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DYNAMICS OF PUBLIC TRANSPORT IN GHANA: THE CASE OF THE
USE OF TRICYCLES IN THE GREATER ACCRA METROPOLITAN AREA
(GAMA)

BY

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DECLARATION

I hereby declare that this thesis is the result of my independent investigation undertaken with meticulous supervision. I have consulted and used other scholarly works which have been duly acknowledged. I confirm that this thesis is original and has never been submitted, in part or whole, at the University of Ghana or any other institution for the award of an academic degree.



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ABSTRACT

Transportation serves as a critical enabler for human mobility, goods movement, and service delivery. Most urban commuters rely on public transport systems to satisfy their mobility needs. Although transportation is not an end in itself but a means to various goals, urban residents face intricate challenges tied to their location, income, time constraints, objectives, mode feasibility, accessibility, and other factors while accessing transportation services. To address these challenges, SDG 11.2 promotes affordable and sustainable transportation systems, with access to public transport as a key indicator. In Ghana, public transport is provided by buses, minibuses (trotro) and car taxis. However, the dynamics of public transport in Ghana have changed since the advent of tricycles as a mode of public transport. Tricycles have gained popularity among urban commuters due to deficiencies in transportation infrastructure, regulations, heavy traffic, and high fares associated with traditional modes. Yet, the long-term sustainability of tricycles as a public transport solution remains uncertain. This study investigates the evolving dynamics of public transport in the Greater Accra Metropolitan Area (GAMA), examining the evolution, adoption factors, and public opinions regarding tricycles as a sustainable transport option. Furthermore, it delves into the legal and institutional framework of tricycle transport services in urban Ghana. Employing a mixed-method approach integrated in rational choice theory and Alphonzo's (2005) social-ecological framework, data were collected through a survey involving 610 users and riders. In addition, qualitative insights were gathered from 40 participants which included government transport officials through in-depth and key informant interviews as well as observation. Accessibility emerged as the foremost factor influencing tricycle adoption, while safety ranked as the least significant. Over 90% of respondents attributed the proliferation of tricycles to factors like serving underserved routes, ability to move through alleys, affordability, unemployment, and the high costs of alternative modes. The most notable challenges discovered included rivalry with other transport network operators, reckless riding and poor licensing. Regulatory institutions such as the Driver and Vehicle Licensing Authority (DVLA) and the Ghana Police-Motor Traffic and Transport Department (GP-MTTD) were found to be scrupulously carrying out their responsibilities to promote sustainable urban transportation, but greater coordination is required to solve the dilemma of public tricycle transport operation. In order to prevent accidents and effectively control their operation, a revision of LI 2180 is recommended, in addition to interim strict adherence to traffic regulations and training.

DEDICATION

I dedicate this work to God Almighty and to Mr. P. Y. Agyekum, a very kind and fine gentleman.



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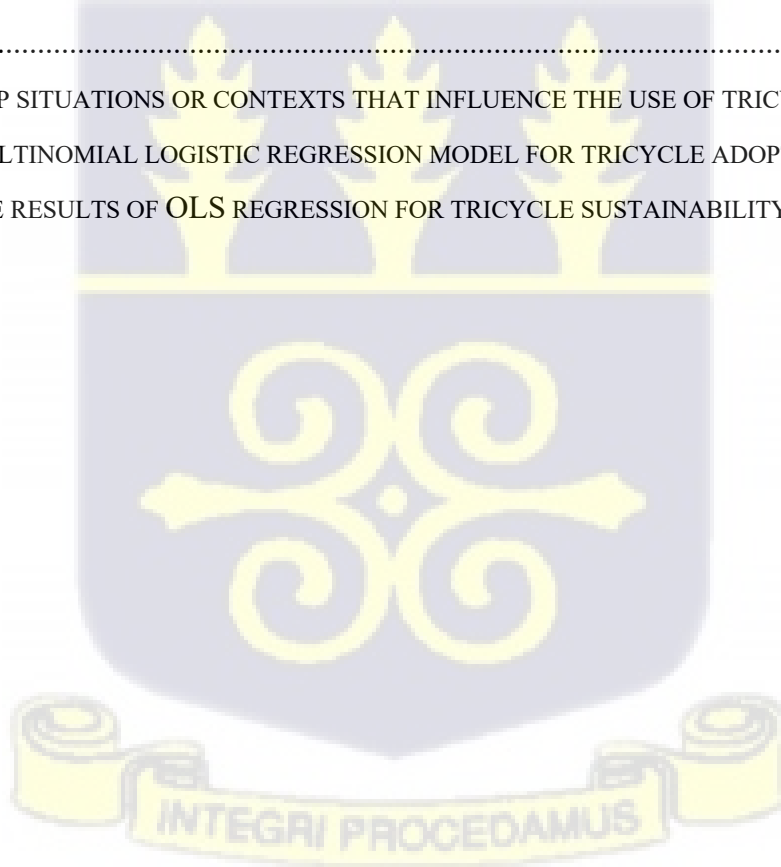
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LIST OF ABBREVIATIONS

BBC-	British Broadcasting Corporation
CAPI-	Computer-Assisted Personal Interviews
CBD-	Central Business District
CNG-	Compressed Natural Gas
DUR-	Department of Urban Roads
DVLA-	Driver Vehicle and Licensing Authority
EPA-	Environmental Protection Agency
GAMA-	Greater Accra Metropolitan Area
GNFS-	Ghana National Fire Service
GPRTU-	Ghana Private Road Transport Union
GPS-MTTD-	Ghana Police Service- Motor Transport and Traffic Department
GSA-	Ghana Statistical Authority
GSS-	Ghana Statistical Service
IDI-	In-depth Interviews
IMTs-	Intermediate Means of Transport
IPT-	Intermediate Public Transportation
JHS-	Junior High School
Kg-	Kilogrammes
KI-	Key Informant
KII-	Key Informant Interview
Kmh-	Kilometres per hour
LI-	Legislative Instrument
Limited-	Ltd.

LPG-	Liquefied Petroleum Gas
LUSPA-	Land Use and Spatial Planning Authority
MCE-	Municipal Chief Executive
MNL-	Multinomial Logistics
MoT-	Ministry of Transport
MRH-	Ministry of Roads and Highways
NADMO-	National Disaster Management Organization
NRSA-	National Road Safety Authority
OLS-	Ordinary Least Squares
PAARI-	Police Action Against Rider Indiscipline
PCA-	Principal Component Analysis
PM10-	Particulate Matter
PROTOA-	Progressive Transport Owners' Association
SDG-	Sustainable Development Goals
SHS-	Senior High School
SPSS-	Statistical Programme for Social Sciences
SSA-	Sub-Saharan Africa
TO-	Transport Officer
UITP-	Union Africaine des Transports Publics
UN-	United Nations
UN-DESA-	United Nations-Department of Economic and Social Affairs
UN-HABITAT-	United Nations Human Settlements Programme
VIF	Variance Inflation Factor
WCED-	World Commission on Environment and Development

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

It is undeniable that urban transportation in Africa and certainly some parts of Ghana have experienced new dynamics for varied reasons related to the exigencies of urban life (Hasan, 2013; Mbara, 2016; Obiri-Yeboah et al., 2021). Regardless of the efforts made by governments and private entities to improve the conventional forms of public transport such as shared car-taxis, mini-buses and half-licit motorbikes, auto-rickshaws (motor tricycles) have become popular as a relatively new trend of transportation in some urban areas in Ghana. The proliferation and acceptance of tricycles have been stronger in areas where intermediate public transportation (IPT) like taxis, auto-rickshaws, motorbikes and cycle rickshaws remained the major forms of transportation (Asafo-Adjei et al., 2017). These forms of vehicles are often paid for by users except when they are used for private purposes. Inarguably, the process of using IPTs like motor tricycles and -bikes is catching up in the southern parts of Ghana (Obiri-Yeboah et al., 2021) amid policy debates regarding the acceptance of motorbikes as conventional means of public transport (Tuffour & Appiagyei, 2014).

Literature (Cervero, 2000; Cervero & Golub, 2007; Kashi & Carello, 2020) suggest that Africa's transportation sector is largely informal due to inadequate formal transportation services. With similar situations in other African countries (Ehebrecht et al., 2018), the use of motor tricycles has exposed the disparities in transportation services, providing essential assistance to urban residents with low to middle incomes (Mbara, 2016; Onyango, 2018). Aside from the cost of transportation, this transformation is mainly the result of changing land-use dynamics such as sprawling or urban expansion, which compels labour to live in distant

peripheral communities while accessing livelihoods at city centres (Kashi & Carello, 2020; Poku-Boansi & Adarkwa, 2014).

The urban form in Ghana, like those in other developing countries, is characterized by the centrality of urban facilities in the core of the city (Acheampong et al., 2017; Cobbinah & Amoako, 2014; Doan & Oduro, 2012). This implies that the location of jobs, housing facilities as well as commercial hubs in urban areas largely influence travel behaviour. Studies like Zhao and Li (2018), Zhao (2013), Zhao (2010) and Oppong-Yeboah and Gim (2020) have shown that commuting behaviour is significantly related to the built environment where people live and work. Moreover, travel behaviour in Ghana usually revolves around economic activity, health and education (GSS, 2013) leading to increased motorized trips as urbanization increases. Consequently, this suggests that people need to make trips to these central points for reasons related to their livelihoods, education, and health.

Nasri and Zhang (2018) have further indicated that travel behaviour does not only depend on urban sprawl but also on other indicators such as accessibility, housing composition and centrality of the area. People therefore make travel decisions based on their location, accessibility and affordability of the transportation options available (Oppong-Yeboah & Gim, 2020; Kashi & Carello, 2020). Increasing population, and subsequently urbanization and conurbation, denotes a higher demand for transportation services (Amoh-Gyimah & Aidoo, 2013; Cobbinah & Amoako, 2014; Poku-Boansi & Adarkwa, 2014; Poku-Boansi & Cobbinah, 2017); hence, the transformation presented by tricycles in addressing the high demand for motorization (Tuffour & Appiagyei, 2014) within and between communities.

The tricycle is a relatively new dimension and addition to the transportation sector in Ghana; and generally previous studies have treated it as a form of intermediate transportation (Asafo-Adjei et al., 2017; Acheampong, 2017), public transport (Agyemang, 2017; Oppong-Yeboah

& Gim, 2020) or informal transportation (Cervero, 2000). Existing literature also suggests that it is more entrenched in the northern parts of Ghana with acceptance being mixed in the south of Ghana (Abane, 2011; Asafo-Adjei et al., 2017; Ehebrecht et al., 2018; Tuffour & Appiagyei, 2014) partially because Ghanaian road traffic laws, specifically, the Legislative Instrument (LI) 2180 which is the road traffic regulatory act in Ghana prohibit their usage.

Largely, specific studies regarding motor tricycles have revealed that motor tricycles are transportation gap fillers as they serve as feeders to larger transportation services (Asafo-Adjei et al., 2017; Bradley, 2014; Mani et al., 2012; Mani & Pant, 2012; Mbara, 2016; Onyango, 2018). More so, tricycles have become attractive to urbanites mainly for their ability to penetrate and navigate through traffic (Obiri-Yeboah et al., 2021; Cervero, 2000; Onyango, 2018), which is a major challenge in most developing countries (Kashi & Carello, 2020; Tekolla et al., 2021). The tricycle's flexibility in terms of routes, timing and fares (Asafo-Adjei et al., 2017; Bradley, 2014; Onyango, 2018; Tichagwa, 2016) is an added advantage to unserved groups who would have been otherwise cut off. In addition, it does well in areas without a formal road network, thus allowing many individuals and households to move around at a relatively lower cost.

Irrespective of the positive aspects of motor tricycles, researchers have often raised concerns about their safety (Cervero & Golub, 2007; Dinye, 2013; Priye & Manoj, 2020; Tuffour & Appiagyei, 2014), the fact that they are largely unregulated (Bradley, 2014; Mbara, 2016) and illegal in the case of Ghana (Jack et al., 2021). Furthermore, they are purported to be a leading cause of accidents in Accra and researchers often cite concerns about their legitimacy (Jack et al., 2021; Tuffour & Appiagyei, 2014).

This study is sited in the Greater Accra Metropolitan area, which is predominantly urbanized with a large bustling central business district and known for its critical transportation challenges

similar to most metropolitan cities in the Global South. Transportation needs continue to rise in these areas due to the increasing population and urbanization. Therefore, the improvement and increased supply of transportation to address transport inadequacies, such as road traffic congestion and high transportation fares, is imperative (Ashiagbor et al., 2019; Kashi & Carello, 2020; Møller-Jensen, 2021; Oppong-Yeboah & Gim, 2020). Typical of most cities around the African continent, Accra is wildly expanding and the increase in car ownership has led to congestion and high volumes of traffic. Travel time has increased due to sprawling and government is unable to catch up with transportation demands due to poor and inconsistent planning (Oteng-Ababio & Agyemang, 2015). These deficits are then taken care of by informal transport service providers, mainly *trotros* (local name for the shared minibus system), some of which are old vehicles sometimes overloaded with passengers and paid load. This practice potentially threatens the safety of passengers and other road users (Kashi & Carello, 2020).

Consequently, the proliferation of tricycles has become a convenient alternative to dodge traffic, increase accessibility and meet affordable transportation costs in parts of Accra. It also demonstrates an expansion in commuting options, especially for low-income people in these locations (Jack et al., 2021).

Following the current increased use of tricycles for short-distance journeys in Accra, it has become imperative to investigate their nature, evolution and operation as well as perceptions of their sustainability. As portrayed in literature, the economic contexts and the changing land-use patterns in Accra have contributed to the dynamics in transportation in recent years. Moreover, the motor tricycle, locally known as ‘Pragiya’, is operating parallel to the usual car taxi and ‘*trotro*’ transportation systems in the provision of short-distance transport services in portions of Accra.

Accra is critical for this study due to the fact that it is the capital and serves as a reference point in issues of development for Ghana; and that the Greater Accra Municipal Area (GAMA) has seen an upsurge in the use of motor tricycles in recent times regardless of Legislative Instrument (LI) 2180. Previously, the use of tricycles as a short-distance public transport mode was an inexistent phenomenon; with most short-distance journeys made by bicycle, on foot or through other motorized options like the car taxi or '*trotro*' (Abane, 2011; Poku-Boansi, 2020).

This study was specifically carried out in Dome, in the Ga East Municipality, Oyibi in the Kpone Katamanso Municipality and Pokuase-Amasaman in the Ga West Municipality because they are among the communities in GAMA where the use of tricycles has evolved and proliferated. Although Accra is predominantly urban and has access to a variety of transportation services, it is saddled with an inadequate supply of these services for reasons related to the intricacies of urbanization and high population growth.

1.2 Problem statement

The use of motor tricycles as an alternative form of public transport is becoming commonplace in some parts of Accra irrespective of LI 2180 (the road traffic regulatory act), which prohibits the commercial usage of tricycles for public transport (Jack et al., 2021; Tuffour & Appiagyei, 2014). Regardless of the debates about its operational legitimacy, safety and regulation issues, the motor tricycle has exploded in popularity over the last couple of years (Dinye, 2013; Obiri-Yeboah et al., 2021). For instance, in 2017, the Driver and Vehicle Licensing Authority (DVLA) registered 8174 tricycles. This figure shot up by 153% by the end of 2018; by March 2022, there were 143,617 trikes registered by the DVLA. Thus, from 2017 to March 2022, the registered number of tricycles had multiplied about 17 times or saw a percentage increase of 1657 (DVLA, 2022). This shows the significant increase in the use of tricycles over the period in Ghana. Although it is a relatively recent development in the southern part of Ghana, it is

rapidly becoming an attractive solution to various transportation needs. Apart from carrying passengers, it is very instrumental in garbage collection as well as the freight and delivery industry. Recently, the Accra Metropolitan Assembly (AMA) won an international award for integrating informal garbage collection¹ into its waste management strategies, in which tricycles played a major role (Oduro-Appiah et al., 2019).

Currently, the city has sprawled such that people live farther away from commercial areas where public transport and other services are not easily accessible. The monocentric nature of urbanization in Ghana further necessitates the movement of people from the peripheries to central business areas to conduct business on a regular basis. As a result, there is a higher demand for motorized transportation due to sprawling on the edges as well as the development of new less dense communities (Abane, 2011; Poku-Boansi & Cobbinah, 2017). Thus, while some researchers (Oteng-Ababio & Agyemang, 2015; Poku-Boansi & Adarkwa, 2014) allude to transportation infrastructural deficits generally, research on tricycles (Onyango, 2018; Oteng-Ababio & Agyemang, 2015; Mbari, 2016) have concentrated on unserved routes, traffic and traffic management systems and infrastructure, for example, road networks, and availability of different modes, and increased motorized travel as being the cause of proliferation and adoption of tricycles (Obiri-Yeboah et al., 2021). These assertions are often without the intricate roles of government transport agencies who play major roles in a context of weak planning and poor transport infrastructure (Oteng-Ababio & Agyemang, 2015).

Furthermore, Accra's transportation condition is particularly characterized by rapid motorization, congestion, road and transport network infrastructural inadequacies, and

¹ Joy Online (2019). Accra wins award for Informal Waste Collection Expansion Project.

<https://www.myjoyonline.com/accra-wins-award-for-informal-waste-collection-expansion-project/>

declining travel speeds by all motorized modes, especially public transport (Kashi & Carello, 2020). Thus, studies on tricycle transport (Jack et al., 2021; Obiri-Yeboah et al., 2021; Tuffour & Appiagyei, 2014) often focus on how it is solving numerous transport challenges but little or no attention is given to its sustainability. In literature, the tricycle has often been researched as a form of informal and intermediary transport (Asafo-Adjei et al., 2017). However, its sustainability, in terms of social, economic and environmental perspectives is yet to be sufficiently addressed. Being aware of the multifaceted and complex nature of sustainability as well as the pros and cons of the tricycle, which is the newest addition to the modes of road transportation in the urban south of Ghana, few studies on tricycles have explored it as a sustainable form of transportation in Ghana. Rather, it has often been researched in terms of its contribution to sustainable development focusing on sustainable livelihoods and access to transportation (Afukaar et al., 2017; 2019; Obiri-Yeboah et al., 2021).

Additionally, low density and bad road conditions result in irregular access to transport services pre-empted by unavailable commercial vehicles on irregular routes. This situation has led to increased car ownership and traffic volumes with implications for how transportation needs are met in the metropolis (Kashi & Carello, 2020). Also, these shortfalls have ramifications for transportation rates, which are already high and steadily increasing. Hence some studies (Asafo-Adjei et al., 2017; Onyango, 2018) have emphasized limited transport access which generates a lot of grey areas that leave some urbanites out of transportation supply or frustrate their efforts to meet transport needs due to, for instance, their location or income levels.

Therefore, it is evident that a person's location can cause them to be left behind. Thus, the United Nations Sustainable Development Group (UNSDG) recognizes geography as one of the five key factors associated with vulnerability. Their analyses suggest that people may be left behind on a geographical basis when they are at risk of exclusion because of their location, inaccessible transportation, and mobility-related transport disparities. Moreover, other key

factors, such as socioeconomic status, for example, income and governance in terms of policies and legal frameworks, can increase their vulnerability and further leave them behind (United Nations Sustainable Development Group, 2022).

The increased use of tricycles for public transport has also been attributed to high rates of unemployment in Ghana, which compels young people to engage in the tricycle business. This has culminated in researchers (Doherty, 2020; Obiri-Yeboah et al., 2021) giving more attention to the economic efficiency aspect of the business. However, it is important to explore the social and the environmental aspects to help provide different policy directions.

In meeting the versatile needs of contemporary urbanites and driven by the market forces of demand and supply, transportation in Ghana has evolved to include the motor tricycle, which provides invaluable services in some parts of Accra (Obiri-Yeboah et al., 2021; Tuffour & Appiagyei, 2014). Thus, considering all these debates and gaps in literature, it is important to understand why commuters use a vehicle that is illegal and generally perceived to be unsafe by users and government transport agencies. Further, it is imperative to know how this vehicle operates, identify users, and appreciate why and how they use it for urban transport planning and expansion purposes. Moreover, it is equally important to know whether such a vehicle can be a sustainable mode and help achieve an inclusive urban transport system in congruence with Sustainable Development Goal (SDG) target 11.2, which seeks affordable and sustainable transport systems.

As a result, this study investigates the operation of tricycles and furthers the conversation by elucidating their evolution in the urban south of Ghana. It also investigates the reasons for adoption and examines respondents' perceptions of the tricycle as a sustainable means of public transport.

1.3 Main objective

The main objective of this study is to examine the evolution of tricycles as a public transport system in GAMA elucidating the drivers of this change and what the implications are for sustainable urban transportation.

1.3.1 Specific objectives

1. Examine the nature and evolution of tricycle transport in the GAMA and the factors underlying its development.
2. Analyse factors that influence the adoption of the tricycle as a means of urban transport and its associated challenges.
3. Assess sustainability perceptions of tricycles using sustainable transport anchor points.
4. Evaluate the existing policy, legal, and institutional infrastructure governing tricycle transport services in urban Ghana.

1.4 Main research question

The main research question is ‘how has the tricycle become a popular means of transport among a cross-section of Ghanaian urbanites and what factors are influencing this change?’

1.4.1 Specific research question

1. What is the nature of the tricycle and what are the factors underlying its development as a form of urban transport?
2. Why do urban commuters adopt the tricycle as a means of public transport and what are the associated challenges?
3. How is the tricycle perceived as a sustainable means of urban transport?

4. To what extent do the existing policy, legal and institutional infrastructures governing tricycle transport in Ghana address the tricycle transport dilemma?

1.5 Justification of the study

The proliferation of auto-rickshaws or motor tricycles as a form of public transport is phenomenal but literature from Ghana is limited. More so, as an entrenched means of transportation in the northern parts of Ghana, which is gradually gaining acceptance in the south, it is imperative to investigate this shift. This study contributes to the broader conversation on transportation by evaluating the sustainability of the tricycle and identifying reasons for its utility in Southern Ghana where it is gaining more popularity. Furthermore, insights from this study have implications for urban transportation and urban planning. Above all, the completion of this study is an addition to the literature on auto-rickshaws or motor tricycles in Ghana.

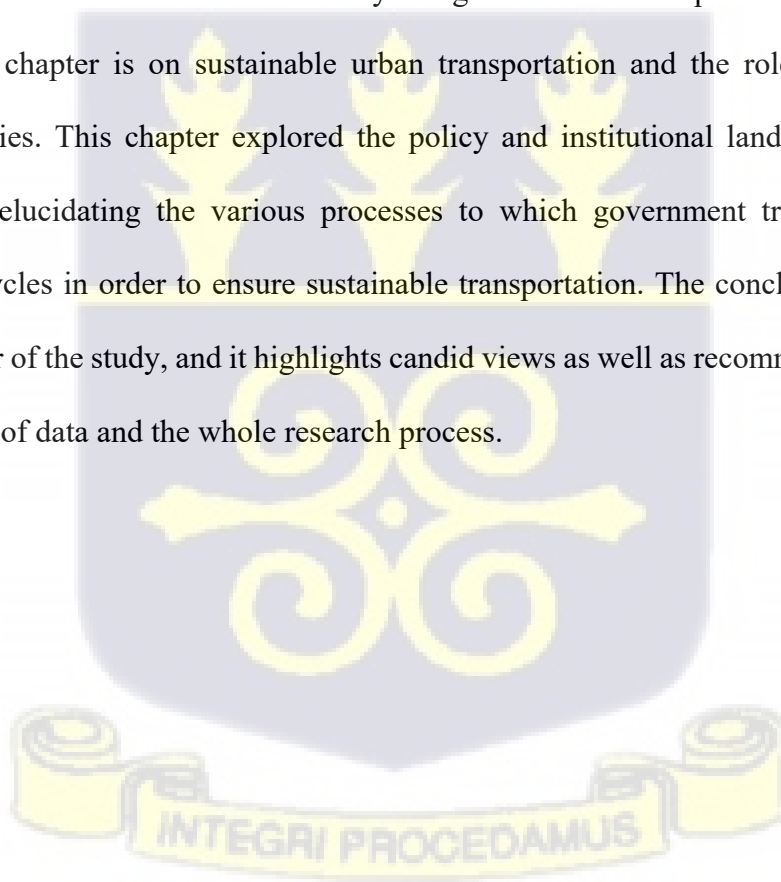
Furthermore, insights from this study provide information on commuters and what their real transportation needs are, which are crucial for transportation planning purposes. In the same vein, the result of this study is an ingress into streamlining the operations of tricycles and help to appreciate any decision on a future with or without tricycles. This is because the study identifies actors and their justification for the use of tricycles with implications for transport inclusion, livelihoods, and the environment generally.

