.4903

Table 5.9 presents the four dimensions of implementation of quality road management systems in Lusaka. The measures of central tendency further revealed that the factors which affected the implementation of quality road safety systems within Lusaka were safety knowledge sharing (mean 3.800); and road type (mean 3.618). The descriptive statistics revealed indifference among the respondents regarding road user attitude (mean 3.182) and road quality (mean 2.800).

Correlation was undertaken to compare the implementation factors with the road safety management system.

Table 5.16: Correlations

Correlations

		Road quality	Safety knowledge sharing	Road user attitude	Road type	implementation of quality road safety systems
Road quality	Pearson Correlation	1	-.113	.897**	-.178	.648**
	Sig. (2-tailed)		.410	.000	.193	.000
	N	55	55	55	55	55
Safety knowledge sharing	Pearson Correlation	-.113	1	-.379**	.636**	.068
	Sig. (2-tailed)	.410		.004	.000	.622
	N	55	55	55	55	55
Road user attitude	Pearson Correlation	.897**	-.379**	1	-.595**	.481**
	Sig. (2-tailed)	.000	.004		.000	.000
	N	55	55	55	55	55
Road type	Pearson Correlation	-.178	.636**	-.595**	1	.107
	Sig. (2-tailed)	.193	.000	.000		.437
	N	55	55	55	55	55
implementation of quality road safety systems	Pearson Correlation	.648**	.068	.481**	.107	1
	Sig. (2-tailed)	.000	.622	.000	.437	
	N	55	55	55	55	55

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

By correlation of means, table 5.10 there was found significant relationships among the variables. Basing on the 95% confidence level, p-values <.05 represented significant relationships among the variables. In this regard, road quality had a significant relationship with implementation of quality road safety systems (sig. 0.000) and the attitude of road users (sig. 0.000). Informal road safety knowledge sharing was significantly correlated with road user attitude (sig.0.004) and road type (sig. 0.000). Road user attitude was significantly correlated with road quality (sig. 0.000); informal road safety knowledge sharing (sig. 0.004); road type (sig. 0.000) and implementation of quality road safety systems (sig. 0.000). The implementation of quality road safety systems was significantly correlated with road quality (sig. 0.000) and road user attitude (sig. 0.000). The implementation of quality road safety systems was not significantly correlated with variables whose sig. were >0.050. These were informal road safety knowledge sharing (sig. 0.622) and road type (sig. 0.437).

5.4.3 Relationship between safety management systems and the reduction in road accidents in Lusaka

The second research objective was to examine the relationship between road safety management systems and the reduction in road accidents in Lusaka. Linear Regression was conducted to establish the relationship between road safety management systems and the reduction in road accidents in Lusaka.

Table 5.17: Model Summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.931[a]	.868	.857	.1937

a. Predictors: (Constant), Safety management system, Upgraded roads, Speed cameras, Road maintenance, Safety management institutions, Safety management policies

Table 5.11 shows the model summary for the data. With an R of .931, it means that the independent variables predict the dependent variable by 93.1%. There was no big difference between the R and the R Square of .857.

Table 5.18: Analysis of Variance

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.305	4	3.076	81.952	.000[b]
	Residual	1.877	50	.038		
	Total	14.182	54			

a. Dependent Variable: Reduction in road accidents in Lusaka

b. Predictors: (Constant), Safety management system, Upgraded roads, Speed cameras, Road maintenance, Safety management institutions, Safety management policies

The ANOVA table above (Table 4.12) shows that the model was fit for the data according to the sig of .000. Thus, reduction in road accidents in Lusaka could be assessed by safety management system design; upgraded roads; speed cameras; road maintenance; safety management institutions and safety management policies.

Table 5.19: Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.205	.906		-.226	.822
	Safety management system	.494	.141	.606	3.500	.001
	Upgraded roads	0.000	.097	0.000	0.000	1.000
	Speed cameras	.032	.030	.055	1.060	.294
	Road maintenance	.046	.196	.012	.233	.816
	Safety management institutions	-.373	.138	-.465	-2.691	.008
	Safety management policies	.985	.055	.937	18.014	.000

a. Dependent Variable: Reduction in road accidents in Lusaka

Having run a multiple regression to predict road safety management systems on the reduction of road accidents in Lusaka as in table 5.13, three variables statistically significantly predicted the influence, F (4.50) = 81.952, p<0.050 at 0.000, R^2 .868. The variables which added statistically significantly to the prediction with p < .05 were safety management systems in place (sig.0.001); road safety management institutions (sig. 0.008); and road safety management policies (sig. 0.000). The variables which did not statistically significantly predict reduction in road accidents were speed cameras (sig. 0.294>0.05) and road maintenance (sig. 0.816>0.05)

5.4.4 Framework for Effectiveness of Road Safety Quality Management System

The third research objective was to develop a framework for effectiveness of the road safety quality management system in matters of road safety within Lusaka.

