UNIVERSITY OF RWANDA

COLLEGE OF SCIENCE AND TECHNOLOGY

TITLE OF THE PROJECT:

ASSESSMENT OF BARRIERS TO ELECTRICAL VEHICLES DISSEMINATION IN RWANDA

A project submitted to the African Center of Excellence in Energy for

Sustainable Development (ACE-ESD)

In partial fulfillment of the requirement for the degree of

MASTERS OF SCIENCE IN (ENERGY ECONOMICS**)**

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October, 2024

DECLARATION

I, INGABIRE Alliance, the undersigned, declare that this Project proposal is my original work, and has not been presented for a degree in University of Rwanda or any other universities. All sources of materials that will be used for the thesis work will have been fully acknowledged.

Names: **INGABIRE Alliance**

Date:……...../……/…… Signature

This thesis project has been submitted for examination with my approval as a university advisor.

Dr**. HAKIZIMANA Jean De Dieu** _____ ____

Thesis Advisor Signature

ACKNOWLEDGEMENTS

My research for this thesis brought me into contact with several participants. I would like to express special thanks to everyone who helped and contributed during the course of this research.
I really appreciate my mentor, Dr. **HAKIZIMANA Jean De Dieu**, for his excellent academic guidance and confidence in my ability to conduct research.
Special thanks to my family for their patience and encouragement during my time at the University of Rwanda. I would also like to thank my classmates and friends.
Finally, God deserves the glory for His wonderful gifts of health, intelligence, and the grace of obedience.

INGABIRE Alliance

ABSTRACT

The purpose of this study was to assess the barriers to electric vehicles dissemination in Rwanda. Even though electric cars (EVs) are becoming more and more popular throughout Africa, including Rwanda, as a sustainable mobility solution, there are still several obstacles standing in the way of EV adoption and widespread distribution. In conducting this research, three specific objectives were to assess the key barriers to the dissemination of electric vehicles in Rwanda, to identify the factors influencing the adoption of electric vehicles and finally to evaluate the attitudes of Rwandan consumers towards electric vehicles. Population of the study was 23 employees of MININFRA / Headquarters and out of them 63 employees were selected by using universal sampling technique. Questionnaire and documentation were used as tools of data collection. Furthermore, descriptive statistics was used in analysis. Findings indicated that 63 (100%) respondents strongly agreed that electric vehicles have lower overall costs over the lifetime of the vehicle; 60 (95.2%) respondents strongly agreed that the price of EVs and environmental factors significantly influence Rwanda's client's consumer adoption while 3(4.8%) respondents agreed the point, finally 63 (100%) respondents strongly agreed that electric vehicles in Rwanda also are more environmentally friendly and also other 100% of respondents strongly agreed that Rwandan consumers are primarily motivated by environmental concerns; 54 (85.7%) respondents strongly agreed that electric vehicles in Rwanda have full driving automation is perceived as a useful technology and 9 (14.3%) respondents agreed the point. The study concluded that there is a positive relationship between barriers and electric vehicles dissemination in Rwanda. The researcher recommended that Rwandan government and its partners should also increase the number of public charging stations, which is a must. As a rule of thumb, regions should provide 1 public charging point for every 10 registered electric vehicles.

TBLE OF CONTENTS

LIST OF ABBREVIATIONS AND SIGNS

ACE : African Center of Excellence

BEV : Battery Electric Vehicle

CAPEX : Capital Expenditure

CEOs : Chief Executive Officers

DC : District of Colombia

E-REVs : Extended-Range Battery Electric Vehicles

ESD : Energy for Sustainable Development

EVs : Electric Vehicles

FCEVs : Fuel Cell Electric Vehicles

GHGs : Greenhouse Gases

HEVs : Hybrid Electric Vehicles

ICE : Internal Combustion Engine

ICEV : Internal combustion engine vehicle

IEA : International Energy Administration

MININFRA : Ministry of Infrastructure

OPEX : Operating expenses

PHEVs : Plug-In Hybrid Electric Vehicles

SPSS : Statistical Package for Social Sciences

TPB : Theory of Planned Behavior

TRA : Theory of Reasoned Action

UNEP : United Nation Environmental Program

US : United States

ZEVs : Zero Emissions Vehicles

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CHAPTER 1.
INTODUCTION

This chapter presents the background, the problem statement, objectives of the study, the significance of the study, limitation of the study, scope of the study and organization of the study.

1.1 Background of the study

Worldwide, Electric vehicles (EVs) are classified based on their fuel technologies, of which there are four types: plug-in hybrid electric vehicles (PHEVs), extended-range battery electric vehicles (E-REVs), battery electric vehicles (BEVs), and hybrid electric vehicles (HEVs). It has been proposed that EVs are a good solution for the problem of GHGs (greenhouse gases) caused by transportation and air pollutant emissions. Most developed countries are carrying out a variety public policies and financial incentives for the large-scale adoption of EVs.

At the international perspective, electric vehicles, or EVs, are becoming more and more popular; yet, certain nations have seen greater success than others. While industrialized nations have been at the forefront, they have also encountered and are confronting obstacles to the adoption of EVs. As an example, China has emerged as the world's fastest-growing electric vehicle (EV) market, with 2.3 million electric vehicles in active use, while Norway leads the world in EV usage. The Netherlands is one of the largest expanding EV markets globally. The market for electric vehicles has grown quickly in the United Kingdom, and this development tendency is anticipated to continue. German Sales of electric vehicles (EVs) tripled to exceed 194,000 units in 2020 in France. More than 65,000 electric cars are currently in use in Thailand.

In developed countries like United States, the United Kingdom, the Netherlands, Singapore, Canada, France, Sweden, Australia and Israel. Electric vehicles form a solution to one part of the transport challenge in relation to sustainability. This is mainly through their potential to reduce fossil fuel consumption, and therefore GHG emissions; by as much as 90% if they are using renewable, local energy sources. EVs therefore also have the potential to reduce air, water and

noise pollution (Nigro 2011), which in turn decrease public health issues and ecosystem damage (The Center for Climate and Energy Solutions 2012).

At regional perspective, by sector, road transport is the largest contributor to global warming (Skeie *et al*., 2009). Through electrification of vehicles, the emission due to the combustion engine can be reduced, battery electric vehicle (BEV) offer the potential to reduce GHG emissions and cut the dependency on fossil fuels for transportation. Furthermore, the positive impact of GHG emission reduction from road transport could be abolished due to the emission produced from the use of fossil fuels for electricity production. Therefore, the electricity produced for CS should be provided by RES, it is important for the power sector to start switching for renewable energy, or to implement new renewable power sources integrated with CS to reduce the overload of electricity on the power grid (Rautiainen, 2015) approaching a sustainable development for the road transportation sector. The integration of RES with EV varies a lot by country, based on the demand of electricity and level of infrastructure.

At national level, Rwanda has embraced EVs to curb air pollution from soot-spewing vehicles, with close to 900 locally made electric vehicles now plying the country's roads. Although wealthy nations have led the way in the adoption of electric vehicles (EVs), emerging nations such as Rwanda have also achieved noteworthy progress in this domain. In an effort to reduce air pollution caused by soot-emitting automobiles, Rwanda has embraced electric cars (EVs), with around 900 locally built EVs currently on the road environment. Additionally, the Rwandan government has implemented a number of policies and The Rwandan government, seeing the advantages of electric vehicles, wants to quickly switch to electric motorbikes, or e-motos, and eventually to EVs in general. These obstacles present an opportunity for Rwandan startup KABISA, which aims to upend the auto industry by offering a full EV ecosystem. The goal of KABISA is to improve access to transportation that is efficient, safe, and green. In order to do this, KABISA is creating an EV servicing garage in Kigali and establishing a public charging network in addition to selling and leasing EVs.

Furthermore, undergoing a radical change in the transportation sector to adopt sustainable and low-emission options because evidence suggests that this sector is one of the main sources of the world's energy consumption and greenhouse gas emissions (Ajanovic, 2016)). Electric vehicles (EVs) have shown promise in lowering air pollution, reducing greenhouse gas emissions, and reducing the need for fossil fuels. It is acknowledged that electric cars, or EVs, have the potential to provide sustainable transportation.(She, Z. Y., Sun, Q., Ma, J. J., & Xie, B. C. . , (2017)). Rwanda is also still making significant strides toward sustainable development. The nation has put in place a number of programs to support environmentally friendly transportation and sustainable energy.

Rwanda's participation in the UNEP-launched Electric Mobility Programme, which was established in 2017, is a testament to the country's dedication to environmental sustainability. In order to lower greenhouse gas emissions and enhance air quality, this program attempts to assist nations in implementing electric transportation. One of the main drivers of the world's energy consumption and greenhouse gas emissions is the transportation industry. At a time when issues with traditional passenger automobile transportation based on fossil fuels, such as rising emissions and air pollution and growing reliance on energy imports, are becoming more minor. (Ajanovic, A., & Haas, R. (). : , ., 2016).

1.2. Statement of the problem

Electric motors use energy far more efficiently than their internal combustion counterparts, which waste a huge amount of energy through friction. Electric motors are able to convert up to 85% of the energy they burn into motion, compared to less than 40% with a combustion engine. Despite a broad consensus on the large-scale adoption of EVs in the world, its benefits and realization ultimately fall on the willingness of consumers to accept new technology.

Even though electric cars (EVs) are becoming more and more popular throughout Africa, including Rwanda, as a sustainable mobility solution, there are still several obstacles standing in the way of EV adoption and widespread distribution. Typically, as seen in the car market in Rwanda, the number of EVs and their utilization is low due to the fact that most of them are expensive and not easy for many customers to buy; moreover, the perception of the use of these cars is still difficult for many Rwandan consumers even though the taxes are removed from these cars.

Therefore, the researcher sees that it is imperative to recognize and tackle these obstacles in order to expedite the shift towards environmentally friendly and sustainable transportation infrastructure. Furthermore, the research project's issue statement is: What are the main obstacles to the widespread use of electric vehicles in developing nations like Rwanda, and how may these obstacles be removed to encourage EV adoption in the nation?

1.3. Objectives of the study

The study has both general and specific objectives.

1.3.1. General objective

The main objective of this study was to assess the barriers to electric vehicles dissemination in Rwanda.

1.3.2. Specific Objectives

i. Assess the key barriers to the dissemination of electric vehicles in Rwanda.
ii. Identify the factors influencing the adoption of electric vehicles.
iii. Evaluate the attitudes of Rwandan consumers towards electric vehicles.