1.6 Organization of chapters

The study is organized into seven chapters. Chapter One gives an introduction, which is a general overview of the study, and it covers major aspects such as a general background to the study, problem statement, objectives and research questions. These provide an entry point into

the topic, explicating the problem and clarifying the objectives of this study. Following the introductory chapter are the intervening chapters, which include firstly, a literature review, and then the theoretical as well as the conceptual framework. These situated the problem in literature and described identified theories used to support the study. The third chapter is the methodology, which details how the study was conducted. This is followed by three empirical chapters on the four objectives of the study.

The first empirical chapter is on the nature and evolution of tricycle transportation. This chapter encapsulates the development of tricycles as a means of urban transport and it is followed by a chapter on the adoption of tricycles. This chapter elaborated on factors influencing adoption, how it is used, and assessed its sustainability using sustainable transport anchor points. The final empirical chapter is on sustainable urban transportation and the role of government transport agencies. This chapter explored the policy and institutional landscape of tricycle transportation, elucidating the various processes to which government transport agencies predispose tricycles in order to ensure sustainable transportation. The conclusion constitutes the final chapter of the study, and it highlights candid views as well as recommendations based on the analyses of data and the whole research process.



CHAPTER TWO

LITERATURE REVIEW, THEORETICAL CONSIDERATIONS AND CONCEPTUAL FRAMEWORK

2.1 Introduction

This chapter concentrates on the review of relevant literature in the area of the pervasive use of tricycles as a means of public transport. It focuses on urban intermediate transportation; the institutional and policy parameters; and the sustainability of the use of tricycles. The review situates tricycle transportation within the broader conversation on urban intermediate transportation; public (informal) transportation; and further within the theory of need and rational choice theory. The chapter debates some of the existing knowledge on tricycles beginning with a historical development from Asia and how it is used around the world; and shows how this study builds on it in a conceptual framework.

The chapter is in six parts with 15 subsections. The first part includes seven subsections that give an overview of how tricycle transportation evolved in Ghana focussing on the nature of tricycles and the policy and institutional environment. It also explores tricycles as an informal means of transportation and examines their benefits and implications for urban transportation. The second part explored the determinants of mode selection while the third part deals with sustainable transportation and the contentions on tricycles as sustainable means of public transport. Part four looked at the challenges involved with the use of tricycles as public transport while part five unpacked the theories in which the study was situated. The final part of this chapter comprises the conceptual framework derived from the review of related literature and the conclusion, which also summarizes the whole chapter.

2.2 The evolution of tricycle transportation in Ghana

2.2.1 The nature and historical development of tricycles as a means of public transport

The auto-rickshaw, also known as the motor-tricycle rickshaw, possibly originated from the Mazda Go three-wheeled vehicle; the very first of its kind in history designed in Japan in the 1930s for the carrying of goods (MAZDA, 2021; Pistonudos, 2021; The Economist, 2014). It is a motorized version of the manually pulled rickshaw popularly used in India where it serves as the most common IPT (Dike, 2012; Elmardi Suleiman Khayal, 2019; Mani & Pant, 2012).

The auto-rickshaw is a cheap but compact and adaptable three-wheeled vehicle; hence, it is known for its unique and versatile functions (Ehebrecht et al., 2018; Elmardi Suleiman Khayal, 2019; Jack et al., 2021; Onyango, 2018; The Economist, 2014). Apart from its three-wheeled feature, the tricycle uses handle-bar controls similar to that of a motorbike and is powered by pedals or hand cranks in some models (Jack et al., 2021; Mani, 2012). It is made up of metal frames roofed with canvass material or leather with dropdowns of the same material on the sides. It has a capacity for a maximum of four adult passengers including the driver and is powered by an electric motor or car engine with a fuel tank capacity of 10.5 litres. It has ample space for luggage and a maximum speed level of 80km per hour. Consuming a litre of fuel every 38km travelled, it has been argued that the tricycle is an adequate means of intra-city commuting (Dike, 2012; Jack et al., 2021; Mani & Pant, 2012).

The growth of tricycle transport in the Global South, notably in Sub-Saharan Africa, South Asia, and Southeast Asia, demonstrates both the problems and adaptations of urban transportation in fast-growing cities. Motorised tricycles have thus become a popular means of transportation due to their low cost, adaptability, and ability to negotiate crowded metropolitan areas (Jack et al., 2021; Mbara, 2016; Onyango, 2018). In the Philippines for example, tricycles are the predominant form of transportation in many cities and towns (Ong et al., 2023; Recio et al., 2019). In India, auto-rickshaws provide a similar service (Mani, 2012) and in Africa,

tricycles are used for passenger and cargo transportation, catering to the different demands of urban and peri-urban regions (Al-Hasan et al., 2015; Bamidele, 2016; Busari, 2024; Dike, 2012; Ehebrecht et al., 2018; Obiri-Yeboah et al., 2021). The rise of tricycle transportation in Southern urbanisation is a dynamic facet of urban mobility, reflecting the specific difficulties and opportunities that cities in the Global South confront (Obiri-Yeboah et al., 2021; Oteng-Ababio & Agyemang, 2015).

Although it originated from Asia as a cheaper means of public transport, it has permeated most developing countries for similar reasons (Dike, 2012; Jack et al., 2021) and it is currently changing the scope of transportation in several other African countries (Ehebrecht et al., 2018; Evans et al., 2018; Tuffour & Appiagyei, 2014). The Economist (2014) reported that Bangladesh, Egypt, India, Nigeria, Peru, Sri Lanka and Thailand remain the largest market in the motor-tricycle business. Some of its common names around Africa include *Pragiya* in Ghana, Keke in Nigeria, Boda Boda in Uganda, Tuk-tuk in Kenya, Ethiopia, and Tanzania, Pousse-pousse in Madagascar, Raksha or Tuk-tuk in Sudan and a host of other names in other African countries (Elmardi Suleiman Khayal, 2019; Jack et al., 2021; Tuffour & Appiagyei, 2014).

As an emerging phenomenon, its proliferation across Africa and the value users derive from it has often been captured in how it is described. Regarding its benefit of penetrating and manoeuvring in traffic, a British Broadcasting Corporation (BBC) Africa report stated that motor tricycles, which are the traffic dodging staple of India, are making their way to Africa as several thousand are being shipped (BBC, 2017). In terms of employment, Obiri-Yeboah et al. (2021) describe the operators as the new players in Africa's transportation sector where the operation of motor tricycles has provided a source of income to several hitherto unemployed youth. Mbara (2016) likewise described it as the new kid on the block because it fills a transportation gap by providing first and last-mile trips for low-income groups.

Tricycles have emerged at a point in history when transportation is almost a dilemma for urbanites in developing countries, especially the poor and middle class, needing cheaper and quicker transportation due to the high cost of transportation from conventional modes and excessive rush hour traffic (Oteng-Ababio & Agyemang, 2015). An example of this mobility dilemma was identified by Møller-Jensen (2021) who used qualitative methods to demonstrate that traffic congestion in Accra, Ghana's capital city, contributes to women's unpleasant experience of mobility in the city. Poku-Boansi and Cobbinah (2017) likewise found that some urbanites reduce motorized travel due to traffic congestion and resort to the use of mobile applications. Evidently, traffic congestion is a major challenge in Accra and generally in African cities and it impedes effective and efficient mobility experiences. It is often attributed to rapid population growth, urbanization and poor transportation infrastructure (Kumar & Barrett, 2008; Møller-Jensen, 2021; Poku-Boansi & Cobbinah, 2017; Tekolla et al., 2021).

Growing populations and increasing urbanization are two major concurrent phenomena that generally influence challenges and expansions in transportation services (De Soto, 1990). As a country's population incessantly grows, expansions in transportation services are required if economic growth is an expected end. As has been argued by Oteng-Ababio and Agyemang (2015), failure to invest adequately in transportation has resulted in transportation challenges being experienced. Appropriate investments in transportation are fundamental because transportation turns the wheels of the economy through the movement of people, goods and services (Kaufmann, 2014; Victor & Ponnuswamy, 2012).

Additionally, urbanization has implications for land and spatial dynamics (Cobbinah & Amoako, 2014 ; Poku-Boansi & Cobbinah, 2017). As Boansi (2020) rightly concluded, urban growth and urbanization shape the travel behaviour of urbanites; and as Fillone and Mateo-Babiano (2018) have noted, the urban structure of a historic urban centre in Manila, for example, has influenced how people travel in the district.

Moreover, with the kind of monocentric urbanization taking place in Ghana where facilities and jobs are concentrated in the Central Business Districts (CBDs) (Acheampong, Agyemang, & Abdul-Fatawu, 2017; Doan & Oduro, 2012; Nasri, Arefeh & Zhang, 2018), bustling and congestion have become the norm in these central points. Consequently, as populations increase and communities become more urbanized, these should be paralleled with adequate urban transportation facilities as suggested by Cascetta (2001). However, this is often not the case in most developing countries, including Ghana; thus, creating a problematic transportation system where demand often exceeds supply leading to transportation poverty (Dinye, 2013; Kashi & Carello, 2020; Oteng-Ababio & Agyemang, 2015).

Another factor that has influenced the influx of tricycles as a means of public transport is the role of the government as a regulator of public transport and not the sole provider. It began with the privatization of transportation through the Structural Adjustment Programme of the 1980s when the government's role of being the sole provider of public transport was consigned to a regulator. This allowed private operators to enter the transportation business in significant numbers (Poku-Boansi, 2020), which is still the practice.

Irrespective of increasing population and urban expansion, successive Ghanaian governments have generally made huge annual investments in the transportation sector (Ministry of Finance, 2020). However, mismanagement and financial inadequacies often cripple governments' efforts to completely meet the transportation needs of the Ghanaian populace (Poku-Boansi, 2020; Poku-Boansi & Cobbinah, 2017). Kumar (2011) has indicated that political and economic deregulation as well as other regional and national level factors like reduced shipment cost of motorbikes and tricycles opened up the system for private operators into the hitherto government domain. Since governments relinquished their responsibility of providing adequate transportation to that of the regulator, private individuals, companies and cooperatives have been the major suppliers of road transportation in Ghana (Poku-Boansi, 2020).

Although the motor tricycle has not been accepted as a legal means of public transport in Ghana, the reality is that many urban commuters resort to it for various transportation needs (Jack et al., 2021; Obiri-Yeboah et al., 2021; Oteng-Ababio & Agyemang, 2015) for various reasons. The next sections discuss how tricycles have been researched as informal transportation and some of the benefits commuters derive from their use.

2.2.2 Tricycles in the Ghanaian context

This sub-section focuses on what tricycles are in the Ghanaian context, how they have been researched by various authors and the debates generated in the past few years. The *Pragiya* is one of the two main types of tricycles used for commercial purposes in Ghana. There is the freight type with a bucket, mostly used for carrying loads but occasionally some passengers and it is popularly called “Motor King or Aboboyaa”. The cycle rickshaw type generally used in carrying passengers and sometimes loads is the *Pragiya* or *Mahama Can Do*; two of the popular names for the auto-rickshaw in Ghana (Dinye, 2013; Jack et al., 2021). Most of the studies on tricycles in Ghana have however concentrated on employment (Dinye, 2013; Jing, Dzoagbe, Amouzou, & Ayivi, 2019), policy dimensions (Afukaar et al., 2019; Jack et al., 2021; Oteng-Ababio & Agyemang, 2015), activities, operation and management of operators (Jing et al., 2019; Obiri-Yeboah et al., 2021; Tuffour & Appiagyei, 2014) and safety (Jack et al., 2021; Sebiawu et al., 2014).

According to DVLA (2014) as cited by Afukaar et al. (2019), tricycles are mostly found in Northern Ghana. This shows major regional disparities, as motorcycles and motor tricycles account for over 90% of all registered vehicles in northern Ghana but only around 15% of registered vehicles in Southern Ghana. This is corroborated by the findings of Abane's (2011) study on travel behaviour in Ghana. Above all, there are city-wide disparities (Tuffour & Appiagyei, 2014) as tricycle operation is not visible in all cities in the south of Ghana.

As noted by Obiri-Yeboah et al. (2021), very few studies have been done on tricycles in Ghana; obviously because it is quite a recent phenomenon even though its spread in some parts of southern Ghana has been dramatic. Consequently, most previous studies were done on *Okada*, the motorbike that serves similar purposes as the tricycle. In effect, both the tricycle and the motorbike are forms of informal transportation and they are both used for short-distance journeys or as intermediate transportation (Afukaar et al., 2019). As a result, some authors (Dinye, 2013; Jack et al., 2021) study them together. Most of the studies were conducted at the rural (Afukaar et al., 2019; Asafo-Adjei et al., 2017) or urban (Obiri-Yeboah et al., 2021; Tuffour & Appiagyei, 2014) levels with some distinguishing between the urban and rural parts of northern Ghana (Dinye, 2013).

In terms of how tricycles have been researched in Ghana, different approaches have been used to study this phenomenon. Authors have used quantitative methods when they needed to establish relationships and how widespread these relationships were. For example, Obiri-Yeboah et al. (2021) used descriptive statistics and logistic regression analysis to show the interactions between variables; and Oteng-Ababio and Agyemang (2015) employed a mixed study approach to uncover nuances through interviews as well as preponderance through a questionnaire survey. Predominantly qualitative studies focused on users and non-users to explore the extent of significance or implications of the tricycle for transportation. Asafo-Adjei et al. (2017) and Dinye (2013) could be cited as examples in this regard.

It is worth noting that aside from academics, the media has made an input in this ongoing conversation through their news articles regarding the activities of motorcycle operators. These reports have taken economic, social and political dimensions and many times a little of each aspect. Annang (2018) in the *Finder Online* wrote about the proliferation of motor tricycles that were hitherto common in Muslim communities and were making their way into non-Muslim communities in the south of Ghana. Dogbe (2020), on the other hand, reported on

centralized stations for motorbike operators. The parliamentary debate about the review of LI 2180 on whether to accept or not to accept motorbikes and tricycles as conventional means of transport has been reported on by Ayisi (2019). The adjoining paragraphs describe the focal points of some of the studies conducted on tricycles in Ghana.

Using qualitative methods, Dinye (2013) sought to elucidate the significance of motorcycle transport on social and economic development in the Wa Municipality of the Upper West Region. The study revealed that although motorcycles seem risky (Sebiawu et al., 2014; Tuffour & Appiagyei, 2014), they serve as a primary mode of transport to most urban residents. Besides it being seen as an element of honour and economic success, its high patronage has contributed to the economic and social development of the municipality by making inaccessible roads accessible and substituting for the inadequate public transport system in peri-urban areas. Furthermore, it has become an avenue for employment in areas such as spare parts dealerships, fuel stations and motorcycle mechanics with remarkable spill overs (Dinye, 2013; Owusu-Ansah et al., 2022). This validates the critical role of the motor tricycle in deprived and unserved communities, which cannot be ignored for both rural and urban Ghana despite its safety implications.

Oteng-Ababio and Agyemang (2015) likewise recognized the versatile use of the motorbike considering the challenging state of urban transportation but do not dismiss the risks involved either. They, however, argued that inadequate urban transportation infrastructure has given rise to the *okada* business as they traced the current *okada war* to the breakdown of the formal bus system at the onset of the Structural Adjustment Programme (SAP). By employing a mixed study approach and with the use of questionnaire surveys and interviews in Accra, the authors noted gross policy failures even though efforts are being made to improve transportation services. In their view, the outcomes of these interventions in recent times have been, at best, discouraging because most of the strategies do not solve the problems they are supposed to

address; instead, they create additional ones and therefore are cost-ineffective. They also found that although *okada* is an illegal business according to LI 2180, it is a thriving business in the country (Oteng-Ababio & Agyemang, 2015). In essence, despite these monumental complementary roles tricycles play in urban transportation, their operations are considered illegal.

In a quest to provide data to shape policy on rural transportation due to its significance for access to markets and other services, Afukaar et al. (2019) carried out a study on rural transportation using mixed methods in three distinct ecological zones in Ghana. Their major finding was that the banned motorcycle was the most commonly used vehicle in rural Ghana. The authors advocated the continuous usage of motorbikes in rural areas and their restricted commercial use in urban areas. This study highlighted the contextual transport challenge regarding the use of intermediate transport. It showed that in rural areas where car taxis are cheaper than motorbikes, commuters were saddled with the problem of overloaded cars, long waiting hours and poor service predictability (Afukaar et al., 2017). Thus, the fact remains that motorbikes are the best alternative for rural transportation even though it is slightly more costly. Regarding motorbikes and tricycles as intermediate means of transport (IMT), Asafo-Adjei et al. (2017) evaluated the critical role IMTs play in addressing the transportation needs of Ghana's rural poor. Unlike Dinye (2013), Afukaar et al. (2019) used qualitative data collection methods for depth and accordingly found that IMTs have a favourable influence on the transportation of light and medium loads that are difficult for humans to carry but expensive to transfer by other means. Although the authors do not dismiss the determinants of IMT adoption as outlined by other authors, they believe that other factors, such as culture, in recent times contributes to the disparities in IMT adoption in northern and southern Ghana overlooking the impact of poverty in property acquisition. Undoubtedly, poverty can limit a person's options for acquiring a vehicle to cheaper types like motorbikes and tricycles instead of a car or bus. It

is common knowledge that poverty incidence is higher in the northern parts of Ghana than in other places (Ghana Statistical Service 2019); hence, the role of poverty could have opened up different perspectives to this discussion (Jittrapirom, 2015).

Tuffour and Appiagyei (2014) further investigated the management and operation of motorcycle taxi services in Accra. They focused on the perspectives of operators, users, and non-users of motorbikes. It was discovered that motorcycle taxi services in the Accra Metropolis are primarily used by short-distance daily commuters, particularly during periods of significant traffic congestion (Jittrapirom, 2015; Obiri-Yeboah et al., 2021). Concerning the commercialization of motorbikes even when the law on its restriction is being reviewed, this study revealed that public opinion is divided. While a slight majority of non-users are concerned about safety and legality issues, a greater majority of users perceived the use of motorbikes as convenient in beating traffic (Obiri-Yeboah et al., 2021; Tuffour & Appiagyei, 2014).

Using Ho in the Volta Region of Ghana as a case study, Jing et al. (2019) looked into the influence of tricycles on Ghana's economy and transportation. They aimed to determine how tricycles have improved economic activity; determine how tricycles have improved transportation and find solutions to overcome issues associated with the operation of motor-tricycles in Ghana. With the use of interviews and focus group discussions, they found that the introduction of tricycles in the municipality has a favourable impact on citizens' socio-economic development and well-being. In line with previous studies (Dinye, 2013; Obiri-Yeboah et al., 2021; Tuffour & Appiagyei, 2014), the study found that tricycles had a considerable impact on transportation and commercial activity, as well as the creation of various jobs and providing a stable source of income for the Municipality's young people. This is suggestive of the fact that in both urban north and south of Ghana, tricycle operation has proved to be a viable business transforming local economies.

In recognition of these socio-economic benefits of the tricycle coupled with the ban on its commercial usage as well as safety concerns regarding tricycle operation, Jack et al., (2021) interrogated whether the legalization of motorbikes and tricycles in Ghana was enough to curb externalities and improve safety. Although their operations are considered to be a good source of income (Dinye, 2013; Jack et al., 2021; Jing et al., 2019; Obiri-Yeboah et al., 2021), Jack et al., (2021) noted that riders are aware that some of their colleagues use the same means to perpetuate robberies in and around the city. They however concluded that legalization, dependent on stricter measures was a necessary step for improved safety.

Furthermore, it has been reported that centralized stations could be another way of improving safety in the tricycle business as averred by the NDC running mate during the events leading to the 2020 general elections in Ghana (Dogbe, 2020). Thus, while Oteng-Ababio and Agyemang (2015) articulated a more participatory stakeholder discussion on the policy that restricts the commercialization of motorcycles, Jack et al. (2021) advocated for legalization with stronger restrictions for operators. On the contrary, Afukaar et al. (2019) disapprove of the legalization of motorcycles for commercial use but advocated for a more nuanced regulation due to the special cases of regions in northern Ghana. Clearly, the need for a definite policy to address the peculiar transportation needs of commuters in certain circumstances is evident. Consequently, Afukaar et al. (2019) further suggested that if tricycles are allowed to operate in certain prescribed situations, it will foster regulation and safe practices. Presumably, safety regarding the operations of tricycles relies on legalization and recognition issues.

Transportation has been found to be a male-dominated activity (Odoom et al., 2020) as well as other noticeable trends. In this regard, Obiri-Yeboah et al. (2021) set out to investigate the characterization of 429 tricycle operators in Kumasi. The study revealed that the tricycle business is dominated by young hitherto unemployed males (Al-Hasan et al., 2015; Dapilah et al., 2017; Doherty, 2020). Their study further disclosed inadequate licensing and that more

educated operators serviced and kept their tricycles better than their counterparts who had less education. They also noted that the activities of tricycle operators contribute to the sustainability of the city of Kumasi in that they provide affordable transportation to enhance mobility while generating income with spill over effects (Dinye, 2013; Doherty, 2020; Jack et al., 2021).

2.2.3 Tricycles as informal transportation

This sub-section presents the tricycle as an informal means of public transport. It throws more light on the issues that generally surround informal transport and how they develop. Informal transportation is a global phenomenon but very popular in the Global South where governments lack the resources to provide standard transportation needs to all commuters (Union Africaine des Transports Publics (UITP), 2021). Informal forms of transportation often include low-performance small vehicles, privately owned and operated at commercial rates by individual entrepreneurs and small and medium-scale companies and cooperatives (Cervero, 2000; Poku-Boansi, 2020; UITP, 2021). Its customer base is usually low-income people and some middle-income workers. As pointed out by Obiri-Yeboah et al. (2021), the operators of informal transport systems have operational licensing and registration issues. They are known to work hard for long hours in extremely competitive environments and are often associated with significant externalities of urban life (Cervero, 2000; Doherty, 2020).

Moreover, quality is often compromised because informal transport systems employ old, rickety vehicles often too costly to maintain. Drivers either work for different owners, drive their own vehicles or share as in the case of Uber car-sharing (Cervero, 2000; UITP, 2021). But the sector has seen significant growth in Ghana since 1992 despite its institutional, logistical and financial challenges (Poku-Boansi, 2020). The tricycle is considered an old form of informal transportation used around Africa providing jobs to thousands of unskilled young

people (Cervero, 2000; Obiri-Yeboah et al., 2021; Victor & Ponnuswamy, 2012). Informal transport operators are perceived to have little or no formal education (Cervero, 2000). On the contrary, studies like Al-Hasan et al. (2015) and Dapilah et al. (2017) found that respondents had gained a reasonable level of formal education but for lack of a more preferred job, remained in the tricycle business; and Hart (2016) acknowledged that unemployed male young adults have always been attracted to transportation as a job option.

Similar to several other African countries, Ghana's transportation sector is largely informal and dominated by the private sector (Cervero, 2000; Ehebrecht et al., 2018; Poku-Boansi, 2020). Tricycles and motorbikes have traditionally not been conventional modes of supplying public transport in Ghana except for private use in the northern parts of Ghana and for courier services (Abane, 2011; Asafo-Adjei et al., 2017; Jack et al., 2021; Tuffour & Appiagyei, 2014). Debates are currently ongoing regarding their commercialization in the southern parts (Jack et al., 2021; Tuffour & Appiagyei, 2014).