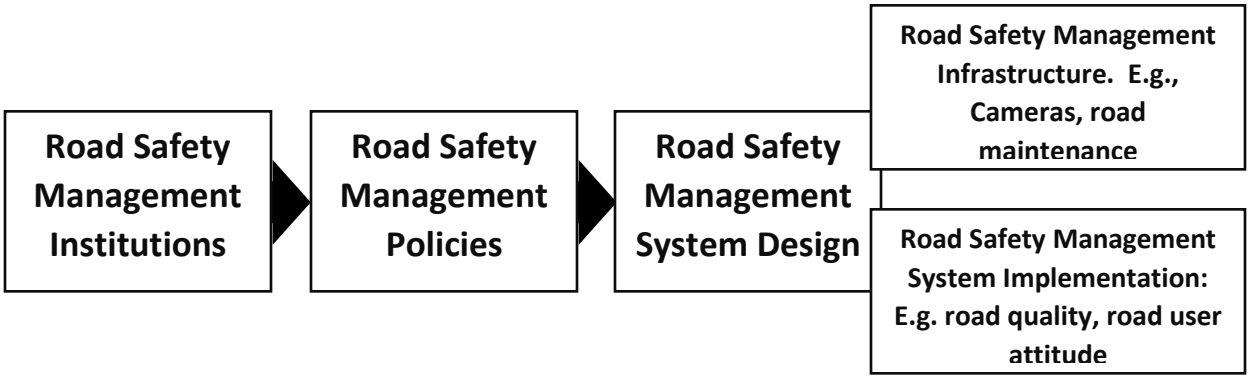


Figure 7.1. Framework for Effectiveness of Road Safety Quality Management System

The framework developed, basing on the findings of the study is that, the road safety management system in Lusaka should channel resources, firstly to the areas of immediate significance, then to other areas. In this model, it is granted that an effective road safety management system should first consider the safety management systems; road safety management institutions and road safety management policies. Within this framework, other road safety measures such as speed cameras and road maintenance can be considered. The implementation of quality road safety management systems can **be best attained by improving road quality and road user attitude.** best attained by improving road quality and road user attitudes.

5.5 Qualitative Data Analysis

In order to obtain detailed information on the challenges affecting implementation of road quality management system, interviews were conducted with key informants using a semi-structured interview guide. The findings were as outlined below:

5.5.1 Challenges Affecting Implementation of Road Quality Management System

The interviewees were asked to indicate what, in their opinion, are the challenges with road quality management system.

The challenges indicated included and not limited to;

a. Poor road infrastructure design

b. Non adherence to technical standards

c. Low uptake of recommended measures

a) Poor road infrastructure design

The research interviews revealed that poor road infrastructure design about road accidents, has posed to be a problem. The respondents indicated that road infrastructure design adopted is mainly characterized by lack of transparency and to some extent, they are mainly politically driven.

“Road infrastructure design has a key role in reducing road traffic crashes as it affects how road users interact with the roads. Road infrastructure should be forgiving and self-explaining. Despite having standards, the practices have not been adhered to as per provision in the ZPPA Act.”- Anonymous respondent

It is worth noting that this in itself has the potential to hinder the progress or implementation of a good road quality safety management system.

b) Non adherence to technical standards

The respondents indicated that road safety management system face a problem relating to non-adherence to technical standards. The interviews revealed that it is good practice to have technical standards. Usually, if technical standards are not set in advance, the accidents can be occurring frequently.

“Mostly technical standards are not thoroughly set and as a result they normally cause accidents. This has had adverse effects with regards to having a strong foundation for the road safety management system, thereby affecting the level of its sustainability” – Anonymous respondent

c) Low uptake of the recommended measures

The interview revealed that one of the main issues with the road safety management system has been the low acceptance of the suggested solutions by the implementing agencies. The main emphasis has been on guaranteeing quality while ignoring the results.

About 70% of the current road traffic accidents have experienced poorly specified frames of reference, according to the research. Here, the emphasis was on trying to assure quality work during the implementation process, but the deadline remained unclear, therefore the end resulted in a delay in the process of putting the proposed measures into action. Respondent RDA/Ministry of Finance Any effective management system for traffic safety makes sure that the team adheres to the mandate and works within its parameters. The agencies should anticipate issues throughout the implementation stage because they are likely to be a recipe for failure after recommended measures are defined and disseminated for agreement.

5.5.2 Technical Inputs for Establishing Quality Road Management System Framework in Road Accidents

The Agency conducts Road Safety Audits and Road Safety Inspections and recommended measures for road safety improvements to cater for all road users. The recommendations are submitted to the Road Development Agency and the Lusaka City Council. Measures aimed at ensuring that the needs of all road users are catered for. This will be enhanced through the implementation of the Non-Motorized Transport (NMT) Strategy. The respondents indicated that there is a need to establish an effective road safety management system for road accident.

CHAPTER SIX

DISCUSSION AND ANALYSIS OF RESULTS

6.1 Introduction

The chapter includes a discussion and analysis of the study findings from Chapter 5 that were previously given. The chapter also includes previously published works from chapters 2 and 3. The chapter also offers the suggested framework for managing the quality of road safety, which aims to improve the use of a safe road management system in accidents.

6.2 Discussion of Research Findings

The discussion of the research findings was done in line with the established research objectives.

6.2.1 Factors affecting the implementation of quality road safety systems

Based on the research, all respondents believed that monitoring road safety is a crucial component that should be successfully executed in order to manage traffic accidents on Lusaka roads. This suggests that a quality road safety management system in place will almost certainly result in a decrease in traffic accidents. According to the results of table 5.8 in chapter 5, 40.0% of respondents believe that drivers have the necessary knowledge and abilities to implement the road safety management system effectively, while 23.6% strongly agreed, 32.7% disagreed, and 3.6% of respondents severely disagreed. This is true in that an efficient safety management system reaction plan makes accident mitigation simple. In order to fulfil road safety goals in terms of time, quality, safety, and environmental sustainability, managing accidents has been acknowledged as a very significant procedure, according to Mills (2001), who supports this importance of quality safety road management system in traffic accidents. A variety of criteria are connected to high-quality road management systems, according to the

research. Like other projects, the quality safety road management system is susceptible to a number of factors, such as;

6.2.1.1 Factors of road safety are learned through formal institutions concerned with driving and road safety

The study found that one of the main elements of safety-related road management systems was driving and traffic safety. According to the results, 49% of respondents agreed, 25% strongly agreed, 20% disagreed, 2% severely disagreed, and 4% of respondents neither disagreed nor agreed under this aspect. Learning about road safety from official institutions can help prevent the number of incidents on the roads from declining. (Simuyemba) (2018).