1.4. Significance of the study

The research project focused on the barriers to electric vehicle dissemination in Rwanda holds significant importance for various stakeholders and contributes to the overall understanding and advancement of sustainable transportation in the country. Environmental impact in Rwanda, like many other countries, faces significant challenges related to air pollution, greenhouse gas emissions, and climate change. By identifying and addressing the barriers to electric vehicle adoption, the study can contribute to reducing the carbon footprint and mitigating the environmental impact of transportation in Rwanda. This is particularly crucial, as the transportation sector is a major contributor to air pollution and carbon emissions.

The adoption of electric vehicles can stimulate economic growth and create new job opportunities. The study can provide insights into the potential economic benefits associated with electric vehicle

deployment, such as the establishment of charging infrastructure, local manufacturing and assembly, and the development of a skilled workforce in the electric vehicle sector.

1.5. Limitations of the study

The result of this study may be limited in assessment of barriers to electric vehicles dissemination in Rwanda. The reason why this study was limited in this area is because Rwanda has a limited number of electric vehicles available, which could make it challenging to recruit a large sample size. Since the adoption of electric vehicles in Rwanda may still be in its early stages, the number of EV users might be relatively small. The study also provides insights and recommendations to support the development of effective strategies for the wider adoption of electric vehicles in Rwanda.

1.6. Scope of the study

This research study focused on analyzing the barriers to the dissemination of electric vehicles (EVs) within the context of Rwanda. The research also identified and categorized the key barriers to electric vehicle dissemination in Rwanda. These barriers may include, but are not limited to, high upfront costs, limited charging infrastructure, consumer awareness and knowledge gaps, and policy and regulatory challenges. While this research project focused on electric vehicle dissemination barriers in Rwanda by considering the period between 2019 and 2023, it also did not include the technical aspects of EV technology or an extensive analysis of the environmental impacts of EVs. The study aimed to provide insights and recommendations to support the development of effective strategies for the wider adoption of electric vehicles in Rwanda.

1.7. Expected outcomes and significance of the study

Identification of key barriers hindering electric vehicle adoption in Rwanda and Understanding the impact of these barriers on the dissemination of electric vehicles in the country. Also, Recommendations for addressing and overcoming the identified barriers.

1.8. Organization of the study

This thesis is composed of five chapters. Chapter one deals with the study background, problem statement, research objectives and questions, hypothesis statement, significance of the study, scope, and expected outcome of the study. Chapter Two reviews literature on the assessment of barriers to electrical vehicle dissemination. Further, this chapter also discusses the theoretical and conceptual framework of the study. The third chapter deals with the methodology of the study. This includes the selection and study area description, data type and source, research design and research strategy, data processing, definition and description of variables, as well as model specification. Chapters four and five deal with analysis, discussion, conclusion, and recommendations, respectively.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

This chapter presents the theoretical literature, empirical literature, research gap, theoretical framework, conceptual framework, and summary. The literature review provided a comprehensive understanding of the barriers to electric vehicle dissemination, with a specific focus on Rwanda. It explored existing studies, reports, and publications related to electric mobility and barriers to adoption. This review also provided a comprehensive understanding of the challenges specific to Rwanda.

2.1. Theoretical framework

Below section presents different theories related to this research study.

2.1.1. Theory of Planned Behavior

The theory of planned behavior (TPB) is a psychological theory that links beliefs to behavior. The theory maintains that three core components, namely, attitude, subjective norms, and perceived behavioral control, together shape an individual's behavioral intentions. In turn, a tenet of TPB is that behavioral intention is the most proximal determinant of human social behavior. The theory was elaborated by Icek Ajzen for the purpose of improving the predictive power of the theory of reasoned action (TRA). Ajzen's idea was to include perceived behavioral control in TPB. Perceived behavior control was not a component of TRA. TPB has been applied to studies of the relations among beliefs, attitudes, behavioral intentions, and behaviors in various human domains. These domains include, but are not limited to, advertising, public relations, advertising campaigns, healthcare, sport management consumer/household finance, and sustainability.

Icek Ajzen (1985) proposed TPB in his chapter "From intentions to actions: A theory of planned behavior." TPB developed out of TRA, a theory first proposed in 1980 by Martin Fishbein and Ajzen. TRA was in turn grounded in various theories bearing on attitude and attitude change, including learning theories, expectancy-value theories, attribution theory, and consistency

theories (e.g., Heider's balance theory, Osgood and Tannenbaum's congruity theory, and Festinger's dissonance theory). According to TRA, if an individual evaluates a suggested behavior as positive (attitude), and if he or she believes significant others want the person to perform the behavior (subjective norm), the intention (motivation) to perform the behavior will be greater and the individual will be more likely to perform the behavior. Attitudes and subjective norms are highly correlated with behavioral intention; behavioral intention is correlated with actual behavior.

Research, however, shows that behavioral intention does not always lead to actual behavior. Because behavioral intention cannot be the exclusive determinant of behavior where an individual's control over the behavior is incomplete, Ajzen introduced TPB by adding to TRA the component "perceived behavioral control". In this way he extended TRA to better predict actual behavior. Perceived behavioral control refers to the degree to which a person believes that he or she can perform a given behavior. Perceived behavioral control involves the perception of the individual's own ability to perform the behavior. In other words, perceived behavioral control is behavior- or goal-specific. That perception varies by environmental circumstances and the behavior involved. The theory of planned behavior suggests that people are much more likely to intend to enact certain behaviors when they feel that they can enact them successfully.

Therefore, this theory is focused on individual attitudes, subjective norms, and perceived behavioral control as predictors of a person's intention to perform a particular behavior. In the context of electric vehicle adoption in Rwanda, TPB can be applied as follows: (i) attitudes: Understanding the attitudes of Rwandan consumers toward electric vehicles is critical. Do they perceive EVs as environmentally friendly, cost-effective, and practical for their needs?; (ii) Subjective Norms: Social influence and cultural norms are significant factors influencing decision-making. Examining how social norms, peer recommendations, and government support impact EV adoption is essential; (iii) Perceived Behavioral Control: Assessing the extent to which individuals believe they have control over their ability to adopt electric vehicles, considering factors like charging infrastructure, affordability, and government policies.

2.1.2. Environmental Psychology Theory

Environmental psychology includes theory aimed at improving our relationship with the natural environment and making buildings more humane. Environmental psychology was not fully recognized as its own field until the late 1960s when scientists began to question the tie between human behavior and our natural and built environments. Since its conception, the field has been committed to the development of a discipline that is both value oriented and problem oriented, prioritizing research aimed at solving complex environmental problems in the pursuit of individual well-being within a larger society. When solving problems involving human-environment interactions, whether global or local, one must have a model of human nature that predicts the environmental conditions under which humans will respond well. This model can help design, manage, protect and/or restore environments that enhance reasonable behavior, predict the likely outcomes when these conditions are not met, and diagnose problem situations.

The field develops such a model of human nature while retaining a broad and inherently multidisciplinary focus. It explores such dissimilar issues as common property resource management, wayfinding in complex settings, the effect of environmental stress on human performance, the characteristics of restorative environments, human information processing, and the promotion of durable conservation behavior. Lately, alongside the increased focus on climate change in society and the social sciences and the re-emergence of limits-to-growth concerns, there has been an increased focus on environmental sustainability issues within the field. This multidisciplinary paradigm has not only characterized the dynamic for which environmental psychology is expected to develop, but it has also been the catalyst in attracting other schools of knowledge in its pursuit, aside from research psychologists.

Therefore, this theory is linked to the study by offering insights into how environmental attitudes and perceived behavioral control influence the adoption of eco-friendly technologies. These theories help in understanding the environmental awareness and motivations of Rwandan consumers with respect to electric vehicles.

2.1.3. Policy Diffusion Theory

Public policy decision-making is complex, and one approach to better understand the intricacies of policymaking is to consider theories of the policy process (Cairney & Oliver, 2017; Fafard, 2015; Fafard & Cassola, 2020). The present study focuses on policy diffusion, where policy decisions in one jurisdiction influence policymaking in other jurisdictions (Berry & Berry, 2014). Policy diffusion is anchored in the recognition that policy adoption is inherently interdependent, and rarely occurs as a result of internal factors alone (Berry & Berry, 2014; Petridou, 2014). Policy diffusion is a distinct class of studies within a broader literature on innovation and diffusion (Shipan & Volden, 2012). It draws heavily from Everett Rogers' diffusion of innovations theory (2003), which examines the spread of non-policy innovations (i.e., individual- or organization-level interventions) via communication channels over a range of areas (e.g., teaching practices in school systems, medical/health ideas in hospitals). Scholarship in policy diffusion has evolved to incorporate new approaches and techniques that build upon Roger's original framework (Berry & Berry, 2018; Karch, 2022). The present work is situated within this contemporary scholarship as described next.

Policy diffusion theory has been used to study whether, how, and why policies spread across government jurisdictions. This can occur in four directions: horizontal, diffusion across the same government level (e.g., provincial-to-provincial); bottom-up vertical, occurs from lower- to higher-level governments (e.g., local-to-provincial); top-down vertical, policy spreads from a higher- to lower-level government (e.g., provincial-to-local); and, replication, where a single government applies existing policy ideas to a new analogous policy domain (e.g., policy ideas spread across different domains within the same government) (Shipan & Volden, 2006; Train & Snow, 2019). In addition, five key mechanisms of diffusion have been identified (Berry & Berry, 2014; Maggetti & Gilardi, 2016; Pacheco, 2012; Shipan & Volden, 2008).

Briefly, learning is when policymaking in one jurisdiction is influenced by the observed consequences of policies in other jurisdictions; the more successful a policy, the more likely its adoption elsewhere. Unlike learning, emulation is not contingent on whether a policy "works"; policy decisions are instead influenced by the normative environment or social acceptability. Coercion occurs when one government pressures others to take policy action via

threat or incentive. Competition occurs when policy decisions are made to gain economic advantage (or avoid disadvantage) over other jurisdictions. Finally, social contagion refers to policy learning at the citizen level (as opposed to the government level), and the corresponding policy responsiveness of government officials. Given the significant role of government policies in promoting electric vehicle adoption, Policy Diffusion Theory can provide insights into how policies from other countries or regions have influenced Rwanda's EV initiatives. It helps to understand how international policies and best practices can be applied to the Rwandan context.

2.2. Theoretical literature

EV is a vehicle powered by an electric motor instead of ICE, the motor start to function by the use of the power supplied from the battery which is charged through plugging into electricity. For over a century EV existed, it was introduced after the release of the first DC powered motor in 1830. These vehicles were first developed to replace horses and buggy. However, there were no rechargeable batteries during this period, therefore EV didn't become a viable option until the Frenchmen Gaston Plante and Camille Faure invented and improved (1881) the battery storage (Ramesh, 2019). EVs had their "golden days" at the beginning of the 20th century (Burton, 2013). In 1990, nearly 40% of the cars sold in the US were EVs and 22 % belong to gasoline cars (Burton, 2013). However, the key technologies related to ICEV was developed during this period taking advantage over EVs for their limited range forcing them out of the market, which hinder the electric vehicle development for decades.