The tricycle has often been researched as an intermediate form of transportation that plays a significant role alongside the motorbike in rural and northern Ghana (Afukaar et al., 2017; Asafo-Adjei et al., 2017; Ehebrecht et al., 2018; Tuffour & Appiagyei, 2014). Regarding the importance of intermediate transport in Northern Ghana, Dinye (2013) for instance, has articulated the crucial economic and social role of these vehicles in the development of Wa, the capital town of the Upper West Region of Ghana. In the absence of public transport, tricycles were used to access inaccessible roads in the Wa town (Dinye, 2013). In other studies, it has been researched as a form of informal transportation in urban Ghana (Jack et al., 2021; Obiri-Yeboah et al., 2021) where issues of licensing, safety and congestion seem to be clouding the social service these vehicles provide.

Clearly, the circumstances under which these vehicles are used generally influence their acceptance as a mode of public transport. Regarding its half-licit nature as a means of public transport, Jack et al. (2021) have questioned whether the legalization of tricycle operations will better the fortunes of unemployed young people and address the safety concerns of users. They concluded that it should be legalized but with recourse to adhere to strict operational regulations. In the same way, Bradley (2014) implicitly admits that the activities of tricycles cannot be disregarded entirely, considering the social and economic benefits they generate in Kampala. In another instance, Cervero (2007) cautioned against phasing out informal transport completely because it may be counter-productive due to the value users derive from their services. As observed by the UITP (2021), they are vital to urban life because they are available at any time and provide low fares.

In addition to this, UITP (2021) argues that different scenarios could lead to the emergence of informal transport services. They disclosed that informal transportation services emerge where there is the absence of clear public policy on public transport or where they exist but are not strictly implemented. They added that it could also take place in car-oriented cities, areas where sprawling is rapidly occurring, and where public transport is mainly provided by the private sector. This implies that different conditions can influence the growth of informal transportation.

2.2.4 The logic of survival and the informality of tricycle transportation in urban areas

The visibility of informality cuts across various spheres including transportation but there is a lack of consensus on the value and utility of informality and how to operationalize it (McFarlane, 2019). This is because some authors allude to informality as an urban blight (Davis, 2006). Evans et al. (2018) have indicated that bikes serve the hard-to-reach communities as well as the very low-, low- and middle-income neighbourhoods. Albeit,

tricycle transportation has both value and utility in terms of the invaluable service it provides to low-income groups and the unserved as accentuated by other researchers (Asafo-Adjei et al., 2017; Bradley, 2014; Tuffour & Appiagyei, 2014). Its value and utility are evident in how it meets the transportation deficits that the arm of government is too short to meet. As indicated by Kwakye and Fouracre (1998), Government leverages its cost of public transport provision by providing an enabling environment for the free market to operate within. In this scenario, governments making room for informal transportation should therefore be viewed from the complementarity role informal transport plays rather than as a blight (Lejano & Del Bianco, 2018). This raises concern for those who would have been left out and what the costs could have been on the economy in the absence of cheaper informal transport systems. Evans et al. (2018) therefore recommend that informal urban transport be made more visible in the transport discourse because of the manner in which it weaves the lives of urbanites.

Moreover, informality is amoral, it is neither good nor bad, but its outcomes could be classified as positive or negative (McFarlane, 2019). Informality is driven by the deprivation of certain social services like transportation, which is a reality in both rural and urban areas. These deprivations have further interlocking connections across different issues, socio-economic backgrounds and formal settings (Diaz Olvera et al., 2020). As shown in several studies (Asafo-Adjei et al., 2017; Doherty, 2020; Mbara, 2016; Nutsugbodo et al., 2018; Obeng-Odoom, 2017; Møller-Jensen, 2021; Obiri-Yeboah et al., 2021) transportation has deep connections with gender, age, education, incomes, and location. For example, according to the Ministry of Transport (2012), lack of transportation is one of the key reasons for people's unemployed status in Ghana. Azunre et al. (2021) have therefore averred that informality should be perceived as a productive concept because it has the potential to help achieve Ghana's sustainable city development goals. Thus, rather than criminalizing policies on informality, they should be more inclusive and pro-poor.

Further still, the informal sector is rich in creativity and knowledge. Tricycle operation has emerged in a state of broken and unreliable transportation systems and a lack of decent jobs for the teeming youth. Consequently, local innovations, agency and ingenuity of deprived urbanites could be appreciated as a solution or a response rather than a problem. According to De Soto (1990) and Satterthwaite and Mitlin (2013), informality is a creative reaction to urbanization. It could also be viewed as people with genuine transportation needs who have found a way to have it resolved without the financial commitments of the government. Interstices are easily recognizable by people in need; hence, informal transportation as niche-driven suggests an agency and the need to meet a deprivation. Dinye (2013) and Onyango (2018) have, for instance, made the case that the use of tricycles was an answer to narrow and inaccessible roads in their respective study areas. The concern, however, should be how these innovations could be blended into the general society without creating other problems. As advocated by De Soto (1990), both informal and formal solutions must be employed to address urban problems.

The informal transport sector, as discussed earlier, undoubtedly creates many job opportunities for a lot of people. Consequently, the tricycle comes across as an attempt to be resilient in an economically harsh urban environment. Obviously, without a source of income, it is difficult to withstand shocks and remain resilient in the process. For example, Obiri-Yeboah et al. (2021) found that tricycle operations employ several previously unemployed young males mostly from the northern parts of Ghana who have come to Kumasi in search of greener pastures. Recio et al. (2019) further recognize that transport hubs are economic spaces where many young people earn a living because they attract a lot of informal workers including vendors and transport operators.

This notwithstanding, the normativity of formality impinges on the free performance of the tricycle as an informal transport system. Similar to the concept of *self and other*, formal

transportation is often seen as the *self*, whereas informal transportation is seen as the *other*. As the *other*, it is often associated with pollution, deviant behaviour, and unwieldiness, and is generally unwanted (Cervero, 2000; Jack et al., 2021; Tuffour & Appiagyei, 2014). Meanwhile, times are changing and the pervasiveness of informality makes it the norm (Lejano & Del Bianco, 2018; McFarlane, 2012, 2019) as shown in how the tricycle has made waves and several contributions in countries such as Nigeria (Al-Hasan et al., 2015), Kenya (Onyango, 2018) and India (Mani et al., 2012; Mani & Pant, 2012).

There is also a blurred functionality regarding the use of tricycles as it is for informality and formality. Studies have often recounted the use of tricycles as gap fillers connecting users to other means of transport (Bradley, 2014; Cervero, 2000; Mbara, 2016). Moreover, tricycle operators contribute to formal systems in terms of tax payments, costs of registration and licensing. Albeit not so ideal, they also give security officers tips to absolve them of harassment (Jack et al., 2021). This literal interpretation of blurred functionality is indicative of the difficulty of identifying the point at which informal transportation makes up for the government's inability to provide adequate transportation and when it is being a menace. The main issue about formality and informality, however, is identity. According to Suryanto et al. (2020), self-organized groups have the capacity for collaboration in order to succeed. Thus, appropriate social development, urban planning, and design interventions can enable the informal economy to operate profitably and advantageously in urban environments.

Similarly, Doherty (2020) has echoed how the working environments of motorbike operators are shaped by the stage, the platform, and the municipal registry as institutions that shape operators. These institutions are themselves fluid and further influenced by overlapping contexts. In his view, these conceptualizations over the significance of the motorbike as a source of meaningful income, an avenue of transitioning into male adult life, capital for new businesses as well as other normative social obligations in Kampala's neoliberal moral

economy. He concluded that these concepts that shape the transport sector serve as the moral landscape upon which a policy or reform initiated by the government will be accepted or rejected. Recio et al. (2019) have also admitted that transport hubs attract a lot of informal workers, and allow unemployed young people to make a living. Thus, instead of removing vendors from these economic spaces completely, city planners should have a rethink on how the formal and the informal coproduces each other.

It is in light of these debates that Rekhviashvili and Sgibnev (2020) contend that informal transportation should be redefined to correspond with the growing literature on informality. According to them, while informality is being rethought in academic debates, informal transportation continues to receive negative connotations of being risky, environmentally unfriendly and associated with traffic congestion as well as posing health risks. They, therefore, questioned the dominant connection of informal transport with laissez-faire transport by unveiling the social dimension of informal transport and maintained that informality is not always about economic gains but can also be about culture and ways of living (Lejano & Del Bianco, 2018). Given all these debates, it is crucial to rebrand informal transportation to make it represent what it is to users, operators as well as the general public.

2.2.5 Exploring the roles, benefits and implications of tricycles on urban transportation

Mobility is a major tool for economic growth and development (Kaufmann, 2014). The rate of tricycle proliferation and acceptance among cross-sections of urban commuters in Ghana and some other African countries suggests the significance and utility derived from this vehicle by commuters, especially amidst widespread safety concerns. According to Cervero, (2000) and Ehebrecht, Heinrichs and Lenz (2018), tricycles as a form of informal transport have unique functions and meet the peculiar needs of users. This subsection highlights some of the roles and benefits of tricycle transport and what the implications are for urban transport.

A review of the literature on motor-taxis in SSA by Ehebrecht et al. (2018) indicated that tricycles are used for short-distance mobility and access to places like markets, social facilities, social gatherings, work and home. Serving as complementarity, it provides access to mobility options in rural areas as well as access to other transport modes in urban areas. According to Jittrapirom (2015), motorbike trips are shorter when compared to cars, the short trip time may explain why they are used to dodge traffic.

Cervero (2000) and Ehebrecht et al. (2018) further explain that the functions of these vehicles are often engrained in the local transport system in the sense that they serve the immediate community or local transport needs. For instance, they are used to cover distances that are too far to be made on foot and short enough to be profitably made by public transport. They are used for door-to-door travel services and used as a feeder in unserved settlements (Asafo-Adjei et al., 2017; Ehebrecht et al., 2018; Jack et al., 2021; Obiri-Yeboah et al., 2021). Other localized functions include the creation of jobs and the corresponding improvements in income levels even for spare part dealers and those who keep garages for tricycles and motorbikes (Dinye, 2013; Ehebrecht et al., 2018; Jack et al., 2021; Obiri-Yeboah et al., 2021; Owusu-Ansah et al., 2022).

Largely, specific studies regarding motor tricycles have revealed that motor tricycles are gap fillers as they serve as feeders to larger transportation services (Asafo-Adjei et al., 2017; Bradley, 2014; Mbara, 2016; Onyango, 2018). As gap fillers, they are described as being territorial in terms of sticking to particular routes or carving a niche for themselves due to the nature of their clientele (UITP, 2021). However, Cervero (2000) perceives the concept of gap fillers as a disadvantage because it narrowly defines the market of informal transport operators; describing them as picking the *leftover pieces* from metros and buses. While this may be entirely true, it is this niche that meets the need of poor urban commuters whose peculiar needs cannot be met by the bus system (Mbara, 2016; Rekhviashvili & Sgibnev, 2020).

Motor tricycles' flexibility in terms of routes, timing and fares is an additional advantage to unserved groups who would have been otherwise cut off (Asafo-Adjei et al., 2017; Bradley, 2014; Onyango, 2018; Tichagwa, 2016). Onyango (2018), in particular, has reported that the pocked, rutted and often narrow roads in Kisumu, Kenya, have necessitated the use of motorbikes and tricycles in the area; and Mbara (2016) has admitted that motor tricycles operate in the early and late hours when formal bus transport systems are not in operation. Afukaar et al. (2017) and Ehebrecht et al. (2018) recognized the significance of tricycles and motorbikes for the transportation of agricultural produce in poor road-networked rural areas.

Additionally, a much more recent study by Obiri-Yeboah et al. (2021) revealed that motor tricycles provide job opportunities to young male migrants in Kumasi, the second-largest city in Ghana. Although the operators may be young and may have license issues (Al-Hasan et al., 2015; Dapilah et al., 2017; Obiri-Yeboah et al., 2021), they cannot be described generally as unskilled as suggested by Cervero (2000). Because in the case of Dapilah et al. (2017), for instance, 47% of the operators had tertiary education and in the case of Al-Hasan et al. (2015), 62% had at least secondary education. In terms of job provision, Obiri-Yeboah et al. (2021) perceive their operation as sustainable and a way of enhancing urban transport inclusion. Moreover, a number of authors (Al-Hasan et al., 2015; Jack et al., 2021; Dapilla et al., 2017) agree with their proposition that the operations of tricycle drivers should be strictly regulated. Doherty (2020) has added that aside from incomes, young male adults take pride in working as motorcycle operators in a state of unacceptably high and persistent unemployment.

More so, tricycles have become attractive to urbanites mainly for their ability to penetrate and navigate through traffic (Obiri-Yeboah et al., 2021; Cervero, 2000; Onyango, 2018), which is a major challenge in most developing countries (Møller-Jensen, 2021; Tekolla et al., 2021). Although informal transportation offers a lower quality of service (Poku-Boansi, 2020), its low passenger capacity, as compared to a minibus, gives it the advantage to manoeuvre through

traffic to arrive on time. Furthermore, it takes less time to load and unload and makes limited stops (Cervero, 2000; Ehebrecht et al., 2018; Mani, 2012; Obiri-Yeboah et al., 2021) making it faster than other modes.

Safety is an unlikely benefit of the motor tricycle due to the perceived imbalance emanating from its three-wheels (Harding et al., 2016). Nonetheless, a synthesis of literature by Mani and Pant (2012) suggests that fatal accidents are quite unlikely due to the vehicle's light-weight and low speed. Reaffirming Mani and Pant (2012), Jittrapirom (2015) has further pointed out that motorbikes have a shorter trip speed than cars but he also stressed that the open nature of motorbikes exposes riders to more risk in the event of accidents than cars (Harding et al., 2016). Still on safety, Cervero (2000) has indicated that people feel safer in small vehicles than in bigger ones. Further, Ehebrecht et al. (2018), in their review, notated that motor tricycles provide secure travel at night as compared to the option of walking, supporting the finding of Mbara (2016) who observed that tricycles provide the last trips for night travellers.

On the contrary, a significant number of authors on tricycle operation have raised concerns about safety (Dinye, 2013; Jing et al., 2019; Jittrapirom, 2015; Obiri-Yeboah et al., 2021) as regards the environment, users, non-users and operators. Safety issues on the environment border around emission levels. Thus, Jittrapirom (2015), has for instance found that a motorcycle is more environmentally friendly than a car. Its low resource consumption at both production and operation levels, as well as less emission and pollution, makes it a better replacement for a car in the short term. The concern, however, is it could replace journeys that can be made by walking or using other non-motorized forms of transportation. Moreover, in the long term, the same value will be reached over continuous consumption and accumulated emissions and pollution. Even though electricity is an option that can reduce consumption and emission, this raises concerns about the finiteness of resources. The author described the motorbike as a *time-buying* measure to delay the negative effect of transportation on the

environment while measures are put in place to restore transportation sustainability. This validates other authors (Mani & Pant, 2012) who have emphasized the advantage of tricycles over cars in terms of emissions.

Although not in an attempt to dismiss safety concerns, Asafo-Adjei et al. (2017) have pointed to the fact that as a form of intermediate transportation, tricycles have the benefit of reducing labour costs and serving short-term accessibility and multiple transportation purposes. Nonetheless, easy entry and non-functioning rules on crash helmets amidst poor licensing lead to high incidents of cycle accidents (Sebiawu et al., 2014). And these may serve as deterrents for non-users to some extent (Tuffour & Appiagyei, 2014) as well as entrench the already existing fear and misconceptions held by segments of society. Due to inequalities and low incomes, urban commuters need affordable transport (Obeng-Odoom, 2017).

According to Mani and Pant (2012), the tricycle charges the same fare or a cheaper fare than the bus. Many authors (Jing et al., 2019; Jittrapirom, 2015; Oteng-Ababio & Agyemang, 2015) have stressed affordability as one of the strengths of the tricycle for which they are patronized. This means that coupled with the other benefits of timesaving and speed of reaching their destination, the motor tricycle comes across as the most expedient option for commuters with low incomes or who are in a haste to reach their destinations.

Jittrapirom (2015) has further explained that because it is easy to acquire and operate, ease of entry serves as motivation to enter into a motorized mobility lifestyle. Evans et al. (2018) have admitted that ridership is a popular entry-level job for many of Kampala's young males because the bikes are cheap and easy to acquire. Associated with this is the fact that motorbikes can be parked close to the origin and the destination of a trip and notably requires a small space for parking. In his view, this could make users more inclined to motorized mobility and hence are

more likely to continue to acquire more sophisticated means of transport. This is a condition Knoflach (2013) as cited in (Jittrapirom (2015) terms *Virus Auto*.

While Mani and Pant (2012) admit that tricycles are comfortable, always available and provide access where the bus does not, Harding et al. (2016) have noted that the hard interior nature of the tricycle makes it unsafe and less comfortable for passengers, especially on rugged roads. Moreover, Ehebrecht et al. (2018) have iterated that motorbikes and motor tricycles provide access to remote and underserved areas. Additionally, empirical studies by Onyango (2018), Bradley (2014) and (Dinye, 2013) have similarly suggested that tricycles provide access to unserved areas where the roads are not easily accessible by buses. In the perspective of Onyango (2018), the tricycle is hailed for its ability to swerve traffic and travel on poked and rutted roads in Kisumu, Kenya.

2.2.6 A review of the institutional and policy environment of transportation in Ghana with a focus on tricycle transportation

This subsection expounds on the policy and institutional background of transportation in Ghana with an emphasis on tricycle transportation. The government institutions in charge of transportation in Ghana include the Ministry of Transport (MoT) established in 2009 (Ministry of Transport, 2021a) and the Ministry of Roads and Highways (MRH). The MoT has four directorates that carry out its mandate, namely Policy and Planning; Monitoring and Evaluation; Research, Statistics and Information Management; and Finance and Administration. The ministry also works directly with two agencies, namely Road Transport Services and Maritime. The DVLA and the National Road Safety Authority (NRSA) are both subsidiaries under Road Transport Services. Both agencies were established by Acts of parliament. While the former was established by the DVLA Act 569 of 1999 to ensure good driving standards in Ghana, the latter was established by the National Road Safety Commission

(NRSC) Act 567 of 1999 and was charged with the mandate to ensure the planning, development and coordination of policies concerning road safety (Ministry of Transport, 2021b). However, the NRSC was elevated into an Authority by Act 993 of Parliament in 2019 with added vested power to promote and give policy advice on road safety in Ghana.

The MoT, among other things, hopes to build a transport system that meets the needs of users in terms of accessibility, affordability, reliability, efficiency and effectiveness. It also hopes that this kind of transportation will incorporate development planning, transport planning and appropriate land use to proffer quality transport services. Above all, it is their goal to ensure sustainable transportation through adequate human resources and technology. Their policies include the provision, expansion and maintenance of infrastructure and transportation services in a safe, reliable, accessible, efficient and effective manner to make Ghana a leader in transport services in the sub-region. As part of its policy mandates, it reviews, develops and strengthens the frameworks that ensure an efficient transport system legally and environmentally. Its functions combine the integrated efforts and roles of the NRSA, DVLA and other transport agencies (Ministry of Transport, 2021a). In essence, all vehicles, including motorbikes and motor tricycles for example, are tested and licenced by the DVLA which ensures appropriate testing of drivers and vehicles before licensing and registration.

The MRH is the government institution responsible for the construction of roads in Ghana. MRH exists to offer an integrated, efficient, cost-effective, and long-term road transportation system that is responsive to societal requirements, supports growth and poverty reduction, and is capable of establishing and maintaining Ghana as a West African transportation hub. Policy formulation, monitoring, evaluation and coordination in the road infrastructure sector, development and maintenance of road infrastructure, and improving road safety environment are some of the key functions of the MRH (MRH, 2018). These functions overlap with the mandates and responsibilities of other ministries and government agencies responsible for

transportation issues in the country. These intersections suggest areas of building partnerships and strong monitoring and evaluation systems in practice, not theoretically. The essence is to ensure coordination since the goals of all these institutions and agencies are related.

Laws and policies that govern the use of vehicles and driving in Ghana include the Road Traffic Act (Act 683) passed in 2004 and the Road Traffic Regulation LI 2180. Of these, the most critical to this study is the LI 2180 because it is the most recent, even though both restrict the commercial use of motorbikes and tricycles. LI 2180 rendered the commercial use of motorcycles and motor tricycles a criminal act punishable by law specifically in regulation 128 clauses (1), (2) and (3).

Yet there is mixed public opinion about LI 2180 (Ayisi, 2019; Tuffour & Appiagyei, 2014). Accordingly, parties that have supported the promulgation of LI 2180 include non-governmental organizations, the District Assemblies (Local Government), GPS-MTTD and NRSC. Their concerns bordered around issues of safety. Those who oppose it are mainly the beneficiaries of the *Okada* transport service and the operators (Oteng-Ababio & Agyemang, 2015) and their justifications centre on livelihoods and rising unemployment in the country (Myjoyonline, 2020). Thus, Oteng-Ababio and Agyemang (2015) further noted that the LI 2180 failed to suggest alternative jobs if the law was enforced and all the young people who were involved in this business became unemployed.

As envisaged by Oteng-Ababio and Agyemang (2015), LI 2180 remains on the shelf while the use of motorbikes and tricycles continues and keeps thriving as more tricycles are registered each year by the DVLA (DVLA, 2022). This is because public opinion on this issue is still being shaped as it continues to generate heated debates among operators, lawmakers and cross-sections of the general public. Above all, it has been greatly influenced by politics and political campaigns as well as humanitarian undertones (Dogbe, 2020).

Consequently, Oteng-Ababio and Agyemang (2015) have proffered that instead of seeking for symptoms of what is a policy failure, they recommended a participatory framework based on open communication among a wide range of stakeholders. They further called for a rethinking of the transportation sector's difficulties as part of the city's overall system failure; suggesting that the problem is not entirely with poor and inadequate transportation infrastructure but also the inability to connect urbanites to different but complementary land uses (Litman, 2012). Thus, for the city to perform its role of providing decent jobs and connecting other centres of production greater efforts must be made to ensure integration.

In this light, the Parliament of Ghana has been beseeched to review the law by the minority chief whip of parliament, accentuating the economic benefits of the activity as well as the likely problems the law could create if it is enforced (Parliament of Ghana, 2019). Sections of the general public have likewise requested a review of the law on the grounds of sustainable livelihoods and benefits of the service to users for whom no alternatives were provided (Oteng-Ababio & Agyemang, 2015). As reported by the Daily Graphic on 24th June 2013, residents of Sogakope in the Volta Region staged a protest on the LI 2180, claiming that the *okada* was their primary form of transportation.

It is worth noting that the MoT has begun reviewing the Road Traffic Regulation 2012. It has already done regional discussions as part of the review process to elicit opinions on the commercial use of motorbikes and tricycles. The goal is to have nationwide consultations on proposed legislative changes (Ministry of Finance, 2020).

There is also the Ghana Police Service - Motor Traffic and Transport Department (GPS-MTTD) which is an operational department of the Ghana Police Service established in 1952 with a mandate to enforce traffic regulations. This mandate was however reviewed by the Road Traffic Regulation Act of 2012. Generally, they assist and control traffic and vehicle

compliance by enforcing regulations on insurance, registration, and driver's license requirements. They also arrest and impound drivers and vehicles that do not meet road traffic regulations. All these are meant to prevent road accidents. But when accidents happen, together with other emergency stakeholders like fire and ambulance services, they assist in the management of accident scenes, respond to the injured and recover the dead to the nearest morgue. Additionally, GPS-MTTD proceeds to Motor Courts for peaceful resolution of issues and shares outcomes with NRSA and other stakeholders as well as information on causes of accidents and how they can be prevented. It further organizes stakeholder meetings annually and quarterly while internally building capacity to deliver quality service to road users. It also clears roads for traffic flow, and since 1992, has been doing a post-crash analysis and behaviour of drivers in traffic.

