UNIVERSITY OF CAPE COAST

# INTRODUCTION OF TELEMATICS-BASED INSURANCE AS AN APPROACH TO REDUCE ROAD TRAFFIC CRASHES IN URBAN GHANA –STAKEHOLDERS' PERSPECTIVES FROM SEKONDI-TAKORADI METROPOLIS

ISAAC EDUNYAH

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BY

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Thesis Submitted to the Department of Geography and Regional Planning of the Faculty of Social Sciences, College of Humanities and Legal Studies, University of Cape Coast, in partial fulfilment of the requirements for the award of Doctor of Philosophy degree in Geography and Regional Planning

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# DECLARATION

## Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this University or elsewhere.

Candidate's Signature:..... Date:.....

Name: Isaac Edunyah

## Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature:..... Date:.....

Name: Prof. Albert Machistey Abane

Co - Supervisor's Signature:.....Date:.....

Name: Prof. Simon Mariwah

## ABSTRACT

Road traffic crashes (RTCs) are at a pandemic level all over the world. Annually, road traffic crashes are responsible for 1.35 million deaths and 50 million injuries. In Ghana, annual RTCs account for nearly 2000 deaths and about 15,000 injuries. Several countries have reduced the impact of road traffic crashes through telematics-based insurance policy. In this type of policy, the insurance company collects driving data such as speed, acceleration, braking, and cornering behaviour using a telematics device installed in the vehicle. There are several benefits associated with the use of this innovative policy. However, despite the benefits, research to ascertain whether stakeholders in the transport sector will accept the adoption of telematics as a policy is limited in Ghana. The purpose of this research was to assess the knowledge, awareness, and perceptions of insurance companies and other road transport stakeholder institutions and related groups and their willingness to adopt such a policy in Sekondi-Takoradi as part of the measures to reduce road traffic crashes. The study used a qualitative methodology using an exploratory research design. The study purposively sampled 13 non-life insurance companies and six other transport stakeholder institutions and groups and conducted in-depth interviews to collect data. The results reveal among others that the majority of insurance companies and other transport stakeholder groups in the metropolis are aware of telematics and ready to adopt it as an insurance policy. The study, therefore, recommends that the government of Ghana together with the major stakeholders should provide the needed infrastructure and training to adopt and support the implementation of such a policy.

## KEY WORDS

Awareness

Knowledge

Perceptions

Sekondi-Takoradi, Ghana.

Telematics-based insurance

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## DEDICATION

I dedicate this work to all of the Edunyah family for their support and encouragement.

# TABLE OF CONTENTS

# LIST OF TABLES

# LIST OF FIGURES

## LIST OF ACRONYMS

| | |
|---|---|
| AIDS | Acquired Immune Deficiency Syndrome |
| CI. | Comprehensive Insurance |
| CMTPI | Compulsory Motor Third Party Insurance |
| CTPI | Compulsory Third Party Insurance |
| DBVI | Distance-based Vehicle Insurance |
| DOI | Diffusion of Innovation |
| DUR | Department of Urban Roads |
| ERB | Ethical Review Board |
| EU. | European Union |
| GAGR | Compound Annual Growth Rate |
| GDP | Gross Domestic Product |
| GPHA | Ghana Port and Harbour Authority |
| GNPC | Ghana National Petroleum Corporation |
| GPRS | General Packet Radio Service |
| GPS | Ghana Police Service |
| GRSP | Ghana Road Safety Project |
| GSM | Global system for mobile communication |
| HIV. | Human Immunodeficiency Virus |
| LMIC'S | Low and Middle Income Countries |
| MTTU | Motor Traffic and Transport Unit |
| NCD | No Claim Discount |
| NHTSA | National Highway Safety Administration |
| NIC | National Insurance Commission |
| NRSA | National Road Safety Authority |

| | |
|---|---|
| NRSC | National Road Safety Commission |
| NRSS | National Road Safety Strategy |
| RTC. | Road Traffic Crash |
| SDG | Sustainable Development Goals |
| TAM | Technology Acceptance Model |
| UCC | University of Cape Coast |
| UK | United Kingdom |
| UTAUT | Unified Theory of Acceptance and Use of Technology |
| VELD | Vehicle Examination and Licensing Division |
| WHO | World Health Organisation |

# CHAPTER ONE

# INTRODUCTION

## Background to the Study

Transport is a crucial aspect of human activities worldwide. It is an essential element of the contemporary economy and has a significant impact on the geographical connections between different places. Although road transport operations provide economic advantages, the increase in motor vehicles that comes with economic development also leads to a rise in road traffic crashes (RTC) (Kopits & Cropper, 2005).

A road traffic crash (RTC) refers to any incident involving vehicles on a public roadway, such as collisions between vehicles, vehicles and animals, vehicles and pedestrians, or vehicles and immovable obstacles (Habtamu, et al., 2018). Road traffic collisions are a worldwide occurrence that happens when one or more road users are unable to handle the vehicle and its surroundings (Kadkhodazadek & Zakeri, 2018). RTC incidents have garnered global media attention owing to their significant impact on human lives and property. For instance, RTCs are a leading cause of mortality worldwide and have resulted in millions of people being crippled (Elvik, 2006).

Statistics from the World Health Organisation (WHO, 2018) indicate that global road traffic crashes are responsible for more than 1.35 million deaths and 50 million injuries annually, with about 3,700 people being killed on the road daily. As a result, some countries in Europe including Spain and Italy have reduced road traffic crash fatalities and injury severities through a new innovative insurance delivery known as pay-as-you-drive, and distance-based- insurance using telematics devices (Tooth, 2017). Also, over 40

countries globally, including Switzerland, Denmark, South Korea, South Africa, Kenya, and Ethiopia are providing insurance policies where policy-holders may receive a discount on their insurance premium if they agree to use telematics that monitor their driving behaviour leading to safer driving which will also reduce road traffic crash fatalities and injury severities (Ma, Zhu, Hu, & Chiu, 2018). In the USA alone, 36 percent of all insurance policy-holders were expected to use telematics by 2020 where their driving behaviour could be monitored and a percentage of their premium paid back as a discount if their driving did not result in road traffic crash fatalities and injuries (Lee, Lin, & Zeng, 2016).

Road traffic accidents in Ghana, a Low-Middle-Income Country (LMIC) in Africa, have become a pressing public health concern that requires immediate intervention (Annag, 2019). Boateng (2022) reported that researchers from Ghana's Building and Road Research Institute of the Council for Scientific and Industrial Research approximated that Ghana had 302,712 collisions involving 477,609 cars from 1991 to 2020. Hence, road traffic accidents continue to pose a significant public health and developmental obstacle in Ghana. Media sources consistently demonstrate that the RTC phenomenon has not seen a substantial decline since the commencement of the effort to reduce road traffic accidents over ten years ago. Annually, Ghana's roads see an average of 1,900 fatalities and 15,000 injuries (NRSC, 2020).

Road traffic crashes in Ghana have thus been identified as the second leading cause of death after malaria (Siaw, Duodu, & Sarkodie, 2013). In 2015, WHO ranked Ghana as the 18$^{th}$ most crash-prone country among 34 countries in Africa with a mortality rate of 24.76 percent, per 100,000

population. Data from the National Road Safety Authority (NRSC, 2020), indicate that there was an increase of 14.5 percent in road traffic fatalities from January to March 2020 as compared to the same period in 2019. Out of the 771 people killed, 636 (82%) were males and 135 (18%) were females (NRSC,2020). For the first time in ten years, the Ashanti Region surpassed Greater Accra in terms of the largest number of fatalities, with a recorded total of 171 deaths. The Eastern Region placed third with 127 (16%), while Western Region was seventh with 35 (4.5%).

The vulnerable road user group with the highest risk of fatalities on Ghana's roads continues to be pedestrians with fatalities of 842 deaths representing (39.5%), followed by motorcyclists with 437 deaths (21%), bus occupants with 364 deaths (17%), and car occupants (10.7%). Approximately 60 percent of all road traffic crash fatalities occur on non-urban roads in Ghana. The majority of the road traffic crashes (34.1%) occur on Fridays and Saturdays with December as the most accident-prone- month (NRSC, 2020).

**Statement of the Problem**

In 1988, the Ghanaian government recognised the need of decreasing road traffic collisions (RTCs) inside the nation. Consequently, the Ghana Road Safety Project (GRSP) was established as part of the World Bank Transport Rehabilitation Project. The primary goal of the GRSP was to enhance the knowledge and expertise of key stakeholders in order to effectively address road safety issues in Ghana. The GRSP was established with the aim of enhancing the National Road Safety Committee, which includes the Vehicle Examination and Licencing Division (VELD), the Ghana Highway Authority (GHA), the Department of Urban Roads (DUR), and the Motor Traffic and

Transportation Unit (MTTU) of the Ghana Police Service (GPS) (NRSA, 2020). The Ghana Road Safety Project was finished with some ideas on how to prevent road traffic accidents. An important suggestion was made to restructure the National Road Safety Committee into the National Road Safety Commission (NRSC). This change would provide them the authority to enforce road safety regulations and serve as the central organisation for the road safety campaign (Kwakye & Fouracre, 2008). The Road Safety Act of 1999, also known as Act 567, was enacted to create the National Road Safety Commission (now Authority). Its main objective is to advocate for the adoption of optimal road safety measures among all types of road users, with the aim of reducing road traffic accidents (Agyemen, Abledu, & Semevoh, 2013).

All these policies had very little effect on road traffic crash reduction in Ghana. Therefore, there were calls on the Government and relevant road safety institutions to employ a new method to deal with road traffic crashes in the country (Abane, 2012). One such approach is through a telematics-based insurance policy. There is enough evidence in the literature (Bolderdijk, Knockaert, Steg, & Verhoef, 2011; Jones 2016 ), that the use of telematics will transform road safety as it will argument existing policies and will become a valuable technology to assist with enforcement practices and thereby contribute to reducing the prevalence of road traffic crashes in Ghana. While several studies have been done in developed countries on how telematics-based insurance has been used to address the spate of road traffic crashes situation in some countries such as Italy and Spain (Eling & Kraft,2020), barely is there any research on how this type of innovation can be used in

Ghana. Several works of literature (Afukaar, Antwi, & Ofosu-Amaah, 2003; Agyeman *et al*., 2013; Ackaah,Apuseyine,& Afukaar, 2020) on how road traffic crash fatalities can be reduced in Ghana have concentrated principally on the use of education, engineering, and enforcement as the method which can lead to the reduction in road traffic crashes. However, the literature suggests that the use of these methods have reached the end of their maximum usefulness and are no more useful in reducing road traffic crashes (Tooth, 2017). Nonetheless, there is hardly any study in Ghana on how innovative insurance products such as the telematics-based policy can contribute to the reduction in road traffic crashes. This study is perhaps the first of its kind in Ghana which sought to explore whether telematics-based insurance would be accepted as a policy to reduce road traffic crashes using Sekondi-Takoradi Metropolis as a test case.

**Objectives of the Study**

The general objective of this study was to explore the possibility of insurance companies and other transport stakeholder institutions including telematics as a new product to reduce road traffic crash in the twin-city of Sekondi-Takoradi.

**The specific objectives were to:**

1. Assess the knowledge and awareness of insurance companies and other transport stakeholder institutions about the use of telematics;
2. Explore the perceptions of insurance companies and other transport stakeholder institutions in adopting telematics-based insurance;
3. Examine factors that influence the acceptance of telematics-based insurance as a policy in the Sekondi-Takoradi Metropolis, a

4. Examine how telematics could be integrated into the existing insurance policy.

**Research Questions**

The study sought to address the problem with the following research questions:

1. What is the level of knowledge and awareness of insurance companies and other transport stakeholder institutions about the use of telematics?
2. What are the perceptions of insurance companies and other transport stakeholder institutions on the use of telematics in reducing RTCs?
3. What factors would influence negatively or positively the acceptance of telematics as a policy in Ghana?
4. How can telematics be incorporated into the existing insurance policy framework?

**Significance of the Study**

Understanding the acceptance of telematics as a policy from insurance companies and other transport stakeholder groups in Ghana will go a long way to reducing road traffic crashes in the country. Policy makers in Ghana could benefit from the study regarding the factors influencing the acceptance of telematics as a policy, as this will facilitate decision-making and guide how the integration of this policy will help reduce road traffic crashes. The societal benefits of telematics policy such as reducing road traffic crash fatalities and injury severities warrant an in-depth study into the social acceptance of this technology.

As evidenced by other countries such as Spain, Italy, Kenya, Ethiopia, and South Africa, the findings from the study will be useful for insurance companies in formulating intervention programmes and policies that will ultimately contribute to the reduction of road crashes and injuries in Ghana. It is expected that the findings will also raise awareness among policymakers on the importance of telematics as a policy to reduce road traffic crashes. This research is in line with Ghana's transport policy, which aims at making transport operations safe, efficient, and economically viable (Poku-Boansi, 2020). Furthermore, this aligns with the United Nations' sustainable development goal (SDG,11.2), which aims to ensure that everyone has access to secure, reasonably priced, convenient, and sustainable transportation systems. This goal includes enhancing road safety, particularly through the expansion of public transportation, with a specific focus on meeting the needs of vulnerable individuals such as women, children, persons with disabilities, and older individuals.

**Delimitation**

The study is delimited to the Sekondi-Takoradi Metropolis for certain reasons. Firstly, according to the 2021 Population and Housing Census, the Western Regional capital has experienced population growth from 531,982 in 2010 to 1,034,917 in 2021 (GSS, 2021). This is almost a 100 percent increase in population since the 2010 Population and Housing Census. The Metropolis is highly industrialised and is the most developed district among the 22 districts in the Western Region. Approximately 60 percent of industries in the Western Region are concentrated inside the Sekondi-Takoradi Metropolis (GSS, 2010). These developments support insurance businesses. Any policy

that would improve not only the dividends of these businesses but also reduce road traffic crashes should be useful information.

**Limitations**

This research study has several limitations. The study was limited to Sekondi-Takoradi Metropolis and non-life insurance companies that were in good standing as of the end of December 2020 and other transport stakeholder groups and institutions. Sekondi-Takoradi was chosen because it is the most industrialised hub in the region, with almost the majority of insurance companies in Ghana located in the Metropolis. The study was designed to cover all the twenty-three non-life insurance companies in good standing in the Sekondi-Takoradi Metropolis. However, due to the outbreak of the Covid-19 pandemic, some participants did not allow themselves to be interviewed. This affected the number of participants' interviewed, resulting in a review of the sample size. It was also true that many stakeholders, such as drivers and vehicle owners who are the main users of this innovative policy, were not brought on board in this study, which makes it difficult to generalize the findings.

**Organisation of the Thesis**

In addition to this chapter, the study is organized into seven chapters. Chapter two presents a literature review on telematics and telematics-based insurance; it also focuses on the theoretical and conceptual issues that underpin the study. Chapter three explores the causes of road traffic crashes in general and an overview of motor insurance. The fourth chapter covers the methodology as well as the philosophy underpinning the research and the paradigm relevant to qualitative research. The research approach, research

design, the study area, data collection instruments, data collection procedures, population sample, and data analysis are all covered in this chapter. Chapter five outlines and discusses the results of the data on awareness and knowledge of telematics. The sixth chapter deliberates on the results of the use of telematics, influencing factors, their acceptance,and how telematics can be integrated into the current insurance policy framework. The seventh and final chapter gives the summary, conclusions, recommendations, contribution to knowledge, and areas for further research.

# CHAPTER TWO

# THEORETICAL AND CONCEPTUAL ISSUES

## Introduction

This chapter provides a critical review of the literature on the traditional insurance policy, its weaknesses, and why some insurance companies are replacing it with telematics-based insurance policy as a method of calculating the insurance premium.

As part of the chapter, telematics has been defined, and the types of telematics devices in use have been identified with their strengths and weaknesses. This is followed by a brief introduction to telematics and telematics-based insurance policy in the first section. The concept of telematics-based insurance has also been explained, as well as the benefits associated with telematics-based insurance policy.

## Telematics

The term ‘‘telematics’’ was derived from two Greek words, i.e, tele and Matos. Tele means far away and Matos means own accord (Webb, 2010). Telematics is thus the fusion of information technology and long-distance transmission of data (Holt, 2020).It is the process of sending, receiving, and storing information through communication devices such as the General Packet Radio Service (GPSR) (Hussain, Zainal, Elmedany, & Fakhr, 2012). Vehicle telematics refers to a range of technologies that can be used to monitor driver behaviour on the road (Atchison, 2018). Telematics devices are small gadgets placed into a vehicle for the transmission and application of information (Savicevic, 2017). In the 1970s, Rockwell International Company created an onboard recorder to assess the impact of various gadgets and

driving tactics on fuel efficiency in large trucks, marking the first instance of telematics use. Currently, telematics is mostly associated with driving and intelligent transport systems, healthcare, and daily living (Gvozdenović & Uzelac, 2018).

These devices can record simple data on vehicles such as location, date, time, distance travel, speed, cornering, lane change, acceleration, and deceleration and transfer this data to the insurer (Karapiperis et al., 2015). Contemporary automobiles equipped with safety features, including cruise control, vehicle accident alert system, lane departure warning systems, blind spot information systems, and automated parking, are all equipped with telematics devices (Gvozdenović & Uzelac, 2018). The insurance company does not directly get all the unprocessed data into their system since there is a service provider that is technically responsible for operating the system and gathering the data. By using the gathered data, the insurance business may accurately calculate and determine the appropriate price for the insurance premium (Eling & Kraft, 2020).

Four main types of telematics devices can be used to collect data from vehicle users. These are dongles, black boxes, embedded, and smartphones (Milanović, Milosavljević, Benković, Starčević, & Spasenić, 2020). The dongle is a self-installed, "plug and play'' device provided by insurance companies to be used by the driver for a certain time, from one to six months. This type of device is normally preferred because of its reliability and low cost. The driver can install the device, and it can be transferred from one vehicle to another. It automatically turns on when the ignition system of the vehicle is switched on and can collect data such as the driving location and

style of driving. The challenges associated with this device are that it can be tampered with by the driver, and is also vulnerable to theft (Milanovic *et al.*, 2020).

The black box is fitted by professionals and mostly used in the European market (Kirushanth & Kabaso, 2018). It is often regarded as safe and dependable. Insurance firms primarily use the black box to get comprehensive and precise information on driving behaviours, including speed, abrupt braking, and sharp turning. It has the capability to establish a connection with the engine control unit (ECU) of the vehicle. Additionally, it is beneficial for monitoring the conduct of youthful and inexperienced drivers. An inherent limitation of this technology is its lack of portability, coupled with its high installation expenses (Karapiperis, et al.,2015). Vehicle makers first install inbuilt telematics, which provide services such as remote diagnostics, navigation, and entertainment. Additionally, it has the capability to provide insurance services that rely on telemetry technology. The gadget is linked to the engine control unit (ECU) of the vehicle and has the capability to communicate data on the vehicle's performance. The primary obstacle associated with this particular telematics device is the exorbitant expense of the subscription for customers (Milinkovic et al., 2020).

Due to the progress in mobile technology, smartphones have emerged as the most recent telematics technology. They may function independently or be connected to a car's system to exchange various data with the vehicle. This telematics solution is optimal due to the inclusion of many pertinent sensors, including GPS, accelerometer, and gyroscopes (instruments capable of measuring and preserving the orientation and angular velocity of an item).

Smartphones have the capacity to store a significant amount of data and have exceptional communication skills. The insurance company incurs no expenses for devices, installations, or data connection, and there are no extra charges for the policyholder (Eling, & Lehmann, 2018). The advent of the smartphone as the telematics device within vehicles has greatly expanded the potential to provide feedback information to the driver (Handel et al., 2014).

The smartphone enables a significant portion of data processing to be conducted on the device. This telematics application is very cost-effective since it eliminates the need for specialised car hardware. Additionally, the data gathered is immediately sent from the smartphone to the insurance provider, hence lowering data processing expenses for the firm (Karapiperis *et al*., 2015). The current form of smartphone type of telematics device is shown in Figure 1.

*Figure 1:* Vehicle telematics device
Source: Gidebo and Szpytko (2019)

These devices have the capability to monitor and record many types of data related to cars, including their geographical position, speed, acceleration, engine control unit information, and other relevant data. This information is used by insurance companies and fleet management firms to effectively manage vehicles on the road and offer feedback to the drivers (Kirushanth, 2019).

The devices are also capable of analysing fuel consumption, giving maintenance alerts, registering vehicle crashes, and providing roadside support in times of need (Savicevic, 2017). With the use of telematics, information about traffic situations could be compiled for statistical purposes to enhance service information on the road. Through telematics, risk can be rated on an individual basis. An insurance company can technically identify, measure, and rate a particular person's driving ability. An insurance company can know when, where, at what speed, and how a driver drives, i.e., the number of hard braking, sharp turn, and other dangerous maneuvers (Karapiperis *et al.*, 2015).

In the 1980s, telematics was seen in only a few luxurious cars. As technology advanced, telematics has been incorporated into many automotive designs, which has become known as automotive telematics (Chen, Shih, Chen, & Lin, 2009). Automobile telematics now includes automobile systems that integrate global positioning satellite (GPS) tracking and other wireless connections to provide automated roadside assistance and remote diagnostics (Boris & Szpytko, 2015).

**Application of Telematics**

Telematics is not only limited to the automobile. It is also associated with different sectors of the economy. Construction, power engineering,

medicine, commerce, safety, traffic updates, in-car entertainment, real-time data communications, location reporting and sharing, theft response, wireless safety, hazard alerts, emergency and roadside assistance request systems, vehicle performance measurement, and freight trailer and container tracking are just some of the many uses of telematics that have been implemented (Oliver & Reeeves, 2011).

In the transportation sector, telematics is the use of telecommunication and information systems to monitor and provide feedback to drivers about vehicle location and driving behaviour (Viola, 2001). Advancement in information technology (IT) has revolutionised the way vehicles are designed and built to meet the entertainment, safety, and environmental needs of customers. About 86 percent of all vehicles manufactured since 2006 are equipped with telematics that allow vehicle-to-vehicle communication and vehicle-to-environment communication through the use of mobile communication or smartphone technology (Chen, Shih, Chen, & Lin, 2009).

The use of telematics became a mandatory requirement in all vehicles in the US in 1996, the UK in 2004 (Paefgen, Fleisch, Ackermann, Staake, Best, & Egli, 2013), and all EU countries by 2018 (Kirushanth, 2019). As a result of the increased use of automotive telematics, managing road traffic crashes have taken a new paradigm (Miller & Burgett 2001). Telematics is now the latest technology used to manage road traffic crashes and their severity (Tooth, 2012). The general objectives of telematics are to improve road transport efficiency, improve traffic safety, and ultimately reduce road traffic crashes (Nilsson, Harms, & Peters, 2001). Table 1 shows the sectors of the economy where telematics is applied.

**Table 1: Application of Telematics**

| Sector | Area | Application |
|---|---|---|
| Construction | Institution, industry | Safety, security, lighting, transport, Fire and access control. |
| Power engineering | Power supply, electricity, oil, gas, alternative fuels | Turbines, generators, batteries, backup Supplies, wind power plants fuel cells. |
| Household | Infrastructure, safety, comfort. | Power supply washing machine, dishwashers, lighting, heating, ventilation safety cameras, supervision |
| Medicine | Healthcare, nursing, medical examination, science | Telemedicine, tele surgery, monitoring |
| Industry | Resources, automation, distribution, science | Manufacturing, engines, motors, pumps, valves, conveyors, Processing, assembly, packaging. |
| Transport | Means of transport, infrastructure, and transport systems. | Vehicles, vessels, airplanes, signaling, navigation, Signs, payments |
| Safety | Supervision, tracking, equipment, public structure, crisis management | Police, ambulance, helicopter, fire brigades, Monitoring, internal safety. |
| IT | Public, industry personnel. | Power supply, UPS, routers, memory, switches. |

Source: Mikulski (2010)

**Components of Vehicle Telematics**

Generally, a vehicle telematics system requires some basic components to operate, as shown in Figure 2.

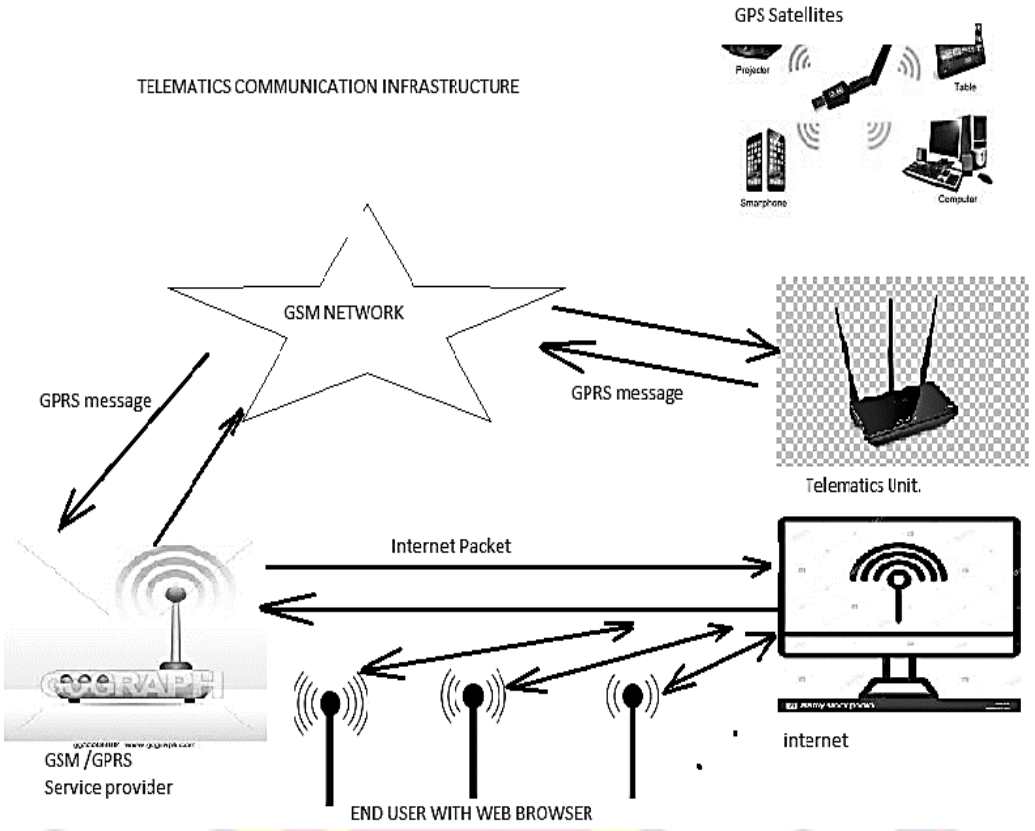


*Figure 2:* Components of vehicle telematics.
Source: Gidebo and Szpytko (2019)

1. The telematics unit
2. GPS Satelites
3. GSM Network
4. GSM/GPRS service provider
5. End user with Web browser
6. Internet connectivity
7. Global position system (GPS).