2.2.1. Electric vehicles

Electric vehicles (EV) are vehicles powered partially or entirely by a rechargeable battery which powers an electric vehicle. EVs can be recharged by plugging into the electricity grid. Since they use no or less fossil fuel, EVs have low or zero tailpipe emissions. In the early part of the century, innovators in Hungary, the Netherlands and the United States -- including a blacksmith from Vermont -- began toying with the concept of a battery-powered vehicle and created some of the first small-scale electric cars. And while Robert Anderson, a British inventor, developed the first

crude electric carriage around this same time, it wasn't until the second half of the 19th century that French and English inventors built some of the first practical electric cars. Energy.gov

In the U.S., the first successful electric car made its debut around 1890 thanks to William Morrison, a chemist who lived in Des Moines, Iowa. His six-passenger vehicle capable of a top speed of 14 miles per hour was little more than an electrified wagon, but it helped spark interest in electric vehicles. Energy.gov

2.2.2. Vehicle Statistics

As of 3rd July 2020, the number of registered vehicles countrywide is 264,524 excluding Security Organs and Government Vehicles. The transport sector is rapidly growing with an Annual vehicle growth rate of 12%, therefore, if no action is taken, air pollution and resulting Adverse health impacts will increase. (MININFRA 2021).

2.2.3.CO2 Emissions from vehicles

In 2021 global CO 2 emissions from the transport sector rebounded, growing by 8% to nearly **7.7** Gt CO 2, up from 7.1 Gt CO 2 in 2020, as pandemic restrictions were lifted and passenger and Goods movements began to pick up following their unprecedented decline in 2020 (IEA 2021). See www.iea.org/reports/transport

2.2.4. Types of electric vehicles

EVs are environmentally friendly known as zero emissions vehicles (ZEVs), the vehicle has less components no engine therefore no tune ups, oil changes and exhaust. In EV the electrical energy is taken from the battery directed to the electrical motor to produce mechanical energy, the mechanical energy is transferred to the driving wheel to produce the kinetic energy of the car, compared to ICEV the practical range is quite smaller (Rautiainen, 2015). EVs have high efficiency in power conversion through the proposition system of electric motor (Cheng, 2009). Therefore, there are three types of EVs:

a) Battery Electric Vehicles (BEVs): Battery electric vehicles, more commonly referred to as EVs or BEVs, are completely electric cars without a gasoline engine. They have rechargeable batteries. The battery pack, which receives its recharge from the grid, provides all of the energy needed to operate the car. Because they don't produce any harmful exhaust emissions or the air pollution risks associated with conventional gasoline-powered vehicles, BEVs are considered zero emissions vehicles.

b) Hybrid Electric Vehicles (HEVs): Hybrid Electric Vehicles, or HEVs, are powered by an electric motor in addition to an internal combustion engine. Regenerative braking provides all of the energy for the battery by recovering energy that would otherwise be wasted during braking to help the gasoline engine accelerate. This braking energy is often wasted as heat in the brake pads and rotors of a car with a conventional internal combustion engine.
Regular hybrids cannot be charged using an EV charging station or plugged into the grid for refilling.

c) Plug-in Hybrid Electric Vehicles (PHEVs): Plug-in Hybrid Electric Vehicles, often known as PHEVs, are powered by an electric motor in addition to an engine. They can use regenerative braking to replenish their battery, just like conventional hybrids. They are different from standard hybrids in that they have a larger battery and can recharge by plugging into the grid.

2.2.5. Benefits of introducing electric vehicles

The following are the benefits of electric vehicles, as compared to corresponding petrol or diesel vehicles: (i)low maintenance cost (almost half depending on vehicle category and use); (ii) Reduced environmental impacts related to climate change; (iii) Reduced dependency on fossil products (oil imports); (iv) Decreased Greenhouse Gas (GHG) emissions by 17%; (v) Reduced importation on oil products by 15% (gasoline 21% and diesel 9%) annually to stabilize balance of payment; (vi) Cost savings of 20 billion Rwandan francs on oil importation up to 2025; (vii) Increased electricity consumption by 132 GWh (15MW-installed capacity) to address the issues of anticipated generation surplus up to 2030.

2.2.5.1. Economic assessment

i) Buses

The evaluation of buses showed that an electric bus's capital cost (CAPEX) is nearly four times more than that of an ICE bus. According to the economic calculations, electric buses would have the same total cost (CAPEX + operational cost, or OPEX) as conventional buses if the cost of batteries and power were cut in half.

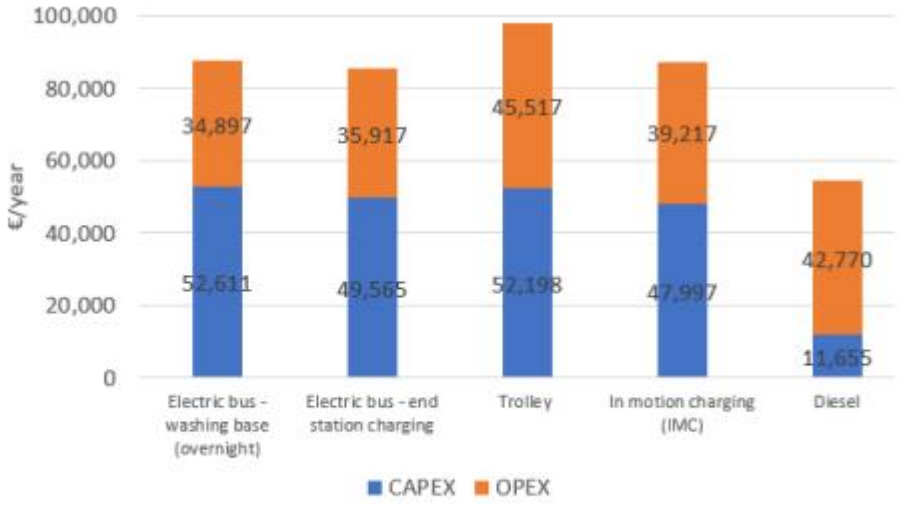

Figure 2: CAPEX and OPEX for bus cases. Single bus costs, including charging infrastructure

ii) Taxi Cars

If electric cars taxis in terms are fully charged overnight or with fast charging, their costs will need to drop by about 15% in order to equal petroleum of life cycle costs. Figure 3 illustrates the taxi example cost divide.

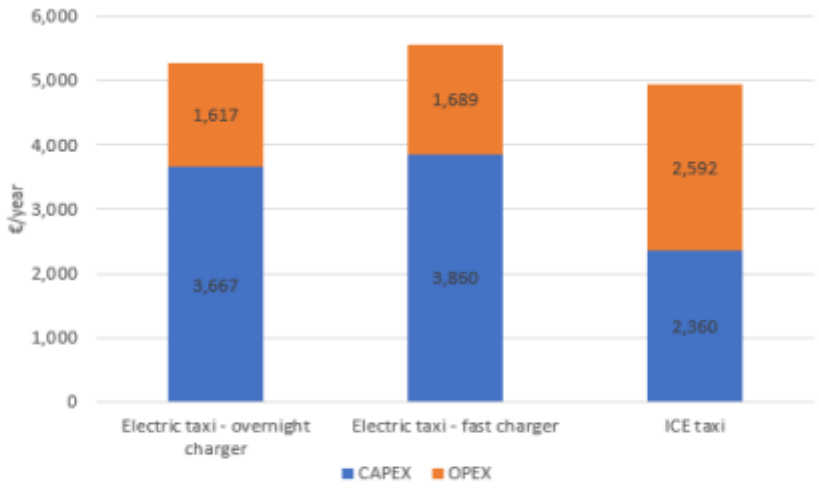

Figure 3: CAPEX and OPEX for taxi cases. Single vehicle costs.

iii) Motorcycle taxi

According to the study, the total cost of electric motorcycle taxis is marginally more than that of motorcycles with internal combustion engines. Moreover, any steps taken to lower the initial capital cost, such as lowering the electricity bill, will strengthen the business case. The total cost of electric motorcycle taxis is marginally more than that of fuel-powered motorcycle taxis, as shown in figure 4 below. https://www.mininfra.gov.rw › Transport

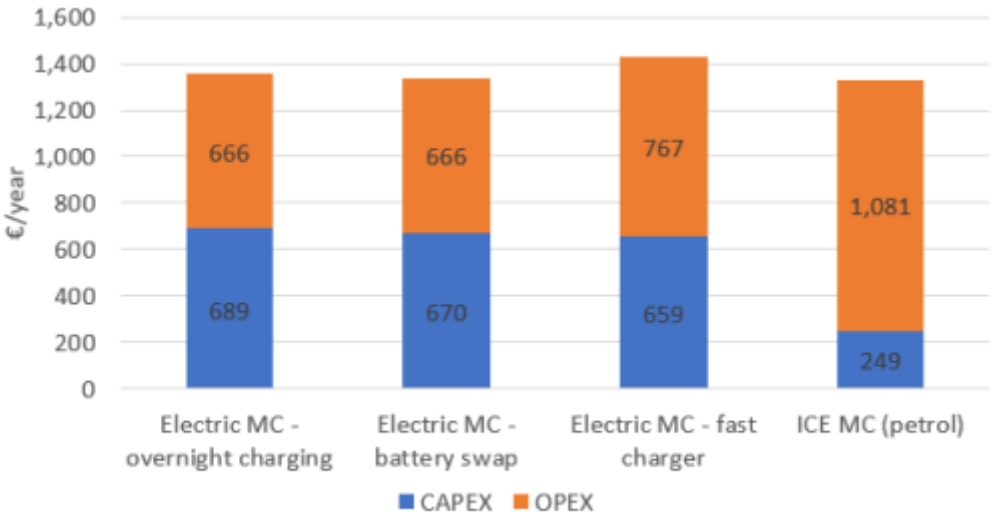

Figure 4: CAPEX and OPEX for MC. Single vehicle costs.

2.2.5.2. Barriers to dissemination

Lack of knowledge: Effective dissemination may be affected if the intended audience is unaware that the material is being distributed or even exists. Weak communication channels or insufficient marketing and promotional activities might lead to a lack of awareness.

Language and cultural barriers: When trying to reach a broad or multinational audience, language and differences in culture might provide obstacles to the distribution of information. Ineffective translations or localizations of content can prevent it from connecting with the target audience.