Other institutions and agencies that ensure road safety in Ghana include the following; National Road Safety Authority (NRSA), Driver and Vehicle Licensing Authority (DVLA), Ministry of Road and Highways (MRH), Ministry of Transport (MOT), Ministry of Health (MOH), Transport Associations like Ghana Private Road Transport Union (GPRTU) and Progressive Transport Owners' Association (PROTOA), Ghana National Fire Service (GNFS) and National Ambulance Service (Ghana Police Service, 2017).

2.2.7 Is it a wave or a new space? Lessons from India and Other African Countries

Tricycle transportation has become a common means of transport in India and many African countries. In Lome, Togo, for instance, it is the most common means of transport to workplaces (Diaz Olvera et al., 2020), while in India it is considered one of the main low-capacity public transport systems (Gadepalli et al., 2020; Kumar et al., 2016). Diaz Olvera et al. (2020) have explained that the proliferation of tricycles in the city of Lome can be attributed to reluctant public governance, structural interdependence, and the fusion between the formal and informal.

In many instances, it is used because it is cheap and readily available (Harding et al., 2016; Mani, 2012; Mani et al., 2012). However, Oteng-Ababio and Agyemang (2015) have attributed the Ghanaian wave to a myriad of factors including poor transport regulations and infrastructure.

In Nigeria, the federal government promoted the use of tricycles actively. In the middle of the 2000s, a program to end poverty had given 1500 motorized tricycles, but these were increasingly supplemented or replaced by commercial two-wheelers (Agheyisi, 2021; Ehebrecht et al., 2018; Obakemi, 2021). In South Africa, Johannesburg, riders are trained and given a license to operate (Mbara, 2016).

India's urban transportation systems heavily rely on and are vibrant with auto rickshaws. However, they also represent a very improvised and inefficient sector that is being lost in India's shifting urban mobility dynamics. It accounts for a sizable portion of motorized travel in major Indian cities. Specifically, 10 and 20% of daily passenger trips taken on motorized road transport modes were served by auto-rickshaws, which have contributed immensely to the ambience pollution in Indian cities (Mani et al., 2012).

Albeit in recent times, as motorbikes face harsh government directives (Ezeibe et al., 2017) and are being banned, tricycles are proliferating (Agheyisi, 2021; Tuffour & Appiagyei, 2014). In Kisumu, Onyango (2018) observed that the tuk-tuk has enormous potential as the greatest means of providing accessible, secure, and flexible public transport in poor locations. According to Agheyisi (2021), the proliferation of tricycles is a response to a void the banning of motorbikes would have created in terms of meeting the transport and financial needs of a cross-section of the people of Benin city. It appears that tricycles are replacing the officially illegal motorized two-wheelers in the city of Aba (Ehebrecht et al., 2018).

It also appears that electric vehicles have a lot of potential for the development of sustainable transportation (Borén et al., 2017). Thus, there seems to be a shift from 4-stroke manual-propelled engines to electric engines. In a study conducted in Kigali, Nairobi, Kisumu and Dar es Salaam, Galuszka et al. (2021) observed that e-mobility is making its way into these cities. However, despite intense work on policies to navigate this transition, there still exist some technical, infrastructural and financial hurdles that need to be surmounted in order to succeed with this shift. With this trend, it can be anticipated that eventually tricycles could be recognized and rightly treated for what they are; serving poverty enclaves as feeders to larger transport networks.

Diaz Olvera et al. (2020) recognize both the invaluable services and nuisance of tricycles, but according to Mani et al. (2012), the best chance to reduce particulate matter¹⁰ (PM₁₀) emissions from auto-rickshaws is to switch from two-stroke to four-stroke engines. Regarding fuels, alternative fuels like compressed natural gas (CNG) and liquefied petroleum gas (LPG) can be used instead of gasoline. However, the ultimate is to eventually replace the four-stroke with electric vehicles. The largest benefit of electric vehicles is the absence of tailpipe emissions, which can enhance the quality of the air in cities (Mani et al., 2012).

Tricycles have morphed from two-stroke engines to four-stroke engines and in recent times, India has adopted electric rickshaws. According to Priye and Manoj (2020), due to its adaptable service and accessibility, the electric rickshaw, a battery-powered, three-wheeled paratransit, has grown in popularity in Indian cities. It is an energy- and environmentally friendly method of paratransit transportation. It has therefore been legalized and given speed limits amidst other challenges (Priye & Manoj, 2020).

Furthermore, the incorporation of Information and Communication Technology (ICT) into the tricycle business has made it more efficient and accessible. For example, riders in Kampala,

Uganda have the option of operating from a stage or from a platform. Thus, the fusion of ICT into tricycle transport provides safer platforms for riders to operate and reach more people using ride-sharing mobile applications (Doherty, 2020). During the peak of COVID 19, tricycles were used to supplement ambulance services in India (Abidi, 2021). These transitions and transformations question whether trikes will also be banned like motorbikes or enhanced at some point (Diaz Olvera et al., 2020).

2.3 Determinants of mode adoption: Modelling mode choice

Commuters employ different modes to achieve their transportation needs (Wood, 2021). Therefore, mode selection is a function of a plethora of known and unknown factors based on certain antecedents of transportation sometimes referred to as transportation attributes, which are ordered after the theory of human motivation (Davidov, 2003; Kumar & Ganguly, 2018; Neely, 2016). Nutsugbodo et al. (2018) refer to them as the antecedents or the psychographic factors in the travel decision-making process. Other factors relating to the personal or demographic features of commuters as well as the environmental characteristics profoundly influence mode choice (Abane, 2011; Alfonzo, 2005; Kandt, 2018).

In line with this, Alfonzo (2005) and Nutsugbodo et al. (2018) defined feasibility as a mode that is suitable for a particular trip/journey; accessibility as the availability of the preferred mode; and safety as the physical conditions of the mode choice. Comfort was defined to comprise ease, convenience and contentment with the mode of transport while pleasurability was a form of enjoyment of the trip and seen as a higher level of comfort.

Transportation planning plays a key part in addressing the issues of sustainability, which is a topic that cuts across disciplines. Consequently, a sustainable design paradigm is not only the best from a technical standpoint but is also supported by stakeholders and policymakers and is

fair and inclusive (Carteni et al., 2020). Above all, it is important to consider spatial relationships as well as how land use factors, which also depend on economic and demographic factors, affect trip attractions and generations. That is, by evaluating mobility patterns and related processes that are influenced by systemic interactions between the transport system and land use, a premise that any intervention in a city must be based on a thorough understanding of the urban entity can be established (Alfonzo, 2005; Barceló, 2019). These individual and environmental characteristics are elaborated in the ensuing sub-sections.

2.3.1 Users' demographic features as determinants of mode choice

As acknowledged by several studies (Dike, 2012; Kandt, 2018; Neely, 2016; Nutsugbodo et al., 2018), the effect of biographic characteristics such as age, education, gender, occupation and level of income cannot be dismissed in conceptualizing mode choice. Nutsugbodo et al. (2018), for example, found that gender, age, income, education, occupation, and the continent of origin had a substantial impact on travellers' choice of public transport modes. These demonstrate the complex interconnections that exist between individual socio-demographics and mode preferences. Kandt's (2018) study, on the other hand, specifically found that aside from sociodemographic features such as gender and social status, car ownership and geographical location were consistent determinants of mode choice. Similarly, Poku-Boansi and Adarkwa (2014) stated that employment status, trip duration and population are significant factors in determining travel behaviour in Kumasi where taxis seem to be the dominant and fastest mode while buses are the least patronized with the longest travel time.

The compelling presence of gender as an influencing factor in transportation and mode choice cannot be ignored. As indicated by Jittrapirom (2015), females travel less by motorbikes with riders riding slower and travelling shorter distances than their male counterparts. Neely (2016) also revealed differences in travel behaviour between men and women. According to his

submission, males generally travelled for business purposes, and more females than males preferred rail for business travels, while more males than females preferred airlines for business journeys.

Furthermore, Kandt (2018) found that males, younger travellers and more educated people tend to have longer trips than females, older people and individuals with access to cars. Regarding gender, Kandt (2018) found that male tourists who choose motorbikes over buses and taxis are significantly higher than females; and for all work and non-work trips, males are more likely to use a car and formal public transport while females tend to walk and use informal and paratransit modes (Kandt, 2018). Hasan (2013), in his study on unjust mobilities, found that women and non-car owners among other marginalized groups like the aged and the sick were the most affected following the banning and restrictions of rickshaw operations in Dhaka.

Mode selection is also influenced by income levels. It has been discovered by Jittrapirom (2015) that a large proportion of income is spent on transportation and that the location of one's residence and one's income level are important determinants in mode selection. In a different dimension, income was discovered to be a distinguishing factor in mode preference, with high preferences for buses being detected when income rises, compared to motorcycles, taxis, and *trotros* (Nutsugbodo et al., 2018). On the contrary, a study by Abane (2011) suggests that rather than the often complained about transportation fares, it is the cost of food, child-rearing costs and entertainment that consume disproportionate amounts of commuters' income. Jittrapirom (2015) further pointed out that participants who lived in the municipality as well as those from low-income households preferred the tricycle more than any other category of participants. Further, as confirmed by Kandt's (2018) study, the regular use of tricycles in the municipality can be ascribed to the unattractiveness of walking due to congestion. He further explained this tendency by stating that particular means of transportation are more convenient depending on a commuter's location. Thus, although the bus services are inefficient, Kandt (2018) claims that

some Paulistanos used them because they had limited options. This are in contrast to Aslam et al. (2019) who found house ownership as a stronger determinant.

Regarding education, Amoh-Gyimah and Aidoo (2013) found that the majority of respondents for all levels except postgraduate used public transport to work. This can be attributed to the fact that people with postgraduate degrees may occupy managerial positions or may have high-paying jobs that can help them acquire their personal means if the job does not come with an official vehicle. Additionally, tourists' preferred mode of transportation was influenced by their educational level. When compared to postgraduates, high school graduates preferred buses over motorcycles, but those with bachelor's degrees preferred taxis when they arrived at their destination (Nutsugbodo et al., 2018).

In terms of age, Kandt (2018) has it that older travellers preferred to drive or walk rather than take public transport and they preferred to take paratransit instead of driving on non-work journeys. Older people of beyond 55 years were less likely to use public transport in Amoh-Gyimah and Aidoo's (2013) study because according to the authors, they may have saved enough or gotten better jobs that increase their chances of purchasing their vehicles. This kind of situation has further been explained as a way of avoiding competition with younger people due to old people's inability to cope with rush hour difficulties (Agyemang, 2017).

2.3.2 Generic and latent transportation attributes

Generic attributes such as accessibility, comfort/convenience, cost, trip duration and reliability are some of the reasons for mode choice (Nutsugbodo et al., 2018; Poku-Boansi & Adarkwa, 2014). Kumar and Ganguly (2018) have further opined that the major attributes most researched include fare (affordability), safety, reliability, comfort and travel time. However,

the transportation fare is weighted above all in developing countries, while in developed countries, safety and reliability are the most considered.

Abane's (2011) study suggests that mode choice is influenced by the assumption of lower cost and greater accessibility of modes. For example, 46.5% and 43.5% of male and female respondents, respectively, cited affordability as the major factor in deciding on their preferred modes of transportation for their journeys, while availability drew 15% and 17% of male and female respondents, respectively. Therefore, reliability of service and safety concerns were the least factors considered in mode selection because that was in God's domain (Konkor et al., 2019). When the data was fragmented by sex, the results remained nearly identical. Although these findings follow the theory of human motivation, the author did not explicitly acknowledge its usage.

Further, Nutsugbodo et al. (2018) similarly found that tourists who expressed a strong preference for the *trotro* were more likely to attribute their preference to affordability, whereas those who preferred buses attributed their preference to comfort/convenience, reliability, and accessibility. *Trotros* and taxis were still the most popular modes of transportation, as had been indicated in earlier studies, mainly because the *trotro* particularly offers lower fares (Abane, 2011). Dike (2012) created a choice model where commuters' preferences between taxi, bus, and tricycles, as well as how tricycles are perceived in Nigeria were examined. He discovered that the most essential criterion for tricycle riders was frequency (accessibility), and the least important consideration was safety. This was, however, not the case with bus riders, who prioritized safety above all else, with frequency coming in last. Furthermore, those who favoured taxis prioritized comfort over frequency (Dike, 2012).

Likewise, Nutsugbodo et al. (2018) found affordability, accessibility, and reliability as key determinants of public transport adoption. Furthermore, according to their findings, certain

tourists preferred the bus over the motorbike by a factor of 1.371 because of its reliability. The results give substantial support for the conclusions Kumar and Ganguly (2018) made.

Additionally, there are other factors that may influence mode selection that are neither based on personal characteristics (demographics), the psychographic features of the vehicle and the pertaining transport need of the commuter. These are attributable to latent attitudinal elements and non-rational decisions that influence decision-making (Davidov, 2003; Kumar & Ganguly, 2018; Neely, 2016). Nutsugbodo et al. (2018) found that commuters often made choices based on these factors, giving an example that safety-conscious tourists chose modes with safety in mind.

According to Neely (2016), mode selection is not always as a result of rational reasoning. Consequently, the author incorporated attitudinal variables into a discrete choice model by using factor analysis to prepare a set of six latent factors that symbolize attitudes that influence transportation in an attempt to compensate for non-rational decisions that people make regarding mode choice. These included dependence on automobiles; preference for automobiles; personal ability to organize long-distance bus or train trips; personal space and safety on public transport; and social network attitudes on various forms of long-distance intercity travel.

Inefficiencies/challenges in other transportation networks could also trigger the selection of another type of mode (Kandt, 2018; Oteng-Ababio & Agyemang, 2015). These may not have direct connection with the commuter's or vehicle's characteristics.

2.3.3 Characteristics of physical environment

Geographical context or location and structure of the urban area influence mode choice (Amoh-Gyimah & Aidoo, 2013; Aslam et al., 2019; Fillone & Mateo-Babiano, 2018; Jittrapirom, 2015;

Kandt, 2018). Frequency of usage, coupled with the immediate availability of modes, are influencing factors of mode choice. According to Abane (2011), people of metropolitan regions favoured the modes that were more often used in their vicinity and confirmed this by the observation that *trotros* were not present in the Tamale data. Thus, for almost all of the journeys studied, commuters used taxis, motorcycles, and bicycles, or depended on business cars. This suggests that commuters prefer modes they know and are familiar with.

The nature of the settlement as regards sprawling and sparsely populated communities also influences mode choice. Abane (2011) further discovered that the four metropolitan regions in the study had grown fast in the recent two to three decades, such that some of the suburbs were located a fair distance from the city centres, resulting in expensive trip prices. Even though travel decisions sometimes depend on monetary resources (Fillone & Mateo-Babiano, 2018), Abane (2011) has observed that transportation fares constitute a small proportion of income and that other household expenses such as food constitute more.

The urban structure influences travel behaviour as well. People in compact cities who live in close neighbourhoods prefer to walk rather than take public transport. The reason for this is that job centres and utilities are close by (Aslam et al., 2019; Fillone & Mateo-Babiano, 2018). Thus according to Kandt (2018), people who live in densely populated places are more inclined to walk since shorter trip durations boost the desire to walk. He speculated, however, that the difficulty of walking in congested cities may lessen the desire to walk, as in Mumbai, where traffic congestion makes walking unpleasant and small vehicles such as tricycles are ideal for avoiding traffic. Fillone and Mateo-Babiano (2018) discovered that the nature of Manila's Ermita District as a compact urban neighbourhood determines why residents rely on walking or bicycle rickshaws. Thus, smaller cities, according to Aslam et al. (2019), are more compact and therefore walkable since jobs are generally within walking distance. In effect, because residential areas constitute the origin of commuting, population and housing operate as the

generators of movements. The urban spatial structure reflects the great range of incomes, living conditions, desires, and ethnicities that exist (Barceló, 2019).

All these together constitute the reason for a choice of mode; but the reason is not always apparent at an instance of making a choice because some of these processes have long taken place and may be renewed with fresh information or situations (Kumar & Ganguly, 2018). However, the choice must meet some sustainability standards (Borén et al., 2017; Carteni et al., 2020).

2.4 The concept of sustainable transportation

Transportation is a great asset providing access to various destinations and, particularly, a major driver of sustainable development (Barceló, 2019). Unarguably, transportation and land use are mutually interactive, shaping each other in the process (Kaufmann, 2014; UN-DESA, 2016; Loo & Tsoi, 2018; Barceló, 2018). However, a bifurcation arises out of the challenges it poses regarding shortfalls in transportation infrastructural developments as well as its externalities (Deakin, 2019; Smit, 2018; Loo & Tsoi, 2018). Barceló (2018) has, for example, indicated that better access to goods and services increases the social and economic gains of a city and that the application of information and communication technology could reap enormous benefits in terms of trips to be made.

Transportation is receiving a lot of attention in development discourse due to its close association with sustainability and the role it plays in the achievement of the SDGs, especially those related to human settlements, economic growth, cities, energy, and infrastructure (UN-DESA, 2016). Moreover, transportation is key to global, regional, and local integration with far-reaching economic, social, and economic ramifications (UN-DESA, 2021). Above all, transportation is a major energy-consuming sector worldwide, being the highest or the second

highest in most countries (Sustainable Mobility for All, 2019). In Ghana, transportation is the second largest energy-consuming sector using up to 2957.9 (Ktoe) of energy as at 2019 (Ghana Energy Commission, 2020).

With transportation being a major source of environmental and noise pollution as well as a cause of death globally (Ayetor et al., 2020; Sustainable Mobility for All, 2019), sustainable transportation cannot be achieved without making several trade-offs (Litman, 2019; Loo & Tsoi, 2018). It must also be noted that there is no universally accepted definition for sustainability and by extension, sustainable transportation. However it is not considered a challenge because multiple definitions are required to unravel the complexity of the sustainability concept (Missimer et al., 2017). The Brundtland Report of 1987 provided a definition that has become seminal and largely a point of reference to many authors on this subject. They defined sustainability as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development (WCED), 1987).

In terms of sustainable transportation, the High-Level Advisory Group of the United Nations has provided a comprehensive definition as part of promoting sustainable cities and a way of streamlining transportation for sustainable development. They defined sustainable transport as “the provision of services and infrastructure for the mobility of people and goods—advancing economic and social development to benefit today’s and future generations—in a manner that is safe, affordable, accessible, efficient, and resilient while minimizing carbon and other emissions and environmental impacts” (UN-DESA, 2016). Additionally, Sustainable Mobility for All (2019) has canonized that sustainable transportation should focus on universal accessibility, efficiency, safety, and green mobility.

To Barceló (2018), there are nodes for international, regional, and local transportation. Urban systems and their hinterlands define regional scales of transportation. The nodes at the local level are composed of hubs of economic, labour, and commercial activity. Traffic flows and their distributions define the linkages, which are configured by road networks and public transport systems. Urban mobility is therefore a means to a goal, namely accessibility; people must travel to destinations in order to meet their requirements and get to the places where activities are taking place.

Furthermore, in perceiving sustainable transportation from a comprehensive and inclusive perspective, Loo and Tsoi (2018) used the "five transformations" theory to disconnect negative transport externalities as an attempt to resolve sustainability issues that lie ahead. The theory involves addressing issues about community, economy, vehicle technology, modal-split, and lifestyle to promote sustainable transportation by emphasizing how to formulate a comprehensive set of policy instruments on multiple spatial scales. Apart from land-use and sustainable transportation planning, their study also stressed the value of using both people-oriented and place-based approaches to promote healthier travel choices and by extension, more bottom-up approaches that consider consumers' preferences and discuss the root causes of realized travel activity.

In a more generic sense, and with emphasis on the social dimension of sustainability, Missimer et al. (2017) developed a framework of five social sustainability principles that can be applied to various social systems including transportation. The five principles suggest that social systems can be sustainable when it does not incur negative health implications, and structural obstacles in the forms of power (political) and norms (cultural) do not serve as hindrances in the achievement of influence, competence, impartial treatment and meaning making. In their view, sustainability is recognizing unsustainable activities and ending their perpetuation through the setting of boundaries to restrain from slipping into the old path; thus, the principles

need to be adhered to in order to avoid the continuous erosion of individual and collective well-being of society (Missimer et al., 2017).

In line with all the definitions above, the European Commission (2011) has surmised sustainable transportation as one that “meets society’s economic, social, and environmental needs whilst minimizing its undesirable impacts on the economy, society, and the environment”, suggesting that current transportation needs should be met but not at the expense of posterity. In meeting current needs, the Brundtland Report of 1987 places emphasis on the essential needs of poor people and the finiteness of resources (WCED, 1987). In effect, a sustainable transport system should be one that “provides for safe, economically viable, and socially acceptable access to people, places, goods, and services” Kanof (2009) as cited in Eskandarpour et al. (2019).

Undoubtedly, transportation has significance for quality of life and opportunities for improving it. This is because a person’s social and economic inclusion is a factor of their ability to be mobile (Kaufmann, 2014; UN-DESA, 2016). Consequently, the focus on sustainable transportation has triggered a transposition from individual-based motorized transport to collective access with particular attention on poverty reduction and general quality of life (UN-DESA, 2021). It is important to recognize that transportation needs in Africa keep growing but many continue to lack access due to poor planning and infrastructural deficits in transportation networks. Sustainable transportation emphasizes how these needs can be met currently without compromising the ability of future generations to meet their needs.

Sustainable transportation also raises concerns about who gains access to transportation and at what cost. Moreover, meeting transportation needs has gains for food security and other well-being issues (Sustainable Mobility for All, 2019). Thus, in measuring sustainable transportation from users’ perspective, the key concepts for consideration are low-income people, inclusion,

safety, accessibility, efficiency and resilience. In this study, however, sustainable transportation is conceptualized as any mode of transportation that encourages shared use and is cost-effective for all while still being environmentally friendly, physically safe, and accessible.

2.4.1 Tricycles as sustainable transport

Governments' efforts towards transportation infrastructural development are evident but the same cannot be said about sustainable transportation. Moreover, the sustainability studies regarding tricycles have been piecemeal and selective in that a lot of studies have looked at the economic sustainability and safety dimensions (Dinye, 2013; Jack et al., 2021; Jing et al., 2019; Obiri-Yeboah et al., 2021) without incorporating the environmental aspect. Most importantly, these studies have not studied the subject matter using the tenets of transport sustainability as described by experts in the field (Borén et al., 2017; Litman, 2019; Missimer et al., 2017; Sustainable Mobility for All, 2019).

This does not auger well for policy formulation and decision-making on tricycle transportation considering its ubiquitous nature (Annang, 2018; Obiri-Yeboah et al., 2021); the debates surrounding its legality (Jack et al., 2021; Oteng-Ababio & Agyemang, 2015; Tuffour & Appiagyei, 2014) and the general implications it has for all (Dinye, 2013; Obiri-Yeboah et al., 2021). For Barceló (2018), sustainability is a complex system that keeps changing. It should therefore not be treated in isolation but rather approached holistically to proffer more lasting results. As Tuffour and Appiagyei (2014) indicated, some non-users declared their unwillingness to use the tricycle even after legalization. Thus, a complete perception assessment of the sustainability of tricycle transportation can potentially arrest the worries and fears of non-users and the general public by projecting some of the social benefits that inure to users. Moreover due to the intricacies regarding motor transport safety, environmental safety

and livelihoods, Oteng-Ababio and Agyemang (2015) have called for a participative evaluation of LI 2180 in Ghana.

Often, researchers show more interest in economic sustainability due to the tricycle's employment avenue for operators. Similarly, cheap transportation becomes a desirable social sustainability aspect because it is affordable to most people. Enhanced mobility or efficient transportation is crucial to sustainable development; hence, the ability of the tricycle to beat traffic has been well articulated (Dinye, 2013; Jack et al., 2021; Obiri-Yeboah et al., 2021).

A more comprehensive study was conducted by Jittrapirom (2015) with the aim of identifying a long-term solution to Chiang Mai's transportation issues. The researcher examined the environmental implications of motorbikes and shared taxi trips to determine which choice was more environmentally friendly. Even though the study was conducted on motorcycles, its conclusions are pertinent to this study because it is a type of informal and intermediary transportation and, more importantly, it is concerned with sustainable mobility in a densely populated metropolis. They concluded that on the average, motorcycles polluted less but pollution will increase with increased number of motorbikes.