Driving data needed is collected and transferred directly from the smartphone to the insurance company. The global positioning system (GPS)

provides the geographical location of vehicles with an accuracy of a few meters (Paefgen *et al.*, 2013). Line-of-sight into vehicle position, velocity, and activity inside geo-fenced areas is made possible. Intense acceleration, jarring braking, and swerving around corners are only some of the behaviours that may be detected by sensors (Hussain et al., 2012).

**Internet connectivity**

To complete the system, internet access is the essential medium required. A hosting server is a device that enables the execution of numerous telematics device activities. The device utilises a long-range wireless interface to transmit diagnostic and associated data to a central host computer, as well as to receive relevant information from the same hosting server (Lowrey, Borrego, Wettig, Banet, Washicko, Berkobin, & Link, 2013). Vehicle telematics uses GPS technology, sensors, and vehicle engine data to gather various sorts of information. This data is then used by fleet operators to effectively manage their fleet. Typically, there are several categories of car telematics systems, although they all have a common fundamental principle: observing and analysing the vehicle and the driver's conduct while on the road (Griebe, & Gruhn, 2014).

**Concept of telematics-based insurance**

Vickrey was the first individual to critique the lump-sum pricing of car insurance for its inefficiency and unfairness due to an improper premium payment structure. As a solution, Vickrey introduced the idea of telematics-based insurance pricing (Boucher, Pérez-Marín, & Santolino, 2013). The first implementation of distance-based insurance pricing was the pay-at-the-pump

(PATP) insurance, which included drivers paying for their coverage at the time of purchasing petrol from the filling station (Boucher et al., 2013).

The concept of telematics-based insurance philosophy means that the traditional system of insurance changes from a fixed cost into a variable cost as the premium paid is based on kilometers driven (Ubbels, & Knockaert, 2015). In the telematics-based insurance policy, the premium is based on the number of times the vehicle is driven during the policy period, this allows motorists who drive less frequently and safely to pay less premium, providing financial incentives for lower-risk motorists (Litman, 2011; Ayuso *et al.*, 2016). Telematics-based insurance replaced the fixed premium (Flat fees) which makes car ownership more attractive (Ubbels, & Knockaert, 2015).

Generally, telematics-based insurance principles are based on the driving behaviour of the insured (Bolderdijk, *et al.,* 2011). This pricing policy encourages policy-holders to limit the amount of driving to save money (Litman, 2005). Therefore, the basic principles of telematics-based insurance (TBI) or distance-based vehicle insurance (DBVI) are that the more one drives the more premium one has to pay and the less one drives the less premium cost leading to cost savings to be made, which is also a benefit to society (Litman, 2018).

**Global telematics usage**

Globally, vehicle telematics has been used extensively to track vehicles, manage fleets, and also used by insurance companies to monitor driving behaviour (Cook, 2020). The use of telematics is an inexorable phenomenon in contemporary automobiles. Telematics systems in automobiles

enable users to premeditate a route from their residence, and they may also get up-to-the-minute data on fuel costs using telematics (Kirushanth, 2019).

Available parking spaces can also be checked with the use of telematics (Coppola & Morisio, 2016). The global telematics market possesses a high level of potential growth; with the advancement of in-vehicle technology, a new system of managing road traffic crashes has emerged (Neumann, 2018). With the use of telematics, several insurance companies are now influencing the way people drive. According to Dharani, Isherwood, Mattone, & Moretti (2020), no country has more than 20 percent telematics penetration as of 2016 (See Figures 3&4). However, Tian, Prybutok, Mirzaei, & Dinulescu (2020) predicted that telematics-based insurance will cross the projected level of 25 billion dollars in 2018 and grow at a rate of 21 percent compound annual growth rate (CAGR) between 2019 and 2026.

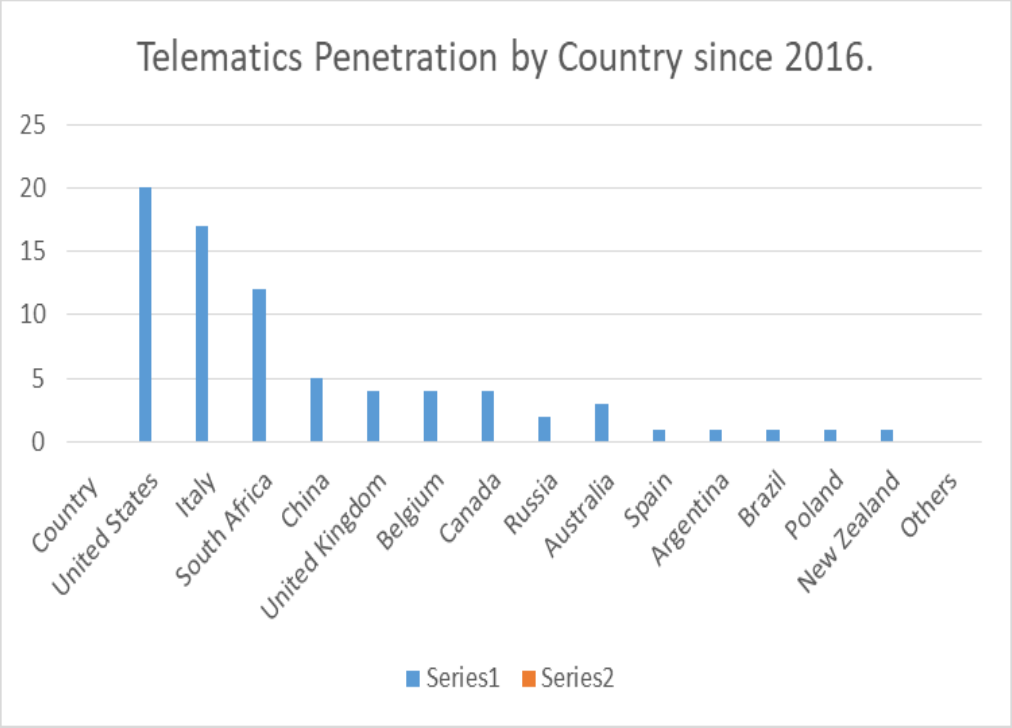


*Figure 3:* Usage-based insurance by country as of 2016.
Source: Dharani, *et al* (2020)

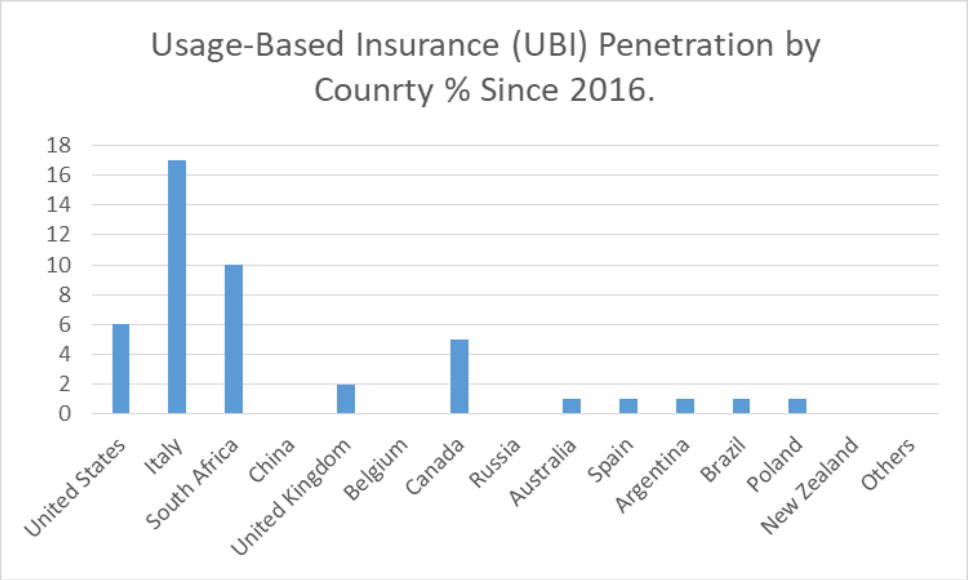


*Figure 4:* Telematics Penetration as of 2016.
Source: Dharani, *et al* (2020).

The use of telematics is also gaining momentum in the low-and middle-income countries such as South Africa, Kenya, and Ethiopia with greater awareness of the benefits of telematics-based insurance (Bhisey, 2020).

Boris & Szpytko (2015) investigated telematics use in Africa and reported that through the use of telematics, the transport system in Africa will become more efficient, safer, and more sustainable, however, these benefits could only be achieved if African countries are ready to invest in the telematics infrastructure. Kurylowicz (2016) conducted a historical perspective of insurance companies in Africa about the use of telematics-based insurance and observed that while telematics-based insurance could be a competitive advantage for insurance companies, it is still not exploited by many insurance companies in Africa. This is because of the lack of understanding of the concept of telematics-based insurance. Staff (2018) also studied the use of telematics in South Africa and projected that telematics

usage will grow by 92 percent in 2022, from 1.3million units in 2017 to 2.5 million.

In another research by Gidebo & Szpytko (2019) in Adisa-baba, it was reported that the use of telematics improved information systems in passenger transport service, improved service quality, and stimulated passenger demand for public transport because it provided needed information for passengers. They further stated that the use of telematics reduced bottlenecks in management decision-making, increased road transport capacity, and enhanced safety.

**Projection of global telematics-based insurance policy usage**

Globally, it has been projected that the use of telematics-based insurance is expected to grow by 40 percent annually (Tooth, 2017). Cordes, Gould, Tiwari & Zafar (2018), have estimated that 15 percent of global vehicles have telematics installed in them and 100 million telematics units are in operation globally. Eling and Kraft (2020) estimate that the value of the worldwide vehicle telematics industry will increase from its 2018 level of $50.4 billion to $320.6 billion by 2026.

There are more telematics-based motor plans in Italy than in the United States (3.3 million) or the United Kingdom (0.6 million) combined (Eling & Kraft, 2020). To reduce the impact of road traffic crashes the government of the United States of America has made it mandatory for all new light vehicles to have telematics devices installed by 2023 (Kuang, Zhao, Hao, & Liu, 2017). When the UK made telematics (e Call, system) mandatory in 2018 for all emergency response vehicles, the emergency response time was reduced by 40

percent in the cities and 50 percent in the rural areas, leading to a four percent reduction in road traffic crashes (Dharina *et al.*, (2020).

**Factors affecting technology acceptance**

Several elements have been suggested in the literature as the determinants of technological adoption. The factors that are considered include demographics, socio-economic status, usability, fearfulness, external motivation, perceived usefulness, internal motivation (enjoyment and pleasure), social influence, frequency of use, system quality, user satisfaction, self-confidence, self-efficacy, attitude, trust, and cultural variations (Shemshad, Lashgarara, Mirdami, & Najaf, 2015). In a study conducted by Renaud & Biljon (2008) in South Africa, they examined the suitability of technology acceptance models for senior mobile phone users. The results showed that the perceived ease of use had a significant impact on users' extrinsic and intrinsic motivation to use technology. Additionally, it was found that fearfulness towards technology negatively affected intrinsic motivation. The acceptability and use of technology in businesses are influenced by cultural variations in various regions, particularly among managers responsible for corporate decision-making.

Furthermore, the acceptance and adoption behaviour of a person is influenced by their socio-economic standing, which encompasses factors such as family income, education, and employment. The socio-economic situation of individuals significantly influences their utilisation of technology and may serve as a limiting factor that impacts the acceptability of technology. This is mostly due to the perception that technology is costly, which is a common belief among the majority of individuals (Shemshad et al., 2015). In a separate

investigation, Tarhini, Hone, & Liu (2015) discovered that self-efficacy significantly influences the prediction of technology acceptance behaviour among students using e-learning platforms in both England and Lebanon. The research also asserted that persons with higher levels of efficacy exhibited more enthusiasm for embracing new technology.

In addition to the above-influencing factors that affect the acceptance and adoption of technology, there are other factors, such as senior management support, customised training, and employee involvement (Rahim, 2008). For example, Kuang *et al.* (2017) noted that the impact of technology acceptance is dependent on the extent to which an employee accepts the technology; thus, employee involvement in the implementation of technology is important in the initial implementation phase of the technology.

Executive endorsement of technological initiatives. Acceptance may be seen via two perspectives: the readiness to provide the necessary infrastructure and the involvement of management in resolving conflicts arising from the implementation of the technology. When employees are given the needed support by their management and receive the necessary training required during the implementation phase of the technology, their willingness to accept the technology will increase (Shemshad *et al.*, 2015).

**Challenges to implementation of telematics-based insurance policy**

One major challenge to telematics-based insurance is the privacy concerns of customers (Paefgen *et al.*, 2013). Many researchers in telematics-based insurance have reported the fear of privacy violation as a major barrier to the acceptance of telematics-based insurance by policy-holders (Eling & Kraft, 2020; Cordes, *et al.*, 2018).

However, according to Kurylowicz (2016), drivers are willing to give up their privacy to insurance companies for minor financial compensation. For example, DeGraaf & Werner (2017) surveyed 10,000 customers of automotive insurance companies in the US on their perception of the use of telematics-based insurance and reported that 55 percent of respondents agreed to be monitored by their insurance companies with the installation of telematics devices, and also found that 90 percent of customers were ready to share their data with their insurance companies. Similarly, Constantinescu, Stancu,& Panait (2018) identified three categories of drivers in their study of driving style monitoring through telematics coupled with price discounts based on their driving performance and found that 26 percent of drivers would allow such monitoring, regardless of the size of the price discount. For undecided drivers, 27percent consider a discount that is large enough to accept telematics monitoring and lastly, for skeptics, 47percent would not be interested at all to be monitored by the use of a telematics device.

Multiple insurance firms are providing various strategies that do not compromise the privacy of drivers. Troncoso, Danezis, Kosta and Preneel (2007) discovered that German insurance companies utilise GPS technology to gather car speed data. The primary objective is to verify compliance with speed limits without storing location data, thus preserving the driver's privacy. Azzopardi & Cotis (2013) conducted a research on telematics-based insurance using SWOT analysis. Their findings indicated that privacy concerns were not a significant problem for most transport operators. However, the primary concern identified was the issue of trust. However, insurance firms and

telematics providers are legally obligated by data protection laws to safeguard the privacy of their clients (Azzopardi & Cotis, 2013).

Another challenge to the implementation of a telematics-based insurance policy is the initial cost associated with the device and the subsequent acceptance of the policy by the intended users (Litman, 2018). To implement the policy successfully, it must first be communicated to the intended users to get their support. Drivers are reluctant when they consider that the discounts offered by insurance companies are not large enough to justify accepting the policy. Litman (2018) and Constantinescu *et al.,* (2020) observed that the initial cost of developing a new policy that will be shifted to the policy holder can result in some policy-holders rejecting the implementation of the policy. It is also difficult to recover the investment cost of the telematics-based policy because telematics will become standard equipment in future cars (Kuang *et al.*, 2017).

**Benefits of telematics-based insurance**

A review of the literature has identified several benefits of a telematics-based insurance policy. These benefits include:

1. Improvement in driving behaviour
2. Vehicle diagnostics and recovery
3. Improved customer segmentation
4. Reduced claim cost
5. Reward drivers for safe driving
6. Prevention of fraud

These benefits are explained in more detail.

The main advantages of telematics-based insurance, as opposed to traditional methods, are its ability to effectively achieve various policy objectives such as efficiency, fairness, safety, environmental sustainability, and driver motivation to enhance their driving behaviour. Additionally, it provides logistical support for transport service providers, facilitates efficient traffic management, and simplifies route planning (Litman, 2012; Gvozdenović & Uzelac, 2018; Tselentis, Yannis, & Vlahogianni, 2016).

The telematics-based insurance policy ensures a more equitable premium for each policyholder compared to the pay-by-the-year policy. This is because consumers are only billed for the precise number of kilometres they travel (Litman, 2012). Lower-income automobile users have the option to decrease their insurance costs by opting for commercial transport over utilising their cars for non-essential trips, thereby making insurance more financially accessible (Troncoso et al., 2007). The use of a telematics-based insurance policy will serve as an incentive mechanism to raise the awareness of drivers on the need to improve their driving behaviour because of the feedback provided to them by their insurance companies (Tselentis, Yannis & Vlahogianni, 2016).

Telematics improves the productivity of drivers owing to their awareness of the presence of telematics in their vehicles. This gives them a sense of responsibility and morale thereby ensuring that they drive carefully (Litman, 2012). Installation of vehicle telematics devices enables vehicle diagnostics, recovery of stolen vehicles, and quick response to emergency services (Husnjak, Peraković, Forenbacher, & Mumdziev, 2015). Telematics-based insurance makes premiums more affordable by rewarding safer drivers

and encouraging drivers to be less aggressive (Ayuso, Guillen, & Pérez-Marín, 2016). According to Jin et al. (2018), when drivers adopt less aggressive driving behaviours while being monitored by telematics devices, they may lower their fuel expenses, hence reducing the overall cost of driving.

Data gathered from telematics can help insurance companies to improve upon the segmentation of customers, underwriting, and pricing accuracy, leading to an increase in profit margins for the insurance company (Bender, 2014). With the use of telematics, correct risk classifications, enhanced pricing accuracy, and retained profitable accounts can be obtained (Vaia, Garmel, Delone, Trautsch, & Menichetti, 2012). Driver's exposure to risk can easily be measured with telematics-based insurance to improve fairness in the premium calculation (Ayuso *et al.*, 2016). The use of telematics-based Insurance can also serve as a proxy for careful drivers, fight fraudulent claims, enable lower premiums, reduce claim costs, and differentiate brands (Husnjak *et al.*, 2015). Telematics-based insurance will enable insurance companies to reduce the claim processing period, which could lead to an improved corporate image as insurance companies could be seen as more customer-oriented (Ayuso *et al.*, 2016). By tracking driving behaviour, insurance companies can create tailor-made insurance plans and improve risk management, which results in better customer satisfaction. Insurance companies can also increase charges for irresponsible drivers and reward customers for safe driving (Mc Kinsey, 2018).

Telematics-based insurance will enable early detection and prevention of fraud and enables pricing based on the risk profiles of drivers (Husnjak *et al.*, 2014). The implementation of a telematics-based insurance policy is

socially beneficial as it encourages drivers to drive less, leading to fewer road traffic crashes and resulting in a reduction in crash cost to society (Tselentis *et al.*, 2016). Telematics-based insurance policy will assist driver behaviour improvement leading to lower fuel consumption, less road traffic congestion, and fewer emissions, therefore, reducing environmental pollution. These benefits are appealing to both insurance companies and other transportation user groups. It has been reported by Tian *et al.*, (2020) that when Unipol, one of the largest insurance companies in Italy, adopted the use of telematics, its market share increased by 10 percent and its profitability by 12 percent.

**Theoretical and conceptual models**

Several theories and models have been used in literature to study how technology is accepted and spread (Cassias & Kun, 2007; Chen, Shih, Chen, & Lin, 2009). This part focuses on the theoretical and conceptual models related to the study. These include the Diffusion of Innovation Theory (DOI) proposed by Roger (2003), the Technology Acceptance Model, and the Unified Theory of Acceptance and Use of Technology (UTAUT) proposed by Venkatesh (Venkatesh & Zhang, 2010).

**Technology Acceptance Model (TAM)**

The Technology Acceptance Model (TAM) was developed to predict the technology adoption or refusal behaviour of individuals and can also be used to explore how organisations accept the use of technology (Osswald, Wurhofer, Trösterer, Beck, & Tscheligi, 2012The model is very efficient in predicting consumers' sentiments towards the utilisation and approval of technology (Chen, 2019). It is more preferred in information technology

acceptance because of its robustness and adaptability of usage compared to other models in the literature (Osswald *et al*., 2012).

The Technology Acceptance Model (TAM) suggests that the user's intention to use technology can be accurately assessed by considering their perception of how easy it is to use (perceived ease of use, PEOU) and how useful it is (perceived usefulness, PU). According to Rahman et al. (2018), a positive attitude and perception of usefulness are likely to result in a positive intention to use the technology. Technology adoption refers to the extent to which an organisation or person is willing to adopt and use new technology as it becomes available (Adell, 2010). According to Adell (2010), if the system is not comprehended enough, it will provide challenges for individuals or organisations to embrace it. An individual's adoption of technology is influenced by two factors: their perception of how easy it is to use and their perception of its utility (Nasri & Charfeddine, 2012). Perceived ease of use refers to an individual's belief in the technology's use without trouble, while perceived usefulness refers to an individual's belief that using the technology would enhance performance. From the model (Figure 5), the perceived usefulness and the perceived ease of use are the major determinants that influence the acceptance and use of technology (Song, Chun, & Kim, 2009).

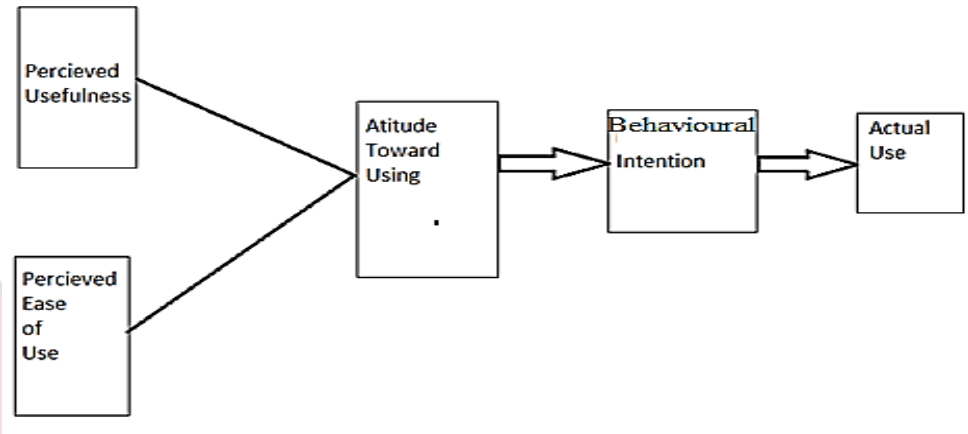


*Figure 5:* Technology Acceptance Model.
Source : Song *et al.*, (2009).

According to Sahin (2006), these two main factors will determine the organisation's or individuals' decision to accept technology or not. Perceived usefulness influences the perceived ease of use and the attitude toward usage and predicts behavioural intention. The behavioural intention is also influenced by the individual's attitude towards the use of technology and their perception of its practical value. Thus, the attitude towards the adoption of technology is influenced by the level of user-friendliness and perceived utility (Song et al., 2009). Based on the paradigm, user conduct towards the technology is determined by the behavioural intention, which is influenced by the attitude towards use. This attitude also represents the individual's thoughts about accepting or rejecting the technology.

Perceived usefulness refers to the belief system of a firm or person, whereby they believe that using technology would improve the performance of their business or themselves. One's attitude towards accepting technology is influenced by both the perceived utility and the perceived ease of usage. According to Taylor & Todd (1995), the level of experience, or lack thereof, will impact the ease of use and perceived usefulness. Individuals with previous technological expertise choose ease of use above perceived usefulness and its

advantages, whereas those without prior knowledge prioritise perceived usefulness over ease of use. Ajen (1991) posited that the acquisition of knowledge or familiarity with a certain object or circumstance will impact the inclination to use it. The fundamental aspect driving this thesis is that when technology enhances the performance of individuals or organisations, the inclination to use the technology will be greater (Amoako-Gyampah & Salam, 2005).

According to Lacey, Close, & Finney (2010), information about a product is a significant aspect in determining whether or not to accept it. This is because knowledge always affects one's view of a product. As individuals or organisations become aware of a product, their view and attitude towards the product tend to grow more favourable (Lacey, et al., 2010). The acquisition of knowledge about a product is seen as a crucial asset and primary catalyst for generating advantages in terms of performance and innovation at the individual, organisational, and broader macro-level of affiliation (Nguyen, Nham, Froese, & Malik, 2019). Multiple scholars concur that the use of TAM (Technology Acceptance Model) is the most efficient framework for forecasting consumers' inclination to embrace technology (Chen, 2019; Liu, 2010; Tain et al., 2020). According to a survey done by Korpelainen (2011), TAM was found to be the most often referenced theory from 1999 to 2010 due to its straightforwardness.

However, the use of TAM has faced criticism owing to specific constraints (Benbasat & Barki, 2007; Kiwanuka, 2015). For example, TAM does not take into account societal influencing elements that might potentially impact the acceptability and utilisation of technology. Bagozzi (2007)

contends that the Technology Acceptance Model (TAM) is too simplistic for studying the adoption and acceptance of technology, since it fails to include crucial variables and behaviours. He further criticised the lack of a robust theory and methodology for identifying the factors that determine perceived utility and perceived ease of use, as well as other foundations for decision-making. According to Chen (2019), TAM's perceived utility and perceived simplicity of use are insufficient indicators of intention since they do not provide meaningful guidance for practitioners. Gefen, Karahanna and Straub (2003) contended that TAM failed to include the influence of gender, despite gender being a basic component of culture.

Koul and Eydgahi (2018) contend that technology acceptance and use include factors beyond those proposed by TAM. They assert that the perception of ubiquity and reachability have a notable and beneficial impact on an individual's desire to embrace and utilise technology. Perceived ubiquity refers to an individual's subjective view of the degree to which technology enables tailored and continuous interactions and communications between the individual and others or networks. Perceived reachability pertains to an individual's view of the extent to which they may easily communicate with others at any time and from any location using technology.

Reachability assumes that users and technology have the capability of being connected and reached by other entities. Ubiquity represents a definitive form of spatial, temporal, and contextual mobility (Kim & Garrison, 2009). The inability of TAM as a theory to provide an efficient means of expanding and adopting its core model has, therefore, limited the usefulness of TAM as

the best theory to investigate the acceptance and use of technology (Benbasat & Barki 2007).

**Diffusion of Innovation Theory**

Diffusion of Innovation Theory (DOI) has gained widespread recognition in the literature (Orr, 2003). This is a theory of why, how, and at what rate new ideas, products, processes, and technology spread from one person to another over time within society or culture (Folorunso *et al.*, 2010 & Zhang, Yu, Yan, & Spil, 2015). Diffusion is the process by which an innovation is communicated through certain channels over time among members of a social system (Dearing & Meyer, 2006). It can also be a social process by which an innovation is communicated over time among members of a communication network or within a social sector.

Diffusion may also occur among people or organisations in response to learning about a new idea, process, or technology (Dearing & Cox, 2018). Innovation can be anything ranging from ideas, knowledge, belief, product or service, technology, or process (Folorunso, *et al.*, 2010). Different societies, people, and cultures take a lot of time to adopt innovation and the rate of diffusion varies, depending on whether the justification for adopting the innovation is based on emotions, effectiveness, or morality (Zhang *et al.*, 2015).

The adoption of a new product, service, idea, or technology does not come at once, but it takes time. People who accept a new system, product, service, idea, or technology must understand what the innovation is and must be convinced of its advantages and disadvantages before adopting the innovation (Sahin, 2006).