Absence of engagement: If the intended audience does not actively interact with the material being delivered, dissemination efforts may be unsuccessful. When the content is not interesting, timely, or tailored to the interests and requirements of the audience, this can happen.

2.2.5.3. Factors influencing the adoption of electric vehicles

Factors influencing the adoption of electric vehicles (EVs) are diverse and can vary across different contexts and regions. Here are three factors. Three key factors influence consumers' decisions to adopt electric vehicles (EVs): economic (financial subsidies, charging infrastructure, cost affordability, and risk of price reduction); functional (intelligent function and sustainability risk); and social (status symbol, culture, and reputation risk). These factors will have a major effect on the adoption of EVs by influencing consumer perceptions. (Xia, Z., Wu, D., & Zhang, L. (2022).: An empirical study based on the diffusion of innovation theory, , 6283., 2022).

a) **Economic Aspect**

Financial incentives are a crucial tool for promoting the widespread use of electric vehicles. As evidenced, for example, by official data, annual sales of EVs in the Chinese market rose after the program's proposal in 2013, but the growth rate decreased beginning in 2018 due to the government's 2017 revision to the subsidy programs. While it is clear that in the long run, financial subsidies have a positive effect on consumers' intents to purchase electric vehicles. Individuals who receive financial assistance tend to be frugal and spend less on transportation, which is very

compatible with their awareness of the need to save resources. Therefore, I believe that financial subsidies can enhance consumers' perceptions of items. Second, monetary subsidies decrease he challenges related to the uptake of electric vehicles. Making EV usage easy is one method to put the money you've saved to use. You can do this by installing charging stations throughout your home. But because the government is willing to help with the difficulties related to EV use, it offers financial subsidies, which can greatly allay consumer anxieties. Financial subsidies lower the purchasing price, which favors EVs over FIs. Furthermore, perceived relative advantage and monetary subsidy have a positive relationship.

Particularly in this age of rapid technical advancement, the cost of production for EVs is unpredictable, and EV prices change more than FIs' do. For instance, over the previous two years, Tesla, the largest EV manufacturer in the world, has reduced its selling pricing multiple times in China. Consequently, some people openly refer to Tesla owners as "leeks." This phenomenon is a reflection of the potential price drop that buyers of electric vehicles may experience. More specifically, cost decrease indicates that consumers' preference for value maintenance and appreciation will not be satisfied because the worth of the goods they purchase now will be less valuable later on. Consequently, individuals feel uneasy about price reductions, which lowers their compatibility rating in the end. Previous research has also shown that consumers' negative feelings, such regret and guilt, can be readily triggered by price uncertainty.

The findings show that the adoption rate of electric vehicles, particularly in urban municipalities, is causally increased by an increase in the number of public charging stations. The reason why the adoption rate of electric vehicles was higher in certain towns could be attributed to variations in the development of public charging infrastructure among municipalities. Therefore, it appears that improving the infrastructure for charging is a useful strategy for raising the percentage of electric vehicles on the road. Competitiveness in Cost for ICE Vehicles Many observers of electric vehicles (EVs) like to point out that the cost of ownership is lower for EVs, meaning that they are currently on par with ICE vehicles. The majority of buyers base their decision to purchase a car on the amount of the loan or lease that they can afford or are willing to pay each month. When EVs are as good drivers range and are priced similarly to ICE vehicles, or at least very similar to them, and

do not come with government subsidies, then and only then will a significant adoption barrier be removed adoption.

b) Functional Aspect

EVs are powered by electricity, just as smart watches, phones, and smart houses. Adding intelligent features to primary and secondary tasks is simple because they share the same energy source. For instance, in order to improve range, manufacturers usually equip EVs with automatic battery backup systems. Therefore, it's very likely that the majority of EVs now have intelligent driving features and dependable internet access. (Ullah, A.; Zhang, Q.; Ahmed, M.s., 2021) . People might therefore believe that EVs are cleverer. According to this study, intelligent features may alter consumers' perceptions of EVs as a whole. To be more specific, people often act in ways that are reflective of who they are out of a desire to show themselves well (Baumeister, R.F.; Jones, E.E. . l. , 1978).

In a similar vein, people's products also, to some degree, define their public identity and personality. Luxurious items, for instance, provide the impression that the owner is (Young, J.H.; Nunes, J.C.; Drèze, X.. , ,., 2010) this kind of consistency is known as compatibility. In this way, an individual's likelihood of developing a high level of compatibility that communicates intellect increases with the perceived intelligence of EVs. Furthermore, intelligent features offer users customized services, making EV use less complicated. And lastly, intellect helps to enhance one's personal image. Customers who think electric vehicles (EVs) are smart will think well of them and desire to learn more about their benefits. The dependability of EVs with regard to range and battery life is measured by the risk of sustainability, which has been identified in prior research as a key consumer concern (Noel, L.; Sovacool, B.K. l. , 2016), (Noel, L.; Zarazua de Rubens, G.; Sovacool, B.K.; Kester, J.y.. , 2019), (Zhang, X.; Bai, X.; Shang, J.. J. , 2018).

In this study, we suggest that an individual's assessment of the innovative traits will be influenced by the sustainability risk. In particular, a flaw that invariably impacts a person's daily use of an EV is low sustainability. EVs have a short cruising range, thus owners must charge them frequently. But compared to conventional gas stations, there are much fewer charging stations. Because of this, EV drivers frequently experience range worry. (Bonges, H.A.; Lusk, A.C. , 2016). Moreover, replacing an EV's battery, which is essential to its operation but is highly susceptible to loss, comes

at a very high cost. Those who are worried about the sustainability risk will view utilizing an EV as complex given the aforementioned concern (He, X.; Zhan, W. . J. 1 , 2018). Ultimately, this means that the relative benefit of EVs over ICVs is diminished by the sustainability risk.

c) Social Aspect

Status symbol refers to the beliefs linking EVs and perceived social status, measured by an individual's sense of superiority. Prior studies have shown that status symbol is an important motivation for consumer purchasing intentions and behaviors (James, M.X.; Hu, Z.; Leonce, T.E. , 2019), (Malviya, S.; Saluja, M.S.; Thakur, A.S. e. , 2013) For example, a survey by Pojani et al. 83] suggested that most adolescents in Tirana, including those who do not particularly like cars and driving, intend to purchase cars because they are considered a necessity and a strong status symbol. In China, the CEOs of Li and NiO, have also publicly touted their EVs' high-end positioning, which can undoubtedly create a noble status symbol. EVs are relatively new compared to FVs; thus, EV owners themselves tend to feel like innovators (Jones, A. , 2018).

Meanwhile, EVs have the characteristics of zero pollution and low-energy consumption; driving an EV establishes an image of an environmental protection practitioner (Klabi, F.; Binzafrah, F. n: , 2021).These symbols form part of an individual's social capital, thereby enhancing the consumer perception of compatibility. As for perceived complexity, the theory of limited attention [(Dukas, R. , 2004). motivates us to believe that the positive outcomes will diminish consumer attention on the negative ones, and compensate for the complexity of EVs. Finally, as a special form of perceived value, status symbol undoubtedly increases the relative advantage of EVs, whereas traditional ICEVs are too common to be a status symbol. Cultural attitudes also can influence EVs adoption. According to the values, regarding environmental responsibility, sustainability, and technological innovation can shape the acceptance and adoption of electric vehicles. Societal shifts towards greener living and a desire to align with perceived societal expectations can drive the uptake of EVs.

2.3. Empirical review

Researchers globally have examined barriers to electric vehicle adoption. Studies from India, Thailand, and other regions have identified various hurdles, including financial barriers, performance and range concerns, a lack of charging infrastructure, and limited consumer awareness.

As Holmberg & Erdemir (2019) refer in their study, electric cars have higher energy efficiency than fossil fuel vehicles due to low thermal losses and low friction, even though the Battery-Electric Vehicles (BEVs) are the most energetically efficient ones, since there is an absence of a reciprocating engine, while other types of electric cars, HEVs, can have both a reciprocating engine and an electric motor. EVs are more silent than ICE vehicles, which also contributes to the reduction of noise pollution, thus, being an important improvement. Electric vehicles have lower maintenance costs than conventional cars, as Riesz *et al.* (2016) state, this because the components of the EV are mostly electrical, and the quantity of moving parts is much lower, comparing with an ICE car, causing less mechanical wearing, thus needing less maintenance and repairs. There are two basic types of EVs, the All Electric Vehicles and the Hybrid Electric Vehicles. Within the first type, AEVs, it is possible to distinguish the BEVs that use a battery as the source of power, wherein electricity is stored. The Fuel Cell Electric Vehicles (FCEVs), that similarly to the BEVs, do not generate tailpipe carbon emissions due to only having an electric engine. Electricity is produced by a blend of hydrogen, stored in a tank, with oxygen from the air.

When electricity in power plants is generated using oil, natural gas or coal, the environmental progress made by substituting the conventional cars by EVs can be lost (Ajanovic & Haas, 2016; Almeida et al. 2018). To effectively reduce the GHG emissions and also diminish the dependency of fossil fuels, measures need to be taken in order to produce electricity through renewable, or at least, cleaner sources. As Holmberg and Erdemir (2019) refer, when electrical energy is obtained through biomass, nuclear, wind, hydro or concentrated solar power, the CO2 emissions are at its lowest levels. Solar photovoltaics and geothermal energy are also viable options, and regardless of emitting a bit more CO2 than the previously stated alternatives, they are both sustainable and renewable. Although it is feasible to supply electrical energy issuing small amounts of CO2, the power grid may require improvements as the number of electric cars rises. It will be observed a

higher demand for energy, to charge the vehicles, at peak hours, which could damage the existing power grids (Anastasiadis et al. 2019). This extra demand also affects the costs of electricity, but it is possible to overcome this setback, and it may not be necessary to expand the electrical grid by making controlled charges out of the rush hours (Almeida *et al.* 2018).

The ever-growing global concern on climate change caused due to vehicular greenhouse gas emission coupled with the depletion of natural resources is driving global economies towards the adoption of alternate fuel technology (Tarei, P. K., Chand, P., & Gupta, H. ()., 2021) . Electric vehicles (EV) are positioned as an alternate green and clean technology. Despite announcing favorable policy measures to encourage EV adoption, as a sustainable solution on transportation the Indian EV researchers have identified multiple barriers that hindering adoption of EV such as performance and range, the total cost of ownership, shortage of charging infrastructure, lack of consumer awareness about EV technology are critically influential in driving EV adoption. Researchers around the globe have studied and reviewed the dynamics of the EV markets for various geographical locations and identified potential barriers towards implementation of the same and presented research implications to augment policy initiatives. conducted a study on electric mobility in Europe and identified the lack of charging infrastructure

Table 1. EV barriers selected from the literature for analysis.