2.4.2 Challenges associated with tricycles as sustainable means of urban public transport

The benefits of transportation in modern society are immense; nonetheless, its externalities are evident and consequential. In the same vein, tricycles may offer invaluable services to segments of society in varied ways, but their disadvantages cannot be ruled out. Researchers have outlined different challenges pertaining to users, other road users, authorities, and society in general with respect to the use of tricycles as public transport.

As a form of transportation, tricycles are affected by generic transportation issues. Al-Hasan et al. (2015) broadly outlined some challenges that generally affect urban transportation including congestion caused by route inadequacy and increasing use of personal mobility; transportation planning without data and inarticulate policy formulations; inadequate transport infrastructures and lack of considerations for equity; and development of a pro-poor and gender-sensitive transport scheme. On tricycles and specifically with regard to drivers, Dike (2012) identified some challenges as well. They include operators' lack of traffic training, lack of control, inadequate licensing, reckless driving, high levels of risk on highways and exposure to the elements of the weather. Although safety presents a challenge with tricycle operators, Onyango (2018) defends this notion and makes the case that, unlike motorbikes, tricycles are more stable with their three wheels, provide shelter from the elements of weather and therefore appear safer. Furthermore, inditing from a more participatory policy formulation perspective, Oteng-Ababio and Agyemang (2015) acknowledged compromised public safety, traffic congestion and growing environmental pollution as some of the problems regarding operation of Okada, another intermediary means of transport popular in Accra and across Ghana.

Other safety issues often raised by scholars include reckless driving, poor maintenance and inadequate licencing (Dinye, 2013; Jack et al., 2021; Obiri-Yeboah et al., 2021; Tuffour & Appiagyei, 2014). For example, inadequate licensing is a challenge emphasized by Obiri-Yeboah et al. (2021) and Jack et al. (2021) among tricycle operators. While the former perceives it as a general licensing problem among informal transport operators, the latter ascribes it to registration bureaucracy. Albeit, licensed drivers are less likely to get involved in road accidents (Sebiawu et al., 2014), many others believe safety on the road is a provision to be made by God (Konkor et al., 2019). Still, on safety, Ehebrecht et al. (2018) and Tuffour and Appiagyei (2014) have observed that motorbikes and tricycles are purportedly used in criminal activities.

Additional challenges include overcharging by operators, traffic congestion and poor parking as identified by Jack et al. (2021). Although, some of the drivers are known for violence and use of abusive language, careless driving and breaking of traffic rules (Ehebrecht et al., 2018), extortion from law enforcement agents is equally challenging for operators (Jack et al., 2021).

Environmental pollution is a major source of bifurcation regarding the commercial use of tricycles. Melo and Baptista (2017) in their study alluded to the fact that light electric commercial vehicles, which include three-wheelers, were efficient in terms of energy consumption. They found that these light vehicles are a viable option and could help with the achievement of better environmental and social objectives while maintaining the same level of operational and traffic performance on logistics in cities. In line with Melo and Baptista (2017), Mani and Pant (2012) admit that motor tricycles emit pollutants into the atmosphere but that newly improved versions emit less. Harding et al. (2016), on the other end of the spectrum, believe that auto-rickshaws contribute heavily to pollution in Indian cities. Balaria et al. (2017) have recommended a shift from 4-stroke engine-propelled trikes to electronic trikes for more efficiency and environmental sustainability. To improve its efficiency, Chidiebere et al. (2014) have also researched the efficiency of tricycles focusing on the body of the vehicle.

2.5 The theoretical underpinning of the study

Two theories were applied to this study, namely the rational choice theory (RCT) and Alfonzo's hierarchy of walking needs and the social-ecological model of walking based on Maslow's (1943) theory of human motivation. These two theories complement each other to explain why and how the tricycle is used by some urban commuters. While the former deals with the monetary decision to be made based on resources available and the utility/satisfaction to be derived for selecting the tricycle, the latter deals with how people are motivated to meet their mobility needs through the adoption of tricycles. These two theories were selected

because they helped to establish whether people used the tricycle merely because of the cost or it was transport-need driven, which to a large extent, highlighted some of the values derived from the use of tricycles.

The two theories complement each other because both explain why people choose tricycles based on cost and needs. However, RCT tends to consider the cost of transport in comparison to other modes of transport without explicitly indicating whether an individual's choice is driven by need, despite recognizing that some derived satisfaction may be need-based. The hierarchy of walking needs was specifically selected because transport needs are diverse and contextual in urban settings. In this study, it illustrates how tricycles may meet certain transport needs for some urban residents. While transport needs are addressed based on the commuter's resources, the theory does not explicitly state that these needs arise from monetary considerations. Additionally, the needs referenced pertain to the mode of transport and not in terms of money.

This subsection attempts to explain how the theories work and how they have been applied to transport mode choice by other authors.

2.5.1 Rational choice theory (RCT)

The term "rational choice" refers to a broad theoretical perspective or family of theories that explain social outcomes by building models of individual behaviour and social context (Hechter & Kanazawa, 1997). Scott (2000) found that rational choice (RC) is not a general theory. RC is more of a spectrum or a collection of theories (Hechter & Kanazawa, 1997). The theory posits that people's choices are a result of monetary considerations or cost-benefit analysis and the satisfaction or utility derived must be greater than this cost. Furthermore, if

the value or benefit gained starts to dwindle, the individual will cease engaging in that activity. However, people ultimately utilize all available resources in their decision-making process.

Thus, to Jensen (2016) rational means that the decision-maker will systematically assess all the alternative choices and choose the best one from the available options based on reason, which is a cognitive process. It also means that people weigh the anticipated costs and advantages of any action before making a decision (Scott, 2000). However, a source of contention regarding what constitutes rationality in the RCT (Hechter & Kanazawa, 1997; Levin & Milgrom, 2004; Quackenbush, 2004) suggests that typically, people act impulsively, emotionally, or just out of habit (Hechter & Kanazawa, 1997).

Applying RCT to transportation, Levin and Milgrom (2004) defined RC as the process of determining what options are available and then selecting the most desirable option based on some consistent criterion. Fillone and Mateo-Babiano (2018) similarly found that the mode choice process presupposes that an individual (the decision-maker) first determines the available options and then evaluates each alternative in a choice experiment using a latent variable called utility. The option with the most utility is then chosen. Likewise in this study, RCT was used to ascertain whether users made monetary considerations when choosing a mode for their trips and whether they would still choose the tricycle if other modes of transport charged similar fares. This was intended to help the researcher determine that, with information on transportation costs and the individual utility derived from their chosen mode, people will either maintain or change their preference for that choice after comparing the costs. Such that if there is a mismatch in the cost and satisfaction derived from choosing the tricycle, then usage is expected to cease or continue.

The principle of preference suggests that people have a preference for one thing more than others or they are neutral. According to Scott (2000) and Hechter and Kanazawa (1997),

individuals are motivated by their objectives, goals or self-interests portrayed in their preferences; thus, suggesting that an agent's goal determines his preference.

Conversely, Boudon (1998) mentioned self-interest as a principal cause of action, but that is difficult to observe because people are sometimes furtive about the intent of their actions. In Levin and Milgrom's (2004) perspective, actions/decisions are meant to satisfy an agent's self-interest, which is arguably shaped by institutions and values (Hechter & Kanazawa, 1997; Lindenberg, 1992). Scott further posits that agents act within the confines of the information available to them. This may suggest that full information is critical in RCT in that individuals cannot choose things they do not know or have unreliable information about.

Every human being seeks to maximize utility because it is the reward gained by the agent (Scott, 2000; Muro-Rodríguez et al., 2017; Quackenbush, 2004). Utility is described as a latent variable that helps in the choice process (Fillone & Mateo-Babiano, 2018).

One of the assumptions of RCT is the fact that people act rationally based on their preferences. In contrast, decision-makers are not always rational. Having evidence to suggest that people make decisions without recourse to economic benefits or preferences does not mean those decisions were irrational. However, Scott (2000) believes that human actions are both rational and non-rational and Quackenbush (2004) explains that preferences other than financial gains motivate people to act at some point. This shows that money or economic benefit is not always the reason why people take certain decisions, and even so, cannot entirely propel rational behaviour. He further argued that rational individuals need not be motivated solely by economic gain.

RCT has been criticized for the fact that real decision-makers are not rational (Quackenbush, 2004). Unlike procedural rationality based on everyday common sense, Quackenbush (2004) believes that RCT is founded on the assumptions of instrumental rationality where the agent

makes no moral judgements about preferences. Instrumental rationality does not consider whether an action is good or bad. It presumes that when an agent is confronted with two choices that must produce an outcome, the agent will choose the one that will produce the highest utility devoid of moral considerations. Another source of critique for RCT has emerged from the fact that in the real world, choices often appear to be highly contextual, that the same person may make different choices in similar conditions at different times and vice versa.

Based on the plethora of objections levelled against RCTs, Boudon (1998) perceives that people as social actors are rational because they have strong beliefs and reasons for their actions. However, it may not always be monetary, especially when the action is normative (beliefs that are not planned or thought through). The results are not always direct; because some people act based on their belief of whether something is true, good, fair or unfair rather than on cost or reward (Boudon, 1998; Scott, 2000).

In terms of the significance of RCT, it has been applied in a wide area of research including transportation (Davidov, 2003; Fillone & Mateo-Babiano, 2018; Jensen, 2016; Levin & Milgrom, 2004; Muro-Rodríguez et al., 2017). Hechter and Kanazawa (1997) have pointed out that RC has long been used in subjects such as politics, labour markets, formal organizations, and criminology but recently begun to make empirical achievements in areas previously thought to be unfriendly, such as the family, gender, and religion.

2.5.2 Alfonzo's hierarchy of walking needs and the social-ecological model of walking based on Maslow (1943)

The second theory supporting this study is the social-ecological model of walking, which utilizes the hierarchy of walking needs based on Maslow's theory of human motivation and a social-ecological framework. Abraham Maslow's (1943) theory highlights key features of the

social-ecological model of walking to give it more grounding. It explains how people behave when there are needs to be satisfied.

Maslow's (1943) theory of human motivation suggests that people are motivated by different needs; and these needs are arranged hierarchically in an order of prepotency because some needs are more fundamental than others. Thus, the theory has it that there are five sets of goals that are generally referred to as the basic needs: physiological, safety, love, esteem, and self-actualization. Humans are propelled by the desire to achieve or sustain the many conditions that underpin these basic needs, as well as certain more cerebral goals. The order in which these needs are arranged implies that the most powerful objective will monopolize consciousness and the least important demands are downplayed, perhaps forgotten or rejected. This is because fulfilled wants are not active motivators. When a need is reasonably well satisfied, the next higher need emerges, which then dominates the conscious existence and serves as the focus of organizational activity. The basic needs have been explained as;

- a) Physiological needs: This is referred to as the hunger need and the prepotent of all the needs. It borders on food and the standard requirements needed for survival because the realization of all other needs depends on this need. However, once this need is satisfied, other needs take pre-eminence in the agent's organization.
- b) Safety needs: This explains the need of an agent to be free from any form of harm or disorderliness. When people no longer have active motivators as far as safety is concerned, they do not feel threatened, just as a satiated man does not feel hungry.
- c) Love needs: This need talks about affection and belongingness.
- d) Self-esteem: These needs lead to the satisfaction of confidence, strength, capability, adequacy, usefulness, and necessity.
- e) Self-actualization: This is a state where all the other needs have been met and people do what they love to do as in, pursuing their dream careers.

There are other characterizations of the basic needs that help with the understanding and application of the theory which include;

- a. The degrees of relative fixity (the theory is not as fixed and rigid as it seems).
- b. Relative satisfaction (agents are usually partially satisfied or unsatisfied about everything simultaneously).
- c. Unconscious nature of needs (agents often have unpremeditated needs).
- d. The generality of needs (theory does not claim universality in recognition of cultural diversity).
- e. Multiple motivations of behaviour (motivation emanates from all the levels of needs or several combinations of these needs).
- f. The centrality of goals to motivation theory (theory does not focus on instigation or motivated behaviour rather on function).

Some researchers have applied this theory in transportation studies by outlining the basic attributes commuters look out for in their attempt to satisfy their transportation need (Alfonzo, 2005; Kumar & Ganguly, 2018; Nutsugbodo, Amenumey, & Mensah, 2018).

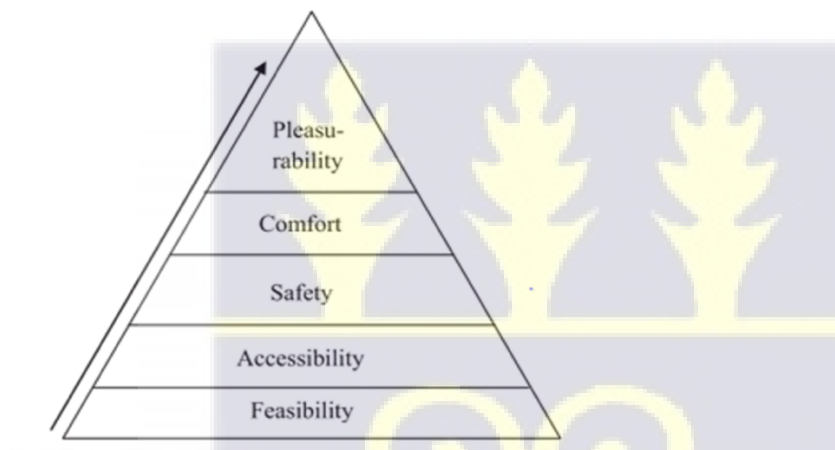
The hierarchy of walking needs is shaped by some basic tenets, similar to Maslow's (1943) theory of motivation. It suggests that a decision to walk can take place at different stages, and some aspects take pre-eminence over others. Further, people are driven by a variety of needs, which are ordered according to their importance, but it is not enough to explain the decision to walk. As a result, it is situated in a social-ecological framework to constitute the socio-ecological model of walking where aspects of the hierarchy become the precursors in the decision-making process of walking.

According to the hierarchy of walking needs model, there are five tiers of needs to consider while making a walking decision. These requirements move from the most fundamental,

feasibility (connected to personal boundaries), to higher-order requirements (related to urban design), such as accessibility, safety, comfort, and pleasurability. Basically, as explained earlier, feasibility embodies the suitability of a vehicle for a trip while accessibility regards the availability of the selected mode. Safety involves determining whether the vehicle can minimize risk, even though risk cannot be completely avoided. Comfort entails how a user enjoys the ride and pleasurability is a higher form of comfort as depicted in Figure 2.1.

Figure 2. 1

The hierarchy of walking needs



Source: Alfonzo (2005)

Similarly in this study, it is perceived that people have a variety of transport needs ranging from feasibility to pleasurability as shown in Figure 2.1. It suggests that the basic transport need that should be met first is feasibility of the transport mode to be selected. This ordering was intended to help understand how users of tricycles perceive and order the transport need that motivate the use of tricycles in GAMA. It must therefore be noted that a person's decision to walk or be mobile does not require that all of their requirements within the hierarchy be met. As a result, satisfying these five requirements is neither required nor sufficient to motivate people to walk. The hierarchy ultimately implies that the lack of higher-order demands (and

accompanying facilities, in the case of the built environment) does not preclude a person from walking if lower-order needs are not met.

Nutsugbodo et al. (2018) adapted this framework to study the public transport mode preference of international tourists in Ghana and its implications for planning. The study discovered that generic aspects of transportation services, such as affordability, accessibility, availability, safety, and comfort, influence international tourists' public transport mode choices in Ghana. Affordability, accessibility, and availability were found to be the most significant predictors of mode choice. Aside from this, there were considerable links between the socio-demographic features of tourists and their behaviour regarding the choice of mode.

2.6 Conceptual Framework

According to the literature, people travel for leisure or to engage in an economic activity (UN-DESA, 2016). In both scenarios, people travel to satisfy a need, but needs can be satisfied based on available resources, which may include information such as availability of different modes, safety of modes, legality issues and economic resources such as money. In this conceptual framework presented in Figure 2.2, the major tricycle actors like authorities, and operators interact to meet the transportation needs of users.

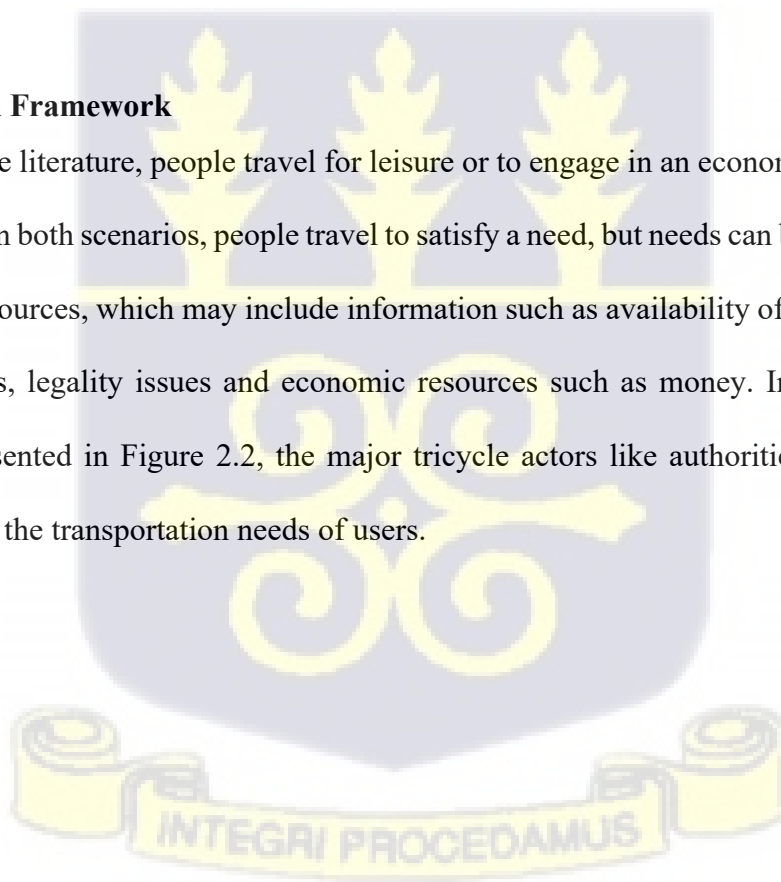
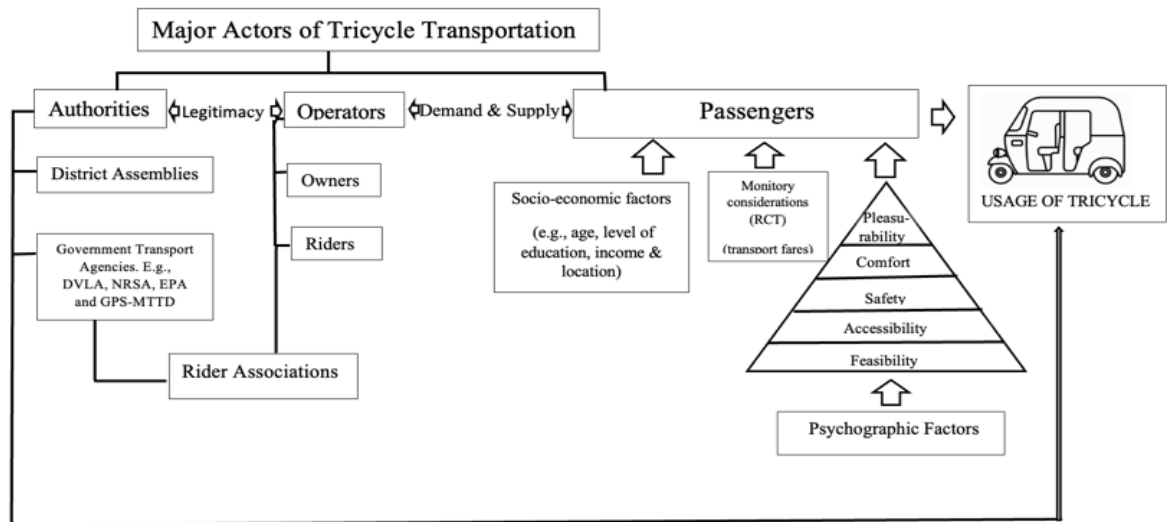


Figure 2. 2*Conceptual framework*

Source: Author's conceptualization from literature and an adaption of Alfonso's (2005) socio-ecological model of walking needs.

To meet a (transport) need, a user needs to consider the resources available and the level or expected satisfaction in order to make the right choice.

As presented in the conceptual framework, the use of tricycles is driven by major actors, namely the authorities like the district assemblies and government transport agencies of which Driver and Vehicle Licensing Authority (DVLA) and National Road Safety Authority (NRSA) are examples. It also includes the Environmental Protection Agency (EPA) and the Ghana Police Service-Motor Transport and Traffic Department (GPS-MTTD). They legitimize the activities of operators through licensing and permissions.

There is also the Riders' Association, which wields informal power in terms of admission and internal discipline. The operators, made up of the owners and the riders, have a demand and supply relationship with the passengers whose socio-economic attributes influence their decision in choosing the tricycle as a mode of transportation. The decision, however, includes a rational decision utilizing the RCT as well as a transportation need-based assessment adapted from the socio-ecological framework of walking needs. Moreover, the psychographic factors

based on the features of the tricycle are the antecedents in making the decision to use a tricycle. The loop that joins sustainable urban transportation and authority suggest the responsibility of these institutions to ensure sustainable urbanization through sustainable urban transportation measures.

Consequently, the RCT and Alphonzo's (2005) hierarchy of walking needs were integrated into this study to help analyse and explain users' transport needs and rational decision-making on tricycles as both influence users' choice of mode. Examining the needs/push factors and rationality of the decision was critical considering the legality, safety and other contesting issues regarding authorities, transport networks and other actors in tricycle operation. The RCT helped to ascertain whether the decision to use tricycles is purely on monetary grounds or otherwise. Better still, since mode selection is attributable to socio-demographic and psychographic factors, the use of the socio-ecological model of walking needs by Alfonso (2005) as adapted from the theory of hierarchy of needs where different needs and characteristics of users were major influencing factors for the use of tricycles.

The study adapted Alfonso's (2005) hierarchy of walking needs and the RCT because travelling involves decision-making with a degree of certainty or uncertainty and, according to Rasouli and Timmermans (2015), choices are made to reflect maximum utility. In literature, just as socioeconomic backgrounds (Oppong-Yeboah & Gim, 2020), monetary implications (Fillone & Mateo-Babiano, 2018) also tend to influence travel decisions. Furthermore, RCT is significant to show whether users do some rational (monetary) evaluation before using the tricycle. Additionally, the social-ecological framework aspect was instrumental in the inclusion of the socio-economic characteristics and transport needs of respondents in modelling tricycle usage. Above all, the framework was used to study walking behaviour, which is a form of mobility and hence can be applied conveniently to transportation (Nutsugbodo et al., 2018).

These theories overall helped to hypothesize which factors influence the decision to use tricycles and, most importantly, the more significant ones.

2.6.1 Conclusion

The nature and evolution of the tricycle as a form of informal public transport were investigated in this chapter. Transportation, in general, has an impact on individual and business economic growth because it is a direct driver of economic activity. However, there are discussions regarding transportation insufficiency and how to address mobility needs, particularly in underserved areas. Various issues about the evolution of tricycles, their legality, safety, and long-term viability in operation were raised in this chapter. The legal and policy framework that encompasses Ghanaian road transportation, as well as its functions, advantages, and repercussions, were extensively explored.

The study used the rapid and thriving operation of tricycles in Ghana's metropolitan south to contextualize altering public transport dynamics. It also went over the idea of human motivation and RCT, which set the tone for the rest of the study by simplifying the factors that influence tricycle transportation among Accra residents. The theories explained the motivation of users in an attempt to have their transportation needs met. These motivations are frequently pecuniary or based on personal preferences regarding needs.