Before an innovative solution to a social problem could be decided, the extent of the problem in society must be known. The questions that need to be asked include the following: what is the effect of the problem that needs attention from society? What is going wrong that needs a solution, and how is the phenomenon negatively impacting society? Uncertainty is an obstacle to innovation-decision, and therefore, any consequences in innovation decisions will create uncertainty (Sahin, 2006). Consequences are changes that occur in an individual or social system as a result of the adoption or rejection of an innovation (Dearing & Meyer, 2006).

There are several stages by which individuals will adapt to innovation. These include the awareness of the need for innovation as well as their willingness and understanding of the innovation. The willingness to adopt innovation by some people will be influenced by an agent who must persuade the individual. People will adopt innovation when they understand and know the benefit to be derived (Sahin, 2006).

**Attributes that determine the diffusion of innovation.**

Roger (2003) describes five attributes that determine the diffusion of innovation rate. These are, relative advantage, compatibility, complexity, triability and observability (Figure 6).

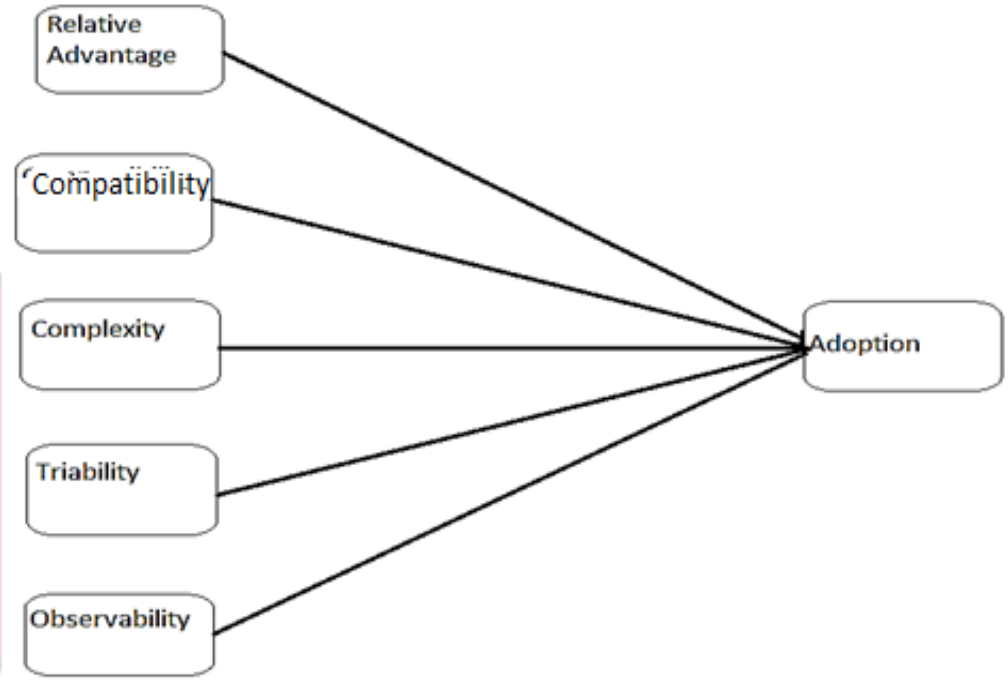


*Figure 6:* The attributes of diffusion of innovation rate.
Source: Turan, Tunc, and Zehir, (2015).

Relative advantage is the degree to which an individual will perceive the innovation as better than the one that it has replaced. People will consider the economic benefit to be derived from the innovation before deciding their willingness to adopt or reject it. Compatibility refers to the extent to which an innovation is viewed as aligning with the adopter's current values and standards. When an invention aligns with the prevailing norms and values, its potential for dissemination is highly accelerated. According to Folorunso et al. (2010), it is considered that when a person sees that innovation has the given attribute, the pace at which it spreads would be enhanced.

Complexity refers to the extent to which an invention is seen as challenging to comprehend and use. Adopters of innovation face challenges when they regard the innovation to be excessively intricate or have difficulty comprehending it.

Trialability on its part is the degree to which an innovation may have experimented on a limited basis. Innovation with higher trialability is more likely to be adopted by an individual than those with limited trialability (Zhang, *et al.*, 2015). People will accept innovation that is on a trial basis because it is assumed that on this basis uncertainty could be rectified before adopting it fully**.**

Observability refers to the degree to which the advantages of an invention are apparent to those who may consider adopting it (Zhang et al., 2015). Individuals will embrace new ideas and technologies only when they realise the tangible outcomes of these innovations. The anticipated outcome's visibility will enhance the pace at which the innovation is embraced (Folorunso et al., 2010).

**Model of innovation**

Several models have been advanced in the literature to show the process of innovation (Roger, 2003; Trott, 2017). As shown in Figure 7, the interactive model of innovation by Trott (2017) explains that organisations that can manage this type of innovation process effectively will be successful innovators.

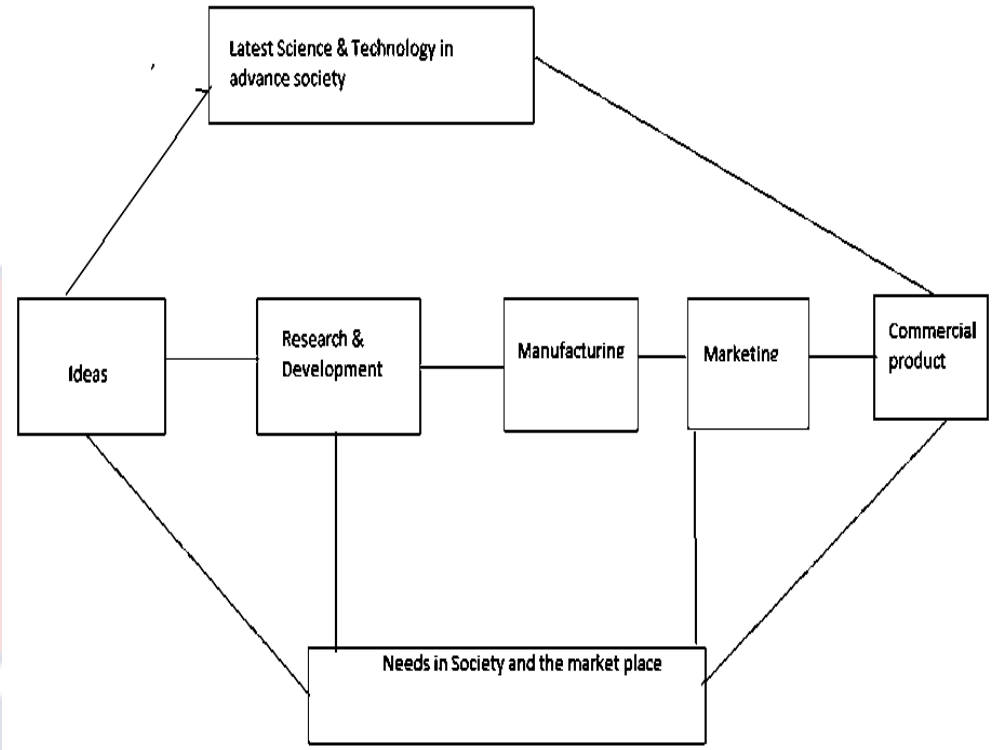


*Figure 7:* An interactive model of innovation.
Source: Trott (2017).

The centre of the model represents organisational functions such as research and development, manufacturing, engineering and design, and marketing. In this framework, the flow of communication channels is not linear as there is a provision for feedback. There is also a linkage between science and technology, research and development, and marketing and sales. The manufacturing function could initiate design improvement of a new product, which would be worked on by the research and development function, with the marketing people also developing innovative ideas through technological development from the marketplace (Trott, 2017).

**Communication channel**

Roger (2003) posited that the second component of the spread of innovation is a communication channel. He elucidated that diffusion is a distinct kind of communication that involves the interchange of message

content related to a novel concept or technology. Communication requires two entities: the sender and the recipient. In order to communicate effectively, it is necessary for one individual to possess either the concept, the methodology, the technology, or the firsthand knowledge of using the concept, technology, or methodology. A communication channel refers to the specific means through which information is sent to the intended recipient (Sahin, 2006). Roger further elucidates that the choice of communication channel has a crucial role in determining the successful transmission of information to the intended recipient. He asserts that the most efficient channel for disseminating information regarding innovation is the mass media, as it has the ability to reach a large audience within a short period.

Nevertheless, in the realm of interpersonal communication, such as face-to-face interaction, it is possible to effectively influence consumers' perceptions of a new product. Roger (2003) suggests that there are two sorts of interpersonal communication: homophilous and heterophyllous. The term used to describe interpersonal communication between two individuals is homophily. Interpersonal homophily refers to the extent to which two persons who interact have similarities in certain traits, such as beliefs, education, and socioeconomic position. When two or more individuals who have opposite attributes also communicate using interpersonal communication channels, this is termed heterophily.

**Time**

Time is the third component in the spread of innovation. Time is the length or period at which a potential adopter of innovation will decide whether to adopt the innovation or not (Roger, 2003). An individual's decision about

an innovation varies as well as the decision made by an organisation. While an individual may take a shorter or longer time to conclude an innovation decision, an organisation may consider several factors while making an innovation decision. Factors such as the internal and external characteristics of the organisation which include policy, cost of the innovation, economic situation, lack of interest in the innovation, lack of information, culture, and value of the organisation are all considered before considering an innovation decision. In this case, the decision process may be prolonged or complicated because of the number of individuals involved (Tornatzky, Fergus, & Avellar, 2013).

**The social system**

The social structure in usage is a crucial determinant of the dissemination of innovation. In his work, Roger (2003) categorises the social structure as the fourth factor in the spread of innovation. He describes it as a collection of interconnected entities that collaborate to solve problems and attain a shared objective. The social system serves as the conduit for the dissemination of an invention (Mahajan, Muller, & Peres, 2010). An individual's adoption or rejection of an invention is contingent upon their social structure, since conduct may be reliably anticipated based on this social framework, hence impacting the spread of innovation. The transmission of innovation is significantly influenced by the norms that form an integral element of the social structure. Norms refer to the established patterns of conduct that members of social groups follow, and they determine what activity is considered acceptable or undesirable within the group structure

(Roger, 2003). According to Zhang *et al.* (2015), the social structure is divided into five categories based on their attitude towards innovation.

These individuals may be categorised as innovators, early adopters, early majority, late majority, and laggards. Innovators are a select group of individuals who are the first adopters of innovation. They possess the ability to comprehend and implement the technical expertise required to introduce innovation into a social system from external sources. The second group consists of early adopters, who are more deeply embedded into the social structure compared to the inventors. An individual who embraces innovation at an early stage has extensive knowledge about the invention, maintains strong connections with emerging technology, and tends to achieve higher levels of economic success. According to Zhang et al. (2015), adopters are reported to possess better levels of education, income, and occupational position compared to non-adopters. The subsequent group consists of the early and late majority adopters, whereas the last groupings are the laggards. These people are, at times, resistors to innovation because of their limited financial resources (Zhang *et al.*, 2015).

**Innovation decision process**

As stated by Roger (2003), the decision to embrace or reject an invention does not happen instantaneously, but rather goes through a series of steps. Roger illustrates these procedures by employing a farming scenario in which a farmer abstained from impulsive decision-making when choosing a new crop seed for planting on their farm. Instead, the farmer acquired knowledge about the new seed through a channel and sought additional clarification before experimenting with it for some time prior to embracing it.

Roger subsequently developed a concept called the innovation-decision process model (refer to Figure 8). The innovation-decision process delineates the reception and subsequent adoption or rejection of an innovative concept across time. Roger (2003) conceptualized five main steps at which innovation decisions are carried out which are knowledge, persuasion, decision, implementation, and confirmation.

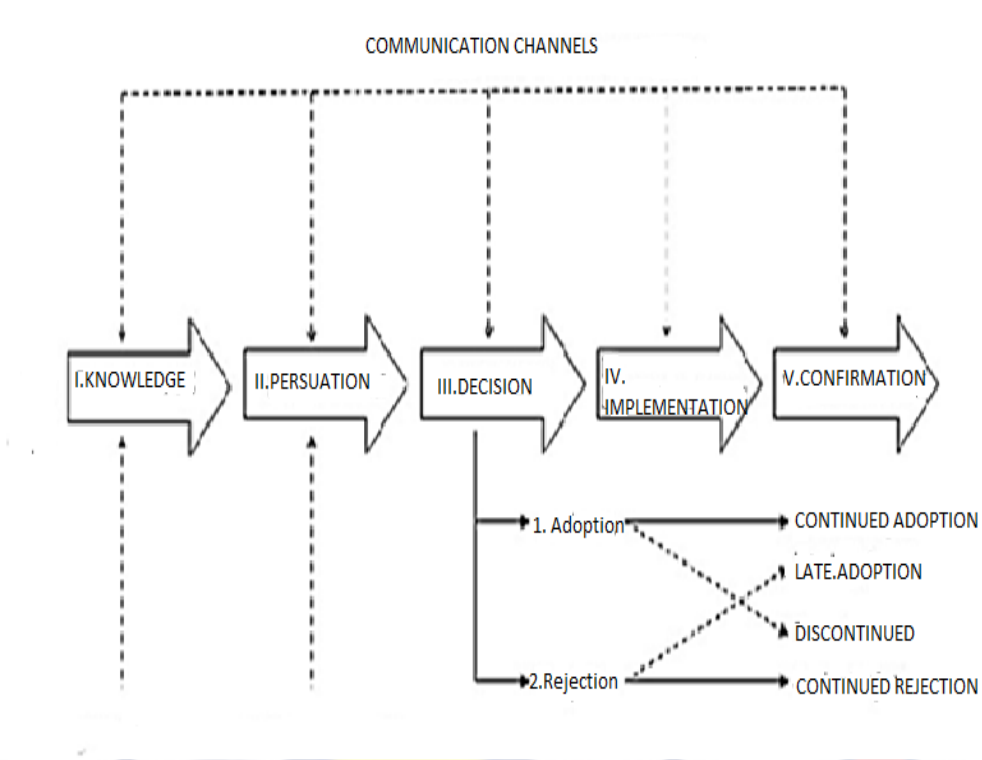


*Figure 8*: Roger's Five Steps in Innovation Decision.
Source: Sahin, 2006.

The first step in the innovation-decision process start when an individual or organisation learns first-hand information about the existence of the new idea or technology. A decision could only be made whether to accept or reject an innovation or idea when there is knowledge about such innovation (Sahin, 2006).

The second is the persuasion stage. Different people take different times to accept or reject innovation. An individual will not decide on

innovation unless they know the benefit to be derived from the innovation. This could only happen during the time of persuasion by early adopters of the innovation. In this phase, an individual or organisation will make a favourable or unfavourable decision about the innovation.

The decision stage will only be made when an individual or organisation has been engaged in some training or activities about the said innovation to know the benefit. This is followed by the implementation stage. Individuals or organisations will decide to adopt or reject innovation when they have tried the innovation during a certain period to ascertain the viability of the innovation and to ensure whether it supersedes the already existing one. The final stage is confirmation of the innovation. This will only occur when an individual or organisation has tested and approved the veracity of the innovation.

**Diffusion of innovation in the insurance industry**

Innovations are becoming the main tool of competition in the insurance industry, which has allowed insurance companies to add value to all insurance products (Klapkiv & Klapkiv, 2017). The insurance industry has become more innovative as a result of advancements in technology. All over the world, insurance companies have developed innovative insurance products at every stage in the sales of insurance products. One factor that brought this type of innovation into insurance companies was the 2007 to 2008 global financial crisis (Nicoletti, & Nicoletti, 2016).

Insurance companies must be able to increase their revenues and reduce operational costs to stay in business (Klapkiv & Klapkiv, 2017). This means insurance companies must be agile and flexible enough to achieve their

aims. Insurance companies have now recognised the need to be innovative in areas of product, process technology, and business model. The ability of insurance companies to be innovative will enable them to serve their customers well and also have a good relationship with them (Nicoletti, & Nicoletti, 2016).

Even though DOI has been used to assess the acceptance and use of technology, Kiwanuka (2015) argues that it accounts for between 47 and 87 percent of the differences in the adoption of innovation. Kiwanuka further argues that for a better understanding of how technology is accepted, different theories can be combined with the DOI to investigate how the use of technology is accepted. This was also supported by Lai, Chau, and Cui (2010) who observed that using both DOI and TAM gives a better explanation of the acceptance of internet banking in Hong Kong, and suggested that no one theory can cover all the factors that can explain users' behavioural intention to the acceptance and adoption of technology, concluding that each theory has its weakness and therefore it is necessary to combine theories that can provide a suitable model to determine factors that affect users intention to accept and adopt the technology.

**The Unified Theory of Acceptance and Use of Technology**

The Unified Theory of Acceptance and Use of Technology (UTAUT) is a commonly used framework for evaluating the adoption and utilisation of technology. Venkatesh and Zhang (2010) identified four primary factors that predict behavioural intention to accept technology and actual technology usage in organisational contexts. These factors are performance expectancy, effort expectancy, social influence, and facilitating conditions. Additionally,

four moderators, namely age, gender, experience, and voluntariness, were found to influence these predictions. This research is supported by previous studies conducted by Liu, Wang, Wang, Zhao, Pan, and Wang (2007) and Escobar-Rodríguez and Carvajal-Trujillo (2014).

UTAUT (see Figure 9) posits that performance expectancy, effort expectancy, social influence, gender, age, experience, and voluntariness of use are factors that influence the intention to use technology. Additionally, technology acceptance is determined by the combination of behavioural intention and facilitating conditions (Venkatesh, Thong, & Xu, 2016; Escobar-Rodríguez & Carvajal-Trujillo, 2014). The theory presented in Figure 9 is an amalgamation of eight previously influential theories and models: the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Motivational Model, the Theory of Planned Behaviour (TPB), a combination of TBP/TAM, the Model of PC Utilisation, Diffusion of Innovation Theory (DOI), and Social Cognitive Theory (SCT) (Williams, Rana, & Dwivedi, 2015). These contributing theories have all been accepted by various researchers on the use and adoption of technology in several areas of technological research.

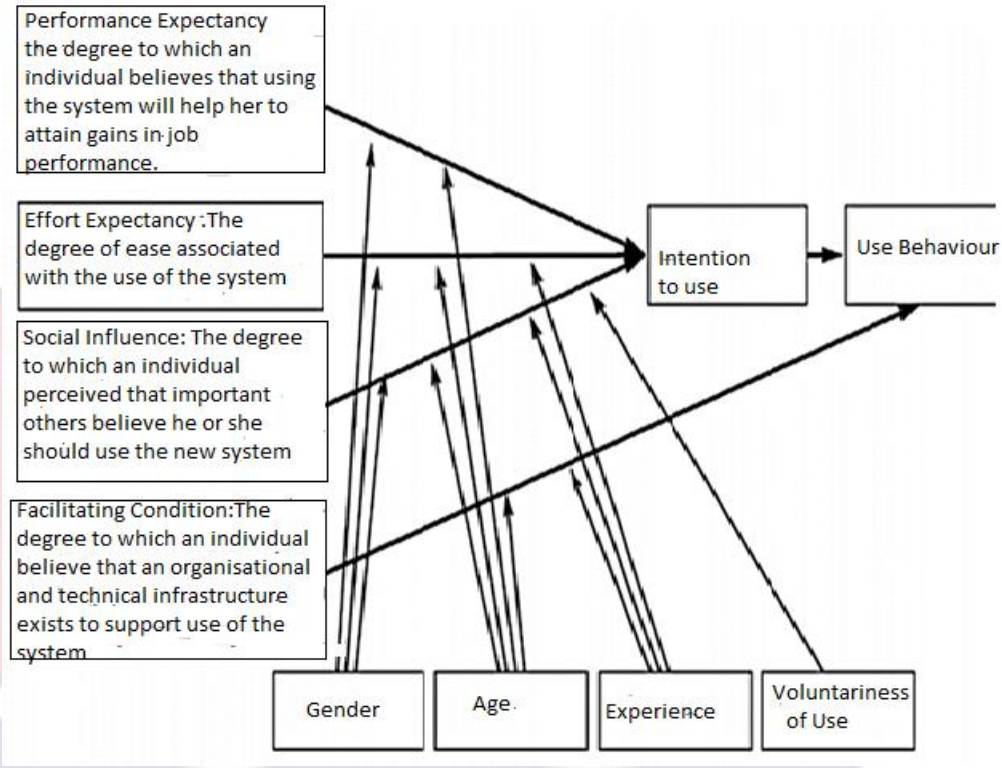


*Figure 9:* The Unified Theory of Acceptance and Use of Technology. Source: Adopted from Venkatesh & Zhang (2010)

**Performance expectancy**

Performance expectancy is the degree to which an individual or organisation believes that the use of technology will improve job performance (Venkatesh & Zhang 2010). Younger males tend to have a greater performance expectation factor due to their want to excel in the professional setting. According to Venkatesh and Zhang (2010), there is a claim that males exhibit a greater inclination towards achieving work performance goals compared to females. Additionally, younger individuals have a more pronounced aspiration for success in their jobs when compared to older workers. According to Davis (1989), if an individual or organisation believes that using or accepting technology will enhance job performance (perceived usefulness), they will readily adopt the technology. In a study conducted in Taiwan, Zhou, Lu, & Wang (2010) examined user acceptance of mobile

internet using the Unified Theory of Acceptance and Use of Technology (UTAUT). They discovered a positive relationship between performance expectancy and intention to use technology. The researchers recommended that organisations should focus on developing technology products that cater to the needs of potential users in order to increase their intention to adopt the technology.

Effort expectation refers to the level of user-perceived ease of use while using technology (Adell, 2010). The impact of the perceived ease of use on the desire to adopt a technology differs across different genders and age groups, with the highest influence shown among younger men who are in the early stages of experience. According to Zhou, Lu, and Wang (2010), there is evidence that effort expectation affects people' desire to utilise technology. Users often express concerns about the time and effort required to use the technology.

Social influence, as defined by Zhou, Lu, and Wang (2010), is the extent to which a person or organisation can persuade others to believe in the potential utility of new technology. This element also impacts the intention to adopt technology. The impact of social influence on behavioural intention is contingent upon factors such as gender, age, experience, and voluntariness, as discovered by Venkatesh and Zhang in 2010.

Facilitating condition refers to the extent to which a person feels that there is enough infrastructure available to enable the use of technology (Venkatesh & Zhang, 2010; Turan, Tunç, & Zehir, 2015). When there are sufficient resources and infrastructure, people or organisations have the chance to embrace the use of technology (Chen, Shih, Chen, & Lin, 2009).

Facilitating circumstances have a favourable link with the use of technology (Turan, Tunç, & Zehir, 2015). Onaolapo & Oyewole (2018) conducted a study to evaluate the utilisation of smartphones for E-learning among Nigerian University students. They found that insufficient infrastructure, insufficient government funding, and absence of regulatory measures were the primary factors contributing to the limited use of smartphones in E-learning by undergraduate and postgraduate students. When individuals or organisations perceived that the infrastructure needed to support the use of technology is available, people are then motivated to adopt the technology. In other words, the adoption of technology hinges on the facilitating conditions available (Onaolapo & Oyewole, 2018). Indeed, Thusi and Maduku (2020) suggest that people will continue to use technology when infrastructure support exists to do so. In a study by Escobar-Rodríguez and Carvajal-Trujillo (2014), it was reported that facilitating condition influences online purchase intention and online use. It has thus been established that facilitating condition is a key determinant of behavioural intention to use technology (Abubakar & Ahmad, 2013).

**Criticism of UTAUT**

The UTAUT theory is more extensive and has more explanatory capability in comparison to other theories related to the acceptance and utilisation of technology. However, it has been argued that the inclusion of additional theoretical mechanisms in UTAUT is important (Dulle & Minishi-Majanja,2011). For instance, Kiwanuka (2015) critiqued that UTAUT fails to include the process by which technology progresses from the inception stage to the adoption stage. As a result, UTAUT has been reviewed (UTAUT2) to

critically examine consumers' acceptance and use of technology by including constructs such as hedonic motivation, price value, and habit (Venkatesh, Thong, & Xu, 2012). Hedonic motivation is defined as the benefits or pleasure a consumer derives from using technology.

According to a research conducted by Kim & Garrison (2009), individuals who consider certain technologies to be applicable in enhancing their job productivity are inclined to actively seek further information on the technology's perceived efficacy. Simultaneously, persons who consider technology as pertinent to their profession would regard it as valuable and enhance their inclination to use it.

**Conceptual Framework for the Study**

Several theories and models have been used to examine technology adoption and utilisation, as shown by the literature review. Diffusion of Innovation (DOI), the Technology Acceptance Model (TAM), and the Unified Theory and Use of Technology (UTAUT) are some of these theories, and some of the factors that affect them are things like familiarity, familiarity with alternatives, perceived usefulness, perceived ease of use, and perceived usefulness. For example, (Escobar-Rodrguez, & Carvajal-Trujillo, 2014; Abubakar & Ahmad, 2013; Dulle & Minishi-Majanja, 2011).

Nevertheless, there is little knowledge about the applicability of these influencing variables to the adoption and use of technology by insurance firms and other players in the transportation business in Ghana. In order to fulfil the research goals and draw upon existing literature, it was necessary to make adjustments to the Unified Theory of Acceptance and Use of Technology (UTAUT) and the Diffusion of Innovation (DOI) model. This resulted in the

development of a conceptual framework for the study, as seen in Figure 10. The choice to merge the models is based on the assertion that no one theory can include all the aspects that elucidate the acceptance and utilisation of technology by diverse individuals and socio-cultural groups (Kiwanuka, 2015; Milanovic et al., 2020; Chen, 2019). The adaption aligns with Mahadeo's (2009) finding, where TAM and DOI were used to elucidate consumers' inclination towards adopting an electronic tax system in Mauritius. Furthermore, the findings align with Rahman's (2017) research, where a blend of TAM and UTAUT frameworks was used to elucidate the drivers' inclination and utilisation of technology, including their suggested array of variables.

In the adapted framework (Figure 10), awareness and knowledge from (DOI) explain that technology can easily be adopted when an individual or organisation becomes aware of the new technology because knowledge and awareness will produce a perception negative or positive about the said technology. The decision in the DOI framework was replaced by perception which is a situation where an individual or organisation makes a conscious decision about whether to use the technology or not. Social influence in the (UTAUT) model is replaced with "challenges." Social influence explains how people or organisations will adopt new technology when they believe that other organisations are adopting the technology. This will influence their behaviour to also adopt the technology since they are all in the same competitive business environment. Social influence is seen as shaping the internal belief structure upon which an individual or organisation's behaviour

intention about the use of technology is formed (Tian, Prybutok, Mirzaei, & Dinulescu, 2020).