6.2.1.2 Safety knowledge was shared through informal channels among motorists

According to the study, drivers communicated safety information among themselves informally. According to the results, 47.3% of respondents agreed that motorists communicated safety information informally; 12.7% strongly agreed; 30.9% disagreed; 9.1% severely disagreed; and 3.6% did not know whether to agree or disagree. According to the responders, failing to share safety knowledge can make it more difficult to successfully execute the safety road management system. It was shown that any kind of delay in the process of ensuring the transfer of safety information has a significant impact on how quickly safety management systems are put into place. Zambia's road safety knowledge systems have successfully moved away from practices based on hunches, judgment, and tradition toward those based on institutional structure, empirical data, and technology (Roberts, 2006).

The researcher claims that it is exceedingly challenging to guarantee that the implementation gets started as intended when road safety knowledge is poorly defined and overly bureaucratic. This is due to the fact that this delay has additional issues, which if resolved quickly would result in traffic accidents. It is important to remember that a lack of knowledge sharing about road safety leads to an increase in accidents,

which has an impact on the sustainability of the safety road system (Bhalla and Gleason, 2020).

6.2.1.3 Road safety is best learned by experience

One of the main contributing elements to traffic accidents was experience. According to the research, there is a high likelihood that the safety system will encounter opposition during implementation and ultimately fail if the appropriate measures are not taken and stakeholders are not properly included. As can be seen from the results, 36.4% of respondents agreed that the best way to learn about road safety is through experience, 23.6% strongly agreed, 32.7% disagreed, 3.6% severely disagreed, and 6% could not decide whether they agreed or disagreed.

According to the researcher, there is a significant risk to the implementation of the road safety system if the impacted community or people are not actively taken into account during the experience-gaining process. The participants stated that the media has been a useful tool for raising awareness of and educating about road safety (Lubbe 2018).

6.2.1.4 Lack of feasibility study

The research study also showed that the practicality of implementing a road safety management system is hampered by the lack of an efficient and comprehensive feasibility evaluation. How well the road safety management system is implemented will depend on how well the feasibility study was executed. The research participants claim that a feasibility study can verify that a road safety management system is both technically and legally possible as well as economically justifiable before it is implemented. The researcher claims that a feasibility study can help to ensure that the intended technology is both environmentally and economically feasible. A feasibility study makes it simple to see the system's effects clearly (Hakkert, 2007).

6.2.1.5 Digital platforms

The research also revealed that one of the main elements in such systems, which are aspects connected with the deployment of road safety management systems, is the use of digital platforms. The researcher reveals that table 5.9 of chapter 5 shows that 25.5% of respondents agree, 10.9% strongly agree, 45.5% disagree, 9.1% strongly disagree,

and 9.1% could not decide whether they agree or disagree that a digital platform shares a best practice review of road safety risks for older road users. The researcher argues that refraining from using a mobile phone is a crucial component of managing road safety (Makwenda, 2021).

The difficulty in acquiring the right-of-way and receiving environmental clearance are two of the three main problems in road experience facing concessionaires, according to Woodridge (2002), who argues that these findings. Identification of the variables influencing management scope definition, timeline, strategy, and job execution plan is necessary for successful management (Karaulova, Kramarenko, & Shevtshenko, 2008).

A number of key causes of accidents were also identified in Khans' (2013) research study on traffic accidents. The environmental component, which included detrimental environmental effects, was one of these elements. Therefore, in order to address this, it is required to undertake road impact assessment research in order to determine the negative effects of the management system as well as the necessary actions that must be taken.

6.2.1.6 Not wearing seat belts, consuming illegal drugs and other safety wear

The study found that managing road safety depends on people using seat belts and other safety gear. Accordingly, the findings from Tables 5.10 and 5.11 show that 14.5% of respondents said using illegal drugs is good, 9.1% said it is very good, and 76.4% of respondents said it is a bad behaviour to use illegal drugs. The majority (94.5%) of respondents indicated that it is bad to not wear seat belts and other safety wear, while 5.5% of respondents said it is good (Ramstedt, 2014).

6.2.1.7 Other factors

The study revealed that good safety management, effective road safety management institutions, proper safety management policies that regulate motorist behavior, constant road maintenance and effective speed trap cameras reduce road traffic accidents

The respondents indicated that good safety management and effective road safety management institutions reduce road traffic accidents. They also indicated that proper

safety management policies that regulate motorist behavior and constant road maintenance constantly reduces road traffic accidents.

6.2.2 Challenges affecting implementation of road quality management system

The study found that poor road infrastructure design has contributed to an issue with regards to traffic accidents. According to the respondents, lack of transparency and, to some extent, political motivation are the key characteristics of the road infrastructure designs that have been adopted. The study found that because it influences how people utilise the roadways, road infrastructure design has a critical role in preventing traffic crashes. The researcher concurred that it is important to note that this in and of itself has the ability to obstruct the development or implementation of an effective system for managing the quality and safety of roads.

The study revealed that there had been a breakdown in the process of including all significant stakeholders in the road quality safety management system. The respondents claimed that not all significant parties were totally engrossed in the implementation of the road quality safety management system. The researcher points out that the feasibility and sustainability of the road safety system may be undermined by insufficient engagement of all key stakeholders in the implementation of a road quality safety management system.