The chapter also looked at some of the difficulties that come with the use of tricycles, which are frequently cited as safety problems and legal issues. Furthermore, sustainability and complementarity of tricycle transportation to major transportation networks were among the main concerns raised throughout these debates. The literature on informality has clearly evolved in focus over time, but the same cannot be said of informal transportation. This is because environmental sustainability issues seem to incessantly override the vital service

tricycles offer in different situations. The impetus is to continue the debates, articulating the complementarity of tricycle operation and anticipate that informal transport literature will eventually correspond to literature on informality. The next chapter explains the methodology used for the study.



CHAPTER THREE

METHODOLOGY AND STUDY AREA

3.1 Introduction

This chapter describes how the research was carried out. It also explains the basis or the justification for the choice of design. From the problem described in chapter one, this study is not only focused on how tricycle usage has upsurged in parts of Accra, but also why it is the case. Furthermore, the process of literature review revealed various methodological ideas that guided and shaped the research approach, data collection and analytical strategies employed in the conduct of this study. Thus, fundamentally, the study adopted a mixed-method research approach as it poses both qualitative and quantitative research questions.

The chapter also provides information on the three study sites in terms of their size, socio-economic and political context; and details the philosophical assumptions and research paradigm, research approach, sampling and sample sizes as well as data collection and analytical strategies. The ethical considerations necessary for this study as well as how to construct a composite index to measure the sustainability of tricycles are all discussed in this chapter. The chapter concludes with challenges encountered in the conduct of the study, a summary and a general conclusion of the chapter.

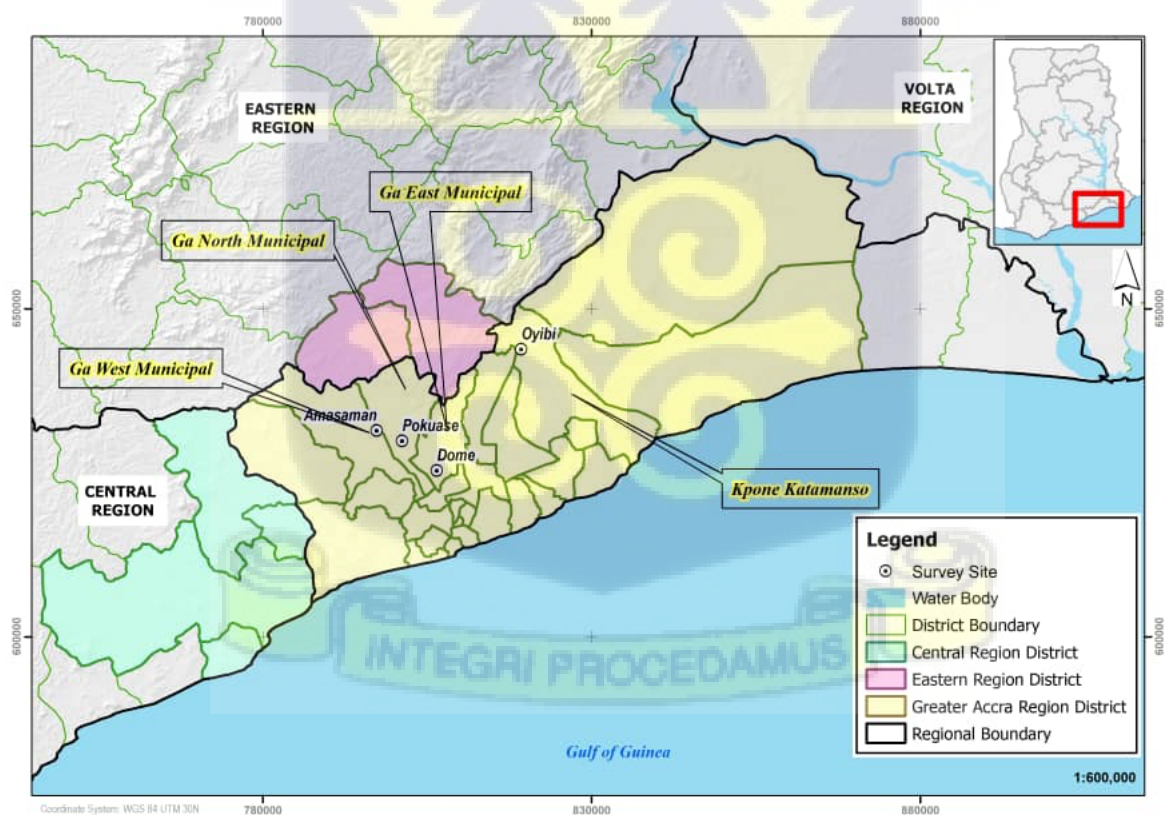
3.2 Description of study locations

The study was purposively sited in three municipal areas, namely Ga East (Dome), Ga West (Pokuasi-Amasaman) and Kpone Katamanso (Oyibi) in the Greater Accra Metropolitan Area GAMA of Ghana, as shown in Figure 3.1. They were purposively selected because they form part of the largest metropolis in Ghana and have experienced the pervasive use of tricycles for public transport in their respective municipalities. GAMA was chosen not just because it is

home to the country's capital or the most densely populated area, but also because it is the country's fastest-growing (most urbanized) metropolis and the hub of economic activity and has resources for all types of transportation. Most importantly, GAMA is where the Okada issue has sparked the most heated debates and responses from the media and the general public (Myjoyonline, 2020; Oteng-Ababio & Agyemang, 2015). It is bordered on the west by the Central Region, on the north by the Eastern Region, on the east by the Volta Region, and on the south by the Atlantic Ocean (Land Use and Spatial Planning Authority (LUSPA), 2021). It is characterized by conurbation as a result of sprawling and youthful populations (Ghana Statistical Service, 2014).

Figure 3. 1

Map of GAMA showing study locations



Source: LUSPA, 2021

Typical of most urban areas around the African continent, GAMA is expanding and increase in car ownership has led to congestion and high volumes of traffic. Travel time has increased due to sprawling and the government is unable to catch up with transportation demands due to poor inconsistent planning. These deficits have been taken care of by informal transport service providers, mainly *trotros*, which are usually old vehicles often loaded beyond capacity, threatening the safety of passengers (Agyemang, 2017; Kashi & Carello, 2020).

Over 70% of the residents of GAMA rely on informal transportation (Kashi & Carello, 2020). Accra's rapid growth and urban sprawl are causing significant societal costs in terms of lost time and environmental degradation. Therefore, according to (Kashi & Carello, 2020), there is a need to improve Accra's transportation system; yet, due to the variability of urban surroundings and a lack of data on traffic and road conditions in Accra, there is uncertainty about the magnitude of the impact of urban transportation initiatives (Kashi & Carello, 2020). The socio-economic and political backgrounds of the three municipalities purposively selected for this study are presented in the ensuing sub-sections.

3.2.1 Ga East Municipality and Dome

Ga East Municipality is located in the northern section of the GAMA, with a geographical area of around 96 square kilometres and is about 29 kilometres from the CBD of Accra. It was established as a district in 2004 by an Act of Parliament (LI 1589), and was later elevated to municipality status by LI 1864 in 2008. Dome is one of the two zonal councils in the Ga East Municipality in the Greater Accra Region of Ghana.

The municipality has roughly 52 settlements, with the majority of the inhabitants residing in urban centres and a few rural settlements. Abokobi, Agbogba, Haatso, Papao, Westlands, Dome, Taifa, Kwabenya, Ashongman, Ablor-Adjei, and Dome Pillar 2 are some of the

municipality's noteworthy settlements. Boi, Sesemi, Adenkrebi, Kponkpo, Adjako, and a portion of Teiman are among the other locations. The public has access to both government and private health services, as well as a fair distribution of educational resources.

According to Ghana's 2010 Population and Housing Census, the municipality's population is around 198,220 people, with a total of 12,372 dwellings and 38,925 households. The Municipal population is currently predicted to be 249,732, based on a 2.6% annual growth rate. It depicts a more youthful population, with females outnumbering males by a small margin. Thus, 49% are males and 51% are females with 90% of residents living in urban areas (Ghana Statistical Service, 2014). For around 55% of the economically active population, farming is the primary source of income. Approximately 70% of the rural population relies on agriculture as their primary source of income, with approximately 95% of them being small-scale farmers. Crop cultivation, poultry production, and livestock production are the main agricultural operations.

Even though Abokobi Zonal Council is the seat of the municipal government, the mainland market (usually called the Dome market) is located at Dome in the municipality. The Dome market is said to be a fast-growing market with infrastructural deficits and congestion; and poor road networks have contributed to the long travel hours of some residents in the area (Ghana Statistical Service, 2014). A visit to the site revealed the presence of many tricycles in operation, especially around the market and nearby communities.

The municipality believes that the general upgrading of the road network, maintenance, and rehabilitation will enable and lower transportation costs, as well as link the municipality's rural economy with the urban economy to reduce poverty. As it is in the other research sites, roads are the only form of transportation in the municipality and they are mainly in poor condition, according to the municipality's composite budget for 2022-2025 (Ga West Municipal Assembly, 2022a)

Generally, Dome has mixed land use characteristics. Apart from the large land market and the transport nodes, Dome has several socio-cultural locations and residential areas, some of which are not a walkable distance from the commercial centre. The roads are rutted and dusty in some parts of the commercial centre. Because of the market, Dome is characterized by human and vehicular traffic.

3.2.2 Ga West Municipality and Pokuase-Amasaman

Amasaman is the capital of Ga West Municipality, and it was formed out of the former Ga Municipality as part of the government's policy on decentralization and local government reforms in 2004. It is located on about 145.4 square kilometres of land and has about 72 settlements. Its neighbours are Ga East Municipal and Accra Metropolitan Assembly on the east, in the north, Akuapem South Municipality and in the south, Ga South Municipality.

The municipality operates through several departments and agencies. Among the many functions of the Ga West Municipal Assembly are: encouraging productive activities and social development in the district, as well as removing any barriers to initiative and growth; launching basic infrastructural development programs and providing municipal work and services in the district; being in charge of the district's human settlements and environmental development, improvement, and administration; and ensuring that the district has easy access to the courts in order to promote justice (Ga West Municipal Assembly, 2022b).

According to the 2010 census, there are more females than there are males in the district. The census further shows that the population peaked at the age group 0-4 years (12.7%), followed by the age group 25-29 years (11.1%), and then the percentages reduce from the age group 30-34 onwards showing a more youthful population. Over a third (35%) of the economically active population is employed in the agriculture sector either directly or indirectly. Moreover, most of the farmers are smallholder farmers. With a population of 314,299, the most current census

data shows that the number of females in the Ga West Municipality slightly exceeds that of males (Ghana Statistical Service, 2021).

In terms of roads and other facilities, the municipality has a total length of 103.7 km of paved unpaved roads. It is also home to the Amasaman and Medie markets where most farmers trade their produce. The municipality has a favourable number of health facilities (Ga West Municipal Assembly, 2022b). A few factories are situated in the municipality; hence, offering jobs to young people as factory hands. The Pokuase-Amasaman road is characterized by vehicular traffic congestion, but the branch roads are often free. The roads in the suburbs are typically rough, muddy, and filled with wide ditches that collect water after rains (Ga West Municipal Assembly, 2022b).

It is worth noting that Pokuase was part of Amasaman or the Ga West Municipality until about four years ago. Pokuase is the seat of administration for the Ga North Municipality. And even though a legislative instrument has been passed to that effect, the transportation department, for example, continued to receive supervision from the transport officer in-charge of Ga West. Furthermore, the data from Ghana's 2010 population and housing census presented Pokuase as part of the Ga West Municipality because they were one municipality at the time. Consequently, in this study, Pokuase and Amasaman were considered as one study site with different tricycle stations.

However, regarding the population of Ga North Municipality, the entire population of 235,292 lives in urban areas and there are slightly more females than males in the municipality. Its major economic activities are commerce and transportation and services (Ghana Statistical Service, 2021).

3.2.3 Kpone Katamanso Municipality and Oyibi

The municipality is situated in the Greater Accra Region's eastern part, stretching from the coast to the southern lower slopes of the Akuapim mountains. It has several neighbours. In the southern part, the district is bordered on the east by Ningo-Pampram District and on the west by Tema Metropolitan Assembly. On the south, it is bordered by the Gulf of Guinea. It shares borders with Ashiaman Municipal Assembly on the southwest and Adentan Municipal Assembly on the motorway in the centre belt. Shai-Osudoku District is on the northeast, La-Nkwantanang-Madina Municipal is on the northwest, and Akwapim South District is on the north. The CBD of Accra is barely 38 kilometres away from the Kpone-Katamanso Municipal Assembly. With the Legislative Instrument (LI) 2031, the Kpone-Katamanso Municipal Assembly (KKMA) was separated from the Tema Metropolitan Assembly in 2012. The municipality is divided into four Area Councils, which are as follows:

1. KPONE (Afieye, Laloi and Dingla)
2. KAMSBEG (Kakasunanka, Nmlitsakpo, Sebrepor, Bethelhem and Gbetsile)
3. ZEKAS (Zenu, Katamanso, Appolonia and Saasabi)
4. ONSBAC (Oyibi, Nanoman, Saduase and Bawaleshie)

Thus, the study community, Oyibi, falls within the fourth zonal council of the municipality. It has a lot of new settlements, which are a distance away from the main Adenta-Oyibi-Dodowa road as well as numerous small and medium-scale businesses.

According to the Ghana Statistical Service, the district's population in 2010 was 109,864, accounting for 2.7% of the region's total population. Males were 53,376 or made up 48.7% of the population, while females were 56,488 and constituted 51.3 % of the population. About 90.4% of the residents live in areas, which can be described as urban. Data from the 2021 population and housing census further shows that there are more females than males in the municipality. However, the population of 417,334 has almost quadrupled since the 2010

population and housing census while the urban population has increased to about 94.6% (Ghana Statistical Service, 2021; Kpone Katamanso Municipal Assembly, 2021b).

Agriculture, industry, and commerce/service make up the municipality's local economy. The industrial and service sectors, which employ the majority of the workforce, are the economy's backbone. Approximately 13.5% of the population is employed in agriculture.

The Zenu market, Timber market, Kpone, Washington, and Katamanso (Timber) markets are five functional market centres with developing lorry parks to supplement commercial operations in the municipality. Apart from the Assembly-managed Kpone Market, the remainder of the markets are run by individuals and organisations.

Despite the fact that the municipality is easily accessible and well-connected to nearby towns, most roads are dusty, rough, uneven, and muddy during the rainy season. The municipality's overall road length is 480.1 km, with 2.2 km of asphaltic, 2.9 km of concrete, 54 km of surface treated, and 421 km of gravel and soil roads. Residents in the municipality have access to several health facilities: seven public, 21 private, and one quasi-government facility (Kpone Katamanso Municipal Assembly, 2021a).

3.3 Research Methodology

3.3.1 Philosophical assumptions and research paradigm

The study was guided by some assumptions, the first of which is the nature of the study and the second, the researcher's worldview of knowledge construction. Creswell (2007) maintains that in every research, the philosophical assumptions, paradigms and interpretive or theoretical frameworks should be outlined from the start. These, according to him, set the research into perspective. He further added that these are mutually interdependent (Rehman & Alharthi, 2016) and not only determine how the research is done but also shape the process. Quite

remarkable to these initial decisions is the fact that the choice of an approach implicitly determines what kinds of philosophical, paradigmatic and methodological position that can be assumed.

The aim of this research, which fundamentally sought to study the determinants of tricycles as a form of public transport, requires some amount of width in order to have the justification to make some degree of generalization and/or confirmation. This approach is an attempt to quantify aspects of tricycle transportation; hence, the need to obtain numerical large data that can be analysed statistically (Creswell, 2007; Haq, 2014). Accordingly, the positivist research paradigm would have been most appropriate but for the aspect of the study that seeks an explanation and understanding of the legal framework of tricycle operation as well as certain qualitative determinants of tricycle use: the study was therefore guided by the pragmatist paradigm. This paradigm adopts any technique that helps in answering research questions (Creswell, 2007; Denscombe, 2008) and bridges the gap between the strict positivist and new research philosophy (Kaushik & Walsh, 2019) by creating a middle ground between quantitative and qualitative methods (Fetters & Freshwater, 2015). Above all, it is the most suitable paradigm for the convergent mixed method design (Creswell & Plano Clark, 2011; Haq, 2014).

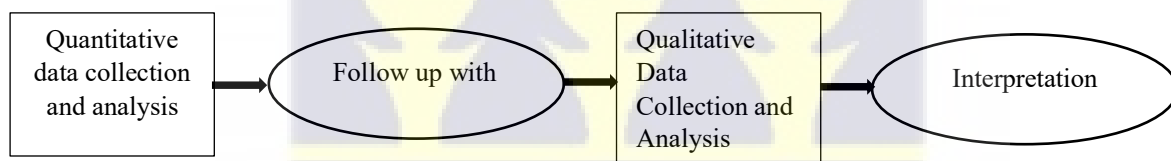
After a lot of thought about the utility and significance of various research methods, mixed-method approach was decided on. This is because people's world views are influenced by their social, economic, and political environments; hence, context-bound pragmatism seemed to be more attractive and appropriate. Furthermore, a mixed methodological approach produces deep knowledge that takes these intricacies into consideration thus achieving multiple goals (Creswell, 2002; Denscombe, 2008; Haq, 2014; Kaushik & Walsh, 2019; Morgan, 2014).

3.3.2 Research Approach

The research approach comprises the step-by-step procedures of the research and this is based on certain assumptions such as the nature and background of the study as hinted at earlier. Out of the numerous mixed approaches outlined (Creswell & Plano Clark, 2011; Johnson & Onwuegbuzie, 2004), the sequential explanatory mixed methods approach was employed in this study. In the perspective of Creswell, Klassen, Plano Clark, and Smith (2011), mixed-method simply means the utilization of multiple methods or integrating or combining various strategies with the goal of maximizing the benefits of both quantitative and qualitative strands as shown in Figure 3.2.

Figure 3. 2

The sequential mixed methods approach



Adopted from Creswell and Plano Clark (2011).

In using the sequential explanatory mixed methods approach, both qualitative and quantitative strands were applied to this study sequentially. The first was the quantitative data collection, and after some preliminary analysis and results, the qualitative followed and both were merged at the interpretation stage (Creswell & Plano Clark, 2011). The two data sets were mixed at the point of interpretation where data were compared, contrasted, and synthesized using identified content areas represented in both data sets. The results were summarized and interpreted separately or converged depending on the nature of the research question to be addressed.

The rationale for this approach is the need to know the ways in which the qualitative findings could help to explain the quantitative findings on the evolving phenomenon of tricycles as forms of public transport in urban Ghana. As a form of triangulated approach, it produced triangulated findings that complemented each other for a more elaborate understanding of the topic. The essence, more importantly, was to bridge the gap of large sample size and generalization in the quantitative design and the small sample size and detail required in qualitative designs (Creswell & Plano Clark, 2011).

Furthermore, according to Fetter and Freshwater (2015), synergies could be created by using mixed methods and this can be an entry point for integration that could highlight various ways a phenomenon can be studied. Consequently, this approach ensured completeness and expansion in the sense that it provided both depth and width. Thus, integration in this study was done through theory, design, methodologies, analysis, interpretation, visualization and presentation of the results (Fetter & Freshwater, 2015).

As a study embedded in development studies which is multidisciplinary in nature, this approach enabled the answering of different research questions by exploring and examining different data sets while highlighting areas of convergence and divergence (Creswell & Plano Clark, 2011; Fetter & Freshwater, 2015).

3.3.3 Methods of data collection

In the collection of data, both quantitative and qualitative methods were employed. The data sources for the study included both primary and secondary sources. Primary data collection methods included quantitative and qualitative methods. Secondary data were obtained from written materials including reports, newspaper articles and blog materials. The methods of data collection included a survey for the quantitative aspect with data being collected from 405 users and 205 riders.

Data for the qualitative aspect of the study comprised primary data collected using key informant interviews (KIIs), observation, and in-depth interviews (IDIs) (See Appendix II, III and IV). The data from key informant interviews were collected from authorities (mainly the Municipal Assembly transport office, the Driver and Vehicle Licensing Authority (DVLA), the Environmental Protection Agency (EPA), the Ghana Police Service-Motor Transport and Traffic Department (GPS- MTTD) and National Road Safety Authority (NRSA)). It also included Station Masters and tricycle owners.

In all, 40 participants comprising 12 users (4 males and 8 females), 12 male riders, six heads of institutions /authorities (5 males and 1 female), five station masters (all males) and five male tricycle owners were sampled for qualitative data. Thus, out of the 40 participants, only 9 were females. The rest were males. It is worth noting that the qualitative data from riders and users were expected to expound the quantitative data and make up for issues that the literature review and quantitative questionnaire did not cover.

3.3.3.1 Survey

Quantitative primary data collection methods included a structured survey done by the administration of questionnaires to users and operators (riders specifically). A survey is a technique used for investigation through direct observation of a phenomenon or systematic data collection from a population via personal contact and interviews. This method is employed when sufficient information about a specific issue is not available in files or other sources. Surveys are a crucial tool for gathering evidence related to certain social problems (Pandey & Pandey, 2015).

Because surveying all users and operators of tricycles was impracticable, sampling was used to acquire a representative fraction of all users and operators of the tricycle transportation

system. The sampling procedure began with the purposive selection of Greater Accra as the study site. This was followed by the purposive selection of three areas in the Greater Accra Municipality where the use of tricycles had various usages including public transport. The three selected areas include Dome, Pokuasi-Amasaman and Oyibi municipalities. These were selected because the use of tricycles for public transport is entrenched in these areas.

In determining a sample size, which should be representative of the population, there is the need for the population size, the margin of error, the confidence level and the standard deviation. The population size refers to the total number of persons who are intended to be represented by the sample. This number of subjects (people) must correspond to the demographics that are of interest to the study (Singh & Masuku, 2011; Uakarn et al., 2021). Because the research interest was in individuals as sample units in this study, tricycle operators and users in the three study areas (Dome, Pokuase Amasaman, and Oyibi) were needed to determine the sample size. It should be emphasized that these are unidentified populations. Furthermore, the margin of error, also known as the confidence interval, specifies how much above or below the population mean could be allowed for the sample mean to drift.

The confidence level refers to the level of assurance that the actual mean will fall within the confidence interval, and the standard deviation is the amount of variation that may be expected in the responses. In other words, it is the proportion of people who choose a particular option, which is commonly given in decimals. A conventional 5% margin of error was used to ensure a suitable sample size in line with (Obiri-Yeboah et al., 2021) and as commonly employed by other studies (Kelley & Preacher, 2012).

The sample size was calculated using Andrew Fisher's formula which provides the least number of people to be sampled as shown below;

$$ss = \frac{(Z - score)^2 * StdDev(1 - StdDev)}{(CI)^2}$$

- Where Z-score is the z value corresponding to the chosen confidence level
= 95% (Z-score is 1.960)
- StdDev is the standard deviation =0.5
- CI is the confidence interval = +/- 4%

From the formula and the values given above, the least estimation for the sample size was 600. Eventually, a sample of 610 was drawn due to over sampling which is better because the larger the sample the lesser the error even though at a decreasing rate (Hamed, 2016) and also because the estimate was for the least sample to be drawn, more sampling units could be drawn. Employing convenient sampling, the sampling units were obtained at places where the tricycles and the users could easily be spotted, for example, the shoulders of roads in the central business area and markets. Presumably and logically based on the initial least estimate of the sample, and because the population of users is higher than that of operators, two-thirds of the sample was allotted to users and a third to operators using quota sampling method determined by the researcher. Quota sampling ensures that a certain attribute of a population sample is represented exactly as desired by the investigator (Acharya et al., 2013) and the essence was to ensure that both riders and users are reasonably represented in the sample. However, due to over-sampling, 5 more riders and 5 more users were sampled in the field. Table 3.1 shows the final distribution according to users and operators as well as the study locations.

Table 3. 1: Sample Size

	Dome	Oyibi	P-Amasaman	Total
Users	131	134	140	405
Operators	94	45	66	205
Total	225	179	206	610

Source: Field work, April 2022.