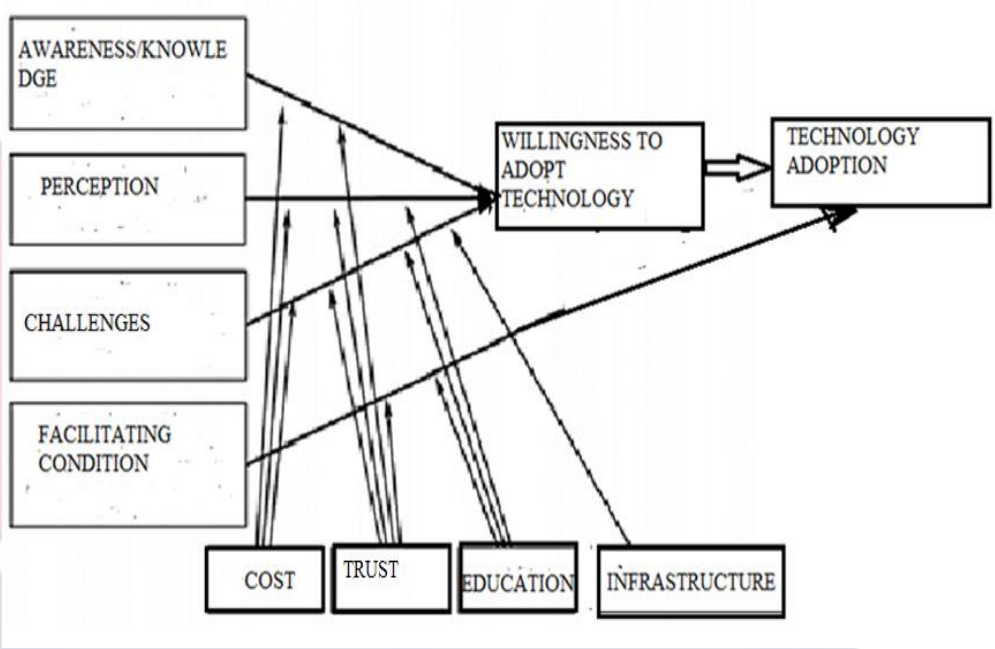


*Figure 10:* A conceptual framework on technology acceptance. Adapted from Roger, 2003; Venkatesh & Zhang, 2014.

The internal orientation of social influence is reflected in an organisation's belief that using technology will enhance its performance in the eyes of the general public (Maruping, Bala, Venketesh, Brown, 2017). Facilitating condition (UTAUT) is also adapted in this framework. Facilitating condition clarifies individuals' or organisations' willingness or preparedness to adopt technology when they believe that infrastructure exists to support the introduction or the implementation of new technology.

Technology awareness refers to knowledge and understanding concerning a particular technological product or service (Ahmed & Ward 2016). According to Kiwanuka (2015), the adoption of technology consists of three phases, namely attitude, adoption, and acceptance also influenced by the socio-demographic characteristics of the user of the technology. The user of the technology will first assess the technology and form a mental picture of

what he or she expects from the technology. This is the attitude phase and it involves raising awareness and interest in the technology among users. Abubakar & Ahmad (2013) posits that awareness of a product will raise its spread, in other words, if there is awareness, it will increase the user's intention to use the technology because awareness is an important requirement for the development of moral norms. Awareness of technology can be of great value for enhancing its use.

Alharbi, Papadaki and Dowland (2017) explained that lack of awareness is a major hindrance to the acceptance, rejection, and use of technology because awareness plays an important role in the acceptance of new technology and lack of it will unavoidably influence potential users of technology. Therefore, for any technology to be accepted and adopted, there must be an awareness creation. Similarly, Ahmed & Ward (2016) stated that when people are aware of a technology it tends to improve their willingness towards using the technology.

**Perception**

Perception is the cognitive process by which humans arrange and interpret their sensory perceptions in order to derive significance from their surroundings (Robbins & Judge, 2007). Ewing & Handy (2009) also describes perception as the cognitive process of acquiring consciousness or comprehension of sensory information. They further said that an individual's perception is influenced by the interaction of their attitude, interest, prior experiences, cultural background, and interpretation of the received stimuli. Put simply, familiarity and understanding of a product or technology will shape one's perspective, potentially impacting how individuals or

organisations see the technology, thereby influencing their willingness to embrace and employ it.

In a study by Haring, Mougenot, Ono, & Watanabe *(*2014), it was reported that there is a positive relationship between cultural background on perception, assumption, and attitude toward the acceptance of technology.

Several factors have been identified in the literature as a challenge to the implementation of a telematics-based insurance policy (Litman, 2018; Constantinescu, Stancu, & Panait, 2018). Insurance companies must develop and change how the premium is calculated by modifying their computer programmes, in so doing, insurance companies need different types of equipment, different applications, and different data plans. Also, the cost of the telematics device, the installation, and maintenance of the devices all come as an additional cost to the company and present a significant challenge to insurance companies in their ability to accept and integrate telematics-based insurance policies (Ocken, 2012; Karapiperis, Birnbaum, Brandenburg., Castagna., Grenberg, Harbage, & Obersteadt, 2015). Another challenge to the implementation of the telematics-based insurance policy is the lower premium attached to the policy. This means that insurance companies, in the initial stage of the implementation of the policy, must sacrifice some margin of profit for most of their profitable customers (Bender, 2014). This sometimes prevents some insurance companies from implementing this type of policy.

Before integrating a telematics-based insurance policy into the existing one, insurance companies must have support from the policyholders regarding the benefits of the policy to them. One of the challenges to the implementation of a telematics-based insurance policy is the degree to which policyholders are

ready to embrace the technology. According to Karapiperis *et al.* (2015), less than half of the people involved in telematics-based insurance in the US market said they would be happy to be monitored irrespective of any discount given. Also, the implementation of the policy increases data portability concerns among policy-holders. Notwithstanding the benefit derived from the telematics-based insurance policy, one of the factors that affect the implementation of this type of policy is that a lot of drivers are not comfortable with insurance companies monitoring them. However, according to Stocker & Whalley (2016), a good design programme will help these companies to overcome this challenge.

With the advancement in technology and its associated advantages, several companies are expanding their business portfolio by investing in technology. In addition, companies are also working to encourage their clients to get familiar with technological advancement to enhance their preparedness to use technology (Ahmed &Ward 2016). According to Karapipiries (2015), the majority of insurance policy-holders are prepared to adopt the telematics-based insurance policy with even as low as a ten percent premium discount offered by insurance companies.

The adoption phase of technology acceptance involves users trying the technology, purchasing, adopting, and implementing the technology. In this context, telematics use represents the adoption of the telematics policy. Kiwanuka (2015) said that the adoption of technology begins with the customer's choice to buy a product or service. This decision is influenced by the customer's attitude and expectations towards the product, forming the

foundation for consideration. The decision for the adoption or rejection will also be made following a trial of the product by the user.

**Research Gaps**

Two main gaps were uncovered in the literature during the review which this present study will address. The first was that several works of literature (Afukaar, *et al*., 2003; Agyemang , 2018;Ackaah, Apuseyine & Afukaar, 2020) on how road traffic crash fatalities can be reduced in Ghana have concentrated principally on the use of education, engineering, and enforcement as the method which can lead to the reduction in road traffic crashes in Ghana. However, the literature argues that the use of these methods has reached the end of their maximum usefulness and is no longer effective in managing road traffic crashes (Tooth, 2017). Second, there is hardly any study in Ghana on how telematics-based insurance policies can contribute to the reduction in road traffic crashes. Therefore, there is a need to research telematics-based insurance policies and how they can help reduce the spate of road traffic crashes. This study, therefore, fills these gaps by exploring the acceptance of telematics-based insurance policies and how they can be integrated into the existing insurance policy framework to reduce the rate of road traffic crashes in Ghana using the Sekondi-Takoradi metropolis.

**Summary**

In this chapter, a critical review of the literature on the traditional methods of insurance, their weaknesses, and why they have been replaced with telematics-based policies has been examined. The term telematics has been defined, and the concept of telematics-based insurance policy has been described. The research has also analysed the theoretical and conceptual

underpinnings that support it. Some factors found to be associated with the acceptance and adoption of innovation include knowledge, awareness, persuasion, relative advantage, compatibility, complexity, attitude, perceived usefulness, ease of use, performance expectancy, social influence, trust, and facilitating conditions have been discussed. Finally, a conceptual framework to answer the objectives of this study has been constructed using a combination of models.

# CHAPTER THREE

# CAUSES OF ROAD TRAFFIC CRASHES AND OVERVIEW OF INSURANCE

## Introduction

This chapter provides an overview of the incidence of road traffic crashes and their causes. Interventions used in this country to tackle road traffic crashes have also been discussed. The rest of the chapter focuses on issues relating to insurance. Among them are the history of insurance, the types of automotive insurance products, and recent developments in insurance in Ghana. The section also looks at how automotive insurance premiums are determined in the country, and the role telematics-based insurance policy can play in road traffic crash reduction. The challenges to the implementation of telematics and telematics-based insurance and the benefits to be derived from the implementation of telematics-based insurance in reducing road traffic crashes have also been explained.

## Road traffic crashes in Ghana

Road traffic crash in Ghana is now a public health issue that needs a quick remedial measure (Annag, 2019). Daily media reports show that the road traffic crash phenomenon has not seen any significant decrease since the campaign on road traffic crash reduction began more than a decade ago (Agyeman *et al.*, 2013). Almost every day in Ghana there is a report of a road traffic crash. Road traffic crash in Ghana is said to be the second cause of death after malaria and it is reported that on average 1,900 fatalities are recorded annually in the country with 15,000 injured (Enu, 2015; Safo, 2019). This infers that about six persons are killed every day in Ghana. It is estimated

that annually road traffic crashes cost 1.6 percent of Ghana's gross domestic product (GDP) (NRSC, 2016). The most vulnerable road user groups in Ghana are pedestrians (Jadaan et al., 2018). Pedestrian crashes account for 39.5 percent of all fatalities (Road Crash Statistics 2016). Data compiled by the Motor Traffic and Transport Department (MTTD) of the Ghana Police Service show that between 1991 and 2018, approximately 46,284 fatalities were reported with an average annual increase of 12.76 percent based on 2016 data (NRSC, 2019).

Among the total of 2084 fatalities in 2016, 824 individuals, accounting for 39.5% of the total, were pedestrians. The Ashanti region surpassed the Greater Accra region for the first time in ten years, reporting the highest number of fatalities with 403 deaths (19.3%). The Greater Accra region followed closely with 367 deaths (17.6%), while Brong Ahafo recorded 299 fatalities (14.3%). The Eastern region reported 293 deaths (14.1%), and the Central region had 213 deaths (10.2%). The combined contribution of the five (5) regions accounted for 75.5 percent of all road traffic accidents in Ghana (NRSC, 2016).

Approximately 60 percent of all RTC fatalities occur on non-urban roads. Men are more vulnerable to dying on the roads (78%) than women (22%) in Ghana. The majority of road traffic crashes (34.1%) happen on Fridays and Saturdays, with December as the most accident-prone month in Ghana (NRSC, 2020).

**Contributory factors of road traffic crashes**

The determinants of road traffic crashes are complex and involve many factors. Several researchers such as (Ackaah, & Adonteng, 2011; Ackaah,

Apuseyine, & Afukaar, 2020), have concluded that road traffic crashes could be understood if the factors involved in the crashes are properly identified, thus assisting in formulating strategies to deal with the challenge, literature on road traffic crashes shows that there are multifaceted contributory factors (Theuri, 2008; Jilcha, 2009; Abane, 2012; Zakeri & Kadkhodazadeh, 2015). Bener, Abu-Zidan, Bensiali, Al-Mulla, & Jadaan (2003) conducted a research on enhancing road safety in developing nations. They identified two categories of causes contributing to road traffic accidents: direct and indirect. The primary elements include road user conduct, competence and mindset, traffic engineering, road infrastructure and surroundings, and accessibility of medical services. The indirect elements include demographic aspects, such as population structure and distribution, as well as vehicle-related factors, including the number of cars, their kind, use, and occupancy rate.

**The Human, Vehicle, and Environmental factors**

Road traffic crashes do not just happen, they occur as a result of a combination of factors. In the systems approach, these factors are ascribed to the human, vehicle, and environment that are present at the time of the crash (Botha, 2005). Human, vehicle, and environmental factors play a role in pre-crash, crash, and post-crash situations. In epidemiological terms, these factors could be studied separately in terms of the agent, host, and environment (Jagdish, Roy., Srinivasa, & Jha, 2004). Of the three main factors, the human factor alone is the worse and accounts for 85- 90 percent of the total crashes (Abane, 2012). Pre-crash behaviour includes lack of information about the type of road, attitudes of drivers on the road including inattention, medical condition, alcohol impairment, drug abuse, speeding and disregard for road

traffic rules and regulations, and lack of rules enforcement by police (Aworemi, Abdul-Azeez, & Olabode, 2010).

Vehicle characteristics are another factor that contributes to road traffic crashes and includes the condition of the vehicle such as old or new, roadworthiness, lighting, braking, steering characteristics, and suspension system. This is followed by environmental factors such as the condition of the road, whether the road is paved or graveled, speed limit, types of speed calming measures, and weather conditions. Figure 11 shows a model of road traffic crash causation.

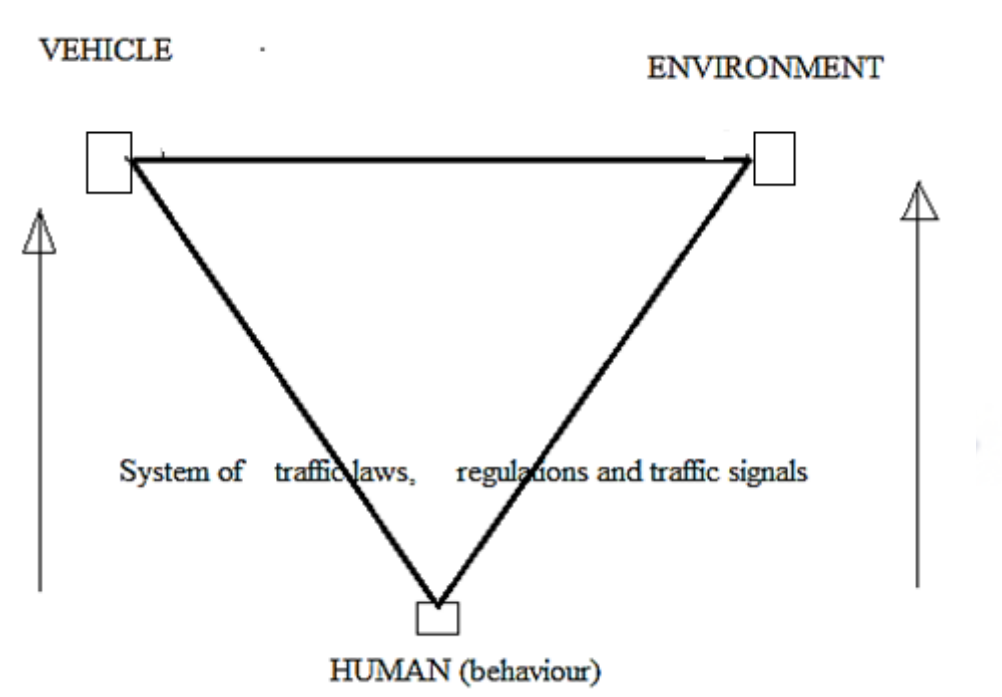


*Figure 11:* Model of main factors causing road traffic crashes.
Source: Jorgensen & Albane, 1999; Abane (2012).

**Speed as a risk factor in road traffic crashes**

Speed is a very noticeable risk factor in road traffic accidents. Speed not only impacts the intensity of a collision but also the likelihood of getting engaged in one (Ubbels & Knockaert, 2015). According to Ma et al. (2018), in the United Kingdom, speeding above the posted speed limit and speeding

significantly different from traffic flow correlates with road traffic crashes. In similar research conducted by Zalat, Zalabani & Mansuri (2015), in Saudi Arabia, speeding was the major cause of all road traffic crashes, accounting for 29.1 percent of all crashes reported in 2006 and 43.1 percent in 2010.

In another research, Nasiri, Nazari, Kamali, Sharifi, and Sharifi (2019) reported that overspeeding, especially in bad weather conditions, increased road traffic crash death rates in Sistan and Baluchistan in Iran between 2013 and 2017. Xu, Bao, Wang, & Liu (2018) also found that in China, speeding and overload of vehicles contributed to 53 percent and 48.4 percent, respectively, of road traffic crashes. In Saudi Arabia, Mansuri, Al-Zalabani, Zalat, and Qabshawi (2015) also reported that speeding is the major contributory factor to road traffic crashes, accounting for 43.1 percent of all crashes in 2010. It is not surprising that Bolderdijk, Knockaert, Steg, & Verhoef (2011) observed that a five percent reduction in speed could lead to as much as a 20 percent reduction in traffic fatalities.

**Fatigue as a risk factor in a road traffic crash**

Another human factor that has also been attributed to road traffic crashes is fatigue. Fatigue is defined as the feeling of drowsiness due to a prolonged period of driving (Goh, Tamrim, & Kee, 2010). When a driver is fatigued, he or she cannot concentrate well, resulting in a crash. In a research conducted by Goh *et al.* (2010), it was reported that 37.7 percent of all commercial drivers encountered fatigue and drowsiness during driving, which was among the most identified reasons behind most of the traffic crashes in Malaysia. Armstrong, Smith, Steinhardt, & Howorth (2008) found in similar research in South Australia that fatigue-related crashes are more fatal than

other forms of crashes because, in a fatigue-related crash, drivers have a reduced reaction time to respond to any traffic hazard, thus preventing a driver from an emergency manoeuvre. However, in China, Xu *et al*. (2018) found that fatigued driving accounted for only 7.1 percent and drink-drive accounted for four percent of the contributory factors to road traffic crashes and attributed the findings to strict laws in China which punish these offences severely.

**Inattentiveness or distraction as a risk factor**

Inattentiveness or distraction is another human component that contributes to road traffic accidents. A "distraction" refers to the condition in which a motorist voluntarily or unwillingly participates in a secondary activity that hampers their ability to accomplish the main duty of driving (Hyer, Sohnle, Mehan, & Ragan, 2003). The National Highway Safety Administration (NHTSA, 2018) defined distraction as the act of drivers shifting their attention away from their usual driving duty to concentrate on another activity. The 2018 study from the National Highway Traffic Safety Administration (NHTSA) reveals that distracted driving behaviour accounted for nine percent of the fatal collisions recorded in the United States in 2017. Damsere-Derry, Ebel, Mock, Afukaar, & Donkor (2010) shown that distraction is not limited to driving but also extends to pedestrian behaviour such as wearing headphones, engaging in mobile phone conversations, eating while walking, smoking, and conversing while crossing the road.

WHO (2011) divided distraction into two categories: internal and external. Internal distraction occurs when a driver decides to turn a radio control or use their mobile phone while driving, while external distraction

occurs when drivers look at the roadside billboards advertising or watch people on the side of the road. A review of the literature shows that several researchers (Gordon, 2005; Young, Regan, & Hammer, 2007), see distraction as one of the problems of inattentiveness in driving. For example, research conducted by Young, Ragan & Hammer, (2007) established that almost a quarter of all road traffic crashes in the United States are attributed to driver distraction. Similar research by Gordon (2005) found that driver distraction alone accounted for 13 percent of road traffic crashes in New Zealand.

According to data from the World Health Organisation (WHO) in (2020), there has been a significant rise in the proportion of drivers who use mobile phones while operating a vehicle, rising from one percent to 11 percent in recent years. Mobile phone use may lead drivers to divert their gaze from the road, remove their hands from the steering wheel, and shift their attention away from the road and the immediate environment. According to a study conducted by the World Health Organisation (WHO) in 2020, drivers who use a mobile phone while driving are four times more prone to being involved in road traffic accidents compared to drivers who do not use mobile phones. Utilising a cell phone while driving diminishes the driver's response time, so impeding their ability to maintain their lane and adhere to an appropriate following distance, perhaps resulting in a collision.

Another factor that has been attributed to road traffic injury severity is the non-use of crash helmets and seatbelts. While the use of crash helmets and seatbelts did not prevent road traffic crashes, the use of a crash helmet has been found to reduce 42 percent of motorcycle crash fatalities and 69 percent of head injuries during a crash (Bendak, 2005). A seatbelt reduces the severity

of the injury caused by a road traffic crash by protecting vehicle occupants in their seats and preventing them from hitting themselves with any part of the interior compartment. The use of seatbelts by front-seat passengers is also found to reduce eye injuries by 60 percent, (Abu-Zidan, Abbas, Hefny, Eid, & Grivna, 2012). WHO (2020) reported that the use of seatbelt by front-seat occupants, reduce the risk of death during a crash by 45-50 percent. In similar research, Bener, Al Humoud, Price, Azhar, Khalid, Rysavy, and Crundall, (2007) found that when the seatbelt law was implemented in Saudi Arabia in 2001 there was a 17.7 percent reduction in road traffic crash fatalities and injuries.

**Vehicle factor**

Vehicle characteristics are another factor that contributes to road traffic crashes and includes the condition of the vehicle such as old or new, roadworthiness, lighting, braking, steering characteristics, and suspension system. The significant role played by the vehicle in road traffic crash occurrence cannot be overemphasised. For example, when the vehicle condition is bad, that is, when the active and passive components of vehicles are not properly maintained, it will have a detrimental effect on both pre-crash, crash, and post-crash phases. A poorly maintained vehicle is the genesis of all road traffic crashes (Atlas magazine, 2020). Non-adherence to vehicle maintenance schedules such as braking systems, wheels and tires, and other major components will lead to road traffic crashes.

Xu *et al.* (2018) found that in China, the second contributory factor to road traffic crashes was the vehicle factor which contributed 37.3percent of all road traffic crashes. Financial constraint is also a factor in road traffic crashes.

According to Chen (2010), the lack of economic and financial resources is hampering the people of Africa by making it impossible to purchase new and safe cars, therefore compromising road traffic safety. In a similar research by

Jagdish et al. (2004), in South India, it was reported that more road traffic crashes were recorded among people of low socioeconomic backgrounds. Worley (2006) also observed that three-quarters of all families in developing countries who lost a family member to road traffic crashes were from low-income groups.

Individuals with lower socio-economic status in low- and middle-income countries (LMICs) have a higher susceptibility to road traffic accidents compared to those with higher income levels (WHO, 2020). In another research in India, Gururaj, (2008) found that road traffic crash was linked with poverty, and reported that road traffic crashes were 13.1 percent and 48.1 percent, per 100, 000 in the poorer socio-economic group. Furthermore, Hazen & Ehiri (2006) found a relationship between road traffic crashes and socio-economic factors. In their study, they found that in Kenya, people with low financial background resort to walking instead of taking public transport, and due to the lack of safe pedestrian walkways, walking results in increased road traffic crashes.

Available data suggests that 80 percent of vehicles used in Ghana are imported as second-hand from developed nations. The majority of these vehicles have fulfilled their intended function and have reached the end of their lifespan. To mitigate the impact of older automobiles on road traffic accidents in Ghana, the Government implemented a prohibition on importing vehicles that exceed 10 years of age into the nation, starting from May 2020

(Sulemana, 2012). According to Agbo, Li, Zheng, & Atombo (2018), technological developments have contributed to a reduction in vehicle design faults. However, failure to regularly maintain some components might lead to their failure and therefore result in road traffic accidents. According to Amedorme & Nsoh, (2016) mechanical problems such as brake failure, tire burst, engine breakdown, poor vehicle lighting system, and faulty steering system continued to be cited in most of the road traffic crashes in Ghana.

**The environmental factor**

The other factor which has been cited in the literature as contributing to the growing road traffic crashes all over the world is the road environment (Summala & Kilpelainen, 2007; Thompson, Baldock, Mathias, & Wundersitz, 2013). WHO (2018) estimates that 80 percent of roads in low-income countries have no pedestrian footpath. Yet road and infrastructure designs can reduce road traffic crashes and their associated fatalities and injuries (Wang, Quddus, & Ison, 2013).The environmental factor associated with road traffic crashes includes road and weather conditions, road layout, type of road surface, horizontal and vertical alignment of the road, and speed limit (Thompson, Baldock, Mathias, & Wundersitz, 2013). Manya Krobo, Teye-Kwodjo (2017) established a correlation between road design and road traffic accidents. He disclosed that the absence of pedestrian walkways, sidewalks, and adequate footbridges are the primary factors contributing to vehicular collisions in the region. Damsere-Derry et al (2010) discovered that 90 percent of pedestrian deaths in Ghana occurred on road sections without a centre median. Additionally, it was discovered that the vast majority (80%) of

pedestrian collisions occurred on the straight portion of the road, whereas 7 to 10 percent took place on the sloped and curved sections, respectively.

Summala & Kilpelainen (2007), in their study on the effect of weather and weather forecast on driver behaviour on road traffic crashes, found that adverse weather conditions like rain, snowfall, and temperature fluctuations are the major cause of increased road traffic crashes in Europe and North America.

In Ghana, literature (Abane, 2012; Ackaah, Apuseyine, & Afukaar, 2020) shows that road condition is one of the major causes of road traffic crashes. The nature of the road is so poor that drivers find it difficult to drive, especially at night. Conditions such as unapproved speed rumps, poor lighting systems along some roads, and poor road markings are factors attributed to poor driving during the night. The possibility of being killed at night in Ghana is 1.3 times more than during the day, and the risk of death is high, 44 percent among pedestrians and 18 percent for motorcyclists as a result of the poor nature of roads.

**Road safety interventions to reduce road traffic crashes**

Conventional road safety measures, such as enforcing seat belt use, enhancing road infrastructure, and enforcing traffic restrictions, have achieved a certain level of success in decreasing fatalities caused by vehicle accidents. According to Boateng (2022), Ghana saw a decline in reported road traffic accidents for the period of January to June 2022, in comparison to the same period in 2021. The statistics revealed that there were 7,687 recorded cases in the first quarter of 2022, compared to 8,188 cases in the previous year 2021. This represents a decrease of 401 cases, equivalent to a 6.12 percent decline.

However, Bolderdijk *et al.* (2011) argue that such interventions have only reduced road traffic crash severity but have done only little to address the human aspect of road traffic crashes. Therefore, to reduce road traffic crashes, a comprehensive road traffic management strategy is required. Road traffic crash management strategies are tools, policies, and interventions that are used by institutions, organisations, road safety practitioners, and policymakers to reduce road traffic crashes. These policies include measures, instruments, counter-measures, actions, responses, and guidelines which reduce road traffic crashes (Hughes, Anund, & Falkmer, 2016).

In 1988, the Ghanaian Government recognised the need of addressing the issue of road traffic accidents inside the nation. Consequently, the Ghana Road Safety Project (GRSP) was established as part of the World Bank Transport Rehabilitation Project (NRSC, 2017). The primary goal of the GRSP was to enhance the knowledge and expertise of key stakeholders in order to effectively address road safety issues in Ghana. The GRSP was established with the objective of enhancing the capacity of the National Road Safety Committee, the Vehicle Examination and Licencing Division (VELD), the Ghana Highway Authority (GHA), the Department of Urban Roads (DUR), and the Motor Traffic and Transportation Unit (MTTU) of the Ghana Police Service (GPS) (NRSC, 2017).