Barrier Type	Code	Actual Barrier	Explanation
Financial barrier	BF1	EV price	EV price in market without purchase subsidy.
	BF2	Battery cost	Battery replacement cost when it reaches end of life.
	BF3	EV fuel cost	Electricity cost of driving EVs.
	BF4	EV maintenance cost	Routine maintenance cost of EVs except repair costs due to accidents.
	BF5	EV resale value	Resale value of EVs once sold as used cars.
Vehicle performance barrier	BP1	Range on a charge	Longest range of driving per one full charge.
	BP2	Engine power	Maximal speed and acceleration of EVs.
	BP3	Reliability	Quality and stability of EVs.
	BP4	Battery life	Battery lifespan caused by degradation.
	BP5	Charging time	Time usage to fully charge an EVs.
	BP6	Safety	Feelling safe while driving EVs.
	BP7	Size and styles	Available size and styles of EVs in market.
Infrastructure barrier	BI1	Public infrastructure availability	Public charging stations or spot services.
	BI2	Infrastructure availability at home	Charging condition in residence communities.
	BI3	Workplace infrastructure availability	Charging condition at the workplace, e.g., office buildings.
	BI4	Highway infrastructure availability	Charging conditions in highway stations.

EVs is a long-term solution to environmental concerns, as shown by their current acceptance rate and predicted improvement. Thus, EVs are and accepted as alternative to internal-combustion engine vehicles (ICEVs), and can provide sustainable transportation. Therefore, there are many varieties of EVs on the market, including hybrid electric vehicles (HEV) and plug-in electric cars.

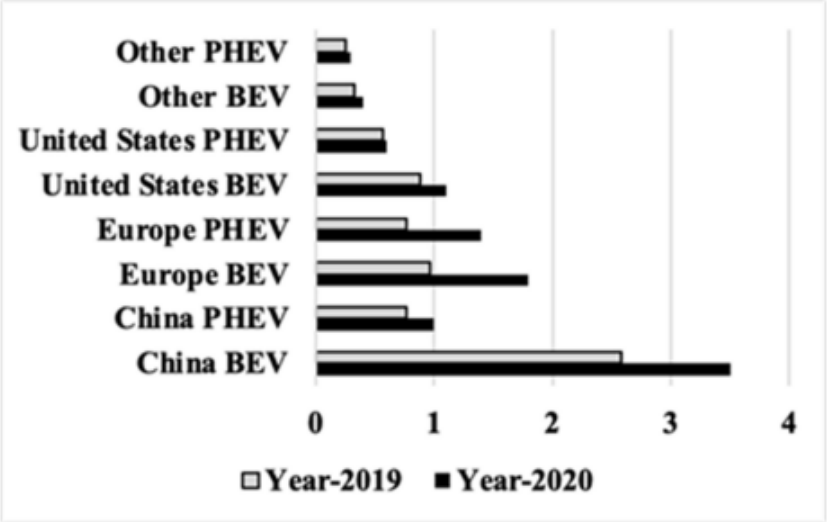

Figure 1. Global electric passenger car stock for 2019 and 2020. BEV: battery electric vehicles; PHEV: plug-in hybrid electric vehicles. Data source: IEA, Global EV Outlook 2021.

(Kongklaew, 2021) Thailand also facing barriers in adoption of EV including Financial Barriers High purchase cost, battery cost, the understanding of fuel and maintenance cost, and resale value are financial barriers to EV adoption. Compared with ICEVs, EVs have limited function. As an emerging new technology, EVs are often expensive due to the lack of an economy of scale and consumers must pay a much higher price than that of ICEVs; thus, the high purchase cost of EVs is a major barrier in many consumer surveys. Battery cost is another barrier, and is a significant portion of EV cost Battery capacity increases with size, purchase cost, and range. However, EVs have advantages in fuel and maintenance costs.

The fuel cost of EVs comes from electricity, which is less expensive and produces fewer direct emissions compared to gasoline-fueled vehicles. EV maintenance cost is also less than that of ICEVs due to the reduced complexity of EV motors. However, consumer purchasing decisions depend on several other factors besides technology and utility. Vehicle Performance Barriers, EV performance barriers include range, engine power, reliability, battery lifespan, charging time, safety, size, and style. Numerous studies revealed that EV performance and range are major barriers to their adoption. Drivers cannot estimate how far they could go or extend a journey on the basis of the remaining battery. Therefore, battery depletion occurs while driving. The limited

range of EVs is a concern to drivers and results in range anxiety during long journeys. Other unsatisfying EV performance issues are charging time safety, and reliability, which are raised by respondents who test-drive EVs. Consumers are also concerned about the limited EV sizes and styles on the market.

Infrastructure Barriers Given that EV range is a major barrier to adoption, the availability of charging infrastructure is essential in order to support the wide adoption of EVs, as is the case with filling stations for ICEVs. Public charging stations are important for EV demand and competition. Overnight home charging is important to boost consumer convenience and the safety and security of vehicles. This comprehensive literature review provides valuable insights into the context of electric vehicle adoption in Rwanda, including the existing theoretical foundations, economic considerations, charging infrastructure, and the critical factors influencing consumer adoption. It highlights the need for solutions to overcome barriers and promote sustainable transportation in the country.

2.4. Conceptual Framework

Conceptual framework below aimed at showing the how Barriers to electrical vehicles dissemination and Electrical vehicles dissemination in Rwanda are associated. The study aimed at exploring the influence of independent variable to dependent variable.

i) Independent variable

ii) Dependent variable

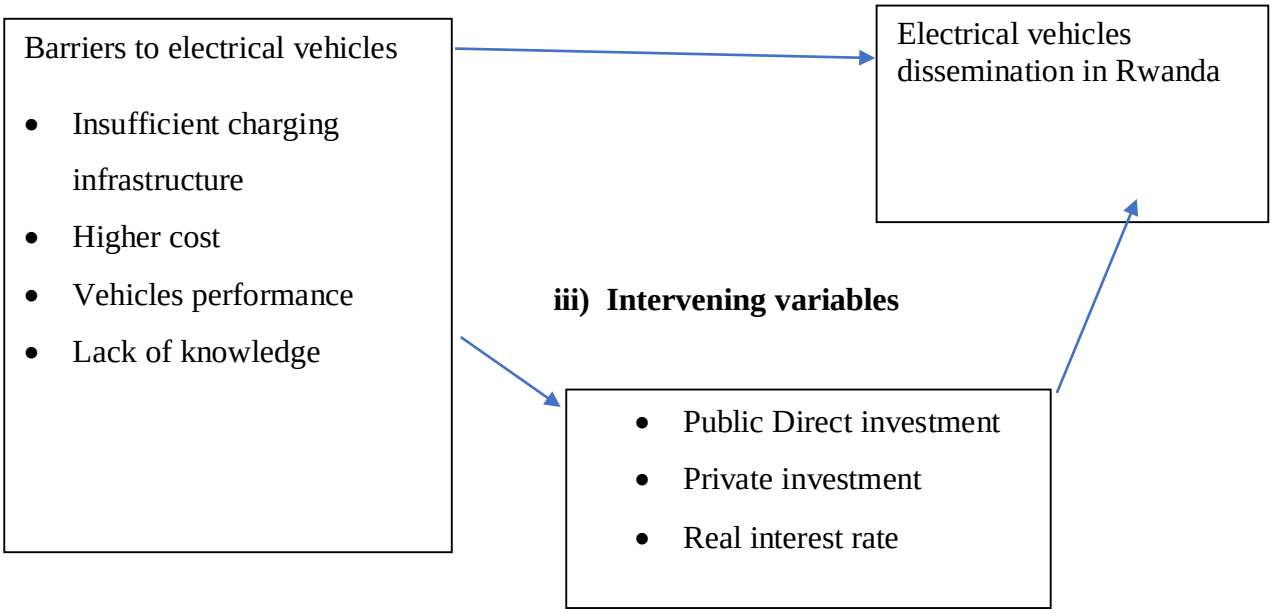

Figure 1: Conceptual Framework

CHAPTER 3

RESEARCH METHODOLOGY

3.0. Introduction

This chapter dealt with methods and techniques used in this research. It provided the details on the design of the study; sampling design, data collection instruments and tools, data processing and analysis and ethical considerations.

3.1 Research design

According to Kothari (2004), research design is a plan, a roadmap, and a blueprint strategy of investigation conceived so as to obtain answers to research questions; it is the heart of any study. The study used a descriptive research design by focusing on the barriers to the dissemination of electric vehicles in Rwanda.

3.2. Population of the study

Although the entire population usually does not participate in a research study, the results from the study are generalized to the entire population. "Population" in statistics includes all members of a defined group that we are studying, collecting information for data-driven decisions (Forzano & Gravether, 2012). Therefore, the study population consisted of 23 employees at MININFRA Headquarters and 40 owners of electrical vehicles in Rwanda.

Table 3.1: Employees of MININFRA/ Headquarters

Departments	Number of employees
Heads of operation	4
Energy Division	7
Transport Division	5
Safety & Licensing Compliance	2
Traffic Management and Communication	5

Source: Primary data (2024)

3.2.1. Sample size and sampling technique

The researcher used the purposive sampling technique to choose 63 respondents because they have enough knowledge about the barriers to the dissemination of electric vehicles in Rwanda.

3.3. Sources of the data

The data collection format depends on the kind of data to be collected. However, in this particular study both primary and secondary data were used. The methods of data collection were questionnaires and documentary evidence. In this research, the sources of data were mainly primary and secondary data. Primary data are those collected at first hand, where a researcher went on the field and collect raw data from the staff of MININFRA. However, secondary data also was used. Those data are collected from sources that have been previously published.

3.3.1. Primary data

According to Russell (2006), primary data sources are forms of evidence usually produced during the historical period under investigation. In this research, the primary data was composed by information from interviews, and questionnaires with respondents taken from staff of MININFRA.

3.3.2. Secondary data

Secondary data is the information that is got from the written documents, or likewise secondary data can be defined as data that already exists in boxes in some organizations basement or hidden in core of computers (Joel and Berman, 1982). The researcher used secondary data that is generally taken from magazine, newspaper, text books, official documents, published reports, internet, statistics, bulletins and other documents they were enable the researcher to get information that are not covered in primary data methods.

3.4. Data collection instruments and tools

In this section; the researcher used both the questionnaire as well as documentation.