This fact is supported by Hendrickson's (2000) argument that when the primary road safety system characteristics and deliverables are not defined beforehand, different stakeholder expectations manifest. According to Suseno et al. (2015), inclusive stakeholder involvement in the implementation of the road quality safety management system is a crucial procedure because it enables successful participation and acceptance of the road safety system.

The research found that non-adherence to technical standards is a problem for important initiatives like implementing a road quality safety management system. The interviews suggested that having technical standards is a smart idea. Accidents can occur regularly if technical standards are not established in advance. In light of this conclusion, Silungwe (2015) argued that adhering to technical standards is always best

practise. Usually, road quality safety is decreased if the technical standards are not followed.

The research revealed that low uptake of the recommended measures by the implementing agencies has been one of the prominent challenges concerning road safety management systems. Kerzner, (2009) supports this finding by stating that any successful implementation system ensures that the team sticks to the scope and operates within the terms of reference. If the recommended measures are defined and communicated for agreement, then the motorists should anticipate problems, which are likely to recipe failure.

6.2.3 Relationship between safety management systems and the reduction of road accidents in Lusaka

The researcher conducted interviews and issued questionnaires to various road users and agencies in the study city in order to gather opinions from motorists regarding the relationship between safety management systems and the decline in accidents in Lusaka. Out of 19 roads in Lusaka, 14 had road signs, according to the majority of respondents who were asked about road signs and markings. However, either there were no road markings at all on 17 of the 19 roads, or the markings were faded. This supports the opinions of Zambian road users, who identified poor road infrastructure as the second-most likely cause of traffic accidents after human error. The findings of this study about road signs and markings demonstrate that there is a significant correlation between safety management systems and the decline in accidents in Lusaka, since most roads with signs and markings experience fewer accidents than those with no signs or ones that are faded. According to a survey by the European Union Road Federation (ERF), road signs and markings are among the most affordable safety solutions that are accessible to road authorities. In Durham City, research on road signs and markings revealed, among other benefits, a 50% decrease in accidents, a decrease in speed in the 85th percentile, and a decrease in the number of cars exceeding the posted speed limit. There is proof that road signs and markings have an impact on how drivers behave. Therefore, policies that directly affect how drivers behave while driving are the most effective at reducing traffic accidents.

As the primary causes of accidents in Lusaka, the majority of respondents mentioned insufficient public awareness-raising, insufficient enforcement, and insufficient distribution of the road traffic regulations. According to respondents, the most common causes of road traffic accidents in Lusaka include inadequate road infrastructure, intoxicated driving, and general disregard for traffic laws. Respondents emphasised poor road upkeep in relation to the infrastructure of the roads. The human factor was considered first among the causes of road traffic accidents in Zambia by respondents, as was predicted. A high incidence of accidents is strongly correlated with this feature. Therefore, the safety management system that is associated with the decrease in accidents in Lusaka includes good road infrastructure, sober driving, and obeying traffic laws.

The findings show that most drivers admitted to underestimating the speed of an approaching car when overtaking, and most of those who were interviewed claimed they overtook someone who they hadn't seen signaling a right turn. A substantial number of drivers, notably those operating sport or suburban utility vehicles, sometimes known as SUVs, were observed overtaking on curves or straightaways during actual highway observations. As a result, the amount of road traffic incidents, particularly on Lusaka roads, seems to be significantly influenced by this particular human component, misjudging clearance while overtaking or overtaking on bends and solid lines. According to the WHO World Report on Injury Prevention (2018), mistakes such vehicle loss of control, excessive speed, poor judgment, and incorrect overtaking were to blame for 44% of all crashes that the Zambian police reported. Rather than merely advising the driver to be more cautious when overtaking, dealing with the road infrastructure may be more beneficial in the overtaking situation. This demonstrates that there is a connection between the decrease in accidents and safety management systems

The WHO Global Plan for the decade of action for road safety (2011-2020) calls on member nations to carry out initiatives in accordance with the five pillars of road safety: management of road safety, safer roads and mobility, safer cars, safer drivers, and post-crush response. The WHO Global Status Report on Road Safety (2018) has been critically analysed, and it is clear that Zambia's weakest pillar is safer roads and

mobility. Once more, this is consistent with the study's conclusions and emphasises how urgently Zambia needs to fix its road infrastructure. Certainly, the Zambian government has taken action to solve this issue through Pave Zambia 2000 and Link Zambia 8000. However, there is still much that has to be done about the condition of current roads, including repairs, road signage, motorist education, and road markings. Implementing a road safety management system is one of the most important tactics Zambia should employ to lessen traffic accidents, according to research respondents.

6.3 Framework for the Effectiveness of the Road Safety Quality Management System in Matters of Road Safety Within Lusaka

Along with identifying the difficulties, the research revealed important technological components for a framework for implementing a road safety management system. The author agrees that institutional capability and stakeholder participation require checks and balances in order for a road safety management system to be effective. The ability to successfully counteract emerging issues, particularly in road safety management systems, depends largely on the strength of these categories. A management framework with these technical inputs will undoubtedly contribute to a decrease in future traffic incidents.

The National Road Fund Agency (NRFA), the Road Development Agency (RDA), the Ministry of Finance (MoF), the Road Transport, and the Safety Agency make up the framework for the efficiency of the Road Safety Quality Management System in areas of road safety in Lusaka (RTSA). Any amount of inefficiency with these organizations, which make up the main regulatory framework for road safety management systems, warrants quick attention. This is due to the fact that the process's viability is jeopardized if the system's legal regulatory framework continues to be unsuccessful since it will lack the support or backup of the legal system that it sorely needs. These government organizations play a crucial role in supplying primary data on the viability and planning techniques involved in the deployment of road safety management systems.