The Ghana Road Safety Project concluded with many suggestions aimed at enhancing road traffic safety in Ghana. An example of a suggestion was to convert the National Road Safety Committee into the National Road Safety Commission (NRSA). The purpose of this initiative was to enhance their ability to enhance road safety standards and serve as the central hub for

road safety initiatives (Kwakye & Fouracre, 2008). The National Road Safety Commission Act, 1999 (Act, 567) was superseded by the National Road Safety Authority Act, 2019 (Acts, 993) in August 2019. The new act has the added responsibility of promoting road safety practises among road users and overseeing all road safety actions (NRSC, 2017).

Figure 12 shows the state of the road traffic crash situation in Ghana. The figure shows that between 2011 and 2013 there was a slight increase in the number of fatalities, using 2010 as the base year. The only time there was a decrease in the rate of fatalities was in the year 2014. However, there was a sudden rise in fatalities from 2015 to 2018, which indicates that Ghana is losing the fight against road traffic crashes and, therefore, urgent measures are needed to reverse this trend. Since several interventions have been used without any clear success, there is the need to try different interventions, and this is where the use of telematics and telematics-based insurance comes in, which is the focus of this study.

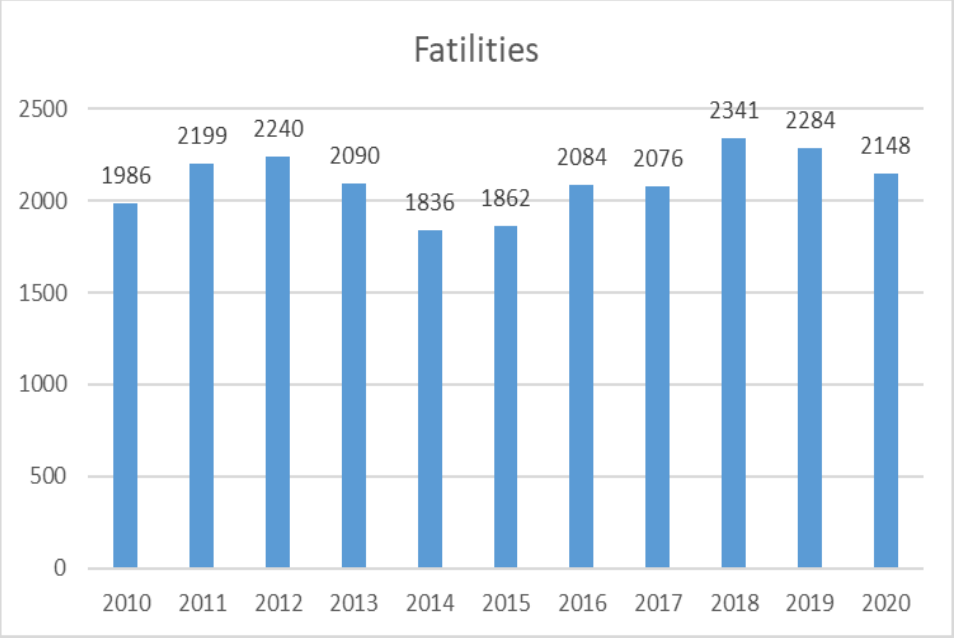


*Figure 12*: Road traffic fatalities in Ghana from 2010 to 2020.
Source. (NRSC, 2021).

## Overview of Insurance

### General insurance

Insurance functions by pooling risks, which involves the sharing of hazards among a large number of individuals or a group. This process effectively diminishes the risks encountered by both the group and the individuals within it (Pidchosa & Dovhosheia, 2019). Individuals make payments to get insurance coverage and, in return, obtain a commitment from the insurer that the insurance company would compensate them in the case of a loss (Nimoh, Baah, & Tham-Agyekum, 2011). The insurance sector comprises many entities, including the insured, the insurer, agents, brokers, and other auxiliary organisations. Internationally, several bodies and groups oversee insurance operations. These organisations and associations are responsible for controlling the insurance industry and creating and implementing standards to promote fair competition among members of the association (Pidchosa & Dovhosheia, 2019).

### Automotive Insurance

Automotive insurance is a transfer of risk that allows a policyholder to receive financial compensation for damage to his or her vehicle as a result of an event beyond his or her control (Hamm, 2008). Insurance firms assume these risks in return for a specified sum of money, known as a premium, paid by the policyholder in advance. Insurance firms must effectively handle these risks by setting a justifiable premium for the risks they take on and generating a decent level of profit. The premium must strike a balance between being sufficiently low to maintain client interest in the transfer while being high enough to ensure the profitability of the insurer is not at risk (Yoa, 2018).

The global market for automotive insurance expanded by $33 billion in 2013 (Mckinsey, 2018) with most growth coming from emerging markets like China, India, Indonesia, Malaysia, Vietnam, and the Middle East. Emerging Asia captured 38 percent of the global insurance industry (Mckinsey, 2018). In some emerging markets, premium prices have been dropping due to fewer crashes and increased competition from the direct market. Growth in insurance is driven by a continuous surge in car ownership which has risen about nine percent annually since 2006 (Mckinsey, 2018).

According to Mckinsey (2018), the growth of car insurance in the mature market remained stagnant from 2006 to 2012. The persistent lack of growth observed can be attributed to the ongoing trend primarily influenced by advancements in technology. This includes the implementation of advanced safety features in automobiles, such as the anti-lock braking system (ABS), airbags, electronic stability control, and autonomous emergency braking system, resulting in a decrease in the number of accidents.

Insurance plays a major role in the development of global economies. Insurance is a very large industry and involves trillions of dollars in expenditure (Kunreuther, Pauly, McMorrow, 2013). Global insurance premiums increased by 1.5 percent in 2017, down from 2.2 percent in 2016, with non-life premium slowing to 2.8 percent in 2017 adjusted for inflation from 3.3 percent in 2016 (Pidchosa & Dovhosheia, 2019).

Pidchosa and Dovhosheia (2019) reported that in 2017, the United States had the highest worldwide market share of insurance premiums, accounting for 56.1%. Subsequently, the United Kingdom accounted for 7.8% of the total, followed closely by Japan at 7.7%. France, Germany, Korea, Italy,

Spain, and Australia all made significant contributions, with percentages of 6.2%, 6.1%, 3.6%, 3.0%, 1.5%, and 1.4% respectively. In 2017, insurance premiums saw consistent worldwide growth. In 2017, there was a rise in gross premiums in those nations for both the life and non-life sectors of the business (Kunreuther et al., 2013).

**Insurance products in Ghana**

Insurance policies in Ghana are of two types: Life insurance and non-life insurance. Life insurance encompasses all insurance policies related to the well-being and mortality of an individual, as well as provisions for funeral expenses. Non-life insurance plans primarily aim to safeguard tangible assets and financial interests in everyday life, including automobiles, residences, other properties, and potential monetary setbacks (Johansson & Ohlsson, 2010). Non-life insurance plans may be categorised into three primary types: private third-party, third-party fire and theft, and comprehensive policies. In addition, there are commercial third-party insurance policies, commercial comprehensive insurance policies, commercial fire and theft insurance policies, and partly comprehensive insurance policies (Pidchosa & Dovhosheia, 2019).

Using a motor vehicle on a public road without insurance to cover its third-party liabilities is considered a violation of the motor vehicle third-party legislation (Kumaga, Kuttu, & Asuming, 2016). In the compulsory third-party insurance policy, the insurance company is the first party (insurer) the individual or the party who transfers his or her risk to another person or party is known as the second party (insured). The victim or an individual who will benefit from the policy is the third party. The compulsory third-party

insurance policy compensates for bodily injury and property damage claims made against the policyholder, keeper, and driver of a vehicle (Pidchosa & Dovhosheia, 2019).

The partial comprehensive insurance policy compensates for property losses to the insured vehicle due to fire, theft, and other forms of a crash, and the fully comprehensive policy compensates for all losses covered by the third party and partial comprehensive policy (Decarolis, Polyakova, & Ryan, (2020). In addition to the coverage provided by third-party liability insurance, comprehensive motor insurance protects the insured's vehicle from perils such as fire (including explosion and lightning), flood, earthquake, vandalism, theft, and collision damage (Kumaga, et al., 2016). The primary distinction between comprehensive insurance and legally required third-party insurance is that the former provides protection for the insured's vehicle up to the car's worth, while the latter does not.

To create a policy, an ex-ante premium is generally paid by the first party. This premium paid is used as a guarantee to compensate any claimant in the event of any claim against the first party under this policy. Generally, this type of policy has the following features: legally enforceable risk transfers, a consideration which is a premium paid by the first party against risk and, or benefits, a risk pool created if there are many parties, and finally, distribution of benefits from the pool ( Paolucci, & Shmueli, 2011).

**History of Insurance in Ghana**

The vehicle insurance industry in Ghana has the greatest portion of non-life insurance policies and is seeing rapid growth in the Sub-Saharan African area (Azaare, Wu, Gumah, Ampaw, & Kwadwo, 2021). The origins of

the Ghana insurance sector may be traced back to the colonial period, during which insurance transactions were conducted by foreign trade businesses acting as intermediaries for insurance companies based in the United Kingdom (Boadu, Dwomo-Fokuo, Boakye, & Frimpong, 2014). In 1924, the Royal Exchange Assurance Corporation, represented by its principal agent Barclays Bank, established a branch on the Gold Coast (Alhassan & Fiador, 2014). The first Gold Coast Insurance Company was founded in 1955 and subsequently rebranded as Ghana Insurance Company in anticipation of Ghana's impending independence. The first automobile insurance business was founded in Ghana in 1958. The State Insurance Company(SIC) was established as a result of a merger between Gold Coast Insurance Company and Cooperative Insurance Society in 1962 (Alhassan & Fiador, 2014). Currently, besides the State Insurance Company, there are other major insurance companies like Phoenix Life Assurance Company, Metropolitan Insurance Company, Provident Life Assurance Company, and Done Well Life Insurance Company (National Insurance Commission (NIC) (2020).

The National Insurance Commission (NIC) of Ghana was established as a legal entity under the Insurance Act, 2006 (Act, 724), which replaced the Insurance law of 1989 (PNDC, Law 227). The NIC's main role is to ensure the efficient management, oversight, regulation, monitoring, and control of insurance activities in Ghana (Frimpong, 2014). Prior to 2016, the insurance market had several issues such as fraudulent insurance registrations, complexities in evaluating claims after road accidents, and the issue of underpricing (NIC, 2020). In order to address these challenges, the National Insurance Commission of Ghana implemented several reforms such as the

financial condition report, approval of commission rate, introduction of risk-based capital requirement, and conducted workshops and educational training for industry stakeholders. These measures were implemented to enhance operational efficiency (Ghana's Insurance Act, 2021). As of the end of March 2019, Ghana had 62 registered insurance companies in the country, comprising 29 non-life, 24 life insurance, 3 reinsurance, 4 reinsurance brokers, 2 loss adjusters, and 7800 insurance agents. Together they employ 12, 500 people and contribute 1.2 percent of Ghana's gross domestic product (GDP).

In Ghana, insurance operations are categorised into two main sectors: life insurance and non-life insurance. The primary categories of life insurance products are universal life, burial, whole life endowment, and group life insurance. Non-life insurance businesses specialise in providing coverage for several types of risks, including car insurance, fire insurance, burglary insurance, theft insurance, property damage insurance, marine insurance, aviation insurance, and general liability insurance. According to the National Insurance Commission (NIC) in 2017, the total revenue premium of insurance firms increased by 26 percent, reaching GHs.2.4 billion compared to GHs.2 billion in 2016. In 2017, the insurance penetration rate in Ghana was 1.2 percent, and the total assets amounted to GHs.5.4 billion. Average daily claims made by non-life companies to policyholders stood at 0.7 million. (See, Table 2)

**Table 2. Claim awarded to clients from 2013 to 2017**

| | 2013 | 2014 | 1015 | 2016 | 2017 |
|---|---|---|---|---|---|
| No. of award | 115 | 107 | 128 | 105 | 78 |
| Total amount (GHC). | 282,816 | 551, 900 | 682, 764 | 606, 241 | 1,276,772.31 |
| Average claim per award (GHC). | 2, 459 | 5,158 | 5,334 | 5774 | 16369 |

Source: NIC, 2018.

**Types of Motor Insurance Products in Ghana**

Ghana has two types of motor vehicle insurance policies: Compulsory Motor Third Party Insurance (CMTPI) and Comprehensive Insurance (CI) (NIC, 2020). However, other insurance companies have policies such as third-party fire and theft and executive. The executive policy is for the topmost people, those that cannot do without a vehicle. In this type of policy when an insured has a problem with his or her car, they are given a courtesy car till the problem on the car has been resolved.

As to the National Insurance Commission (NIC) report from 2020, the Motor Road Traffic Act of 1958 requires that all vehicles operating on roadways must possess a valid third-party insurance liability coverage. This insurance provides coverage for the insured's financial responsibility in the event of a car accident resulting in injury to a third party or their property. The third-party insurance provides coverage for any physical injury or death sustained by a third party as a result of a collision involving an insured vehicle, as well as any damage caused to property belonging to a third party. The third-party insurance policy does not provide coverage for the car owner, nor does it refund any expenditures incurred by the owner for vehicle repairs

and maintenance after an accident. Additionally, individuals do not have the option to opt out of this policy (NIC, 2018). According to Cohen and Dehejia (2004), mandatory third-party insurance legislation requires drivers to bear some of the costs that they impose on other road users by their driving conduct.

The second type of motor insurance policy in Ghana is Comprehensive Insurance (CI). Whereas Compulsory Third Party Insurance only covers someone other than the policyholder (insured) involved in the contract, the Comprehensive Insurance policy covers the policyholder's liability as well as liability incurred during a crash. Comprehensive Insurance cover is not compulsory; however, if a policyholder wants to guard against financial risk, it is the best as it covers the policyholder's vehicle as well as other kinds of misfortune.

**Recent development in the insurance sector in Ghana**

Financial institutions in Ghana in recent times have gone through turbulent conditions. Since the beginning of 2018, financial institutions have been mandated to increase their working capital to cope with the challenges posed by the growing oil industry in the country (NIC, 2020). This directive was later also transferred to the insurance industry. To help address the enormous problems that confronted the National Insurance Commission (such as fake third-party stickers), the NIC, in collaboration with the Driver Vehicle and Licensing Authority (DVLA), set up a new central database to validate all motor insurance in Ghana (NIC, 2020).

Also, to prevent the undercutting of premiums paid by the policyholder, the commission set a limit for third-party motor and death

claims. NIC also started the implementation of the enhancement of no claim discount (NCD) which ensures that a driver who is not involved in a road crash the previous year will have his or her premium reduced by a percentage (NIC, 2018).

**Motor Insurance Billing**

All over the world, the practice of calculating insurance premiums is based on factors like the age of the driver, the age of the vehicle, the geographical location of the vehicle, private or commercial, and the engine capacity (Johansson & Ohlsson, 2010). This method which is known as the lump-sum calculation does not take into consideration the behaviour of the driver, but charges all drivers the same premium irrespective of the risk level they pose (Husnjak *et al.*, 2015).

Adverse selection becomes an issue when insurers are unable to distinguish between high-risk and low-risk individuals by applying varying premiums (Ma et al., 2018). Consequently, issues such as extended daytime driving, nighttime driving, driving when fatigued, displaying aggressive driving behaviour, and the likelihood of traffic accidents will remain without any motivation to prioritise safe driving (Tooth, 2017).

The traditional method of calculating premium means that drivers with low risk are subsidising drivers with high risk, and do not encourage safer driving (Tselentis *et al.*, 2016). This method of pricing insurance premiums using such parameters is currently being phased out (Tooth, 2017). A good premium rating variable must have certain standards. For instance, it has to be fair to every policyholder and has to be based on the policyholder's driving behaviour (Yoa, 2018).

The main reason behind telematics-based insurance policies is to enable insurance companies to charge policy-holders based on information such as kilometres driven, time and day of driving, and behaviour of the driver because these variables correlate with road traffic crashes (Husnjak *et al.*, 2015). With a telematics-based insurance policy, these data can now be calculated using onboard diagnostic (OBD) units placed in a vehicle (Vaia *et al.*, 2012).

Policies like pay-as-you-drive, user-base-insurance, and pay-how-you-drive drive, which are telematics-based, are used to accomplish premium differentiation and have been implemented by several insurance companies around the world (Tselentis *et al.*, 2016). It is felt that when technological-based insurance is used in calculating premiums, it will serve as an instrument to raise awareness of drivers and improve their driving behaviour (Litman, 2018). Therefore, driving style can be influenced by the use of technology (telematics).

**Role of the Motor Insurance industry in road safety management**

A driver who wants to achieve safe records in their driving career is more likely to avoid a crash than a driver who has no care for safety (Tooth, 2017). If insurance is both designed and implemented well to look into the behaviour of drivers, it can have an enormous impact on improving road safety (Carvajal & Louat, 2015). One important aspect that has not been taken into consideration when studying different possibilities for reducing road traffic fatalities and injuries is the possible effect of motor insurance premium policies, as insurance premium reflects the individual driver risk profile (Gao, Ren, Ge, Zhang, Elzamly, Salleh, & Bishnoi, 2016).

Motor insurance is one solution to manage the risk posed by the road transport industry and a means to improve damages arising from road traffic crashes, unlike the traditional method of determining the premium by only looking at variables such as the age of the driver, the age of the vehicle, the number of passengers the vehicle can carry, and where the vehicle is parked, without taking into consideration the behaviour of the drivers.

The introduction of telematics in vehicles has brought great relief to insurance companies in that they (insurance companies) can gather key-specific information like the road behaviour and performance of the driver and use this information as feedback to promote good driving behaviour, which will have benefits of reducing road traffic crash (Mortimer, Wijnands, Harris, Tapp, & Stevenson, 2018). Insurance companies can use telematics to calculate the exact insurance premium to be paid by the policyholder. Through the use of telematics, insurance companies can perform better risk segmentation and pricing because the data captured from the vehicle will describe real-time driver behaviour (Julia, 2017).

**Summary**

This chapter has examined the causes of road traffic crashes in general and at the national level. Three main causes are found to account for the road traffic crash phenomenon. These are humans, vehicles, and the environment. Among the three main factors, the human factor was found to contribute to between 80 percent and 90 percent of all road traffic crashes, with speed as a major human contributory factor. Other factors include poorly maintained vehicle components such as brakes, wheels, tires, and other major components, which also have a detrimental effect on road traffic crashes and

injury severity. Lastly, environmental factors such as weather conditions, poorly constructed road layout, poor road maintenance, types of road surface, and bad road furniture all have terrible consequences on the road traffic crash phenomenon. Again, in this chapter, general insurance has been defined, and automotive insurance, which is the focus of this study, is explained. The overview of global insurance and the history of insurance in Ghana have been outlined. Types of insurance products in Ghana with their characteristics have been discussed, and the recent development in the insurance industry in the country has been explained. The traditional insurance policy and the current insurance policy used to reduce the impact of road traffic crashes in different countries have also been outlined.

# CHAPTER FOUR

# RESEARCH METHODOLOGY

## Introduction

This study is about using innovative insurance products (Telematics) to reduce road traffic crashes in Ghana. The chapter presents a description of the methods used in conducting the study. It begins with the study area and the choice of the study area. The philosophical perspective of the study, its strength, and its weakness have been discussed in the chapter. Next is an outline of sources of data, target population, sample size, sampling procedure, and data collection instruments. Also covered are data processing and analysis and finally the ethical considerations of the research.

## Study Area

The research is conducted at the Sekondi-Takoradi Metropolitan Assembly (STMA). Established in 2008, this local authority in Ghana was created under the legislative instrument (L.I) 1928. The STMA consists of a total of 78 assembly members, including 49 elected officials, 23 government appointments, and 5 ex-officio members who are members of parliament. The Metropolitan Chief Executive is also a member of the assembly. The metropolis has an administrative structure consisting of 16 decentralised departments, of which 11 are now functioning. The assembly comprises four sub-metropolitan councils, namely Sekondi-sub-metro, Takoradi-sub-metro, Effia-Kwesimintsim sub-metro, and Essikado-Ketan-sub-metro (STMA, 2021). Figure 13 displays a cartographic representation of the Sekondi-Takoradi city and its surrounding areas.

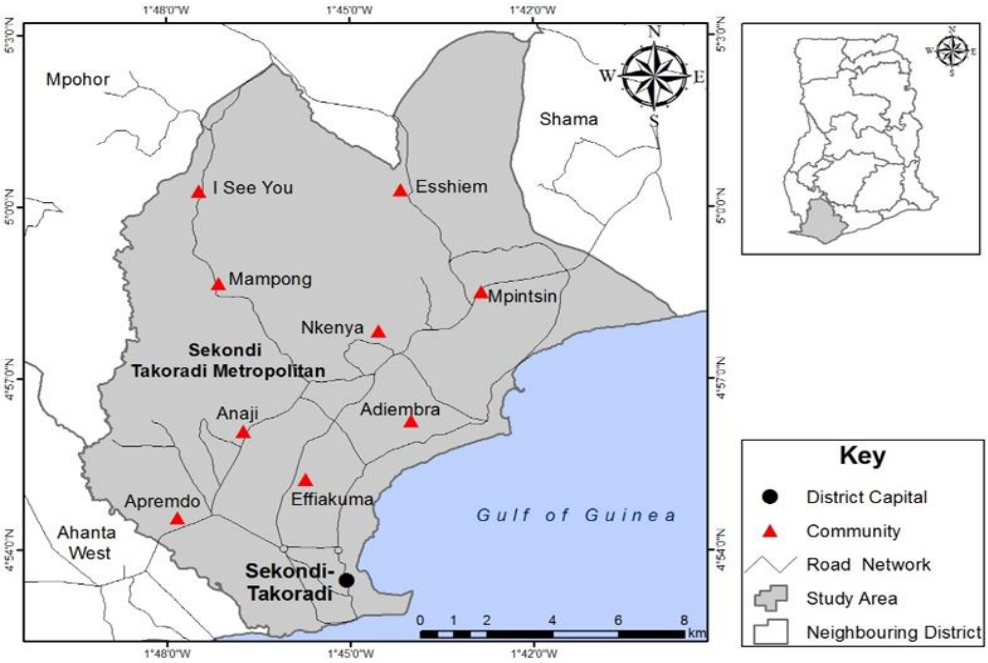


*Figure 13:* Map of Sekondi Takoradi Metropolis

**Location and size**

The Sekondi-Takoradi Metropolis is a Metropolitan district within the Western region, one of 22 such districts. The metropolis is delimited to the north by Mpohor-District, to the south by the Gulf of Guinea, west by Ahanta West District, and to the east by the Shama District. The overall size of the region is 192 square kilometres, with Sekondi serving as the administrative centre. The city is situated on the western shore, with the Trans-West African highway traversing through it. Sekondi-Takoradi is situated around 280 kilometres to the west of Accra and 130 kilometres to the east of La Cote D'Ivoire (STMA, 2021).

**Socio-Economic Characteristics of the Study Area**

The metropolis' local economy is categorised into three primary sectors: manufacturing, agriculture, and services. The city has a range of industrial operations, including cement production, cocoa processing, paper making, wood processing, and other small-scale companies. The service

industry is the primary employer of the work force in the city, including shipping, hotel, restaurant, bulk oil storage, distribution, and retail transport services (STMA, 2021).

The population of the Western Regional Capital increased from 531,982 in 2010 to 1,034,917 in 2021, as reported by the Census of Population and Housing (GSS, 2021). The Metropolis is the most developed of the Western Region's 22 districts and one of the most industrialised in the nation. Approximately 60% of Western Region industries are concentrated in the Sekondi-Takoradi Metropolis (GSS, 2021).

**The Choice of Study Area**

The choice of the Sekondi-Takoradi as the study area was motivated by several factors. Firstly, it is the Western regional capital and has all 27 nonlife insurance companies in Ghana located in the metropolis. Also a report from the Building and Road Research Institute (BRRI) and published by the National Road Safety Commission indicated that Sekondi-Takoradi is among the five major road traffic crash-prone cities in Ghana. (See Table 3).

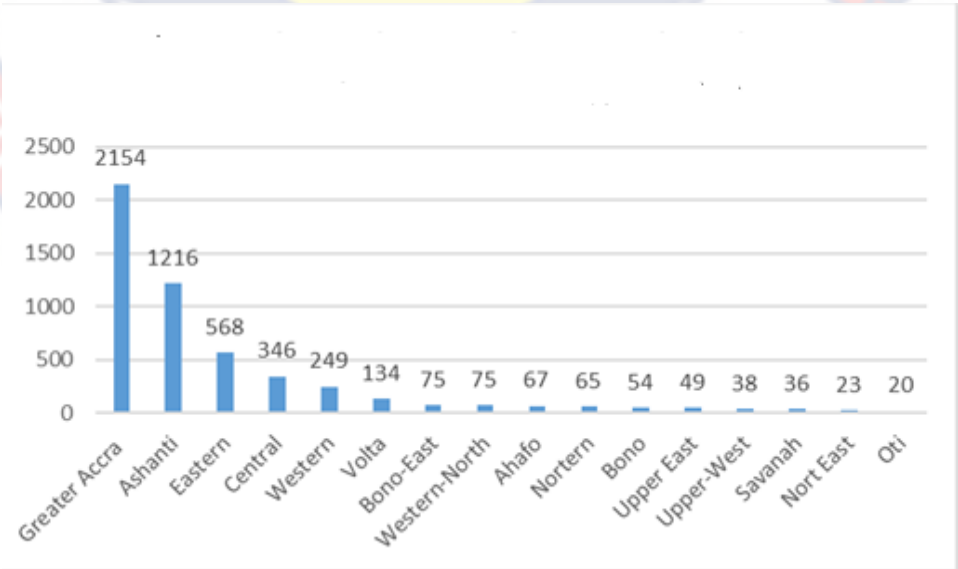


*Figure14*: Regional Distribution of Reported crashes in Ghana. 1st quarter, 2021. Source: NRSC. Traffic Crashes in Ghana. Statistics, 2021

According to Obeng-Odoom 2014; Mahama, Annan, Amponsah, & Sebil, 2012), though road traffic fatalities have reduced slightly, property damage as a result of road traffic crashes has seen an upward trend. Table 3 shows the road traffic crash cases in the metropolis from 2001 to 2016.

**Table 3: Crash, casualties, and fatalities in Sekondi-Takoradi. 2001-2016**

| YEAR | FATAL | SERIOUS | SLIGHT | DAMAGE | TOTAL |
|---|---|---|---|---|---|
| 2001 | 16 | 42 | 51 | 72 | 181 |
| 2011 | 16 | 26 | 36 | 62 | 140 |
| 2015 | 11 | 31 | 43 | 80 | 165 |
| 2016 | 6 | 29 | 19 | 48 | 102 |

Source: MOT. Traffic Crashes in Ghana. Statistics 2016.

Obeng-Odoom (2014), in his book 'Oiling the Urban Economy'', found out that the reasons behind the recent road traffic crash trend in Sekondi-Takoradi are five-fold: first, the population in the metropolis has increased as a result of the oil discovery in 2007. People have moved into the metropolis from different parts of the country, making transport a lucrative business in the metropolis. Also, the oil discovery and employment attached to it have increased people's disposable income, making them shift from the use of public transport (buses) to the use of taxis or private hiring services.