3.4.1. Questionnaire

According to Carl and Roger (1991) questionnaire is a set of question, designed to generate data necessary for accomplishing objective of research study. The questionnaire contained by closed ended questions and these questions are limiting the respondent's response/ opinion using pre-

selected alternatives. As a technique of data collection, a questionnaire was used because it is easy to administer and it saved time.

3.4.2. Documentation

The analysis of documents is another major way of gathering data. A document refers to any written materials that may be used as a source of information about the subject matter (Bernard, 2016). The researcher used documentation to get theories useful for the research; this was also used in attaining much information regarding the barriers to the dissemination of electric vehicles in Rwanda. It required the researcher to consult different books and internet websites related to how electrical vehicles are currently working and the major barriers to their dissemination in Rwanda.

3.5. Data analysis

Analyzing data is a process of cleaning, inspecting, transforming, and modeling data with the objective of highlighting useful information, suggesting conclusions, and supporting decisions making (De Vos, 2001). The analysis of the data was based on descriptive statistics. This study generated quantitative data. Quantitative data was arranged and aligned to particular research questions, after which frequencies and percentages were used to analyze and present it. The data was analyzed using computer software called Statistical Package for Social Sciences (SPSS). This processed the frequencies and percentages, which were used to discuss the findings.

3.6. Ethical considerations

The study was conducted with some ethical considerations. Each respondent to the study was first informed about the purpose and objective of the study and the questionnaires to be administered. After explaining the objective of the study, respondents were assured of anonymity and confidentiality before being administered the questionnaire. The researcher requested authority from some departments of MINIFRA to be allowed to collect data. Literal data was accessed from reports and from the internet, which ensured that the information was already public. As a recent former employee of the MININFRA, the researcher has in-depth information on the set categories of MININFRA information, which enabled the researcher to create a questionnaire whose question items do not contravene the policy.

CHAPTER 4

DATA INTERPRETATION, PRESENTATION AND ANALYSIS

4.0. Introduction

The chapter comprises the data presentation, interpretation, and analysis of the findings as set out in the research methodology. The results were presented through the assessment of barriers to electrical vehicles dissemination in Rwanda. Based on the objectives of the study and research questions, information was gathered from 63 respondents taken from owners of electrical vehicles in Rwanda from 2019 up to 2023.

4.1. Respondent's profile

This section gives more details about the respondent's profile who participated in the study in terms of their age, gender, educational level, occupation and the time working within the company.

Table 4.1: Demographics Respondent's Profile

Age		**Frequency**	**Percent**
Valid	21 -30 years	11	17.5
	31-40 years	34	53.9
	41-50 years	10	15.9
	51 years and above	8	12.7
Gender		**Frequency**	**Percent**
Valid	Male	38	60.3
	Female	25	39.7
Education qualification			
		Frequency	Percent
Valid	Master's degree	21	33.4
	Bachelor's degree	35	55.5
	Secondary level	7	11.1
Years of experience			
		Frequency	Percent
Valid	1 to 5 years	14	22.2
	5 to 10 years	27	42.9
	10 years and above	22	34.9
Total		**63**	**100**

Source: Primary data (2024)

Table 4.1 reveals that 17.5% of respondents are belong to the age group of 21-30 years while 53.9% of respondents are belonging to the age group of 31 - 40 years; 15.9% of respondents are belong to the age group of 41 - 50 years; furthermore and finally 12.7% of respondents are belong to the age group of 51 years and above. Therefore, implies that all categories of respondents in terms of age have participated in this study; 38 (60.3%) respondents were female while 25 (39.7%) respondents were male; therefore, we may conclude by saying that both female and male employees currently working at MININFRA/ Headquarter have been participated in this study however the gender inequality in respondents occurred at small rate where female are greater than male categories. Furthermore, majority of 21 respondents representing by 33.4% hold a master's degree, followed by 35 respondents representing by 55.5% who hold a secondary level and lastly 7 respondents representing by 11.1% hold a secondary level. Therefore, majority employees of MININFRA/ Headquarters and owners of EVs in Rwanda have been well accomplished their studies. Finally, 22.2% of respondents are belonging to the year's group between 1 to 5years, the second category of 42.9% of respondents are belonging to the year's group of 5 – 10 years, and finally other 34.9% of respondents are belonging to the year's group of 10 years and above. Therefore, years of experience at MININFRA/ Headquarters and owners of EVs in Rwanda provide a vehicle for collaborators to become aware of intersected similarities, thereby providing a foundation for identification.

4.2. Key barriers to the dissemination of electric vehicles in Rwanda

Companies manufacturing and assembling electric vehicles (battery electric vehicles, plug-in hybrid electric vehicles and hybrid electric vehicles) in Rwanda are given other incentives in the investment code such as 15% Corporate Income Tax (CIT) and tax holiday (irrespective of the investment value).

4.2.1. Insufficient charging infrastructure

EV infrastructure is defined as structures, machinery, and equipment necessary and integral to support an EV, including battery chargers, rapid chargers, and battery exchange stations.

Table 4.2: Perception views "Insufficient charging infrastructure"

		Frequencies and Percentages											
	Statements	**SA**	**%**	**A**	**%**	**N**	**%**	**D**	**%**	**T**	**%**	**M**	**St.D**
1	In Rwanda, smart charging stations are enough for charging EVs operators to share data connections	63	100	0	0	0	0	0	0	**63**	**100**	**5.00**	**.000**
2	Smart charging can't effectively help address the grid capacity issue by reducing the load on the grid	57	90.5	6	9.5	0	0	0	0	**63**	**100**	**4.62**	**.416**
3	Wherever the country is, there are limited fast charging stations that are not as prevalent as needed	60	95.2	3	4.8	0	0	0	0	**63**	**100**	**4. 98**	**.422**
4	Economic development of Rwanda always creates a corresponding need for additional electric grid capacity	48	76.1	15	23.9	0	0	0	0	**63**	**100**	**3.84**	**.317**
	Overall Mean											**4.61**	

Source: Primary data (2024)

Table 4.2 indicates that 63 (100%) respondents strongly agreed that In Rwanda, smart charging stations are enough for charging EVs operators to share data connections; 57 (90.5%) respondents strongly agreed that Smart charging can't effectively help address the grid capacity issue by reducing the load on the grid and 6 (9.5%) respondents agreed the point; finally, 48 (76.1%) respondents strongly agreed that economic development of Rwanda always creates a corresponding need for additional electric grid capacity while other 15 (23.5%) respondents agreed on the point. Furthermore, all statements provided an overall mean was 4.61 which are classified in the range of $3.25 \leq \mu \leq 5.00$: Very high mean which indicate strong positive relationship between insufficient charging infrastructure barrier and electrical vehicles dissemination in Rwanda. Therefore, Rwanda currently faces a number of difficulties, including a lack of robust electrical

charging infrastructure, battery production capabilities, electricity consumption, charger compatibility, improper charging location, and high prices for electric vehicles, particularly four-wheelers.

4.2.2. Higher costs

Electric cars rely on complex systems and components, such as the electric motor, battery management system, and charging infrastructure, that are still relatively new.

Table 4.3: Perception views of respondents on "Higher costs"

		Frequencies and Percentages											
	Statements	**SA**	**%**	**A**	**%**	**N**	**%**	**D**	**%**	**T**	**%**	**M**	**St.D**
1	Rwandan government, business and investors have enough resources to fund the development of a robust charging network	63	100	0	0	0	0	0	0	**63**	**100**	**5.00**	**.000**
2	Both power electricity rates and utility upgrades are higher in Rwanda	61	96.8	2	3.2	0	0	0	0	**63**	**100**	**4.92**	**.446**
3	In Rwanda, both medium and heavy duty EVs are comparatively more expensive to purchase than their diesel counterparts	54	85.7	9	14.3	0	0	0	0	**63**	**100**	**4.63**	**.406**
4	Rwandan government, business and investors have enough resources to fund the development of a robust charging network	63	100	0	0	0	0	0	0	**63**	**100**	**5.00**	**.000**
	Overall Mean											**4.887**	

Source: Primary data (2024)

Table 4.3 indicates that 63 (100%) respondents strongly agreed that Rwandan government, business and investors have enough resources to fund the development of a robust charging network; 61 (96.8%) respondents strongly agreed that both power electricity rates and utility

upgrades are higher in Rwanda and 2 (3.2%) respondents agreed the point, finally 54 (85.7%) respondents strongly agreed that in Rwanda, both medium and heavy duty EVs are comparatively more expensive to purchase than their diesel counterparts and 9 (14.3%) respondents agreed the point. Additionally, all statements provided an overall mean was 4.887 which are classified in the range of $3.25 \leq \mu \leq 5.00$: Very high mean which indicate strong positive relationship between higher costs barrier and the and electrical vehicles dissemination. Therefore, the battery is the heart of an electric vehicle and is what powers the car. It's also the most expensive component of an electric car, accounting for a large portion of the overall cost. At the moment, batteries for electric cars are still relatively expensive to produce, which is one of the reasons the cost of electric cars is higher.

4.2.3. Vehicles performance

Electric vehicles often come with a very high electronics specification as standard. EVs have better acceleration than gas cars. That's because electric motors deliver full torque right away, unlike internal combustion engines that need to gear up. Electric motors are an incredibly efficient and durable technology, meaning less maintenance and a longer life time than gas engines.

Table 4.4: Perception views "Vehicles performance"

		Frequencies and Percentages											
Statements		**SA**	**%**	**A**	**%**	**N**	**%**	**D**	**%**	**T**	**%**	**M**	**St.D**
1	EVs in Rwanda are inconvenience and non-practically for long distance travel	62	98.4	1	1.6	0	0	0	0	**63**	**100**	**4.98**	**.465**
2	There are fears among EV' owners of running out of battery power before reaching a charging station	63	100	0	0	0	0	0	0	**63**	**100**	**5.00**	**.000**
3	EVs convert over 77% of the electrical energy from the grid to power at the wheels	58	92.1	5	7.9	0	0	0	0	**63**	**100**	**4.60**	**.402**
4	There are more expenses than enough speed for every-day usage	49	77.8	14	22.2	0	0	0	0	**63**	**100**	**4.12**	**.398**
	Overall Mean											**4.675**	

Source: Primary data (2024)

Table 4.4 indicates that 63 (100%) respondents strongly agreed that there are fears among EV' owners of running out of battery power before reaching a charging station; 62 (98.4%) respondents strongly agreed that EVs in Rwanda are inconvenience and non-practically for long distance travel while 1 (1.6%) respondents agreed the point, 58 (92.1%) respondents strongly agreed that EVs convert over 77% of the electrical energy from the grid to power at the wheels and 5 (7.9%) respondents agreed the point; finally, 49 (77.8%) respondents strongly agreed that there are more expenses than enough speed for every-day usage while other 14 (22.2%) respondents agreed on the point. Furthermore, all statements provided an overall mean was 4.675 which are classified in the range of $3.25 \leq \mu \leq 5.00$: Very high mean which indicate strong positive relationship between EVs performance barrier and its dissemination Rwanda. Therefore, Rwanda as one of developing country is a leading provider of EV charging services in Eastern African Countries that provides

drivers of electric vehicles and businesses with charging options that are safe, reliable, and simple to use. They have fostered an application in light of ongoing information called Fortum charge and drive. The user of an electric vehicle can use it to manage their payments, get in touch with customer service, find chargers, start and stop charging, view their charging history, and manage their fleet. Furthermore, Electricity can also be made from clean and renewable sources, reducing greenhouse gas emissions and air pollution every time clients drive.