Thus, from Table 3.1, there were 405 users and 205 operators, and it shows that there were more respondents in some locations than others.

A cluster sample is a two-step method in which the total population is divided into clusters or groups, which are often based on geographic locations or districts such as villages or schools. This strategy is especially beneficial when the population is geographically spread, making it impossible to sample and choose a representative sample of all individual elements (Acharya et al., 2013). As illustrated by Acharya et al. (2013) and Pandey and Pandey (2015), the study employed cluster or group sampling, where tricycle stations in Pokuase-Amasaman, Oyibi and Domi were used as clusters and studied in a single stage. A cluster sampling method was used because the population was widespread and unknown.

Employing a convenience sampling technique, respondents were randomly selected from the tricycle stations or the shoulders of roads when passengers were being dropped off or picked up. Convenience sampling is a type of nonprobability sampling where the sample is drawn from a part of the population that is close at hand. This method relies on collecting data from individuals who are readily available, geographically accessible, willing to participate or meet other practical criteria (of being a user or a rider of a tricycle) (Acharya et al., 2013; Etikan et al., 2016; Patton, 2002; Schreie, 2018).

As a non-probability method, convenient sampling is prone to sampling bias. However, unlike purposive sampling, convenience sampling is often used for quantitative analysis if the population is widely spread and the sample is large enough to reduce sampling error. This is because the larger the sample the higher the statistical power of the sample (Etikan et al., 2016). This further explains the researcher's decision to over-sample. Furthermore, the population needs to be homogeneous so that the sample drawn using this method will not differ from a randomly selected sample (Etikan et al., 2016). The convenient sample was used in this study

because the estimated sample size (600) was large enough and the targeted population was widely spread. Above all, using three different locations and qualitative tools could make up for outliers and missing data. Studies that have used convenient sampling in a quantitative data analyses include Morgan et al. (2019) and Yakubu et al. (2019).

To do this, the researcher with the support of ten trained field assistants went to the selected tricycle stations where riders and users could be easily spotted dropping off or picking up passengers from 6 am – 6 pm taking an hour break between 11 am and 12 pm and between 3 pm and 4 pm. The ten field assistants were trained on the questionnaire for the data collection using computer-assisted personal interviewing (CAPI), a skill they had as frequent enumerators. The sample did not distinguish between registered and unregistered vehicles because the unregistered vehicles were a minute fraction and, moreover, the research interest was the riders and how they operated, not the vehicles. In all, a total of 610 respondents comprising 405 users and 205 operators from Dome, Oyibi and Pokuasi-Amasaman were sampled for this study. From Dome, there were 225 respondents, Oyibi, 179 and Pokuase-Amasaman, 206 respondents.

The study utilized a questionnaire with several sections to collect quantitative data from users and operators using CAPI (see Appendix I). The sections included socio-economic data, the nature and evolution of tricycles, factors influencing the decision to use tricycles, tricycles as sustainable transport and challenges militating against tricycles as sustainable transport.

The socioeconomic data were useful in describing the respondents and were used to ascertain how they influence usage, perceptions of proliferation and sustainability. Data on proliferation and sustainability provided the entry points for some policy considerations regarding the adoption or otherwise of tricycles as a form of public transport. Data were presented using tables and graphs.

3.3.3.2 Key informant interviews

Qualitative data were collected using key informant interviews which is a qualitative, in-depth interview with people who have been chosen for their specific understanding of a topic of interest. The interviews may be unstructured and akin to a casual conversation between friends, with interviewers crafting questions from a list of topics to explore on the guide (Mokhtar & Rahman, 2020). In this study, 16 key informant interviews were conducted. The participants included 4 heads of institutions comprising senior officers from EPA, NRSA, DVLA, GPS – MTTD, 2 transport officers, 5 Station Masters and 5 tricycle owners. The heads of institutions, transport officers, and station masters were selected using a convenient sampling procedure. The tricycle owners were sampled through snowball sampling, a method where initially selected subjects lead to the identification of additional participants. This approach allows for a progressively growing sample as the study continues (Acharya et al., 2013).

According to Patton (2002), in qualitative research, there are no sample size guidelines. What the researcher wants to know, the objective of the investigation, what is at stake, what is valuable, what will yield credibility, and what the researcher can do with the time and resources available are the factors that influence sample size. Furthermore, Patton (2002) believes that within a qualitative investigation strategy, triangulation can be achieved by combining interviewing and observations, as well as blending different sorts of purposeful sampling. Consequently, different sampling procedures were used to obtain the qualitative sample for the study.

The interview structure for the authorities (transport officers, DVLA, NRSA, EPA and GPS-MTTD) was the same but probing was tailored to their individual mandates. The questions explored the nature of their work, legal backing and their views on sustainable transport. It also included their impressions on the upsurge of tricycle usage, associated challenges and the way forward. The station masters, on the other hand, were asked about how the stations were started,

what motivated them to start and what the challenges have been. Additionally, the tricycle owners were asked about their motivations for owning tricycles, how they obtained their trikes, the benefits as well as the challenges and the effects tricycles may have on the environment.

3.3.3.3 In-depth interviews

Generally, interviews explore people's experiences, views, opinions, and sentiments, and this information is elicited through open-ended inquiries and probes (Patton, 2002). In-depth interviews specifically are individual open-ended interviews that delve into the respondent's thoughts, emotions, and viewpoints (Bloor & Wood, 2006). The data is made up of verbatim quotations with enough context to be understandable and the data is collected from subjects who have a rich experience of what is being investigated (Patton, 2002). The in-depth interviews were conducted among riders and users of tricycles using purposive sampling methods. Purposive sampling is a non-probability sampling technique commonly used in qualitative research. It involves the deliberate selection of participants, settings, or events that are believed to provide the most relevant and rich data for a study. This technique is particularly useful when researchers are interested in understanding specific phenomena or when the focus is on particular characteristics of a population that are not randomly distributed (Acharya et al., 2013; Hamed, 2016).

It was used because the researcher had an interest in recruiting riders who had ridden the tricycle for more than a year to provide in-depth information on the tricycle operation. Regarding users, the interest was in regular users. However, some users were purposively selected because they had bulky goods aside from being regular users. The goal of purposive sampling was to select a sample based on the frequent use of the tricycle as well as the unique manners in which some passengers used it in the study areas. These passengers were seen by

the researcher to be using the tricycle to cart bags of rice, corn, and charcoal; corn and cassava dough; firewood; and other bulky wares from the market near the tricycle station. The interviews were made possible with the help of cooperative station masters who linked the researcher to some of these passengers. The essence was to ascertain how users with heavy market wares depend on tricycles for their mobility.

In all, a total of 12 information-rich case tricycle users and 12 riders who used the mode daily for various purposes were interviewed for the study. Usually, by the 9th or 10th person, a saturation point had been reached but a few more interviews were done to round the figure up to 12 for both riders and users. Basically, they were asked about their awareness of LI 2180, period of inception, motivation to use or ride the tricycle, benefits inured and challenges. Further still, in the in-depth interviews, both riders and users were asked about the implications of tricycles on urban transportation and the future.

3.3.3.4 Observation

Observation was used as one of the complementary qualitative tools of data collection at the various sites where the tricycles were spotted. Observation is a qualitative data collection instrument that allows a researcher to study the day-to-day activities of groups and individuals (Malgorzata Ciesielska et al., 2018; Wästerfors, 2018). According to Marshall and Rossman (1989, p.79) as cited by Kawulich (2012), observation is the systematic description of the events, behaviours, and artefacts of a social setting. Patton (2002) is of the view that observation comprises the descriptions of activities, behaviours, actions, discussions, interpersonal encounters, organizational or community processes, or any other facet of observable human experience collected during fieldwork. Field notes such as extensive, thorough descriptions of the observations, including the circumstances in which they were

made make up the data. It can be structured or unstructured but in both ways, some watching and recording take place (Byrne, 2017) albeit, what is observed depends on the study and it must be reflexively and contextually defined (Wästerfors, 2018). Observation was used as part of the data collection tools in this study for the purposes of complementarity.

Wästerfors (2018) has further noted that in observation, three things are observed: what people do and say (details); how things are completed in strings or chains of acts or practices (sequences); and what others experience without using words, the mood, the 'air' or tone of a social setting (atmosphere). Drawing on the above and using an observation guide, data on the details of tricycles (colour, brand, presence of music, decoration and neatness) were collected, riders (physical appearance), and passengers (with load, company, manner of joining tricycle).

Regarding sequences, data were collected on what passengers and riders do when they arrive at *the stage*, the process of how passengers join the tricycle and how riders pick passengers and what happens after passengers have been picked. In terms of atmosphere, data were collected on attitudes and reactions of riders towards passengers with payload, with a company, aged and physically challenged passengers as well as their fellow riders generally and vice versa. As part of the data on the atmosphere, data on the attitudes and moods of both passengers and riders during peak hours were collected. Apart from observation, the rest of the data collection tools as well as the sampling procedures have been summarized in Table 3.2.

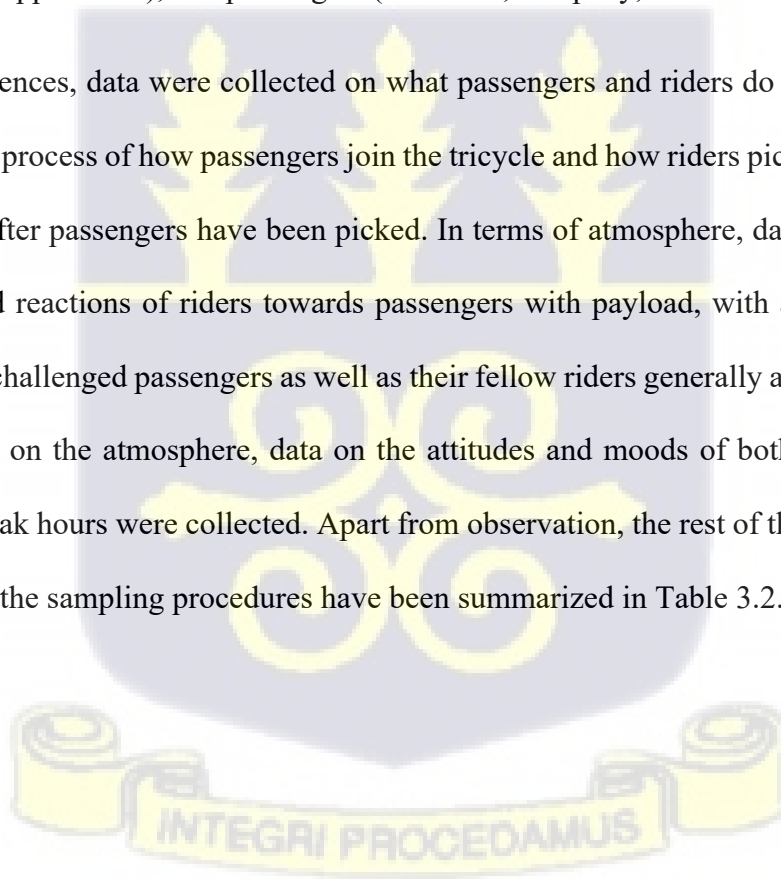


Table 3. 2: Qualitative research participants, sampling, sample size and tools

	Qualitative Approach				
<i>Research participants</i>	Users	Riders	Authorities	Station masters	Owners
<i>Sampling procedure</i>	Purposive	Purposive	Expert choice or Purposive	Expert choice or Purposive	Snowballing
<i>Sample size</i>	12	12	6	5	5
<i>Data collection tools</i>	In-depth interview	In-depth interview	Key informant interview	Key informant interview	Key informant interview

Source: Field work, April 2022.

Table 3.2 shows that different data collection tools and sampling procedures were used to undertake the qualitative aspect of the study.

3.3.4 Recording and storing data

The recording and storage of qualitative data is a crucial aspect of qualitative research. According to Patton (2002), software programs that are of high quality make it easier to store, code, retrieve, compare, and link data. Similarly, McLellan et al. (2003) have indicated that storage is best done with qualitative data analysis software, which allows for easy retrieval and analysis. They added that hard-copy transcripts should be locked in a safe cabinet. Thus, the data were stored on the researcher's personal computer and backed up on other storage devices which included other software facilities available to the researcher for storage.

3.4 Measuring sustainable transportation

Measuring sustainable transport requires the identification of certain indicators that users of transport facilities perceive to be promoting community liveability. These indicators are summed up in the sustainability goals including environmental, social and economic sustainability (Litman, 2019). The imperative was to explore the sustainability of the use of tricycles in urban areas by analysing respondents' views (on tricycle use) in the purview of

some sustainability principles. Table 3.3 shows the dimensions of sustainability, the transport sustainability goal, corresponding objectives and indicators as well as the variables for measurement.

Table 3. 3: Framework for measuring sustainable transportation

Dimension of Sustainability	Transport Sustainability Goal	Objective	Indicators	Variables
Social	Universal accessibility	Fairness and equity	Connects poor (conveys the poor to their destinations) Connects other vulnerable (conveys children, women, aged, disabled to their destinations)	Sex, age, disability, level of education, occupation, satisfaction with destination
Economic	Efficiency	Time and money efficiency	Reliable Affordable	Waiting time Proportion of income spent on transportation
Social	Safety	Physical safety	Avoids fatalities Avoids injuries	No. of accidents No. of injuries
Environment	Green mobility	Green environment	Minimized traffic noise exposure Minimized air pollution	Perceived level of traffic noise exposure Perceived level of exposure to air pollution

Source: Litman (2019), Sustainable Mobility for All (2019) and World Commission on Environment and Development (1987)

Sustainability is a multifaceted concept that requires an aggregate measure to ensure comprehensive analysis. Inadequately using one variable would likely thwart and limit the information being put across by leaving out salient aspects of the concept and this could

adversely influence policy decisions (Pandian et al., 2013). Thus, any estimation of sustainability in its generic sense should include economic, social and environmental measurements unless the attention is on one particular dimension. Furthermore, each of these individual aspects has its unique contents, goals and indicators; and according to Miola and Schiltz (2019), a different selection of indicators and approaches to measurement influence performance or estimates. Most of the indicators of the SDGs are not quantitatively defined (Miola & Schiltz, 2019) making it difficult to measure sustainability using a single approach or indicator.

3.4.1 Measuring sustainable transportation using composite index

A composite indicator or performance index is useful for measuring concepts that are not uniquely defined and therefore not directly measurable (Becker et al., 2017). Sustainability was therefore measured using seven variables (indicators) from the three dimensions of sustainability. These include ‘connects the poor’, ‘connects other vulnerable like women and aged’, ‘avoids fatalities and avoids injuries’, which constitute indicators for the social dimension. The economic dimension was measured using ‘reliability’ and ‘affordability’ while the environmental aspect was measured using ‘minimize traffic noise’ and ‘minimize air pollution’ (Litman, 2019; Sustainable Mobility for All, 2019; World Commission on Environment and Development, 1987).

Three sub-composite scores of sustainability were calculated based on the three aspects of sustainability. The three scores provided the sustainability score. Even though weighting has a strong impact on composite indicators because some indicators may be more important than others (Becker et al., 2017; Miola & Schiltz, 2019), all indicators had equal weight without any exception and the measure was calculated using the principal composite analysis.

Principal component analysis (PCA) is typically thought of as a data reduction statistical approach. It reduces the number of variables in an analysis by defining a set of uncorrelated linear combinations of the variables that account for the majority of the variation. PCA seeks unit-length ($L'L = I$) linear combinations of the variables with the highest variance. The first main component has the most variation overall. The variance of the second principal component is the greatest among all unit-length linear combinations that are uncorrelated to the first principal component, and so on (Jackson, 2003; Jolliffe, 2002). As cited by Jolliffe and Cadima (2016), Pearson (1901) and Hotelling (1933) were the pioneers of PCA.

Among all unit-length linear combinations of the variables, the final principal component exhibits the lowest variance. The vital information is partitioned throughout the components in a certain way: the components are orthogonal, and early components carry more information than later components. Thus, PCA is simply a linear transformation of data. The characteristics of principal components are quite useful. Some of these are geometric in nature. Usually the principal components and principal scores are uncorrelated (orthogonal) with one another (Jackson, 2003; Jolliffe, 2002). In effect, a composite index helps to present a simple illustration of a complex or multi-dimensional phenomenon like sustainability, which cannot be explained with one variable (See Appendix V).

3.5 Analysis and interpretation of quantitative and qualitative data

Data from both strands were analysed separately according to the procedures involved in the implementation of the sequential explanatory mixed methods design. Analysis of the three objectives was based on the responses from participants and document analysis. Qualitative data were analysed using content analysis as described by Patton (2002). The process started with the transcription of interviews followed by pattern and theme analyses which involves studying the transcripts to recognize patterns and themes. Patterns and themes are similar,

except that patterns are the descriptive findings whereas the theme is categorical or topical in nature (Patton, 2002). The results of the analyses were presented under various topics in the empirical chapters of this report. These were supported with notes on observation from the field which provided more insight and confirmation to some of the responses in the interviews.

To achieve objective one, which was to examine the nature of tricycles, and their evolution as well as determinants of tricycle use as a means of public transport, quantitative and some qualitative methods were used. Quantitative data were gathered on the trip origin and destination as well as the characteristics of users to know the cross-section of society that used the tricycle with data on the determinants of tricycle use. Cross-tabulation and chi-square tests were done using STATA 14.0 and Statistical Programme for Social Sciences (SPSS) version 25 to ascertain which factors influenced the adoption of tricycles as a means of public transport.

Data for objective two were obtained through the responses from Section 2 of the questionnaire and analysis of KIIs and IDIs. Data from the observation of how the tricycles were used in the study areas were used to augment qualitative data and the overall integration of data for this aspect of the study.

To obtain the second and third objectives of analysing factors influencing the adoption and associated challenges of the tricycle as a means of public transport as well as its sustainability, quantitative and some qualitative data were used as well. Regarding the quantitative aspect, a regression analysis was done using socio-economic data and psychographic factors as well as other travel contexts. These were used together with users' composite sustainability scores to ascertain users' perceptions of tricycles as sustainable transport. Pre-coded quantitative data were analysed using SPSS and STATA with qualitative data serving as auxiliary data for confirmation and better insight. The quantitative data were presented using tables and graphs as well as written descriptions.

Objective three, which was to assess the policy, legal and institutional framework space for the use of tricycle transport services in urban Ghana, was obtained using qualitative data from in-depth interviews and key informant interviews in content analysis. Descriptive statistics from the quantitative data provided an entry point into this discussion.

It is important to note here that both SPSS and STATA were used because for multivariate analysis, SPSS is effective, and the data can be easily compiled and presented. However, STATA has the benefit of its capacity for sample selection and analyses can be done based on 60% or 80% of the dataset. Thus, while each of them has a strength and a weakness, both were employed because, when combined, the strength of STATA compensates for the weakness of SPSS and vice versa.

3.6 Empirical models for the study

This subsection describes the empirical models for this study. Two types of regression, namely multinomial regression and ordinary least scales were used in this study. Details are presented in the subsequent section.

3.6.1 Multinomial Regression Model

This study used a multinomial logistic regression model (MNL) to examine the determinants of tricycle adoption. The MNL model is best suited for cross-sectional data, as is in this study, making it the ideal model to analyse the data. Another crucial element is that the MNL model allows for the analysis of factors influencing mode choice in the context of multiple options (Greene, 2012). The dependent variables are tricycle adoption and sustainability of tricycle transport. The explanatory variables for tricycle adoption are socioeconomic characteristics (age, gender, educational level, average monthly income) transport need (feasibility,

accessibility, comfort, safety and pleasurability), and other trip contexts, some of which emanate from the psychographic variables (average trip length, number of trips per day, trip purpose, trip type and time of first trip).

The choice of explanatory variables emanated from conceptual and theoretical concepts and literature. Table 3.3 summarises the study variables offering a brief description and mode of measurement. Multinomial logistic regression allows for more than two categories of the dependent variable. All users had used *Pragiya* before and they were distinguished with the primary mode. Thus, in this study, the dependent variable takes on four categories: *Pragiya* primary mode users; *trotro* primary mode users; car taxi primary mode users; and personal car primary mode users. Like binary logistic regression, multinomial logistic regression uses maximum likelihood estimation to evaluate the probability of categorical membership. Thus, the probability of users selecting *Pragiya* depending on their socio-economic characteristics and other trip contexts can be modelled as a nonlinear relationship, where the probability of choosing *Pragiya* is a function of a set of explanatory variables. Generally, this non-linear relationship can be stated as:

$$PRIMODE_i = \beta_0 + \beta_1 COMFORT_i + \beta_2 SAFETY_i + \beta_3 AVAIL_i + \beta_4 PLEASURE_i + \beta_5 FEAS + \beta_6 SEX_i + \beta_7 INCOME_i + \beta_8 AGE_i + \beta_9 TRIP_TYPE_i + \beta_{10} TRIP_NUM_i + \beta_{11} TRIP_PURPOSE_i + \beta_{12} TRIP_TIME_i + \beta_{13} TRIP_LENGTH_i + \varepsilon_i \quad (xx)$$



Where;

$PRIMODE_i$ is the primary transport mode (dependent variable)

$COMFORT_i$ is comfortability importance placed on mode

$SAFETY_i$ is safety importance placed on mode

$AVAIL_i$ is accessibility / availability importance placed on mode

$PLEASURE_i$ is pleasure importance placed on mode

$FEAS_i$ is feasibility importance placed on mode

SEX_i is sex of passenger

$INCOME_i$ is average monthly income

AGE_i is age category of the passenger

$TRIP_TYPE_i$ is type of trip often taken by passenger

$TRIP_NUM_i$ is the number of trips often taken by passenger

$TRIP_PURPOSE_i$ is the purpose of trips

$TRIP_TIME_i$ is the time first trips are often embarked

$TRIP_LENGTH_i$ is the average length of typical trips

ε_i is the error term

β_0 is the constant term

B_i are the parameter estimates

In the MNL model, $Prim_tmode$ is a dependent variable representing the adoption of tricycles presented in the primary modes of users. Thus, the $prim_tmode$ is presented in a categorical form and measured by the mode the users adopt often. Respondents were asked which modes they often combined with *Pragiya* and the responses were *trotro*, car taxi and personal car. It also includes those who used *Pragiya* as their primary mode because they used *Pragiya* more than they used other modes. The independent variables include user characteristics, psychographic and other travel contexts like gender, age, education, monthly income, trip type and trip length.

3.6.2 Ordinary Least Square Regression Model

An Ordinary Least Squares (OLS) model was used to determine the sustainability of tricycle transportation services. There are certain assumptions that need to be met in order to use OLS

regression. First, a regression model is said to be linear in statistics if all of its terms are either constants or parameters multiplied by independent variables. The values of the error term should be determined by random chance and the average value of the error term must be equal to zero in order for the model to be unbiased.

Furthermore, the error term and all independent variables must have no correlation: when there is a correlation, endogeneity occurs. Also, the observations of the error term are unrelated to one another. Thus, the error term should not allow one observation to anticipate the subsequent observation because the variance of the error term is constant (no heteroscedasticity). For each observation, the error variance ought to be constant. In other words, regardless of the observation or set of observations, the variance remains constant. To verify this assumption, a residuals vs fitted value plot can be made. Above all, a perfect linear relationship between an independent variable and the other explanatory factors does not exist. If two variables have a perfect correlation, they may be different manifestations of the same variable. The error term is distributed uniformly even though this assumption is optional.