Another factor affecting road safety in the metropolis is that people can afford to purchase private cars, and some have even purchased cars for inexperienced drivers or drivers with fake licenses to run taxi services, therefore resulting in the rise in road traffic crashes in the metropolis. In addition, as car rentals in the metropolis increase, more people become

vulnerable road users as a result of an unsafe act of driving (Obeng-Odoom, 2014).

Finally, the dramatic increase in the microfinance and savings and loan business entering into the transport business by pre-financing private and commercial vehicles to individuals and transport associations has also contributed to the rise in road traffic crashes.

**Research Philosophy**

Historically, several research paradigms have dominated social science research with different assumptions (Creswell, 2014). According to Liamputtong and Ezzy (2005), these approaches include positivism, interpretivism, and symbolic interactionism. The research paradigm used is determined by the specifics of the subject at hand. In this study, the interpretivism paradigm with qualitative research design is used as a foundation to guide the research. Imanda (2014) states that studies involving the behaviour of people, lived experiences, emotions, feelings, and organisational behaviour are better done using qualitative data that are descriptive and interpretative.

Interpretivism is often regarded as a qualitative research technique (Creswell, 2014). Interpretivism posits that humans strive to comprehend the world in which they live and operate, and construct personal and subjective interpretations of their encounters. Interpretivism posits that reality cannot be objectively defined or articulated by a researcher, but rather, it is shaped and perpetuated using communication, practise, and engagement with people (Tracy, 2013).

An interpretive researcher tries to know why and how things happen through participants' views to understand the phenomenon. In the interpretivism paradigm, the researcher deduces the meaning others have about the phenomenon and makes sense of that meaning (Creswell (2014). The approach made it possible to understand the context or setting of the participants by visiting the context and obtaining data personally. The data from the field was shaped through experience and knowledge about the phenomenon.

**Research Design**

The selection of a certain research design is determined by the research issues being investigated. Various methods of inquiry exist for examining a research topic (Creswell, 2014). Creswell (2014) has proposed three distinct study designs: qualitative, quantitative, and mixed-method. In order to achieve the goals of this study, a qualitative research design was chosen, specifically one that aligns with the interpretivism paradigm. This approach is deemed most suitable as it allows for a comprehensive exploration of the participant's emotions, viewpoints, and experiences, while also interpreting the significance of their actions (Rahman, 2017).

Qualitative research approach offers a comprehensive comprehension of the significance, activities, and both observable and unobservable occurrences, attitudes, intentions, and behaviours. The statement by Govender (2012) emphasises that it allows participants to express their opinions and explores underlying concerns that are not immediately apparent in their attitudes and actions. In this research study, the qualitative research strategy was chosen due to its association with small sample numbers and its ability to

provide a comprehensive description and analysis without imposing limitations on the research scope or the characteristics of the participants (Langos, 2014). Moreover, the primary benefit of qualitative research is in its ability to provide a comprehensive and profound comprehension of the target group being examined. Methods such as interviews and focus group discussions enable study participants to provide more elaborate and precise responses (Vanderstop & Johnston, 2008). Interviews in qualitative research offer a chance for collaborative exploration, comprehension, and elucidation of subjectively experienced phenomena. They allow for adaptive and stimulating discussions that shed light on participants' perspectives and lived experiences (Tracy, 2013).

However, the key challenge with qualitative research design is that it is subject to human error. The skills and the ability of the researcher is also major factor in qualitative research; therefore, the validity, reliability, credibility, and authenticity of qualitative research are paramount (Flick, 2018).

**Sources of Data**

Two sources of data were used for this study: primary and secondary. The primary data source came from the field interview that was conducted with the insurance companies and transport stakeholders in the Sekondi-Takoradi metropolis. There were two sources of secondary data: one from road traffic crash statistics from the National Road Safety Authority, which is provided by the Building and Road Research Institute (BRRI), and other relevant literature.

**Target Population**

Data published by the National Insurance Commission in the Daily Graphic of Ghana, 18th November 2020 (insurance companies in good standing), indicates that there are 130 insurance companies in Ghana, comprising 17 life insurance companies, 23 non-life, three reinsurance companies, one reinsurance contract office, and 91 insurance brokers and loss adjusters. According to the NIC (2020), at the end of October 2020, there were 23 non-life insurance companies in good standing in Ghana. Given the objectives of the study, these 23 non-life insurance companies and transport stakeholder organisations such as the Motor Traffic and Transport Department (MTTD), National Insurance Commission (NIC), Driver Vehicle and Licensing Authority (DVLA), Metro Mass Transit (MMT), State Transport Company (STC) formed the target population for the study.

**Sampling Procedure**

Marshall, Cardon, Poddar, and Fontenot (2013) state that there are no established guidelines for determining the appropriate sample size in qualitative research. The determination of the sample size is contingent upon the specific research objectives, the nature of the phenomena under investigation, the desired use of the findings, the need for credibility, and the constraints imposed by time and resources. The criteria for selecting participating companies in the study were as follows: (a) the companies had to be non-life insurance companies, (b) they had to be in good standing as of the 2020 financial year, and (c) the participants had to be branch managers in order to qualify for the interview. The intention behind these criteria was to ensure that participants could provide relevant information to address the

research questions and meet the study's objectives. With the other transport stakeholder groups, to qualify for the interview, the participant must be the head of the institution or the group. Purposive sampling was thus used to select participants based on their expertise on the topic, experience, and knowledge relevant to the research question (Vogt, Gardner, & Haeffele, 2012). One of the key benefits of using purposive sampling is that the researcher knew the characteristics of the participants before recruiting them.

**Data Collection Instrument**

The study adopted an open-ended, face-to-face, in-depth, semi-structured interview guide to collect the data. The instrument comprised five sections. Section A centred on awareness and knowledge about telematics. Section B focused on perceptions about the use of telematics-based insurance policies in Ghana. Section C sought to know the perceived factors that will affect the acceptance of telematics. Section D looked at the preparedness to accept telematics-based insurance policies and how they can be integrated into the current insurance policy. The final section, E, looked at the socio-demographic characteristic of the participants.

**Pretesting the Instrument**

Before the fieldwork, the interview guide was pretested in the Tarkwa Nsueam Metropolis between 15th and 20th May 2021. Tarkwa Nsueam Metropolis was selected for the pretesting of the interview guide because of the similar characteristics it possesses to the Sekondi-Takoradi Metropolis. Tarkwa Nsueam Metropolis has all the insurance companies and other stakeholder groups. Five participants, made up of three heads of insurance companies, one head from the DVLA, and one from MTTD, were selected for

the pretesting of the instrument. The reason for the pretesting was to check for the validity and reliability of the research instrument, including wording and mistakes in the instrument. The average duration during the pre-test was 40 minutes.

**Methods of Data Collection**

Ethical clearance was received from the University of Cape Coast Institutional Review Board (Ref. No: UCCIRB/CHLS/2021/30) before starting the fieldwork. An introductory letter indicating the purpose of the study and the benefits to the participating companies was obtained from the Department of Geography and Regional Planning of the University of Cape Coast and taken to all the participants. The letter made it clear how the confidentiality of all participants would be assured, stating the willingness of the participants to withdraw from the study anytime they wished and making participating in this research voluntary for all participants. In the field, all the Covid - 19 protocols which include washing of hands, the use of sanitizers, and thermometer guns were adhered to before the start of each interview.

Every participant received a detailed explanation of the importance of the study to their respective organisations. Participants were guaranteed anonymity, with the assurance that their information would be handled with utmost secrecy and not shared with any third party. Additionally, participants were informed that they may request the identity and contact details of the researcher if desired. Furthermore, the researcher is open to provide the findings of the study to all participating firms at their request. The interviews started on 25$^{th}$ September 2020 to 5$^{th}$ January 2021 at the participants' place of work and lasted between forty-five minutes and one hour. Avoidance of

questions that can be answered with a simple yes or no, as well as questions that have limited response options, was implemented to prevent the provision of deceptive responses. The responses given by the participants were documented using an audio recording device, with the participants' consent.

**Fieldwork Challenges**

The major challenge encountered in the fieldwork was the unwillingness of some managers to allow for the interview. The study was originally planned to interview 23 insurance companies in good standing and six transport stakeholder groups making a total of 29 participants. However, the interview period coincided with the Covid -19 era, and a majority of the managers were unwilling to allow access to their offices. A few of them did not permit the conversation to be recorded, attributing it to the policy of the company. As a result, the plan was reviewed bringing the actual sample size to nineteen. Another major challenge encountered was a distraction from within the staff of the company or from customers who wanted to make inquiries. This at times led to prolonged interview periods.

**Data Processing and Analysis**

After all the field interviews, the data was manually transcribed into a written text after which it was corrected for grammar and language using the Microsoft office suite. After transcribing the data into text, the data were coded into six thematic areas covering awareness and knowledge, perception, preparedness to adopt, benefits of the policy, perceived challenges, and suggestions on how telematics-based insurance policy could be integrated into the current insurance policy. A sample of the interview guide is presented in appendix 1.

The data collected from the field was evaluated the next day prior to returning to the field. Savage, Devine, Cunningham, Friedman, Laurison, Miles, and Taylor (2015) recommend that data collection and analysis should be conducted simultaneously. This approach allows the researcher to continuously alternate between analysing the existing data and devising methods for gathering new data. Additionally, they said that doing early data analysis allows for the creation of the interim report.

**Summary**

This chapter focused on how the data for this study was collected. It explained the research design, the approach used for the study, the strengths and weaknesses of the chosen design, and its underlying philosophy. The study area was briefly described. The population for the research and their socio-demographic characteristics are stated in this chapter. The sampling procedure used and the sample size and their advantages and disadvantages have been explained. The data collection instrument (research protocol) for the study has been stated with its strengths and weaknesses. The data collection procedure, how, where, and when the data was collected are stated in the chapter. How the collected data were processed and analysed and the computer software used are all explained.

# CHAPTER FIVE

# AWARENESS AND KNOWLEDGE OF TELEMATICS

## Introduction

The previous chapter discussed the theoretical and conceptual frameworks which underpin this study and also outlined the trend of road traffic crashes in Ghana. It further examined the role of insurance companies and their contributions to road traffic crash reduction in other parts of the world, such as Italy, China, and Australia, through the use of telematics-based policy. The key finding is that telematics-based insurance policy has been accepted globally as a new method of reducing road traffic crashes (Neumann, 2018; Kiurshanth, 2019; *Dharani et al.*, 2020).

This chapter examines the level of awareness and knowledge of insurance companies and other transport stakeholder groups on telematics in the Sekondi-Takoradi Metropolis. Structurally, this chapter consists of four thematic sections. The first section presents the socio-demographic characteristics of the participants. The next discusses the awareness and knowledge of the participants on telematics. The third section covers the perceived acceptance of telematics-based insurance policies. Finally, a summary of this chapter and the focus of the next chapter is provided.

## Socio-Demographic Characteristics of Participants

The characteristics considered in this study include sex, age, educational attainment, occupational status, years of employment, and other professional qualifications (Table 5). Socio-demographic characteristics affect an individual's knowledge and awareness about their job. They also help to understand people's perceptions and how this relates to their job environment

and performance (Ugwu & Ugwu, 2017). The age of the participants ranged between 30 and 59 years. Among the participants, four were females aged 30 to 49 years while the age of their male counterparts ranged between 30 and 59 years.

A total of 19 participants were interviewed for the study. Table 4 shows that the majority (36% ) of the participants were between the age of 30-39 years, 32 percent were aged 40-49 years, whilst another six (32%) were between the age of 50-59 years. Relative to their educational background, five (26% ) had a post-graduate level certificate, nine (47% ) had a first degree, two (11%) had Higher National Certificate and three (16%) had other certificates. Concerning their employment years, 21percent had worked below five years, 42 percent for a period of 11-15 years, five percent worked between 16 and 20 years whilst 16 percent had worked for more than 20 years.

**Table 4: Socio-Demographic Characteristics of participants**

| Demographic variable | Frequency | Percentage (%) |
|---|---|---|
| **Gender** | | |
| Male | 15 | 79 |
| Female | 4 | 21 |
| **TOTAL** | **19** | **100** |
| | | |
| **Age** | | |
| 20-29 | Nil | Nil |
| 30-39 | 7 | 36 |
| 40-49 | 6 | 32 |
| 50-59 | 6 | 32 |
| **TOTAL** | **19** | **100** |
| | | |
| **Academic status** | | |
| Post-graduate | 5 | 26 |
| Undergraduate | 9 | 47 |
| HND | 2 | 11 |
| Others | 3 | 16 |
| **TOTAL** | **19** | **100** |

**Table 4 Cont;D**

| | | |
|---|---|---|
| **Years in Employment** | | |
| Under 5 | 4 | 21 |
| 6-10 | 3 | 16 |
| 11-15 | 8 | 42 |
| 16-20 | 1 | 5 |
| Above 20 | 3 | 16 |
| **TOTAL** | **19** | **100** |
| | | |
| **Participants companies** | | |
| Insurance | 13 | 68.4 |
| Transport institution | 6 | 31.6 |
| **TOTAL** | **19** | **100** |

**Participants' view on Road Traffic Crashes in Ghana**

This study examines how telematics-based insurance can be used to reduce the rate of road traffic crashes in Ghana. Several interventions have been introduced to reduce road traffic crashes which have proven futile (Abane, 2004, 2012, Botha, 2005 & Gyimah 2020). Therefore, there are calls for an innovative approach to reducing road carnage in the country (Abane, 2004, 2012 & Amoako-Sakyi, 2016). There are arguments that when insurance products are well developed they can mitigate road carnage (Tooth, 2017). Several factors have been attributed to the increase in road carnage in the country (Abane, 2012, Botha, 2005 & Gyimah 2020). Among the contributory factors, driver behaviour was seen as the major contributory factor accounting for more than 85- 95 % of all carnage on the road (Abane, 2012).

According to National Road Safety Authority, overspeeding, recklessness, inconsiderate driving, driving without due care and attention, and using a mobile phone while driving are seen as the major human contributory factors to road carnage in Ghana. These are followed by environmental factors such as poor road design, poor road markings, and a lack of proper

street lights (Agyemang, 2018). Other factors include the condition of the vehicle such as defective lights, poor braking system, and lack of effective vehicle maintenance (Gyimah, 2020).

This study also revealed that participants had different views about the road traffic crash situation in the country and how authorities handled this problem. Participants believed that the government of Ghana is not serious when it comes to issues of road traffic crashes in the country. Their reasons were that if the government applied the same attitude they applied in tackling the COVID-19 pandemic to the issue of road traffic crashes, then perhaps the country would have made significant strides in curbing the frequency of road crashes. Some participants were of the view that some drivers did not pass through the proper channel to acquire a driving license in the metropolis. They believed that some drivers still use unapproved methods (Goro boys) to get their licenses, and in doing so, resulted in road carnage in the country. For example, one participant opined that:

*Honestly, I have repeatedly said that if the government tackled the issue of road traffic crashes with the same urgency that it did with the COVID-19 pandemic, we could have saved a lot of lives that have been lost*. [Participant from insurance company].

*When they are giving the license, I think they don't take a further look to check the background of the person. Somebody pays for somebody to help him pass the exams to have the license and you could see that the person doesn't have the experience of being on the road, but because he has bribed his way through, he has a license then he calls himself a driver*. [Participant from insurance company].

The above narratives explained that the government of Ghana is not showing any seriousness in managing road traffic crashes because the government is not investing the financial resources needed to manage road traffic crashes in the country. Also, institutions like the DVLA which are responsible for making sure that the proper procedures are followed to acquire licenses in Ghana are not doing enough to prevent the use of '*Goro boys*'. This makes it possible for people to acquire licenses through unapproved channels resulting in a lot of untrained drivers on the road leading to road traffic crashes.

Other participants were of the view that road carnage has been with us for ages and that finding the solution has been a major headache for the stakeholders in Ghana's road transport sector.

*Road traffic crashes in Ghana have been with us for quite a long time but finding the solution is our problem. For some people, whether the road is good or bad, they prefer to over speed; they will never reduce their speed. They think it's a machine therefore they can go as long as the vehicle moves.* [Participants from STC]

Other participants also believed that the role of driving schools in training drivers before giving them their licenses has contributed to the increase in road carnage and the government of the day should have a second look at driving schools and the training they provide to drivers.

*Accidents in Ghana have gone up recently I think the problem is the driving schools because when somebody goes and pays and gets a driving license that is all.* [Participant from GPRTU].

According to some participants, everybody has a role to play in reducing road traffic crashes in the county and that road traffic crash prevention is not the responsibility of the government only. They believed all stakeholders should come on board to find a lasting solution to this menace on our roads.

*Road traffic crashes in Sekondi-Takoradi as the name implies are a shared responsibility. I think institutions, stakeholders for that matter, and everybody must be concerned about it and if everybody is playing his or her part well I think it will go a long way to solve the problem. If you look at the statistics the National Road Safety Authority has been putting out in the public domain, they say COVID-19 is killing people but just within February and March, there are about seven hundred [700] people who just died in road crashes through no fault of theirs. So, I mean we can play a major role to calm this menace down. Accidents have about four major causes, weather conditions, the human factor, road Engineering, and last but not least vehicle design. These are the things one has to look at to assess the situation. [Participant from DVLA].*

The above response shows that, to some stakeholders, road traffic crashes are a major concern to many Ghanaians than the effect of the Covid-19 pandemic. The majority of participants were of the view that if the government of Ghana spends a lot of resources in managing road traffic crashes, like the resources allocated to fighting the Covid-19 pandemic, Ghana could achieve the Road Safety Authority's mission of reducing road traffic crash fatalities to a single digit.

**Awareness and knowledge of telematics**

Road traffic crashes in Ghana are now a public health issue in the country. Several interventions and policies have been formulated since the beginning of the road safety campaign in 1989, to reduce road carnage in Ghana (Afukaar, *et al,* 2003; Ackaah & Adonteng, 2011). All these policies and interventions have seen very little result in the improvement of road traffic crashes. There is therefore a call to reduce road traffic crashes using an innovative approach in Ghana (Abane, 2012). In several countries around the world, different innovative methods have been used to reduce the road traffic crash phenomenon (Bolderdijk *et al.,* 2011). One such method is telematics-based insurance policies, where drivers are monitored with telematics devices installed in their vehicles when they purchase an insurance policy. Fleet Industry Advisory Group (FIAG,2017). This type of policy has seen a reduction in road traffic crashes in many countries (Ippisch, 2012). However, in Ghana, no such innovative policy exists to reduce road traffic carnage. Therefore, the first objective of the study sought to assess the level of knowledge and awareness of insurance companies and other transport stakeholder institutions about the use of telematics as a policy to reduce road traffic crashes. The data showed that participants had different views about telematics (tracking devices) and how they can be used to reduce road traffic crashes. This was an indication that they were aware and had knowledge about the device. This was what one participant said about telematics:

I *know that Telematics is about the tracking of vehicles' movement on the road but I am not aware that it can be used to reduce road traffic crashes. How?*

*What I know about tracking devices is that some companies use them to track their drivers' speed limits.* [Participant from NRSA]

Other participants were also of the view that the use of telematics could check the location of drivers, reduce the carelessness of drivers, and make them drive more carefully. The following excerpts reflect some of their views on telematics:

*I know that telematics is a machine that will check the location of the vehicle when it is moving or when is not even in motion. Yes, a careless driver can cause an accident to occur. And if you're being tracked by a device, you know that somebody is watching you so definitely it will reduce your carelessness and that will reduce road accidents*. [Participant from insurance]

*A vehicle tracking device is an object put on a vehicle with a central monitoring system that can give you information about the distance the vehicle is traveling, the speed at which the vehicle is going at a particular time, and the location of the vehicle at a particular point in time. It monitors the movement of the vehicle at a point in time but I don't think it can reduce speed, how?* (Participant from transport union).

Other participants also stated that the use of tracking devices or telematics was to enable them to check the mileage of their vehicles and also just in case there was any attempted theft, they could easily locate their vehicles.

*Yes, currently I have one fixed on my car. When the tracking device is mounted on your vehicle, it checks the mileage. It gives whoever is monitoring the location of the car an alert, so if the vehicle is being moved it will indicate the person monitoring the vehicle. In case the vehicle is stolen, the device can*

*track it and give the exact location of the vehicle. It also indicates when maintenance of the vehicle is due so that whoever is in charge of the vehicle can quickly go in for the maintenance*. [Participant from Insurance].

From the responses above, nearly all participants affirmed that they had the knowledge and were also aware of the vehicle tracking device (telematics), its uses, and its importance in vehicles. For instance, a participant from the National Insurance Commission (NIC) confirmed that the majority of their vehicles had tracking devices mounted on them. It was also confirmed by participants from the State Transport Company (STC) that the majority of STC buses had tracking devices planted in them as a result of several complaints received from clients about the behaviour of some of their drivers relating to overspeeding and careless driving. Therefore the use of telematics was not new among the participants in the Secondi-Takoradi metropolis. The study also found that some individuals in insurance companies and a few transport operators in transport user groups including the Ghana Private Road Transport Union (GRPTU) were already using telematics to monitor their vehicles and drivers' movements. Even though these people were using telematics technology, only a few of them were aware that telematics or vehicle tracking devices could be used as a method of reducing road traffic crashes.

The implication is that since some people were already using this technology, it was easy for them to accept the introduction of this policy. These findings affirm the diffusion of innovation theory by Roger (2003) which explains that the first step in accepting innovation is when an individual or organisation learned first-hand information about the existence of the new

idea or technology. A decision could only be made whether to accept or reject the innovation or idea when there is knowledge about such technology. This also corroborates the findings by (Ahmed, 2016; Abubakar, 2013) who posit that awareness of a product will raise its spread, In other words, if there is awareness, it will increase the intention to use the technology because awareness is an important requirement for the development of moral norms. On the contrary, a lack of awareness is a major hindrance to the acceptance, rejection, and use of technology (Alharbi *et al.*, 2017).

This finding further confirms the theory of TAM which asserts that knowledge, awareness, and perceptions about technology will lead to the acceptance or rejection of such technology because adoption and acceptance of technology increase when an individual or organisation becomes aware of the new technology. The above response also affirms the study by (Lacey *et al.*,2010), who also found that knowledge about a product is also the influencing factor in deciding to accept a product or not, as knowledge will always influence perception. As an individual or organisation becomes aware of a product their perception and attitude towards the product become more positive than negative.

**Summary**

Drawing from the conceptual framework, this chapter sought to assess the awareness and knowledge of telematics among the people of the Sekondi-Takoradi metropolis. From the data gathered it was found that most of the participants were aware of telematics and had knowledge that, it is a device placed in a vehicle to control vehicle movement. Some participants were also of the view that a careless driver can cause a road traffic crash, but if they

were aware that they were being tracked by such a device they would reduce their carelessness which would result in reduced road traffic crashes. Others also knew that telematics was a device that is put in a vehicle with a central monitoring system that gives information about the distance the vehicle was traveling and speed at a particular time. However, others also believed that telematics was a device that would enable a stolen vehicle to be recovered which would minimise vehicle theft. From the above findings, it is an indication that telematics was not new to most of the participants in the Sekondi-Takoradi Metropolis.

# CHAPTER SIX

# USE OF TELEMATICS AND FACTORS INFLUENCING THEIR ACCEPTANCE AND HOW TELEMATIC COULD BE INTEGRATED INTO THE CURRENT INSURANCE POLICY

## Introduction

The previous chapter examined stakeholders' knowledge and awareness about the use of vehicle telematics devices in reducing road traffic crashes. From the data, it was discovered that participants had knowledge and were familiar with the use of telematics devices. It was further revealed that some transport institutions and groups were already using this device to control their fleet movement. This chapter examines the perceptions and factors likely to influence the acceptance of telematics-based insurance and how such a policy can be integrated into the existing insurance policy framework.

## Participants' perceptions of a telematics device

Perception is the opinion of an individual, group, or organisation which is important in decision-making (Robbins & Judge, 2017). This opinion is based on information about the reputation of the organisation, the individual, or the group (Quintero, Railean, & Benenson, 2020). The theory of perception explains that different people perceive things in different ways, and how one perceives them may affect the way they think about technology and can also influence their acceptance and adoption of technology (Robbins & Judge, 2017). In this study, perception is seen as how people view the implementation of a telematics-based insurance policy in the Sekondi-Takoradi Metropolis.

TAM was specifically designed by Davis to test the acceptance of technology. It theorised that the perception of users on the ease of use and usefulness of the technology is the major determinant of technology acceptance and use. From Davis' point of view, positive perceptions of the ease of use and usefulness of the technology will significantly affect the intention to accept and adopt technology (Halawi, 2007). Therefore, this section sought to examine the perceptions of insurance companies and other transport institutions and groups about the use of telematics as a policy to reduce road traffic crashes and the factors influencing their acceptance in the Sekondi-Takoradi metropolis. Participants perceived that the use of telematics devices would make drivers more disciplined on the road because they would be aware that their driving behaviour was being monitored, and they would be careful on the road, as this could affect their insurance premium charge.

This was how one participant perceived telematics:

*I think using telematics in Ghana, especially with the transport unions will help a lot. I think that using telematics in Ghana will help to reduce road traffic crashes. It will make drivers more discipline on the road. The introduction of a tracking device will help drivers to drive carefully. So the tracking device will go a long way to check the drivers.* [ A participant from National Road Safety Authority].

This view corroborates a similar study conducted by Litman (2012) who found that the use of telematics improved the productivity of drivers. Their awareness of the presence of telematics in their vehicles gave them a sense of responsibility and morale, thus ensuring that they drive carefully. The finding also corroborates that of Robbins & Judge (2007) that individuals' or

organisations' expectation about a technology will affect their perception of whether to accept the technology or not because the expectation shapes perception.

Participants suggested that the introduction of a telematics policy in Sekondi-Takoradi would go a long way to help insurance companies from paying too many claims. The observation below illustrates this.

*It is not a bad idea, as a requirement it will help insurance companies because if there is no accident, we also don't pay. So, if we have a telematics device, I think it will help the insurance companies to reduce the payment of claims. It will reduce our cost. We are charging more because there are more road accidents. If there is a reduction in accidents, insurance companies will not pay too many claims and will even reduce the premium, so I think it's a good idea*. [ A participant from insurance company]

This supports the assertion that, with telematics policy, insurers can make their pricing more precise. That is, low-risk drivers will pay less premium because they would be careful and high-risk drivers will pay more premium because their probability of having a road traffic crash would be high (Eling, & Kraft, 2020). This also corroborates a similar observation by Bender (2014) who reported that data gathered from telematics can help insurance companies to improve segmentation of drivers, underwriting, and pricing policy, leading to an increase in profit margin for insurance companies as a result of reduced road traffic crashes.

Participants were of the view that the implementation of the telematics-based insurance policy was likely to control driving behaviour since the majority of road traffic crashes in Ghana were attributed to human error

(Abane, 2012). Thus, the only way to improve this type of attitude among drivers was through the implementation of this technology. The following excerpts are illustrative:

*I think the implementation of such a policy is good because, when I read a lot of the police reports that come out, accidents are caused by reckless driving so if people drive carelessly and now there is a device to check it. I see that as a good policy.* [A participant from an insurance company].