According to the study's findings, businesses must foster an environment that facilitates the establishment of a management system for road safety and accident management. This was accomplished by the board of directors approving the firm's

organizational strategy and giving management complete authority to implement it. Additionally, all of these processes must take road safety management systems into account. As a result, all drivers and road agencies can include management aspects into road safety management system regulations to benefit from safety management.

The RTSA should establish and implement a Road Safety Strategic Plan with a thorough monitoring and assessment Framework to ensure the effectiveness of the Road Safety Quality Management System in areas of road safety within Lusaka. An evidence-based bundle of interventions with precise coverage goals should be included in the strategic plan. In order to increase road traffic enforcement, road user sensitization and behavior change campaigns, do not drink and drive campaigns, area-wide speed calming, and other speed control measures, the Zambian government should give the RTSA and Zambia Police more financial, material, and logistical resources. The Zambian government should develop a special strategy through RTSA to protect vulnerable road users, including cyclists, motorcyclists, and pedestrians.

Zambia should consider implementing a framework for altering road user behavior through measures that affect the road user while the road is being used in order for the Road Safety Quality Management System to be effective in areas of road safety inside Lusaka. This covers advancements in road marking, cautionary signage, speed indicator technology, etc. The Road Fund Agency should immediately allocate funds to the Road Development Agency and Local Authorities to enhance road markings and signage. In order to produce evidence for its initiatives and to inform road safety policies and strategies from regional and international evidence.

6.3.1 Rationale for Developing the Framework

The study used the results of the literature review, theoretical and conceptual analysis, as well as the quantitative and qualitative data analysis, to create a framework for managing the quality of road safety. By guaranteeing that high-quality and standard road networks are implemented within given quality requirements and achieve user satisfaction, the proposed framework is intended to improve road safety quality management systems.

The framework used by the study was based on the Tripod Beta theory, which Reason developed in 1990 and maintains that accidents occur as a result of a confluence of errors and negligence at several organizational levels (Katsakiori, and Sakellaropoulos, 2009). The Tripod approach contends that a lack of controls and inefficient barriers are to blame for accidents (Khakzad, 2012). Unknown forces functioning within organizations cause unsafe activities (active failures). These methods, referred to as BRF, deal with difficulties with individuals, groups, and technology (Kerlinger, 2015).

6.3.2 Framework Validation

Misra et al (2012) the success of any suggested metric is contingent on the development of its validation, it's understanding by its users, and a close link between the metric and the attribute intended to be assessed. The process of attempting to guarantee that the framework accurately reflects the traits of the general population and is not restricted to the samples used in the estimation is known as validation (Al Shamsi, 2019). According to Banda's theory from 2019, validation of the framework aims to determine whether the measure it is to apply is adequate; as a result, validity raises the framework's level of trust and confidence.

The developed road safety quality management framework was validated by distributing surveys and conducting semi-interviews with three technocrats from the traffic department of the Zambian police, three RATSA officers, and three officers from the ministry of local government and development, for a total of nine participants. The technocrats from the traffic department of the Zambian police, the RATSA officers, and officers from the ministry of local government and development indicated that most of the motorists do not follow the attributes of the road safety quality management system. There must be a strong sense of involvement by each stakeholder making the implementation process a significant challenge. This has made traffic regulations and law offenders get away with any violations and renewal of licenses to have no link to traffic offenses or violations committed by the driver or the car owner.

6.3.3 Feedback from expert

Table 6. 1: shows the areas of concern that the key validators commented on.

Area of concern	Comments
Safety Institution	• Road crash prevention demands a methodical, organized reaction, spearheaded by an organization with the necessary resources and accountability.
Safety Management policy	• To establish a high-quality safety management system, an effective road safety management policy is required for direction.
Road quality systems	• Every production process requires a quality system, and the construction of roads and highways is no different. The requirement for quality control on these criteria has significantly expanded in recent years due to considerable increases in traffic intensities.
Strategic meetings (Stakeholder)	• For road safety to gain widespread acceptance, it needs time and planning. But the system management framework needs to specify the expected unique stakeholder responsibilities.
Safety Culture	• It is necessary to have a thorough safety culture that outlines the procedures for managing the quality and safety of the roads. Poor safety cultures have been linked to numerous serious accidents and injuries, and they can have an equal impact on safety results as the safety management system itself.
Road design assessment	• This is an important aspect of quality control and it should be a continuous process to achieve desired safety measures that will effectively reduce traffic accidents
Environmental and environment	• The framework was supposed to highlight how climate issues will be handled, this is critical because it comes unexpected and may affect the whole safety management systems (framework needed to outline a force majeure strategy)

Monitoring and evaluation	• Safety management is not a desk issue, it involves a lot of practical assignments and including monitoring and evaluation on the framework makes it easier to enhance the road safety quality management.

Analysis of the Expert's comments

The researcher analyzed the comments from the validators per thematic area as follows:

Safety Institution

The research ascertains the Preventing death and serious injury in road crashes requires a systematic, planned response, led by an appropriately resourced and accountable institution.

Safety Management policy

The researcher was in agreement as this reflected on the framework as one of the critical issues that effective road safety management policy is necessary for guidance to make it possible to achieve a quality safety management system

Road quality systems

Every production process requires a quality system, and the construction of roads and highways is no different. The necessity for quality control on these criteria has significantly increased in recent years as a result of large increases in traffic intensities. On the subject of road quality systems, the expert and researcher perspectives are in agreement.

Strategic meetings (Stakeholder)

The researcher was in agreement that building grassroots support for road safety takes time and strategy. However, the framework needed to outline the expected specific stakeholder roles in the system management framework. This is recommendable for the framework to be adaptable and comprehensive.