4.2.4. Lack of knowledge

Electric motors' inherent advantage in their ability to quickly deliver maximum torque from rest is the major reason so many EVs are quick.

Table 4.5: Perception views "Lack of knowledge"

		Frequencies and Percentages											
Statements		**SA**	**%**	**A**	**%**	**N**	**%**	**D**	**%**	**T**	**%**	**M**	**St.D**
1	There is enough public awareness and exposure to electric mobility	46	73	17	27	0	0	0	0	**63**	**100**	**4.27**	**.381**
2	Clients of EVs in Rwanda don't have enough knowledge on how these cars generate instant linear torque, which cannot be matched by internal combustion engines	58	92.1	5	7.9	0	0	0	0	**63**	**100**	**4.66**	**.414**
3	Due to the nature of roads, Rwandan clients have limited knowledge about how EVs have instant acceleration	63	100	0	0	0	0	0	0	**63**	**100**	**5.00**	**.000**
4	Lack of knowledge of Rwandan customers significantly impacts consumers' attitudes towards electric two-wheelers	52	82.5	11	17.5	0	0	0	0	**63**	**100**	**4.47**	**.398**
	Overall Mean											**4.6**	

Source: Primary data (2024)

Table 4.5 indicates that 63 (100%) respondents strongly agreed that due to the nature of roads, Rwandan clients have limited knowledge about how EVs have instant acceleration; 58 (92.1%) respondents strongly agreed that clients of EVs in Rwanda don't have enough knowledge on how these cars generate instant linear torque, which cannot be matched by internal combustion engines and 5 (7.9%) respondents agreed the point, 52 (82.5%) respondents strongly agreed that lack of knowledge of Rwandan customers significantly impacts consumers' attitudes towards electric two-wheelers and 11 (17.5%) respondents agreed the point; finally, 46 (73%) respondents strongly agreed that there is enough public awareness and exposure to electric mobility and 17 (27%) respondents agreed the point. Furthermore, all statements provided an overall mean was 4.6 which are classified in the range of $3.25 \leq \mu \leq 5.00$: Very high mean which indicate strong positive relationship between lack of knowledge and EVs dissemination in Rwanda. Therefore, within this designated area, drivers of older vehicles face a daily charge, a measure implemented to curb the high air pollution stemming from older cars in densely populated and high-traffic regions.

4.3. Factors influencing the adoption of electric vehicles

The attitudinal factors such as perceived benefits, social influence, price acceptance, performance, technological consciousness, and marketing, distribution and after-sales have positive effect on EV purchase intention. In view of mitigating the threat of climate change due to emissions from transportation sector and to reduce the dependency on foreign countries for oil, many countries have started to develop policies for promoting sustainable and innovative transport technologies.

Table 4.6: Perception views "Factors influencing the adoption of electric vehicles"

		Frequencies and Percentages											
Statements		**SA**	**%**	**A**	**%**	**N**	**%**	**D**	**%**	**T**	**%**	**M**	**St.D**
1	The price of EVs and environmental factors significantly influence Rwanda's client's consumer adoption	60	95.2	3	4.8	0	0	0	0	**63**	**100**	**4.78**	**.424**
2	Electric vehicles have lower overall costs over the lifetime of the vehicle	63	100	0	0	0	0	0	0	**63**	**100**	**5.00**	**.000**
3	EV charging costs less than filling up gas-powered vehicles	56	88.9	7	11.1	0	0	0	0	**63**	**100**	**4.53**	**.399**
4	Charging infrastructure, purchase cost, and government financial incentives	49	77.8	14	22.2	0	0	0	0	**63**	**100**	**3.92**	**.344**
	Overall Mean											**4.557**	

Source: Primary data (2024)

Table 4.6 indicates that 63 (100%) respondents strongly agreed that electric vehicles have lower overall costs over the lifetime of the vehicle; 60 (95.2%) respondents strongly agreed that the price of EVs and environmental factors significantly influence Rwanda's client's consumer adoption while 3(4.8%) respondents agreed the point, 56 (88.9%) respondents strongly agreed that EV charging costs less than filling up gas-powered vehicles and 7 (11.1%) respondents agreed the point; finally other 49 (77.8%) respondents strongly agreed that charging infrastructure, purchase cost, and government financial incentives while 14 (22.2%) respondents agreed the point. Furthermore, all statements provided an overall mean of 4.557, which is classified in the range of $3.25 \leq \mu \leq 5.00$, this mean that there is a very high mean. Therefore, driving an EV in Rwanda significantly reduces the transportation carbon footprint, generally 50-70% on average if switching from a gas-powered vehicle. Rwandan drivers may also further curb their emissions by charging their EVs with electricity generated by renewable sources.

4.4. Attitudes of Rwandan consumers towards electric vehicles

With a battery-electric vehicle, the motor has fewer moving parts and there's no need to change the oil, resulting in less frequent and cheaper maintenance.

Table 4.7: Perception views "Attitudes of Rwandan consumers towards electric vehicles"

		Frequencies and Percentages											
Statements		**SA**	**%**	**A**	**%**	**N**	**%**	**D**	**%**	**T**	**%**	**M**	**St.D**
1	Rwandan consumers are primarily motivated by environmental concerns	63	100	0	0	0	0	0	0	**63**	**100**	**5.00**	**.000**
2	Electric vehicles in Rwanda have full driving automation is perceived as a useful technology	54	85.7	9	14.3	0	0	0	0	**63**	**100**	**4.54**	**.421**
3	Electric vehicles in Rwanda are always marking the end of parking problems	49	77.7	14	22.3	0	0	0	0	**63**	**100**	**3.95**	**.347**
4	Electric vehicles in Rwanda also are more environmentally friendly	63	100	0	0	0	0	0	0	**63**	**100**	**5.00**	**.000**
	Overall Mean											**4.622**	

Source: Primary data (2024)

Table 4.7 indicates that 63 (100%) respondents strongly agreed that electric vehicles in Rwanda also are more environmentally friendly and also other 100% of respondents strongly agreed that Rwandan consumers are primarily motivated by environmental concerns; 54 (85.7%) respondents strongly agreed that electric vehicles in Rwanda have full driving automation is perceived as a useful technology and 9 (14.3%) respondents agreed the point, finally 49 (77.7%) respondents strongly agreed that electric vehicles in Rwanda are always marking the end of parking problems and 14 (22.3%) respondents agreed the point. Furthermore, all statements provided an overall mean of 4.62, which is classified in the range of $3.25 \leq \mu \leq 5.00$: A very high mean. Therefore, due to heightened concerns surrounding the sustainability of petrochemical resources in Rwandan

economy and the exacerbation of global pollution levels, electric vehicles (EVs) are gaining recognized as a compelling and viable alternative to conventional vehicles (CVs). They are renowned for their capacity to curtail emissions of air pollutants to lower levels, and exhibit superior efficiency compared to conventional internal combustion engines, rendering them a more environmentally sound and sustainable mode of transportation.

4.3. Inferential statistics

Inferential statistics helps to propose explanations for situations or phenomena.

Table 4.8: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.919[a]	.845	.768	.250

a. Predictors: (Constant), Lack of performance, Higher costs, Insufficient infrastructure, Vehicles performance

From the table 4.8 above, R is the correlation coefficient which shows the relationship between the study variables, from the findings shown in the table below there was a positive relationship between the study variables as shown by 0.845 at the 1% significance level. Furthermore, the Adjusted R squared is the coefficient of determination which tells us the variation in the dependent variable due to changes in the independent variables, from the findings in the table above the value of adjusted R squared was 0.768 which is an indication that there was variation of 76.88% on electrical vehicles dissemination in Rwanda due to changes of lack of performance, higher costs, insufficient infrastructure, and vehicles performance at 95% confidence interval. This is an indication that 76.8% of the changes in electrical vehicles dissemination could be account for by the independent variables.

Table 4.9: ANOVAb

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.731	4	.683	10.923	.003[a]
	Residual	.500	58	.062		
	Total	3.231	62			

a. Predictors: (Constant), Lack of performance, Higher costs, Insufficient infrastructure, Vehicles performance

b. Dependent Variable: Electrical vehicles dissemination

Table 4.9 shows that there is a significant vary at .003[a] between barriers to electrical vehicles dissemination in Rwanda.

Table 4.10: Coefficientsa

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.500	.530		2.828	.022
	Insufficient infrastructure	.500	.204	.362	2.449	.040
	Higher costs	.798	.354	.000	.000	.010
	Vehicles performance	1.000	.270	.724	3.703	.006
	Lack of knowledge	1.000	.177	.845	5.657	.000

a. Dependent Variable: Electrical vehicles dissemination

From the regression equation above, it was found that holding all the barriers to a constant zero, electrical vehicles dissemination in Rwanda will be 150 percent, a unit increase in solving issue of insufficient infrastructure would lead to increase the electrical vehicles dissemination in Rwanda at 0.50%, a one percent increase in solving issue about higher costs would lead to an increase electrical vehicles dissemination in Rwanda at 79.8%, a one percentage increase in solving issue regarding vehicles performance would lead to 100% increase of electrical vehicles dissemination in Rwanda and lastly a one percentage increase in solving issue relating to the lack of knowledge

would also lead to 100% increase of electrical vehicles dissemination in Rwanda. Overall, both Vehicles performance and lack of knowledge had the greatest influence on electrical vehicles dissemination in Rwanda, followed by higher costs and finally also insufficient infrastructure. At 5% level of significance and 95% level of confidence, lack of knowledge had 0.000 level of significance; vehicles performance had a 0.006 level of significance, higher costs had 0.010 level of significance and finally insufficient infrastructure had 0.040 level of significance. Therefore, all the variables were significant ($p<0.05$). The multiple regression models for this research can be stated as:

$$\mathbf{Y=1.500+0.500X_1+\ 0.798X_2+1.\ 000X_3+1.\ 000X_4+\varepsilon}$$

CHAPTER 5
SUMMARY OF THE FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.0. Introduction

This section discusses the findings as presented in chapter four in light of the study objectives. Based on the data collected, primary data was collected using a questionnaire and documentary analysis.