*It wouldn't be a bad idea though, but it needs to be well explained and then education has to be done massively because I think when it comes it will help improve driver's behaviour. The rate at which technology is growing in Ghana, I don't see it as a problem, I think we can do it*. [A participant from Metro Mass Transit].

*I think it will help. The driver or the vehicle user will get to know that they are monitoring where they are, and what they are doing at any time so that they can be questioned. Since the insurance companies are also monitoring them, they will be much more careful. I agree with it in the sense that, if they can introduce it, it will go a long way in solving the menace of road accidents.* [A participant from NRSA].

*It is a good idea because it will control most of the drivers from unnecessary speeding. I foresee that it will be useful to drivers if it is introduced and made compulsory. Government should buy the idea and make it compulsory for people to use it. It will reduce speed, track location and anything of that sort and even check theft.* [A participant from insurance company].

Participants were of the view that the current insurance policy was not fair, because according to them, the NIC had regulations that made it mandatory

for all compulsory third-party insurance policy-holders to pay the same premium irrespective of the behaviour of the vehicle type. This did not incentivise people to drive well. These views have been argued in the literature by several researchers (Tooth, 2017, Karapiperis *et al.*, 2015 & Perez-Marin, *et al.*, 2019).

Below is an excerpt from one participant

*Now the NIC has come out with a policy directive that all third-party policy-holders should pay the same premium, it means that reckless drivers and careful drivers are paying the same premium and that is going to affect people's behaviour, because if somebody thinks I am driving well but when it comes to premium I am paying the same as somebody who is not driving well, who is bringing a lot of accident claims, well then let's all go ahead and drive the same. Come what may [A* participant from insurance company*]*.

From the study, it was revealed that the implementation of a telematics-based insurance policy would help reduce the road traffic crash situation in Sekondi-Takoradi. This was because participants were aware of telematics devices and ready to accept their implementation as a policy in the metropolis. This confirms the diffusion of innovative theory, which posits that awareness, knowledge, and understanding of innovation will lead to its adoption. Thus, people will adopt innovation when they understand and know the benefits to be derived. Participants agreed that it was long overdue, and therefore what was needed was education so that the general public would accept it.

The study also supports the notion that acceptance and adoption of technology will depend on the perception individual or organisations develop

about the usefulness of such technology to improve the working life of the individual or the organisation (Zakour, 2004). The findings also corroborate with existing views in extant literature that technology can easily be accepted or rejected when individuals or organisations become aware of the technology because knowledge and awareness will produce a perception of either negative or positive about the said technology.

**Factors influencing the acceptance of telematics**

Several factors have been identified in the literature as a prerequisite for the acceptance of technology. This study discovered that participants' views on the major factors which would affect the acceptance and adoption of telematics-based insurance policies included cost. This encompasses the cost of the telematics device, installation, insurance premium, insurance claims, and environmental costs.

**Cost of the telematics device**

According to the participants, cost played an important role in the acceptance decision making. While some participants viewed cost as a major negative factor in the acceptance of telematics technology, other participants had different views on the implementation and acceptance of telematics policy. Some participants asserted that increasing the cost of insurance premiums would lead to people driving safely on the road. However, some participants, especially from the transport union groups, viewed the introduction of telematics-based insurance policy as another cost burden to transport operators. They asserted that the introduction of telematics into insurance policies should rather reduce their premium and if possible, insurance companies should bear the cost of the device. To the insurance

companies, acceptance and successful implementation of this policy implied substantial investment to the company that would come at a considerable cost. One participant re-echoed that:

*I know everything goes with a cost, so I am considering the cost of the tracker. The insurance companies can go back and reduce their insurance rate when the tracking system is part of the insurance premium. This is because tracking is a kind of check on the user of the vehicle and all vehicle owners.* [A participant from insurance company].

In Ghana, many people see the purchase of an insurance policy as an additional cost burden. Most people indicated that insurance companies were only interested in their profits because, in the event of a crash, insurance companies delayed in compensating their clients. Some participants opined that insurance companies were only interested in selling the product, but when it comes to compensation, they were reluctant to pay claims till the client had gone through a lot of processes. They suggested that if the insurance companies could provide the telematics device for free then it would incentivise them to accept the policy. This finding has been echoed by similar studies conducted by Sreethamol, Sulfiya, & Vineeth, (2018) and Paefgen,(2013) who argued that the cost of telematics devices was a challenge for accepting telematics-based insurance policies in India. Therefore, insurance companies in India installed telematics devices free of charge for drivers with comprehensive insurance policies as a strategy to motivate the acceptance of the telematics policy.

The finding also corroborates with a similar study done by Sumila (2013) in Poland who reported that among some of the reasons behind

negative acceptance of telematics by some drivers were the additional fees for using the telematics device or services. Also, a similar qualitative study conducted in the United Kingdom (UK) by Green, Romanovitch, Garnett, Steinbach, & Lewis, (2020), found those cost savings to be the main incentive for the acceptance of telematics policy by the majority of policy-holders.

In response to an interview question, participants also remarked that:

*This boils down to the ability to pay, so I think if insurance companies will find a way by which they can factor it into the third-party premium without increasing the price then it will be moderate for everyone to afford it. If it is expensive people might find it difficult to accept it.* [Participant from MMT].

Participants were also of the view that the installation cost would push the cost of insurance premiums up. Therefore, if the government and the insurance companies should find a way of pegging this policy with the current premium without increasing the price then they would be willing to accept the policy. This was evident as most people in Sekondi-Takoradi were willing to accept this policy if the cost of the device and the insurance premium would be reduced. This also corroborates a similar study conducted by Buttigieg (2013) in Malta who found that policy-holders complained about the installation and transmission costs. He, therefore, argued that insurance companies must decide whether the cost of the device will be borne by the insured or the insurer.

**Reduction in the insurance claim cost**

Another area related to cost is the reduction of claim costs which will be a major incentive for insurance companies. Insurance companies were happy to accept the adoption of this innovative policy because they asserted

that insurance claim cost was high in the country. This, they claimed, was due to the increased in road traffic crashes, and that the implementation of this policy would help reduce their claim cost as the use of telematics would be a check on clients. Participants opined that:

*It will reduce claim payments because there will be a reduction in accidents, and claim payments will go down and we can even give incentives. We do give incentives but they will be given at a discount, we can still go down with the introduction of telematics.* [ A participant from insurance company].

*Yes, it will be of great benefit. Like I said the core policy of every insurance company is to do the right thing and reduce fraudulent claims, because the more claims you accrue, the more your coffers are depleted. So when this policy is implemented and the rate of accidents goes down, it will be to the advantage of the insurance companies*. [ A participant from insurance company*]*

In a similar qualitative study by Quintero *et al.* (2020), it was found that investment cost was the major challenge to the implementation of the telematics-based insurance policy. This was not the case among insurance companies in the Sekondi-Takoradi metropolis because they did not see investment cost as a challenge to the acceptance and implementation of this policy. Rather, this study revealed that insurance companies in the Sekondi-Takoradi metropolis saw the implementation and adoption of telematics as a way of doing proper customer segmentation and ensuring the proper risk profile of their customers thereby reducing fraudulent claims which led to increased claim costs. This supports the assertion made by Mumdziev, Doernbecher, Perakovic, & Husnjak, (2014), that the use of telematics-based

insurance can also serve as a proxy for careful driving, fight fraudulent claims, enable lower premiums and reduce claim costs. The study also corroborates the theory of UTAUT, on performance expectancy which explains that when individuals or organisations believe that the use of technology will improve their job performance (perceived usefulness) then the probability to accept the technology will be high.

**Education of all stakeholders**

An additional area of concern raised by participants was education. Education was seen as a factor that influenced the acceptance of telematics-based insurance. A review of the literature revealed that insurance companies usually take about three years to implement very basic programmes (Buttigieg, 2013). The implementation of telematics-based policy is not an exception and as a result, extensive education and cooperation of entire stakeholders are required. Participants explained that if insurance companies and the general public were not properly trained or educated on this type of technology, acceptance or implementation will be difficult.

This was what some of the participants had to say:

*One of the factors has to do with constant education. It shouldn't be just a nine-day wonder: we need to educate the public and it shouldn't only be in English. How many people understand English? [*Participant from NRSA*]*

*We have a lot of illiterate drivers so we should come down to their level and make sure we explain the importance of telematics to them. I know the power of radio and television but we can also spread it to the churches and to the mosques where we meet on Fridays and Sundays so that we educate them. We*

*can go to the churches and ask permission just for 30 minutes to educate them.* [Participant from MMT].

The view of the latter, participant supported the argument made by Roger (2003) that the source of communication channel used will determine whether the information will reach the receiver or not, and therefore, recommended that for effective acceptance of technology, mass media is the most efficient medium of communication. Also, the ability to adopt or reject an innovation will be dependent on the social structure that an individual belongs to because behaviour can always be predicted based on the social structure which could also affect innovation. Another participant observed that:

*Education will be the major challenge. Education is a challenge in this country and implementation is also a challenge, that is the problem that we have. We have fine policies on paper but the implementation is the problem*. [Participant from NIC]

Other participants were of the view that attitudinal change in Ghana was difficult. We have so many policies in Ghana, but we fail to implement them because of attitudinal change. That was, policymakers found it difficult to implement any policy in the country due to human attitude.

*In our part of the world, it is very difficult to change. Attitudinal change is a challenge for Ghanaians, and so is our perception of that product. It is only just a hand full that will see the benefit of it; this is a major challenge but can be addressed when we educate them properly. It all boils down to how we can educate them on the benefits.* [Participant from SIC]

These responses implied that once stakeholders are educated on the importance of this technology the possibility to accept will be high. Education will always raise the awareness of the general public on the importance of using technology to reduce road traffic crashes. Others also thought that to implement this policy properly, all stakeholders in the transport sectors should be brought on board, as more input will come from these people about how proper implementation can be made. The excerpt below from participant is illustrative:

*They should consider whether the stakeholders will accept it. So they should bring all the stakeholders on board, the transport unions, the insurance companies, and the government. When all the stakeholders come together and views are collected, I think it will go a long way to help everybody*. [Participant from insurance company].

The results of this study are consistent with a previous study by Kuang, Zhao, Hao, & Liu, (2017) who found that targeted training of individuals or company employees also affects technology acceptance. They noted that the impact of technology acceptance was dependent on the extent to which employees or individuals were involved in the implementation stage of the technology. The results also corroborate the finding made by Balasubramanian, Libarikian, & McElhaney (2018), who argues that there will be a paradigm shift in the way automotive insurance might look in 2030, therefore, insurance companies and their management teams should be customer-focused and invest time and resources to build an understanding of telematics technology to their customers, to compete in business.

**Lack of efficient Internet connectivity**

Another issue of concern raised was the lack of good internet connectivity to support the technology which would also affect the effective implementation of the policy. Participants explained that internet connectivity and other infrastructure needed to support the implementation of the policy should be provided by the government before the implementation of this innovative policy. That is, some of the roads did not have internet connectivity, and maked it difficult to implement this policy across the country. In response to the question, participants explained that:

*Number one will be technology, whether or not the system we have now will be able to accept the policy. How developed is our technological system for it to capture the whole country?* [Participant from MMT]

The above response implied that without the needed infrastructure to support this policy, the possibility to implement it will be difficult. The use of telematics-based insurance depends on the accuracy of the received Global Positioning System (GPS) data from the telematics device (Husnjak *et al.*, 2015). Therefore, to effectively implement a telematics-based insurance policy, extensive infrastructure in information technology (IT) systems is required to collect telematics data on driver behaviour. This affirmation corroborates the theory of UTUAT, and the findings of Venkatesh and Zhang (2010) that when resources and infrastructure are available to support a technology, there is an opportunity for individuals or organisations to adopt such a technology, therefore lack of proper infrastructure means lack of acceptance. Similarly, Okwabi (2014) performed a research that revealed the main obstacle to implementing an intelligent transport system (ITS) in Ghana

is the absence of contemporary and effective vehicle monitoring technology. The usage of telematics systems is hindered by the restricted network capacity and the absence of current Information Communication Technology (ICT) in the transportation system network, which results in ineffective vehicular communication systems.

**Trust**

Trust was also another area of concern raised by some of the participants. Trust is the confidence that one party has in another party's ability to carry out a certain activity that is crucial to the trusting party, regardless of the ability to closely monitor or control the other party. Trust is the fundamental element that underlies interpersonal and corporate communication. Trust plays a vital role in interactive exchanges between stakeholders. This is because customers are expected to pay for services that they have not yet received or experienced. Therefore, trust is a significant factor that customers demand from the implementors of this policy (Agyei, Sun, Abrokwah, Penney, & Ofori-Boafo, 2020).

Participants thought that we were in a country where people did not have trust in the insurance system and that they could do everything in their power to reject this innovative technology if nothing is done about it. For example, participants explained that because of a lack of trust, if the police had not been inspecting insurance stickers along the road as a means of enforcement, people would not purchase an insurance policy in the country. Participants opined that:

*In Ghana, people don't have much trust in insurance so I believed that if the government or the regulating body adopts and then enforces it, it would be a*

*bit easier to merge the two. If NIC could hold on to this policy, I think merging will be a bit easier.* [ Participant from insurance company].

*I think that technology brings transparency. It is very simple, and so I am sure when we have something like this, the first benefit is transparency, it is also going to help build trust, and also, more or less it can lead to insurance penetration. That means that insurance companies contribution to the GDP of the country will go up.* [Participant from insurance company]

This conclusion is consistent with a similar observation by Tian *et al.*, 2020), in the United States of America, that among the millennial generation, trust emerged as a critical factor influencing both the behavioural attitude and the behavioural intention to accept telematics-based insurance policy. Shemshad *et al.* (2015) also found that trust and cultural differences influence the acceptance of technology. Azzopardi & Cotis (2013), who investigated telematics-based insurance using SWOT analysis, concluded that the main issue that influenced the acceptance of telematics was trust. Confidence in the service provider, confidence in the insurance regulator, trust based on economic factors, and trust based on information (see Agyei et al., 2020).

**Benefits of telematics to insurers**

Some of the benefits to be derived from the use of telematics-based insurance have been identified by practitioners and academics alike including a reduction in claim cost, fraudulent claims, and reduction in premium cost (Bordoff & Noel, 2008; Litman, 2011; Ippisch, 2012). With this innovation, insurance companies can sit in the comfort of their office and monitor vehicles along the road if their policy-holders are covered with telematics devices. As stated by one participant:

*It will give the insurance company a bit of comfort because even if a vehicle is missing, with the click of a button I will know where the vehicle is but in our system you can even buy a vehicle, steal it and come and tell the insurance company that the car is missing. I wouldn't know, and it is costing us and this brings fraudulent claims. So I see telematics as a benefit to us because it will prevent fraud and also prevent unnecessary claims*. [Participant from an insurance company].

These responses implied that the use of telematics would also help insurance companies to improve their risk assessment and optimise their pricing accurately based on real-time driving data provided by the telematics device. Data provided by the telematics device would also enable insurance companies to reduce claim costs and prevent fraudulent claims as drivers were monitored on every route. Roger (2003) argues that individuals or organisations will accept technology when they perceive the innovation as being better than the one that it has replaced. Also, people will consider the economic benefits to be derived from such innovation before deciding to accept it. The assertion aligns with Davis' theory of technology acceptance (TAM), which posits that people' or organisations' inclination to adopt technology is influenced by their perception of its ease of use and usefulness.

**Improved company image**

Company image was also another area that could be improved with the implementation of telematics-based insurance. One transport company that was already using this type of device in Ghana had this to say:

*Yes, to be honest with you, ever since these things (telematics devices) were installed and we implemented this policy, such complaints of overspeeding*

*have stopped. We don't hear these complaints. You see, I will be happy if this telematics-based insurance is introduced everywhere in Ghana. I believe the concept is good since it will help reduce road traffic crashes, and will help us to trace stolen cars. You stay in the comfort of your home and track your cars. If they introduce it, we will buy the idea.* [ Participant from transport company].

This observation corroborates similar findings made by Azzopardi and Cortis (2013), who argue that the use of telematics is not only for pricing insurance premiums, but telematics also provides an opportunity for a holistic risk management approach. Tesco UK discovered that by using telematics devices in its cars, they were able to identify and terminate drivers who violated the speed limit on more than three occasions. As a consequence, there was a decrease in fuel consumption and the frequency of crashes. These improvements were then passed on to customers as cost savings. This, in turn, stimulated demand from clients and led to increased profitability for the firm.

**Benefits of telematics to drivers**

Benefits to drivers were supported by several participants. First, participants believed that drivers could improve their driving style through the feedback given to them by their insurance companies while they were being monitored. A good driver could also benefit from the use of telematics in the form of discounts when they improve their driving style. The use of this device would also prevent good drivers from compensating for bad drivers. The use of telematics would also give the drivers' union peace of mind as it would reduce road traffic crashes. This was supported by one participant:

*When this tracking device is installed it will reduce road traffic crashes because drivers would be careful since they know they are being monitored. It will also give us peace of mind, because if for one or two years you have not been involved in an accident then you have your peace of mind*. [Participant from GPRTU]

**Benefit to the general public**

The societal benefits of telematics are enormous; the use of telematics devices could prevent dangerous driving. Drivers will be aware that they are being monitored, which will lead to improved driving behaviour on the road because they will always identify their mistakes through the feedback provided to them by their insurance companies. Things such as overspeeding, dangerous driving, harsh braking, and acceleration can be improved through the use of telematics devices. When these are achieved as stated by one participant, lives and families could be saved through reduced road traffic crashes:

*First and foremost, as I said earlier it will benefit society because most of the crashes that we have investigated were about fatigue driving. A lot of it is about sleeping behind the wheel, and a lot of it is about excessive speeding. So I think that this device will go a long way to monitor all these things and at the end of the day, it's going to benefit society because we wouldn't experience any road traffic crashes.* [Participant from NRSA].

This assertion is consistent with previous research by Bordoff & Noel (2008) who reported that States and the federal government in the United States saved money from reduced road traffic crashes due to lower medical payments and reduced tax revenue losses from incapacitated or seriously

injured workers and fewer emergency service from responding to crashes. The government also saved $128 million and $142 million in 2007 and 2008 respectively when the telematics-based insurance policy was implemented in 2007.

**Integrating Telematics into the Current Insurance Policy.**

**Telematics as an insurance product**

It is now clear that two different systems of automobile insurance are common in practice; compulsory and voluntary. These products are important due to liability factors and also due to states or country regulations. Also, new insurance products are introduced as a result of the changing demand in the insurance market. Therefore, the past few years have prompted insurance companies to react to intense competition in the automobile market and one of such products is a telematics-based insurance policy which can potentially be a very useful tool for insurance companies and policymakers to reduce road traffic crashes by offering financial incentives such as reducing the premium for safe driving behaviour. However, the introduction of a new policy such as this can be challenging because it needs a lot of stakeholder consultation. Integrating such a policy will require a lot of stakeholders to get involved, especially when dealing with monitoring data collection and analysis. Therefore, to integrate telematics-based insurance policy into the existing policy, different stakeholders such as telematics system service providers, telecommunication companies, data integrators, telematic system coordinators, and insurance companies have to join forces to share information and work as business partners without having to merge. All these stakeholders can play a role in the integration and implementation of such a policy (Vaia *et al.*, 2012).

Mobile phones and other mobile devices are a low-cost solution to the integration of this innovative policy as these devices offer a high degree of internet connectivity. Mobile phones and other portable devices provide a means of universally engaging with consumers. They may be utilised with in-vehicle device installations to give an extra avenue for obtaining information. This can be done at a minimal cost, making it an efficient way to execute the policy (Vaia, et al., 2012).

**Current insurance infrastructure in Ghana**

The insurance sector in Ghana is regulated under the Insurance Act of 2021 (Act 1061). This conduct demonstrated substantial compliance with the International Association of Insurance Supervisors (IAIS). The key principles provide enhanced regulatory authority to the National Insurance Commission (now Authority) for overseeing all insurance products in Ghana. The new insurance Act establishes a rigorous regulatory framework to safeguard customers and enhance the availability of insurance for the Ghanaian population. In line with the government of Ghana's efforts to digitise its operations, the National Insurance Commission (now the authority) has introduced the Motor Insurance Database (MID). The primary goals of implementing the Motor Insurance Database were to mitigate the problem of vehicles displaying counterfeit motor insurance stickers on the highways, therefore posing a threat to both lives and property. The auto insurance industry saw a growth rate of 9% in 2019, which increased to 37% in 2021, after the implementation of the digitization strategy (thebftonline.com). The Motor Insurance Database (MID) has comprehensive information of all cars that are covered. The Police, Driver Vehicle and Licencing Authority

(DVLA), and the National Insurance Commission (NIC) use MID records to detect vehicles that are uninsured or have been stolen. The introduction of the Motor Insurance Database (MID) in Ghana on January 20, 2020, aimed to enhance public safety by addressing road traffic accidents and the issue of counterfeit car insurance in the country (Entsie, 2020). In Ghana, the digitalization of motor insurance has introduced a crucial security feature. All motor insurance policies now include a synchronisation capability with the national database. This database can be easily accessed by the insurer, the insured, the police, and transport regulating bodies using any mobile phone. Its purpose is to determine whether a vehicle is insured or not. The same infrastructure can be used in the short to medium term for the integration of the telematics-based insurance policy.

**Participants' views on how to integrate telematics into the current insurance policy**

Assessing the views of how telematics can be integrated into the existing insurance policy, several participants gave varied views. This is an excerpt from a participant:

*Just like to make an example, first, when you take motor insurance we don't give the ECOWAS brown card, you have to come back and pay a new premium for it, but now they have integrated it into the old system so the moment you renew your insurance we automatically give you the ECOWAS brown card because you paid something small.[* Participant from an insurance company].

This assertion is consistent with a similar study by Dillon, & Gary, (2017), who reported that insurance companies who are integrating telematics policy

into an existing policy should not have to change the existing IT infrastructure the old interface can easily be modified.

Generally, participants were of the view that since the traditional insurance policies already existed, after considering the costs, integration of this innovation could be achieved by bringing all stakeholders such as drivers, vehicle owners, and the general public, educating them on the benefits of this innovative technology. This is another excerpt from a participant.

*Implementing new policies needs a lot of stakeholder consultations and public education. So firstly, public education should be intensified for people to understand how the telematics policy works and the benefits to be derived before it is implemented*.[ participant from insurance company].

In a similar investigation conducted by Badawala (2017), it was discovered that the implementation of novel technology or policy requires a higher degree of expertise and insight, as well as a substantial amount of strategic planning, organisation, and coordination. This is in addition to the technical aspects, such as training and public education. Effectively conveying the advantages of the new technology or policy in a clear and understandable way can foster enthusiasm and drive for its deployment. There is the need also to try to understand people's perspectives and tailor implementation to them to ease the problem of acceptance.

Another participant also remarked that:

*Look at the cost element so that everybody can access it and before that, it will also satisfy road users, especially car owners and other drivers because at the end of the day the car owners will buy and the drivers will use the car. So those who are going to buy should be brought on board, and those who are*

*going to use the car should also be brought on board. I mean if you're introducing something into the system, the stakeholders should be brought on board, educate, and tell them about the benefits associated with it.* [Participant from MMT].

This statement also corroborates the observation by Kuang *et al.,* (2017), who noted that the impact of technology acceptance is dependent on the extent to which stakeholders will accept the technology. In the main, stakeholder involvement in the implementation of technology is very important. Other participants also thought that the integration of the system is simple. Once we have the telematics device available it will be easy to integrate into the policy. This is the view of one participant.

*You cannot have the policy implemented without having the telematics device available in the market. I think the policy and the telematics device can go together. Because we have the old policy and now we have the telematics device which will be the new policy. So the two policies can be blended on the same infrastructure.* [Participant from STC]. This affirmation corroborates with similar studies conducted by (Goel, & Gruhn, 2005), on the integration of telematics for efficient management of carrier operations. Among the findings was that since insurance companies benefit from a faster return on investment because there is no need to change the existing infrastructure. In another dimension, there were varied views on how to integrate and implement this policy.

**Implementing the integration**

As part of the perception, the study sought to know whether the integration of the policy should be compulsory, optional, or progressive. From

the data, while a substantial number (13) said it must be a compulsory and one-off policy, a few (six) participants were of the view that to effectively implement this policy it must be started on a progressive and pilot bases until stakeholders such as drivers' awareness are raised before it becomes compulsory. Below are excerpts from some participants:

*It should not be compulsory for every driver but for commercial drivers it should be compulsory because they are not alone on the road they are with passengers and they should be monitored [*Participants from transport institution*].*

*My view is that it should be compulsory, there should be no bargaining, and it should be compulsory right from the beginning.[*Participant from insurance company*]*

*Looking at Ghana you know our mindset is very difficult. if it is not compulsory people will not go for it so though it should be compulsory we should intensify public education. [*Participants from insurance company]

*Depending upon how the country or the government of the day would like to move it, for it to be optional I don't think is the best option, but I think it should be progressive it can be started progressively but as for optional I don't think, because the current insurance system is not optional, it is compulsory but we can start it from the progressive manner after going through a lot of education we can start it from the progressive manner and we see how it goes and then roll it all over. [*Participants from transport institution*].*

**Policy implications**

The views expressed by the participants implied that the implementation of a telematics-based insurance policy within the Sekondi-Takoradi Metropolis would not be difficult, because the current insurance policy already exists in either a comprehensive or third party on existing infrastructure. In the current policy, the insured and the insurer could check or verify insurance status by dialing a code (*920*57*) through the motor insurance database (MID). The same infrastructure can be used to implement this type of policy, where insurance companies can track all their clients and provide them with feedback. Also, once the insurance companies provide the telematics device to their clients, there should not be any additional cost to be incurred by the insured. This can entice policyholders to join the policy on an optional or progressive basis.

**Summary**

This chapter has examined the use of telematics, factors influencing its acceptance and how telematics could be integrated into the current insurance policy framework. Results showed that although the term telematics is new to participants, however, a tracking device is not a new term to all participants. All participants had some knowledge and awareness of the vehicle telematics technology. Some companies and transport institutions, such as the NIC and a few transport operators in the GPRTU in the Metropolis, were using this device as a method of monitoring their vehicle and driver behaviour. Participants were aware and had knowledge of the importance of telematics, such as monitoring drivers driving behaviour, tracking the location of the vehicle in case of theft, and recovering broken-down vehicles along the road.

However, looking at the participant's level of education and their knowledge in the insurance and transport industry, as indicated in Table 5 on socio-demographic characteristics of participants, it was not surprising that almost all participants were aware of the importance of telematics. Nevertheless, what was surprising was that about one in three of the participants did not know that telematics could be used to reduce road traffic crashes. However, as soon as participants became aware that telematics could be used to reduce the impact of road traffic crashes, they were willing to accept and adopt the policy.