Safety Culture

The researcher concurs with the opinion of the experts that a thorough safety culture outlining the methods of managing the quality of the roads has to be improved. Too many serious accidents and injuries have been caused by poor safety cultures, which can have an equal impact on safety results as the safety management system itself within a company.

Road design assessment

This is an important aspect of quality control and it should be a continuous process to achieve desired safety measures that will effectively reduce traffic accidents.

Environmental and environment

The framework was supposed to highlight how climate issues will be handled, this is critical because it comes unexpected and may affect the whole safety management system (framework needed to outline a force majeure strategy). The researcher acknowledges the expert view and is in agreement.

Monitoring and evaluation

The researcher affirms the fact that Safety management is not a desk issue, it involves a lot of practical, assignments and monitoring and evaluation of the framework making it easier to enhance road safety quality management.

6.4 CHAPTER SUMMARY

This chapter provided a discussion and analysis of the research findings on road and safety management systems. It also presents a proposed road safety quality management System framework that is suitable for the enhancement of safety management institutions. It also outlined the validation of the framework.

The next chapter considers the conclusion, recommendations, limitation and recommendation.

CHAPTER SEVEN

CONCLUSION AND RECOMMENDATIONS

7.1 Introduction

This chapter presents the conclusion drawn from the analysis and discussion of the research findings and puts across recommendations to resolve the research problem. It further endeavors to meet the objectives earlier outlined by interrogating the research questions. The chapter also outlines the research's contribution to the body of knowledge and the limitations of the study.

7.2 The effectiveness of the implementation of road safety quality management systems- the case of Lusaka main roads.

The study was aimed at assessing the effectiveness of the Implementation of Road Safety Quality Management Systems- the Case of Lusaka Main Roads. It sought to determine and understand the relationship between road safety management systems and accidents. The research questions were answered as indicated below:

7.2.1 What factors affect Lusaka's implementation of quality road safety systems?

The study came to the conclusion that controlling road safety is a crucial component that should be successfully executed in managing traffic accidents. This suggests that the decrease in traffic accidents is virtually certain with an efficient quality road safety management system in place. This is true in that an efficient safety management system reaction plan makes accident mitigation simple. The study also showed that the lack of an efficient and thorough feasibility study hinders the viability of the implementation of a road safety management system. Inadequate funding for road maintenance negatively impacts the effectiveness of road and safety implementation measures, weakening the institution's sustainability and ultimately leading to poor coordination among stakeholders. The viability of implementing the road safety measures is determined by conducting an efficient feasibility analysis. The study also found that informal channels were used by drivers to exchange safety knowledge. It was shown that any kind of delay in ensuring that safety knowledge is shared has a

significant impact on how quickly safety management systems are implemented. Zambia's road safety knowledge systems have successfully moved away from practices relying on hunches, judgment, and tradition toward those supported by institutional structure, empirical data, and technology.

The survey came to the additional conclusion that absence of digital platforms and failure to use a seat belt were among the key elements impacting traffic safety and contributing to numerous accidents since most drivers and motorists do not follow.

7.2.2 What is the relationship between safety management systems and the reduction of road accidents in Lusaka?

The study concluded there is a high relationship between safety management system and reduction in road accident. There is high possibility to have less accidents by having a well-established road safety management system. The study father concluded that good safety management system effective road safety management institutions, reduces, proper safety management policies that regulate motorist behavior, Constant Road maintenance constantly, effective speed trap cameras, upgraded and renewed city road to a standard level reduces traffic accidents.

The study concluded that well established road safety institution is a key to providing road safety quality management to minimize critical road accidents and protect the motorist and other road users(public) To effect this, a road safety quality management system framework was developed by utilizing road safety elements such as pavements, traffic lights, humps, drainage systems, road signs etc.

7.2.3 Framework for the effectiveness of the road safety quality management system in matters of road safety within Lusaka