5.1. Summary of major findings

This section makes great summary on findings obtained through the influence of financial resources management on project performance at Kigali City.

5.1.1. Findings of first objective

In line with the first objective of the study based on the key barriers to the dissemination of electric vehicles in Rwanda, findings indicated that 63 (100%) respondents strongly agreed that In Rwanda, smart charging stations are enough for charging EVs operators to share data connections; 57 (90.5%) respondents strongly agreed that Smart charging can't effectively help address the grid capacity issue by reducing the load on the grid and 6 (9.5%) respondents agreed the point; 63 (100%) respondents strongly agreed that Rwandan government, business and investors have enough resources to fund the development of a robust charging network; 61 (96.8%) respondents strongly agreed that both power electricity rates and utility upgrades are higher in Rwanda and 2 (3.2%) respondents agreed the point, finally 54 (85.7%) respondents strongly agreed that in Rwanda, both medium and heavy duty EVs are comparatively more expensive to purchase than their diesel counterparts and 9 (14.3%) respondents agreed the point. Additionally, 62 (98.4%) respondents strongly agreed that EVs in Rwanda are inconvenience and non-practically for long distance travel while 1 (1.6%) respondents agreed the point, 58 (92.1%) respondents strongly agreed that EVs convert over 77% of the electrical energy from the grid to power at the wheels and 5 (7.9%) respondents agreed the point; 63 (100%) respondents strongly agreed that due to the nature of roads, Rwandan clients have limited knowledge about how EVs have instant acceleration; 58 (92.1%) respondents strongly agreed that clients of EVs in Rwanda don't have enough knowledge on how these cars generate instant linear torque, which cannot be matched by internal combustion engines and 5 (7.9%) respondents agreed the point.

5.1.2. Findings of second objective

In line with the second objective of the study based on the factors influencing the adoption of electric vehicles, findings indicated that 63 (100%) respondents strongly agreed that electric vehicles have lower overall costs over the lifetime of the vehicle; 60 (95.2%) respondents strongly agreed that the price of EVs and environmental factors significantly influence Rwanda's client's consumer adoption while 3(4.8%) respondents agreed the point, 56 (88.9%) respondents strongly agreed that EV charging costs less than filling up gas-powered vehicles and 7 (11.1%) respondents agreed the point; finally other 49 (77.8%) respondents strongly agreed that charging infrastructure, purchase cost, and government financial incentives while 14 (22.2%) respondents agreed the point. Furthermore, all statements provided an overall mean of 4.557, which is classified in the range of $3.25 \leq \mu \leq 5.00$, this mean that there is a very high mean. Therefore, driving an EV in Rwanda significantly reduces the transportation carbon footprint, generally 50-70% on average if switching from a gas-powered vehicle. Rwandan drivers may also further curb their emissions by charging their EVs with electricity generated by renewable sources.

5.1.3. Findings of third objective

In line with the third objective of the study based on the attitudes of Rwandan consumers towards electric vehicles, results indicated that 63 (100%) respondents strongly agreed that electric vehicles in Rwanda also are more environmentally friendly and also other 100% of respondents strongly agreed that Rwandan consumers are primarily motivated by environmental concerns; 54 (85.7%) respondents strongly agreed that electric vehicles in Rwanda have full driving automation is perceived as a useful technology and 9 (14.3%) respondents agreed the point, finally 49 (77.7%) respondents strongly agreed that electric vehicles in Rwanda are always marking the end of parking problems and 14 (22.3%) respondents agreed the point. Furthermore, all statements provided an overall mean of 4.62, which is classified in the range of $3.25 \leq \mu \leq 5.00$: A very high mean. Therefore, due to heightened concerns surrounding the sustainability of petrochemical resources in Rwandan economy and the exacerbation of global pollution levels, electric vehicles (EVs) are gaining recognized as a compelling and viable alternative to conventional vehicles (CVs). They are renowned for their capacity to curtail emissions of air pollutants to lower levels, and exhibit superior efficiency compared to conventional internal combustion engines, rendering them a more environmentally sound and sustainable mode of transportation.

5.2. Conclusion

Following this research project, the study concluded that many electric vehicles (EVs) have unique energy-saving features, such as regenerative braking. The process uses the electric car's engine as a generator, converting kinetic energy lost during braking into energy stored in the vehicle's battery. In addition, electric vehicles have a lower center of gravity, improving handling, responsiveness and safety. They immediately produce an excessive amount of linear torque that is not possible with an internal combustion engine. Hybrid electric vehicles (HEVs) also typically use less fuel than comparable conventional vehicles because they use electric drive technology to increase vehicle efficiency through regenerative braking and recover energy that may be lost during braking. Both plug-in hybrid vehicles (PHEV) and fully electric vehicles (also known as battery electric vehicles (BEV)) can be driven solely by electricity. Therefore, there is a positive relationship between barriers and electric vehicles dissemination in Rwanda.

5.3. Recommendations

i. The Rwandan government should continue to have a strong fuel cost advantage over conventional governments.
ii. The Rwandan government and its partners should also increase the number of public charging stations, which is a must. As a rule of thumb, regions should provide 1 public charging point for every 10 registered electric vehicles.
iii. The Rwandan government can also capitalize on user-friendly charging infrastructure, particularly by standardizing and introducing more user-friendly rules for parking and paying at public charging stations.
iv. The study also recommended that the Rwandan government develop smart charging systems such as Vehicle2Grid (V2G). This can offset irregularities in local power production and generally reduce grid imbalances.
v. It is critical that the Rwandan government ensures early involvement of power companies in the planning and construction of charging infrastructure.
vi. The Rwandan government should also adjust regional and urban planning. Electric vehicles must be better integrated into urban planning.

5.4. Areas for further researches

The study recommends conducting the same type of research in many different countries with different practices and different strategies to determine their success. Additional research may lead to:

(i) Policy mechanisms to accelerate electric vehicle adoption

(ii) Evidence-based market overview of incentives and disincentives in electric mobility as a key to the sustainable future

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Appendix 1:INTRODUCTION LETTER

Dear Respondent,

My name is INGABIRE Alliance a student at University of Rwanda, College of Science and Technology conducting an academic research study on "***Assessment of barriers to electrical vehicles dissemination in Rwanda"***, aimed at fulfilling the condition for the award of a Master's degree in Energy Economics.

You have been considered to be one of the respondents. You are, therefore, requested to take few minutes of your time to answer these questions in a manner you deem appropriate and these responses will be treated with utmost confidentiality. Your co-operation is highly appreciated.

Appendix 2:Questionnaire

Section A: Respondent's profile

1. Age of respondents

- 21-30 years ☐
- 31-40 years ☐
- 41-50 years ☐
- 51 years and above ☐

2. Gender of respondents

- Male ☐
- Female ☐

3. Education level

- Master's degree ☐
- Bachelors' degree ☐
- Diploma ☐
- Secondary level ☐

4. Years of experience

- Less than 1 year ☐
- 1 to 5years ☐
- 5 to 10 years ☐
- 10 years and above ☐

Section B: Key barriers to the dissemination of electric vehicles in Rwanda

Please rank the following statement on equally scale ranging from strongly disagree to strongly agree where; 1= Strongly agree (SA), 2= Agree (A), 3 = Neutral (N); 4= Disagree (D), 5= strongly disagree (SA).

	Statements					
	Insufficient charging infrastructure	**1**	**2**	**3**	**4**	**5**
1.	In Rwanda, smart charging stations are enough for charging EVs operators to share data connections					
2.	Smart charging can't effectively help address the grid capacity issue by reducing the load on the grid					
3.	Wherever the country is, there are limited fast charging stations that are not as prevalent as needed					
4.	Economic development of Rwanda always creates a corresponding need for additional electric grid capacity					
	Higher costs	**1**	**2**	**3**	**4**	**5**
1.	Rwandan government, business and investors have enough resources to fund the development of a robust charging network					
2.	Both power electricity rates and utility upgrades are higher in Rwanda					
3.	In Rwanda, both medium and heavy duty EVs are comparatively more expensive to purchase than their diesel counterparts					
4.	Maintenance of EVs are not reasonable due to limited number of technicians					
	Vehicles performance	**1**	**2**	**3**	**4**	**5**
1.	EVs in Rwanda are inconvenience and non-practically for long distance travel					
2.	There are fears among EV' owners of running out of battery power before reaching a charging station					
3.	EVs convert over 77% of the electrical energy from the grid to power at the wheels					
4.	There are more expenses than enough speed for every-day usage					
	Lack of knowledge	**1**	**2**	**3**	**4**	**5**
1.	There is enough public awareness and exposure to electric mobility					

2.	Clients of EVs in Rwanda don't have enough knowledge on how these cars generate instant linear torque, which cannot be matched by internal combustion engines					
3.	Due to the nature of roads, Rwandan clients have limited knowledge about how EVs have instant acceleration					
4.	Lack of knowledge of Rwandan customers significantly impacts consumers' attitudes towards electric two-wheelers					

Section C: Factors influencing the adoption of electric vehicles

Please rank the following statement on equally scale ranging from strongly disagree to strongly agree where; 1= Strongly agree (SA), 2= Agree (A), 3 = Neutral (N); 4= Disagree (D), 5= strongly disagree (SA).

	Statements	**1**	**2**	**3**	**4**	**5**
1	The price of EVs and environmental factors significantly influence Rwanda's client's consumer adoption					
2	Electric vehicles have lower overall costs over the lifetime of the vehicle					
3	EV charging costs less than filling up gas-powered vehicles					
4	Charging infrastructure, purchase cost, and government financial incentives					

Section D: Attitudes of Rwandan consumers towards electric vehicles

Please rank the following statement on equally scale ranging from strongly disagree to strongly agree where; 1= Strongly agree (SA), 2= Agree (A), 3 = Neutral (N); 4= Disagree (D), 5= strongly disagree (SA).

	Statements	**1**	**2**	**3**	**4**	**5**
1	Rwandan consumers are primarily motivated by environmental concerns					
2	Electric vehicles in Rwanda have full driving automation is perceived as a useful technology					
3	Electric vehicles in Rwanda are always marking the end of parking problems					
4	Electric vehicles in Rwanda also are more environmentally friendly					

Thank You!