The chapter also examined the factors influencing the acceptance of telematics and how telematics could be integrated into the current insurance policy framework. It emerged that cost, education, internet connectivity (infrastructure), and trust were the major influencing factors in the acceptance of telematics-based insurance policies. It was also observed that when the cost of the policy was low, more people would accept the policy. Educating the public to accept the innovation also came out strongly. Again, it emerged that almost all participants were concerned with the perceived benefits to be derived from the policy. On the issue of how telematics could be integrated into the current insurance policy framework, it was discovered that the integration of technology into the economy of the study area had the potential to drive sustainable growth and development. In particular, investment in information and communication technology (ICT) drives a high productivity rate and a faster economy. The data also revealed that to integrate telematics into the existing insurance policy, different stakeholders such as telematics service providers, telecommunication companies, data integrators, telematics system coordinators, and insurance companies can join forces to share

information and work as business partners without having to merge. Most participants observed that to integrate such a policy, the implementors should look at the cost elements to make sure that people could afford it. Also, the policy should satisfy all users, especially vehicle owners and drivers, since they are the major stakeholders. It was also revealed that the integration of telematics-based insurance policies could allow insurance companies to improve their billing methods by aligning individual risk and price precisely. Participants suggested that more education is needed to be done for people to understand the importance of such a policy before the policy can be implemented on a pilot basis as an optional or progressive product. Finally, it can be said that the probability of accepting and adoptinging the telematics-based insurance policy in Sekondi-Takoradi is high.

# CHAPTER SEVEN

# SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

## Introduction

Road traffic crash in Ghana is considered a public health issue that needs radical measures to reduce their adverse impact on the country. Data from the literature shows that in several parts of the world, telematics-based insurance policy has been accepted as an innovative method for reducing the impact of road traffic crashes. This study was conducted to find out if the telematics-based insurance policy will be accepted by insurance companies and other transport stakeholder institutions and groups in the Sekondi-Takoradi Metropolis. This chapter provides a concise overview of the main discoveries of the research, the derived conclusions, and the suggestions put out. Additionally, it provides valuable input to the existing body of knowledge and suggests potential avenues for future study.

## Summary of the Study

The general objective of the study was to assess the perceptions of insurance companies and other transport stakeholder institutions on the use of vehicle telematics as a policy to reduce road traffic crashes in the Sekondi-Takoradi metropolis.

**The specific objectives were to:**

1. Assess the knowledge and awareness of insurance companies and other transport stakeholder institutions about the use of telematics.
2. Explore the perceptions of insurance companies and other transport stakeholder institutions in adopting telematics-based insurance.

3. Examine factors that are likely to influence the acceptance of telematics-based insurance policies in the study area.
4. Examine how telematics could be integrated into the existing insurance policy.

To achieve the objectives of the study, a qualitative research method was adopted to collect the data. Nineteen (19) participants including thirteen (13) insurance companies and six (6) transport institutions were purposively selected for the study. An in-depth interview guide was used as a data collection instrument. All the participants interviewed were the head of their institutions or groups. For insurance companies to qualify for this study, the company must be a non-life insurance company in good standing as of the end of the 2020 financial year. For other stakeholder groups, the participants must be the head of their group or institution.

Data collected included awareness and knowledge about vehicle telematics, perception of the acceptance of telematics as a policy in Ghana, factors that influence the acceptance of telematics-based insurance policy, preparedness to accept the policy, challenges to the implementation of the policy, the benefit to be derived from the implementation of the policy, and how the use of telematics can be integrated into the existing insurance policy. The acquired data were analysed via MAXQDA, a software tool for qualitative data analysis, and employing content analysis techniques.

**Summary of Key Findings**

The study examined how road traffic crashes can be reduced through innovative insurance delivery (telematics-based insurance) from the perspective of transport stakeholders using Sekondi –Takoradi Metropolis as

a case study. Below is the summary of the results according to the research objectives:

1. The study sought to find the level of knowledge and awareness of insurance companies and other transport stakeholder institutions about the use of telematics. The findings revealed that participants knew vehicle tracking devices and their uses such as locating vehicle location, monitoring vehicle speed, and detecting vehicle theft. Although, participants had knowledge of vehicle tracking devices and were familiar with their uses in monitoring vehicle movement, only a few of the participants knew that telematics could be used to reduce road traffic crashes.
2. This area sought to find the perceptions of insurance companies and other transport stakeholder institutions on the use of telematics in reducing RTCs. It emerged that many participants perceived that the use of telematics devices would make drivers more disciplined on the road because they would be aware that their driving behaviour were being monitored which could let them be more careful on the road, therefore, reducing road traffic crashes. Participants also believed that the introduction of a telematics-based insurance policy would help insurance companies from paying too many claims, detecting vehicle theft, and reducing fraudulent claims.
3. On factors which would influence negatively or positively the acceptance of telematics as a policy in reducing RTCs, in Ghana, it was established from the study that several factors influenced the acceptance of telematics-based policy. These include cost, trust

available infrastructure, and education would be the major influencing factors in telematics acceptance in the Sekondi-Takoradi metropolis.

4. On the issues of how telematics could be incorporated into the existing insurance policy framework, it was revealed that since there was an old policy infrastructure where policy-holders could check the validity of their insurance, the same infrastructure could be used in the short to medium -term as a platform to integrate this policy.
5. Implementing a new policy such as this requires different stakeholders such as telematics system service providers, telecommunication companies, data integrators, telematics system coordinators, and insurance companies. These companies can join forces to share information and work as a business team without having to merge.

The findings of the study have an implication for all stakeholders, because telematics improves risk management for insurance companies, improves driver behaviour as their behaviour is being monitored, reduces claim cost, prevents automotive insurance fraud, reduces road traffic crashes, and reduces the financial burden on the management of road traffic crashes in Ghana.

**Conclusions**

The study's results led to the following conclusions:

1. The study concludes that almost all participants had knowledge of vehicle tracking devices and that most transport companies and institutions are already using telematics devices to track the movement of their fleets. The study also concludes that one insurance company in the country had started to pilot this as a policy. Most participants were

also willing to accept the implementation of telematics-based insurance as a policy because of its perceived benefits.

2. On the issue of perception, the study concludes that insurance companies believe they stand to gain if they get involved in the project of implementing a telematics-based policy because road traffic crashes place a toll on their income. Many transport institutions and groups agreed that the implementation of this policy is long overdue, and therefore, what is needed is to educate the general public on the importance of telematics-based insurance and its benefits in road traffic crash prevention.
3. Relating to factors that will influence the acceptance of telematics-based insurance policy, the study concluded that whereas in some countries intrusion of privacy was the major factor in the acceptance of telematics-based insurance policy, in Sekondi-Takoradi metropolis, participants believed that cost, good infrastructure, which include internet connectivity, education, training and support for all stakeholders could be the major factor which influences the acceptance of telematics-based insurance policy. Notwithstanding, all participants welcomed the idea that the implementation of a telematics-based insurance policy will help reduce the road traffic crash situation.
4. Regarding the integration of telematics-based insurance into the existing policy, the study concluded that since there are existing insurance policies, the integration of this policy can use the existing insurance infrastructure.

**Recommendations**

Based on the conclusions drawn, the following recommendations are made.

1. It is recommended that since the majority of the participants had the knowledge and were also aware of the use of tracking devices, education should be given to all participants especially managers of insurance companies, heads of transport groups, and all major stakeholders of this policy on the financial, societal and environmental benefits of the telematics-based policy.
2. Since there were more benefits of telematics-based insurance over the existing insurance policy, insurance companies should partner government to raise public awareness of the importance of telematics-based insurance policy in reducing road traffic crashes through the National Commission for Civic Education (NCCE) and all civil society groups. This will raise the interest of all stakeholders.
3. Telematics has a significant impact on insurance companies' business profitability. Therefore, they must lure drivers into this policy by providing incentives in the form of discounts to all drivers. This is because drivers may be reluctant when they consider that the discount is not large enough to warrant acceptance. Insurance companies can start the implementation of this policy on a pilot basis. This time the cost of the device can be borne by the insurance companies. Insurance companies should also build trust in their policy-holders, concerning their products and the services they provide. Trust will enable policy-holders to accept this new policy. When the insurance company is seen

as trustworthy by the policyholder there is a higher probability of accepting this new innovative concept.

4. Getting a telematics-based insurance policy operational requires a considerable investment cost, both in infrastructure and technology. The government of Ghana should provide the needed infrastructure such as improved internet connectivity to support the implementation of such an innovative policy. The National Insurance Commission which has the responsibility for regulating the insurance industry in the country should come up with the policy direction concerning the use of telematics policy in Ghana.

**Contribution to Knowledge**

Telematics-based insurance is an emerging technology that has been accepted as a method for reducing road traffic crashes by several insurance companies around the world. Automobile insurance has changed in recent years as a result of advancements in technology. More insurance companies are interested in implementing insurance policy that takes advantage of the new technology. This study examined the awareness, knowledge, and perception of transport stakeholders on the acceptance of telematics-based insurance policies and how they can be integrated into the current insurance policy using the Sekondi-Takoradi metropolis in Ghana. Several lessons have been learned from this study.

According to Silverman (2000), the extent to which a research contributes to knowledge may be evaluated in four specific areas: the development of a new idea or approach, the expansion of an existing study,

and the modification of existing information. The study's contribution to knowledge encompasses the following, as stated above:

1. The study was able to build on the existing studies that focus on finding an innovative approach to reducing road traffic crashes in Ghana (Fronsko, 2011, Abane, 2012 & Bolderdijk *et al.,* 2011). Most literature, especially in Ghana (Afukaar *et al.*, 2003, Agyeman *et al*., 2013 & Afukaar *et al.*, 2020) on how road traffic crash fatalities can be reduced, has concentrated principally on the use of education, engineering, and enforcement. These interventions have reached their ceiling and are no more effective. Therefore, this study contributed to knowledge by emphasizing that the best method of reducing road traffic crashes in Ghana is by integrating telematics into the existing insurance policy.
2. This study has also contributed to knowledge by building on an existing theory on diffusion of innovation, which proposed that diffusion of technology may occur among people or organisations in response to learning about a new idea, process, or technology. This study builds on this theory and proves that when people become aware of the benefits of technology, their willingness to accept the technology is increased.
3. This study also contributes to knowledge by building on the facilitation condition in the theory on Unified Theory on Acceptance and Use of Technology (UTAUT), which is the degree to which an individual or organisation will accept technology when they believe that the infrastructure to support the technology exists. This study supports the

assertion that individuals or organisations will accept technology only when they believe that infrastructure exists to support it.

**Areas for Further Research**

This study sought to explore the acceptance of telematics-based insurance and how it can be integrated into the existing motor insurance policy to reduce road traffic crashes using insurance companies and transport institutions and groups in the Sekondi Takoradi Metropolis in the Western Region.

Future research may focus on the following:

1. Drivers' willingness (or otherwise) to accept telematics-based policy as an insurance product.
2. Also, the study can be replicated in other regions in Ghana to have in-depth knowledge of how the general public perceives this type of innovative policy.
3. Since the benefits of telematics are diverse and research on telematics in Ghana is scarce, a future study may investigate the use of telematics, such as telematics and route planning, telematics and transport information management, and telematics and traffic management systems.

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# APPENDICES

## Appendix A: Interview Guide

**Dear Sir/Madam**

My name is Isaac Edunyah I am pursuing a Ph.D. in geography and regional planning at Cape-Coast University with a specialization in transport planning. As part of the requirement for the award of a Ph.D. A student is required to undertake independent research to produce a thesis. Therefore, this interview is for academic purposes only and not intended for any other purpose. The study is mainly to solicit your views on how the use of telematics-based insurance policy could be integrated into the current insurance policy to reduce road traffic crashes in Ghana. You have the right to accept or deny this interview. If you accept your confidentiality is assured. In case you would need further clarification, you can contact me on the following phone number:

Tel: 0245539247.

Email: isaac.edunyah@stu.ucc.gh

**Section A**

**General issues**

1. Which categories of vehicles do you insure in your company?

3. What can we do as a country to reduce road traffic crashes?

4. How does your institution contribute to road traffic crash reduction?

5. What is your view on road traffic crashes in Ghana? Probe.

**SECTION B**

**Conventional (CURRENT) insurance policy**

2. How many types of policies do you operate?

3. What accounts for the road traffic crash situation in Ghana?

4. How do you think road traffic crashes in Ghana can be reduced/minimized?

5. What determines the amount of premium to be paid by the policyholder?

6. How do you determine the amount on a premium to be paid by the policyholder?

7. Are you familiar with any automobile insurance policy apart from the one you operate?

**SECTION C**

**Awareness**

1. What do you know about telematics? Probe
2. What do you know about vehicle tracking devices? Probe
3. What do you know about pay as you drive insurance policy
4. Do you think telematics could help reduce road traffic crashes in Ghana, how, why, and in what ways?

SECTION D

**Knowledge about telematics-based insurance policy**

1. What do you know about telematics? Probe
2. What do you know about the telematics-based insurance policy? Probe
3. How can telematics improve road traffic crashes? Probe

**SECTION E**

**Perception**

1. What do you think about using telematics in Ghana? Probe for details

2. What do you think about implementing telematics-based insurance as a policy in Ghana? Probe?

3. Why hasn't Ghana implemented a telematics-based insurance policy? Probe?

4. Would you like to recommend this type of policy in Ghana if yes why if not why?

4. How should telematics-based insurance be implemented? Probe.

**SECTION F**

**Preparedness to adopt a telematics-based insurance policy**

1. How well are you prepared to adopt a telematics-based insurance policy?

2. What factors should be considered before implementing a telematics-based insurance policy? Probe.

**Benefits of telematics-based insurance**

1. What do you think will be the benefits of a telematics policy for your institution? Probe

2. What do you think will be the benefits of a telematics-based insurance policy to the country?

**SECTION G**

**Challenges**

1. What do you perceive to be major challenges in implementing telematics-based insurance as a policy? Probe

**Suggestions on how telematics can be integrated**

2. Can you please suggest how telematics-based insurance can be integrated into the current insurance policies?

**Socio-demographic characteristics of the participants**

Can you finally give me a little information about yourself?

1. AGE IN YEARS:
   - 20-29
   - 30-39

- 40-49
- 50-up.

2. SEX/GENDER

- Male
- Female

3. YEARS IN EMPLOYMENT

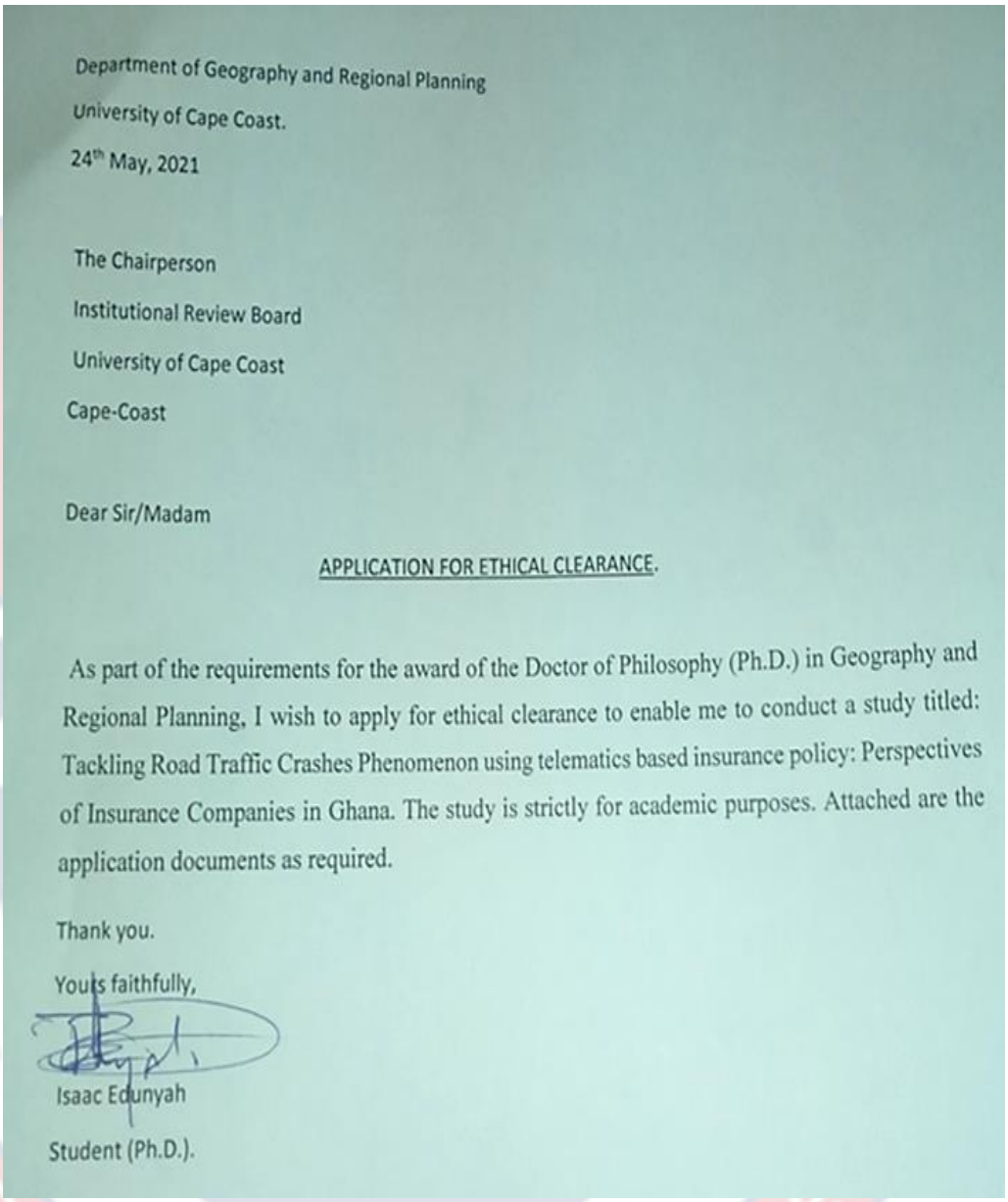
- 1-5
- 6-10
- 11-15
- 16-20
- 21 and Above.

4. Educational Attainment:

- Postgraduate
- Undergraduate
- HND
- SHS
- JSH/MSLC

Any Professional Certificate

## APPENDIX B: Application Letter for Ethical Clearance



Department of Geography and Regional Planning
University of Cape Coast.
24th May, 2021

The Chairperson
Institutional Review Board
University of Cape Coast
Cape-Coast

Dear Sir/Madam

APPLICATION FOR ETHICAL CLEARANCE.

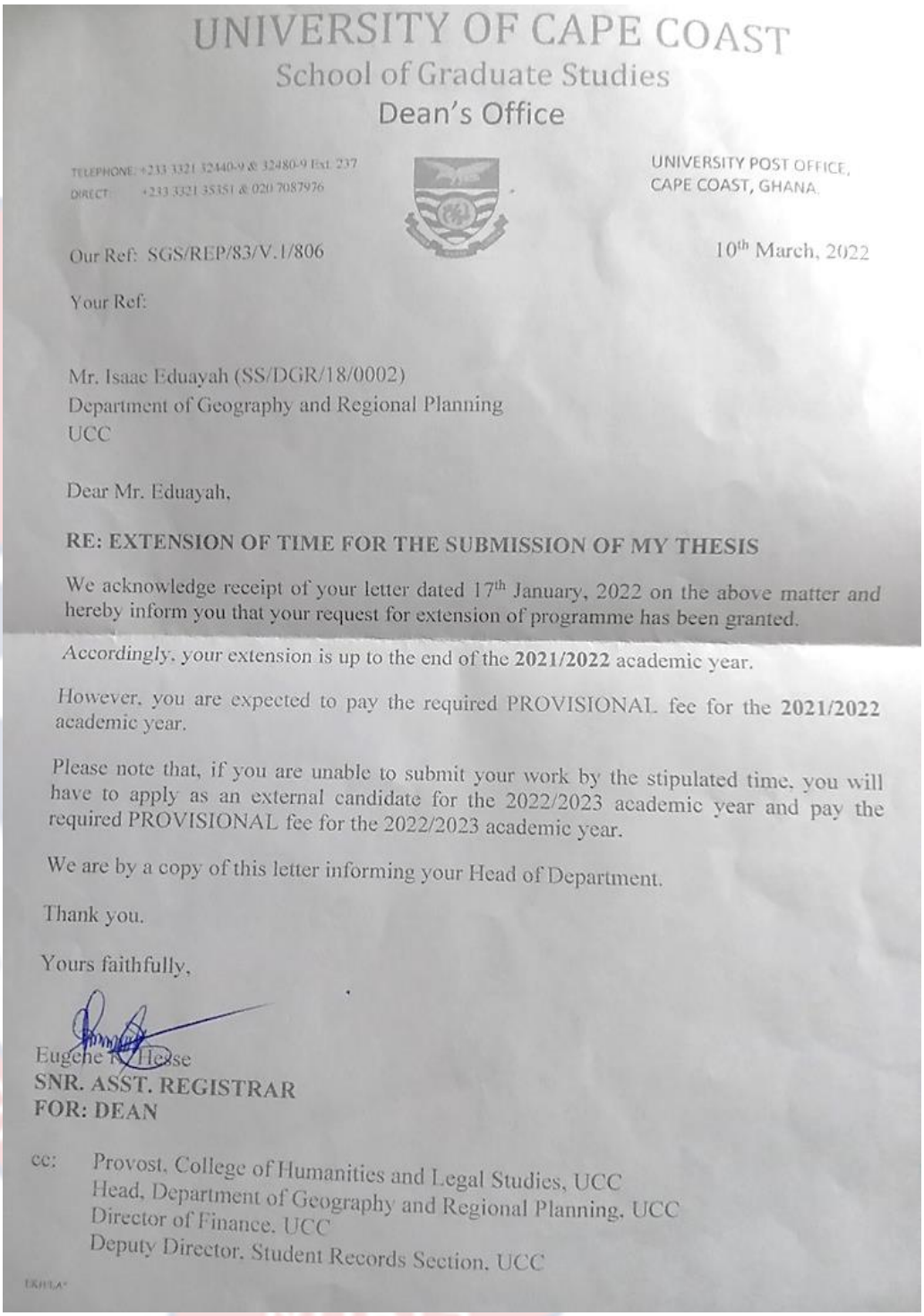
As part of the requirements for the award of the Doctor of Philosophy (Ph.D.) in Geography and Regional Planning, I wish to apply for ethical clearance to enable me to conduct a study titled: Tackling Road Traffic Crashes Phenomenon using telematics based insurance policy: Perspectives of Insurance Companies in Ghana. The study is strictly for academic purposes. Attached are the application documents as required.

Thank you.

Yours faithfully,

Isaac Edunyah
Student (Ph.D.).

## APPENDIX C: Extension of Time for the Submission of Thesis



UNIVERSITY OF CAPE COAST
School of Graduate Studies
Dean's Office

TELEPHONE: +233 3321 32440-9 & 32480-9 Ext. 237
DIRECT: +233 3321 35351 & 020 7087976

UNIVERSITY POST OFFICE,
CAPE COAST, GHANA.

Our Ref: SGS/REP/83/V.1/806

10th March, 2022

Your Ref:

Mr. Isaac Eduayah (SS/DGR/18/0002)
Department of Geography and Regional Planning
UCC

Dear Mr. Eduayah,

**RE: EXTENSION OF TIME FOR THE SUBMISSION OF MY THESIS**

We acknowledge receipt of your letter dated 17th January, 2022 on the above matter and hereby inform you that your request for extension of programme has been granted.

Accordingly, your extension is up to the end of the **2021/2022** academic year.

However, you are expected to pay the required PROVISIONAL fee for the **2021/2022** academic year.

Please note that, if you are unable to submit your work by the stipulated time, you will have to apply as an external candidate for the 2022/2023 academic year and pay the required PROVISIONAL fee for the 2022/2023 academic year.

We are by a copy of this letter informing your Head of Department.

Thank you.

Yours faithfully,

Eugene K. Hesse
**SNR. ASST. REGISTRAR**
**FOR: DEAN**

cc: Provost, College of Humanities and Legal Studies, UCC
Head, Department of Geography and Regional Planning, UCC
Director of Finance, UCC
Deputy Director, Student Records Section, UCC

EKH/LA*

**APPENDIX D: Clearance Letter From the Institutional Review Board.**

UNIVERSITY OF CAPE COAST

INSTITUTIONAL REVIEW BOARD SECRETARIAT

TEL.: 0558093143/0508878309
E-MAIL: irb@ucc.edu.gh
OUR REF: UCC/IRB/A/2016/1105
YOUR REF:
OMB NO: 0990-0279
IORG #: IORG0009096

23RD SEPTEMBER 2021

Mr. Isaac Edunyah
Department of Geography and Regional Planning University of Cape Coast
Dear Mr. Edunyah,

ETHICAL CLEARANCE - ID (UCCIRB/CHLS/2021/30)

The University of Cape Coast Institutional Review Board (UCCIRB) has granted Provisional Approval for the implementation of your research titled Using Telematics to Reduce Road Traffic Crashes: Perspectives of Insurance Companies in Ghana. This approval is valid from 23 rd September 2021 to 22nd September 2022. You may apply for renewal subject to submission of all the required documents that will be prescribed by the UCCIRB. Please note that any modification to the project must be submitted to the UCCIRB for review and approval before its implementation. You are required to submit a periodic review of the protocol to the Board and a final full review to the UCCIRB on completion of the research. The UCCIRB may observe or cause to be observed procedures and records of the research during and after implementation. You are also required to report all serious adverse events related to this study to the UCCIRB within seven days verbally and fourteen days in writing. Always quote the protocol identification number in all future correspondence with us in relation to this protocol.

Yours faithfully,

Dr. Samuel Aseidu Owusu,

UCCIRB Administrator

ADMINISTRATOR
SITUTIONAL REVIEW BOARD
NIVERSITY OF CAPE COAST

**APPENDIX: E: Introductory Letter from Student's Supervisor.**

Department of Geography and Regional Planning

University of Cape Coast

Cape Coast

14 April 2021

The Chairperson

Institutional Review Board

University of Cape Coast

Cape Coast

Dear Sir,

**ETHICAL CLEARANCE FOR CONDUCT OF RESEARCH: MR ISAAC EDUNYAH (SS/DGR/18/0002)**

I write to introduce Mr. Isaac Édunyah (SS/DGR/18/0002), who is pursuing a Doctor of Philosophy Degree at the Department of Geography and Regional Planning, University of Cape Coast. He requires ethical clearance to proceed with his data collection for a thesis titled: TACKLING ROAD TRAFFIC CRASHES PHENOMENON USING TELEMATICS-BASED INSURANCE POLICY: PERSPECTIVES OF INSURANCE COMPANIES IN GHANA.

By this letter, I confirm that the Department has approved Mr. Isaac Edunyah's proposal and has granted him permission to conduct and complete this thesis as part of the requirement for obtaining a Ph.D.

I would, therefore, be most grateful if this thesis proposal could be reviewed to enable him to carry out the research.

Thank you.

Yours faithfully, Prof or A. 


(Student Supervisor)