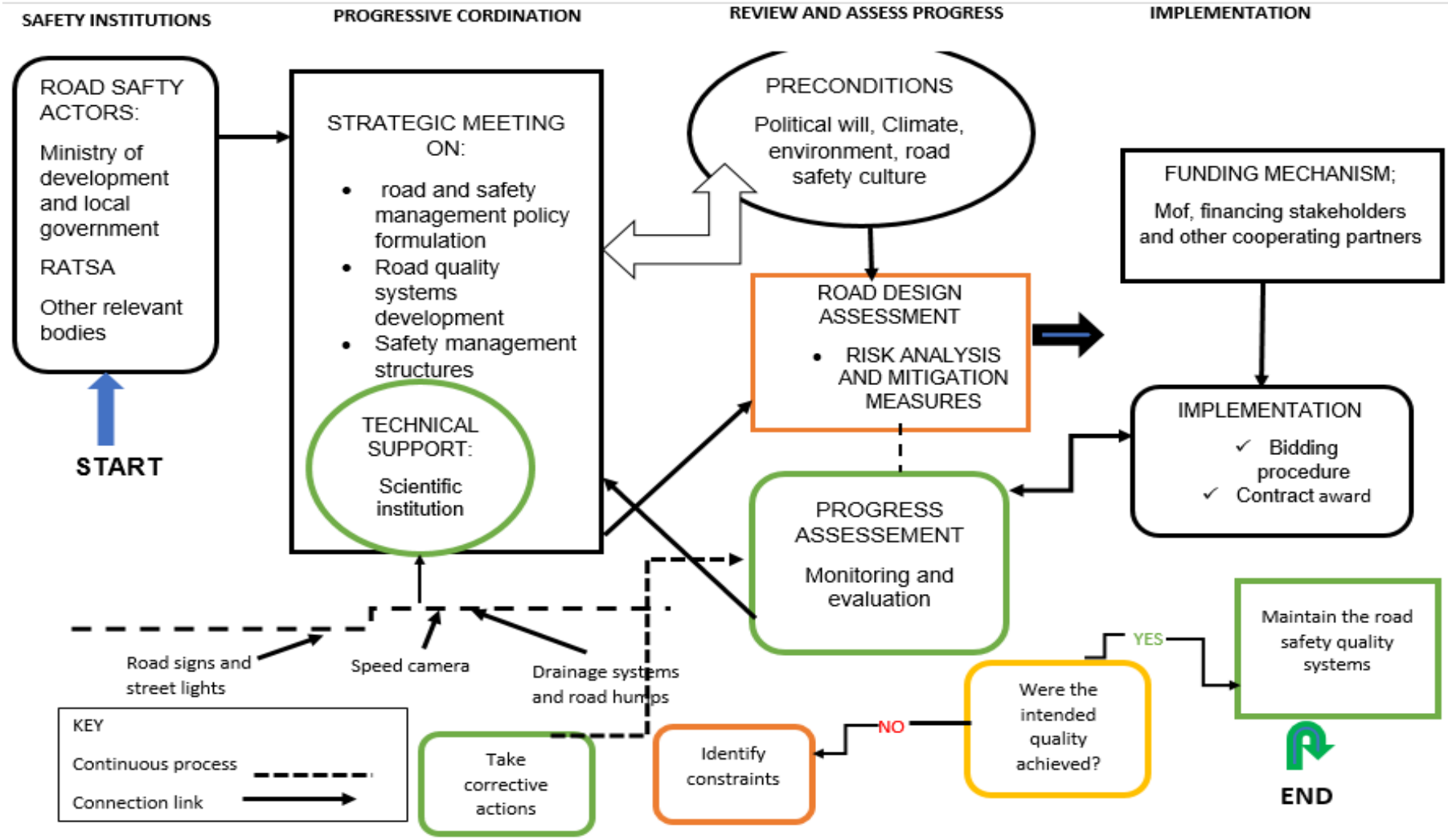


Figure 7.1.A proposed road safety quality management framework

Source: Author (2022)

7.3 Recommendations

i. The study recommends that there should be the effective adoption and continuous implementation of road safety quality management systems such as adequate dissemination of the road traffic regulations, adequate sensitization of the public, adequate enforcement, having effective road safety management institutions, proper safety management policies that regulate motorist behavior and installing effective speed trap cameras on public roads to ensure the safety of road users.

ii. Study also recommends that there must be continuous professional training in road and safety institutions on the importance of road safety management systems and this will definitely be a trickle down to the public hence this will improve road user awareness of safety measures.

iii. The study recommends the adoption of the proposed framework with room for further improvements

7.4 Future Research Areas

The study suggested the following as potential areas for additional/future research

i. The research aimed to assess the effectiveness of the implementation of road sa fety quality management systems. In light of this, the study suggests analysing t he impact of Road Safety Quality Management Systems in road construction industry.

ii. Due to time and budget constraints, the study could only be undertaken in the district of Lusaka; therefore, it suggests that similar research be done in other districts to further explore and enlarge the findings.

7.5 Contributions To Body of Knowledge

The establishment of the proposed sustainability framework for the implementation of road safety quality management systems on recognized critical success factors is the main contribution of this research to the body of knowledge. This might help to improve road safety quality management systems to assure the safety of all road users and, eventually, to observe a decrease in accidents caused by traffic. Additionally, the study

fills in knowledge gaps about how road safety quality management systems affect the decline in traffic accidents.

7.6 Limitations Of the Study

i. Some of the respondents felt the questionnaire was too lengthy and were unable to commit to finishing it out as a result. As a result, it was difficult to get all responders to participate fully.

ii. It was challenging to get qualitative data from some of the informants since they kept postponing the interview owing to prior commitments, and some of them would only delegate after multiple requests. This made it more challenging to swiftly obtain more meaningful information.

7.7 Chapter Summary

Increasing the quality of the road infrastructure or controlling traffic within city limits are two modern approaches to enhancing road safety. Road infrastructure expansion improves driving safety. On the other hand, the quality of the road infrastructure is improving, which makes driving more appealing. The danger of an accident rises with the number of personal vehicles and the volume of traffic. The new approach to improving road safety is to maintain or grow the number of passengers using public transportation. Finding fresh solutions to the problem of improving road safety and the financial viability of bus transportation is important. It is possible to transport passengers with drivers who are less likely to have accidents by supporting bus transportation.

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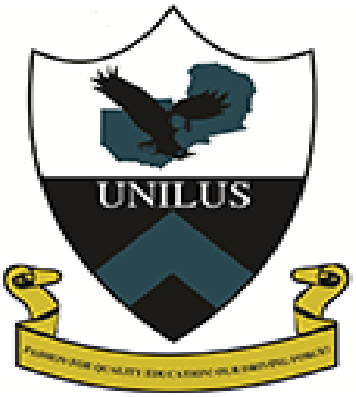
APPENDIX I: SURVEY QUESTIONNAIRE



UNIVERSITY of LUSAKA

SCHOOL OF POSTGRADUATE

RESPONDENTS QUESTIONNAIRE

Dear Respondent,

I am **Brenda Namukoko**, a student at the University of Lusaka (UNILUS) pursuing a Master of Science in Project Management (MSCMPM). I am carrying out research on the **"Effectiveness of the Road Safety Quality Management Systems - Case of Lusaka Main Roads**." You have been purposively selected to help in providing information on this study. This study is purely for academic purposes and your participation is completely voluntary. Your responses will be treated with the utmost confidentiality and therefore there is no cause for fear. The success of this survey depends on your cooperation and the correctness of the information you provide. Thus, your prompt and honest responses will be highly appreciated.

PART A DEMOGRAPHIC DATA

	Gender	
	Male	
	Female	
	Age Profile	
	18-25 years	
	26-35 years	

	36-45 years	
	46 years and above	
	Marital Status	
	Single	
	Married	
	For how long have you been driving?	
	Less than 1 year	
	1 to 5 years	
	More than 5 years	
	Educational attainment	
	Primary	
	Secondary	
	Tertiary	
	No formal education	
	Vehicle Type	
	Light passenger vehicle	
	Light load vehicle	
	Heavy load vehicle	
	Motorcycle	
	Heavy passenger vehicle	
	Agricultural, mining, or machinery	
	Frequency of using public roads	
	Every day	
	Weekdays	
	Weekends	

PART B 1: ROAD AND SAFETY KNOWLEDGE SHARING

- ✓ **To explore the factors affecting the implementation of quality road safety systems within Lusaka.**

What is your view regarding the factors of road safety and knowledge sharing within the following aspects?

Perception	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Factors of road safety are learned through formal institutions concerned with driving and road safety.					
Safety knowledge was shared through informal channels among motorists.					
The media has been an effective channel for road safety education and sensitisation.					
Road safety is best learnt by experience.					
There is a comprehensive education and training programme covering the core competencies of driving and road safety					
Road safety knowledge systems in Zambia have effectively transitioned from actions based on intuition, judgment and tradition to those based on structured institutional, empirical evidence and technology.					
Motorists have appropriate knowledge and skills for effective implementation of the road safety management system.					
There is an accessible and informative (useful) digital platform or database for sharing information and knowledge on best practices regarding road safety for both novice and old motorists.					
a digital platform which shares a best practice review of road safety risks for older road users.					
Factors of road safety are learned through formal institutions concerned with driving and road safety.					
Safety knowledge was shared through informal channels among					

motorists.					
The media has been an effective channel for road safety education and sensitization.					

PART B2: ROAD USER ATTITUDE

To what extent do you consider the following motorist behaviorally factors as important to road safety management?

Drinking alcohol			
Over speeding			
Not wearing seat belts and other safety wear			
Consuming illegal drugs			
Using mobile phone			
Not observing road signage			

Perception	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Road safety enforcement and education have been adequate to improve motorists' behavior					
The perceptions of road safety among drivers vary based on their personal traits and driving experience					
Motorists' behavior is largely responsible for road traffic accidents					

PART B3: ROAD TYPE

Rank the levels of road safety on the following types of roads in Lusaka. 1 being most unsafe and 5 being safest

T2- Lusaka Kafue, Chirundu Trunk Road	
T4 – Lusaka-Chongwe Trunk Road	
M9 – Lusaka Mumbwa Main Road	
Main City Highways	
Residential roads	
Off-road routes accessible to motorists	

PART B4: ROAD QUALITY

Perception	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
City roads are well-designed planned and built.					
Measures to reduce road traffic accidents have been effective.					
City roads have undergone disrepair at a higher rate than the authorities can fix.					
There are constant obstructions on the city roads.					
Maintenance and renewal of roads is consistently done.					
There is an effective system for road hazard correction and elimination in high-risk areas.					
City roads have been upgraded and renewed to acceptable standards.					
The roads have adequate safety features to avert road traffic accidents					

PART C: RELATIONSHIP BETWEEN SAFETY MANAGEMENT SYSTEM AND REDUCTION OF ROAD ACCIDENTS

- ✓ **To examine the relationship between safety management systems and the reduction of road accidents in Lusaka.**

In your opinion indicate the extent to which safety management system influence the reduction of road accidents areas influence contract performance

Perception	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Good safety management reduces road traffic accident					
Effective road safety management institutions reduce road traffic accidents					
Proper safety management policies that regulate motorist					

behavior reduce road traffic accident					
Constant road maintenance constantly reduces road traffic accidents.					
Effective speed trap cameras reduce road traffic accident					
City roads have been upgraded and renewed to acceptable standards.					

The end!

Thank you for your time

APPENDIX II: INTERVIEW GUIDE

UNIVERSITY *of* LUSAKA

SCHOOL OF POSTGRADUATE STUDIES

INTERVIEW GUIDE

Dear Respondent

I am **Brenda Namukoko,** a student at the University of Lusaka (UNILUS) pursuing a Master of Science in Project Management (MSCMPM). I am carrying out research on the **"Effectiveness of the Road Safety Quality Management Systems - Case of Lusaka Main Roads**.**"** You have been purposively selected to help in providing information on this study. This study is purely for academic purposes and your participation is completely voluntary. Your responses will be treated with the utmost confidentiality and therefore there is no cause for fear. The success of this survey depends on your cooperation and the correctness of the information you provide. Thus, your prompt and honest responses will be highly appreciated.

Personal Information

1. Name: ……...

2. Name of Organisation: ……...

3. Position: …….....

4. Highest academic qualification……...

5. How long have you been involved in construction projects……

6. Contact No.: ……...

Interview Questions

1. What intervention measures have you put in place to improve the quality road management system for motorists and pedestrians within the Lusaka district?

2.In your own opinion do you think some road quality management system currently existing helps reduce road traffic accidents within Lusaka district?----------

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3. What are some of the best quality management systems would you recommend to be implemented with Lusaka district main roads?----------

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4. What are the major causes of poor road quality management systems in the Lusaka district and how can this be improved?----------

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5. What else would say about road safety management systems in relation to road traffic accidents?----------

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The end!

Thank you for your time.