Finally, in order to get unbiased estimates with the lowest variance, OLS does not need that the error term adheres to a normal distribution. Examining a normal probability plot is the quickest approach to tell if the residuals follow a normal distribution (Greene, 2012). Generally, this linear relationship can be stated as:

$$SUST_PRAGYA_i = \phi_0 + \phi_1 TnT_i + \phi_2 PRAG_OTH_i + \phi_3 FUEL_EFF_i + \phi_4 UNMOT_i + \phi_5 LOW_INC_i + \phi_6 LOWER_FARES_i \\ + \phi_7 RIVALRY_NTWK_i + \phi_8 LI2180_i + \phi_9 SHORT_DIST_i + \phi_{10} CRIME_MIN_i + \phi_{11} SEX_i + \phi_{12} AGE_CAT_i + \phi_{13} EMPLOY_i \quad (xx)$$

Where;

$SUST_PRAGYA_i$ is perceived sustainability of Pragma services

TnT_i is monthly income spent on transportation

$PRAG_OTH_i$ is Pragma used in combination with other transport modes

$FUEL_EFF_i$ is fuel efficiency of Pragma vehicle

$UNMOT_i$ is Prevalence of unmotorized routes

LOW_INC_i is Prevalence of low income individuals

$LOWER_FARES_i$ is Lower fares charged for Pragma services

$RIVALRY_NTWK_i$ is existence of other rivalry networks

$LI2180_i$ is Awareness of the prohibitive LI2180

$SHORT_DIST_i$ is Availability of short distance services

$CRIME_MIN_i$ is Minimized crime activities in the neighborhood

SEX_i is Gender of respondent

AGE_CAT_i is age category of the respondent

$EMPLOY_i$ is Employment status of the respondent

In the OLS model, $SUST_PRAGYA$ is a dependent variable representing the sustainability of tricycles. It is a continuous composite index obtained from respondents' perceptions of sustainability. The independent variables include user characteristics, psychographic and other travel contexts like gender, age, education, monthly income, awareness of LI 2180, minimizes crime, availability of short-distance services, employment status, etc. The variables used in the empirical models are summarized in Table 3.4.

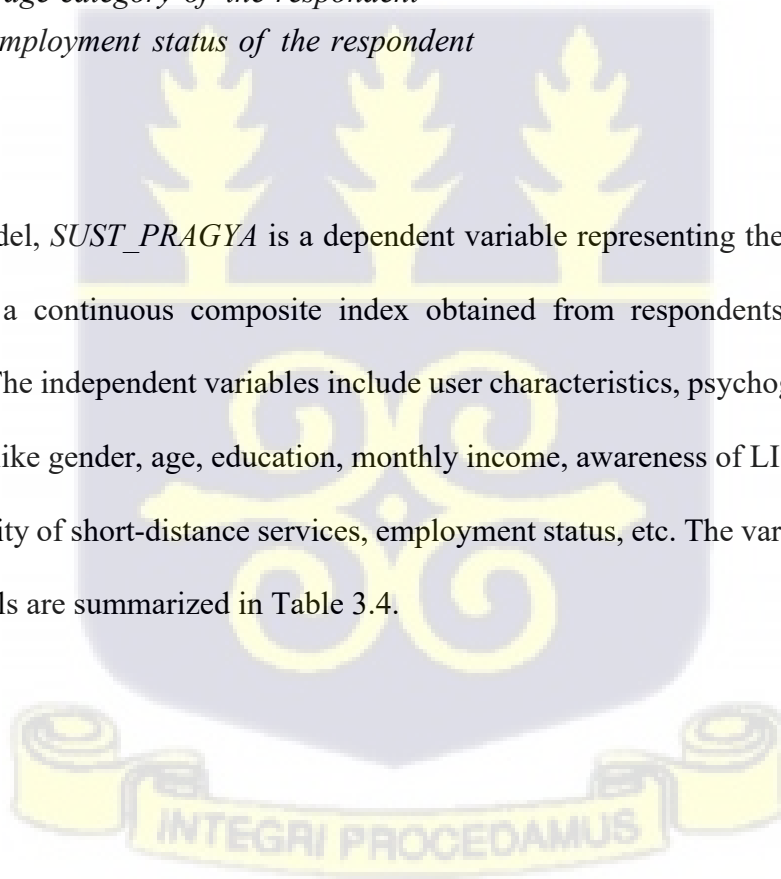


Table 3. 4: Description of research variables

Variable Name	Brief Description	Values/Measurement
Dependent variables Primary Transportation mode	All users have adopted <i>Pragiya</i> at different levels. The primary transport mode is the primary mode a user adopts even though they use <i>Pragiya</i> .	It is a categorical variable measured by respondents' choice of primary mode. The categories are also categorical variables.
Tricycle Sustainability	The sustainability of tricycle transportation services	A continuous variable calculated using PCA.
Independent variable Gender	The sex of the user	It is a dummy variable with values 1=male and 0=female
Education	Educational level completed by the user	It is a categorical variable measured in the highest level completed
Age	Age category of the user	It is a categorical variable measured in years
Average monthly income	Average monthly income of users	Continuous variable measured in amounts in Ghana Cedis earned by user
Average Trip length	Time spent on a trip (origin to destination)	Continuous variable
Number of trips per day	The number of <i>Pragiya</i> trips made in a day	Continuous variable
Time of first trip	The time-of-day users start their first trip	Categorical variable
Trip type	The type of trip a passenger uses for a trip	Categorical variable measured in 1. <i>Passenger loading</i> 2. <i>Dropping</i>
Trip purpose	The purpose for which the trip was made	Categorical variable. Recoded into 1. Economic Activities 2. Social Activities
Feasibility/Flexibility	Feasibility	A continuous variable calculated using PCA
Accessibility	Accessibility	A continuous variable calculated using PCA
Safety	Safety	A continuous variable calculated using PCA
Comfort	Comfort	A continuous variable calculated using PCA
Pleasurability	Pleasurability	A continuous variable calculated using PCA.
Employment status	Employment Status of respondent	Categorical
Crime minimization	Perception that tricycles minimize crime rate in neighbourhoods	Continuous
Monthly income on Transportation	Income respondent spends of transportation	Continuous
Short distance	Availability of short distance services	Continuous
Awareness of LI2180	User's awareness of LI2180	Continuous
Rivalry Network	Other networks in competition with <i>Pragiya</i>	Continuous
Modes <i>Pragiya</i> is combined with	Other modes the <i>Pragiya</i> is combined with	Categorical
Fuel efficiency	The fuel efficiency of the tricycle	Continuous
Unmotorable routes	The presence of unmotorable routes	Continuous
Lower fares	Lower fares charged by <i>Pragiya</i> compared to others	Continuous
Low incomes	The prevalence of low incomes among users	Continuous

3.7 Ethical considerations

In conducting this study, the safety and anonymity of participants were respected during data collection, data protection, storage and in future publication. This is because steps were taken

to safeguard the information provided as well as the identities of participants and respondents. As a result, no names were required in the data collection process. However, in the cases where a participant's name became known, the name was concealed as all participants were eventually given pseudo names.

The study did not bring any harm nor financial benefits to participants, except that participant riders and users were given a token of cell phone talk-time credit worth GHC6.00. Most importantly, ethical clearance was obtained from the University of Ghana Ethical Clearance Committee before the commencement of the study; and COVID-19 protocols were observed during data collection (See Appendix VI).

3.8 Challenges encountered

A number of issues were encountered during the collection of data from respondents, storing data, acquiring reports and papers, and doing analyses. Most importantly, the issue of respondents requesting financial favours before agreeing to interviews was challenging. Those who refused to provide information before the incentives were offered were therefore excluded. As a result, one complete tricycle station was cut off. Nevertheless, a different tricycle station in the same area was selected for the data collection without any problems.

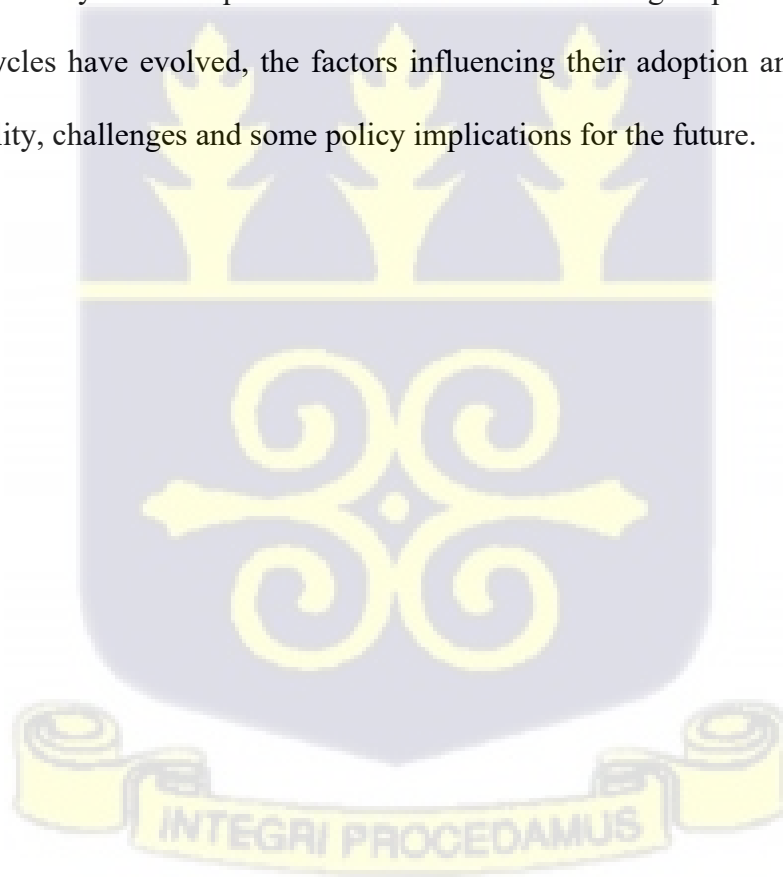
There was a change in the methods for qualitative data collection because participants were more comfortable with the individual approach than a group method. Regardless, all the data that needed to be collected were adequately covered as contrary issues were explored with other participants. This process was long, but it was possible because qualitative research is iterative.

However, the data quality was unaffected by these difficulties that complicated data collection and increased the amount of time spent in the field. This is due to the fact that efforts were

made to ensure that field assistants had the necessary training to guarantee accurate survey data by asking all the valid questions and recording appropriately.

3.9 Summary and conclusion

This chapter has looked at the processes involved in carrying out this research. For example, the specific philosophical underpinnings of the study were outlined in this methodological chapter, along with how they influenced the methodology. Also, the process showed how picking one strategy over another aided the research. To place the study in its proper context, this chapter included additional information about the research communities and participants. Additionally, the analysis technique has been covered. The ensuing empirical chapters, talked about how tricycles have evolved, the factors influencing their adoption and perceptions of their sustainability, challenges and some policy implications for the future.



CHAPTER FOUR

NATURE AND EVOLUTION OF TRICYCLE TRANSPORTATION IN GAMA

4.1 Introduction

Most urbanites use public transport, particularly low- and middle-income individuals who perceive it as the most cost-effective way to get to work and access services (Poku-Boansi & Adarkwa, 2014). As part of the regulation of public transport, the state further permits the use of car taxis and buses by private entities to augment the provision of public transport (Oteng-Ababio & Agyemang, 2015; Poku-Boansi, 2020). This chapter examines the evolution of tricycle transportation, focusing on the types of tricycles found in the research locations, as well as their defining features and differences. Furthermore, the developmental trajectory, operational mechanisms, and integration of tricycles as an important mode within the transportation system of GAMA are explained. The primary goal of this chapter is to give insights into these compact vehicles, the actors involved, and their role in bolstering transportation availability in the study area. The chapter utilizes both qualitative and quantitative data to explain how tricycles have evolved and proliferated.

4.2: Background characteristics of riders and users (quantitative)

In this subsection, data from the questionnaire survey are used to show the socio-economic characteristics of users and riders. As shown in Table 4.1, a total of 205 riders were surveyed for the quantitative data. Dome had the highest proportion of riders, accounting for 45.8%, followed by Pokuase-Amasaman, which had 32.2%. Oyibi, on the other hand, had the lowest proportion of riders (22%).

Table 4. 1: Socio-economic background of riders and users

Variable	Users		Riders	
	frequency	Percentage	Frequency	Percentage
Employment employed	313	77.3	205	100.0
Unemployed	48	11.9	0	0.0
Inactive	44	10.9	0	0.0
Total	405	100.0	205	100.0
Location	131	32.3	94	45.9
Dome				
Pokuase Amasaman	140	34.6	66	32.2
Oyibi	134	33.1	45	22.0
Total	405	100.0	205	100.0
Gender				
Male	184	45.4	205	100.0
Female	221	54.6	0	0.0
Total	405	100.0	205	100.0
Age				
15-24	103	25.4	65	31.71
25-34	213	52.6	112	54.63
35-44	69	17.0	23	11.22
45-54	14	3.5	5	2.44
55+	6	1.5	0	0.0
Total	405	100.0	205	100.0
Education				
No Education	21	5.2	10	4.9
Primary	63	15.6	49	23.9
JHS	127	31.4	80	39.0
SHS	149	36.8	64	31.2
Tertiary	45	11.1	2	1.0
Total	405	100.0	205	100.0
Physical disability				
Yes	4	1.0	4	2.0
No	401	99.0	201	98.0
Total	405	100.0	205	100.0
Years in the municipality				
5 years +	198	48.9	84	41.0
1-5 years	157	38.8	98	47.8
less than 1 year	44	10.9	23	11.2
Transiting	6	1.5	0	0.0
Total	405	100.0	205	100.0
Possess a driving license				
Yes	0	0.0	61	29.8
No	0	0.0	144	70.2
Total	0	0.0	205	100.0

Source: Field data, April 2022.

These distribution patterns signify the relative magnitudes of the tricycle stations. Among them, Dome emerged as the largest station with an estimated unionized rider count of around 120, closely followed by Pokuase-Amasaman with approximately 130 riders. Pokuase and Amasaman reported about 100 and 30 riders respectively, showcasing robust establishment and noteworthy community penetration in these stations. On the other hand, Oyibi's stations, though smaller in scale, collectively accommodated nearly 60 trikes, a suitable capacity for their operations.

Individuals who had previously operated as drivers but had lost their vehicles frequently made the shift to become *Pragiya* riders because they were inactive. Additionally, individuals skilled in various trades, such as painting, masonry, carpentry, and manufacturing labor, as well as those engaged in manual labour like wheelbarrow pushers, transitioned into tricycle ridership due to difficulties in securing contractual employment. This widespread phenomenon underscores the attractiveness of tricycle transportation as an employment option, particularly for unemployed or underemployed young individuals.

This is further substantiated by the fact that over 85% of riders fell within the age bracket of 15 to 34 years. The predominant presence of young men in this occupation supports Hart's (2016) assertion that transport offers viable work opportunities for young males. These findings align with previous research by Ehebrecht et al. (2018), Obiri-Yeboah et al. (2021) and Akaateba et al. (2023) who similarly noted the prevalence of young males among tricycle riders. The observations are also consistent with Odoom et al.'s (2020) findings, underscoring the youthful profile of tricycle riders, thereby reinforcing the existing literature's characterization of the occupation's youthful and male-oriented nature. It would have been intriguing to interact with female riders who are absent from this study, as they are not common in the study location. Their perspectives could provide unique insights and contribute to a more comprehensive understanding of the subject. However, their scarcity in the area limits their

representation in the research (only one female rider was spotted in the study site but did not form part of the sample).

Male dominance in this industry could be attributed to the social orientation and imposition of gender roles on career choices among males and females (Busari, 2024; Mensah et al., 2023). According to Mensah et al. (2023) for example, female riders often face discrimination despite being commended for their careful riding. Busari (2024) also mentioned that female riders experienced financial liberation but comes with challenges, as they often face stress and harassment from the police. Above all, the business is perceived to be risky and tiresome hence Rider 1 indicated that *“our work involves carrying heavy loads sometimes... a woman may not be able to do that”* (Rider 1, Dome). All these may explain the reasons why women often stay out of this business.

Table 4.1 displays the respondents' socio-economic background and shows that 63% had completed at least Junior High School (JHS) or Senior High School (SHS), and 1% had completed tertiary education. Only about 4.9% had no formal education, disconfirming that most public transport operators are not schooled (Cervero & Golub, 2007). The finding supports Al-Hasan et al. (2015), who found that 62% of their respondents had at least secondary education. Moreover, the qualitative data indicated that most of the SHS leavers ride the trikes to gather funds to further their education, further implying that tricycle riders mostly have some level of formal education. Thus, as suggested by key informants in the study, riders can be given proper training and licensing to make their operation safer for themselves, passengers, and other road users.

To ensure that respondents lived in the study areas and were likely to have observed the proliferation of tricycles in the sites, they were asked about the number of years they have resided in the communities. The data shows that about 88.8% of riders had lived at the three

study sites for at least a year. The rest had lived there for less than a year. This is an indication that the majority of the respondents had observed the operation of tricycles in the community for at least a year.

Also, licensing was notably poor among riders. Approximately 30% had licenses, while the remaining majority did not. According to riders, the cost of obtaining a license deters them from doing the right thing as indicated by the qualitative data. For example, Rider 6, a young adult rider who was formally a coconut seller and *Aboboyaa* (trike with bucket) rider, mentioned that *“obtaining a license is very expensive. Sometimes, you have to pay about GHC1000 (about \$129). But if we have to pay this same amount in instalments, I think many riders can afford that and it will encourage us to get our licenses”*. Another rider stated that *“motor and car license should not be the same [regarding cost for cars and motorbikes]. It is too expensive. Why can't I use a car license which is higher to ride a motor? If it were GHC200 or 300, every rider could get one... It ranges from GHC500-1000 (\$65-129). And you cannot have it directly from DVLA too so we go through agents who end up spending our money”* (Rider 8, a former mason and tricycle riders advocate). This may be one of the reasons why the DVLA has digitized the license application process to rid it of the problem with agents. The poor licensing in this study confirms Obiri-Yeboah et al. (2021) and Doherty's (2020) findings on poor licensing. Obiri-Yeboah et al. (2021), for instance, reported that most *Pragiya* riders in Kumasi had no license, but it seemed to be a general practice among public transport operators.

Table 4.1 further shows that there were 405 users in this study of which about 77% were employed, while 22.8% were either unemployed or inactive. Additionally, more than half (54.6%) were females, while the remainder were males implying that women were more likely to use tricycles than men.

Similar to riders, a little over half (52.6%) of users were aged 25-34 years. About a quarter, comprising 25.4%, were between the ages of 15 and 24—users who were 55 years and above constituted about 1.5% suggesting that younger people were more likely to use the tricycle than older people. Additionally, approximately 68% of users had either completed JHS or SHS; and unlike 1% of riders who had tertiary education, about 11% of users had tertiary education.

Close to half of the users (48.9%) had lived in the study sites for more than five years, while some 38.8% had lived there for one to five years. On the other hand, the minorities who were either transiting or had lived in the study sites for less than a year constituted 1.5% and about 11%, respectively. Moreover, most of the users (34.6%) were located at Pokuase-Amasaman. Another 32.3% were at Dome, while about 33% were found at Oyibi. These statistics support the assumption that tricycles are used in particular conurbations or communities for everyday short-distance and other related travels as explicated by Diaz et al. (2016), Jing et al. (2019) and Tuffour and Appiagyei (2014).

Of the 313 out of 405 users who were employed, 38.7% were paid employees and 32.3% were non-agriculture self-employed without employees. The rest (20%) were casual, apprentices, domestic, or other agriculture workers, earning less than GHC1,000.00 (\$129) on average a month. Many paid employees earned between GHC 600-1500.00, an equivalent of about \$77-193.00 a month. This indicates that low- to middle-income groups often commute with tricycles validating Mbara (2016), Evans et al. (2018) and Onyango (2018), who indicated that tricycles/motorbikes serve low-income areas.

4.3 Who are the actors in tricycle transportation?

Obiri-Yeboah et al. (2021), refer to tricycle riders as the ‘new players’ in Africa’s public transport landscape playing significant roles in shaping Africa's public transport system.

Furthermore, Diaz Olvera et al. (2020) have categorised these riders into four categories: self-employed riders, work-and-pay riders, renters, and investors. Aside from the riders, there are a number of additional characters that are connected through intricate relationships. Some of these actors have a more significant role or direct engagement in tricycle ridership than others. The riders, who are responsible for delivering the rides, and the users, who patronize the rides, are the most visible actors. There are the Station Masters and *bookmen* who generally take the responsibility of assisting passengers, collecting taxes and fees from drivers, and ordering vehicle arrival and departure. They ensure that station activities are orderly (Hart, 2016). In all the tricycle stations, there was either an employed bookman or someone (rider or executive) was selected to play that role at any given time.

There were market queens as well, who were regarded as people who played an important role in controlling and organizing market operations, advocating traders' interests, and facilitating interactions between sellers, clients, and municipal authorities. They could also be in charge of settling conflicts, advocating for the rights of market women and other traders, and contributing to the general operation and growth of the market. Generally, the term "market queen" denotes a position of power and leadership within the community's economic and social fabric. It denotes a woman who is popular and powerful in a local market or trade community (Scheiterle & Birner, 2021).

Another group of actors identified are the land guards who are groups of individuals who participate in unauthorised and frequently criminal actions relating to land ownership and disputes in Ghana. Land guards are notorious for forcibly seizing or occupying land without necessary legal authority, frequently using intimidation, threats, and violence. These sometimes pretend to have the support of particular individuals, traditional authorities, or they may even use fictitious documents to declare their ownership of property (Adusei, 2024).

Additionally, tricycle association executives, regulatory agencies, and municipal transport officials are among the less visible or indirect participants. These individuals have diverse influences behind the scenes, either facilitating or impeding tricycle activities. It should be noted that extensive information on regulating agencies and assemblies is found in Chapter 6. Table 4.2 summarises the participants who took part in in-depth interviews. This table provides background information on the participants, such as their tricycle usage, previous and present jobs, and general information. The table particularly includes information from the 12 riders and 12 users that were interviewed. The backgrounds of the participants show that users were mainly informal workers. For instance, traders of different goods or products while riders were also formerly into other forms of informal work like riding *Aboboyaa* (tricycle with a bucket), drivers of car taxis and mobile money vending. They mostly had a previous experience with one motor vehicle or the other. Many of the riders had left their former jobs to work as tricycle riders suggesting that the tricycle business appeared to be more lucrative than the jobs they had.

A major portion of the participants were males because all the riders were males in addition to a few male users. A considerable fraction fell into the young adult or adult category. This was expected because transportation has often been a go to job for young males (Hart, 2016). Also, while many of both users and riders were younger people, a smaller proportion of the participants, however, were older, aged 55 and over. In total, 24 people participated in the in-depth interviews. The number and type of participants as shown in Table 4.2 were critical in constructing pseudonyms that remained consistent throughout the data analysis and report-writing processes.

Table 4. 2: Characteristics of participants for in-depth interviews

Number and Type of Participant	Sex	Age range	Study Site	Any Relevant information
User 1	F	Young Adult	Oyibi	Rice seller. Had lived at Oyibi, after the estates for less than a year
User 2	F	Young Adult	Oyibi	Shopkeeper. Sells oil and spare parts for bicycle, motorbikes and tricycles near one of the trike stations at Oyibi
User 3	F	Adult	Pokuase-Amasaman	Sells onions in a distant community close to Nsawam
User 4	M	Young Adult	Dome	Shoemaker. Makes and sells local Ghanaian slippers
User 5	F	Young Adult	Dome	Shopkeeper. Uses the trike to run errands
User 6	M	Aged	Oyibi	Retired. Lives at Amranhia. Uses the trike to commute from home to the main Adenta-Oyibi road
User 7	F	Middle Aged	Pokuase-Amasaman	Sells cassava~ and corn dough
User 8	F	Middle Aged	Pokuase-Amasaman	Mobile money vendor. Lives in a community with inaccessible and dusty roads
User 9	F	Middle Aged	Pokuase-Amasaman	Sells cassava~ and corn dough in a distant flood-prone community.
User 10	M	Adult	Pokuase-Amasaman	Middle class. Lives around Teacher Kope at Pokuase. Uses the trike for short distance travels
User 11	M	Adult	Dome	Lives at Christian Village towards Dome. Nigerian and a student in a tertiary institution
User 12	F	Adult	Dome	Lives at Legon. Uses the trike on her major shopping days
Rider 1	M	Adult	Dome	Former wheelbarrow pusher and hearse driver. Has established a boutique and a fast-food joint from his profits as a rider
Rider 2	M	Adult	Dome	Had driven a taxi and company car before riding a trike
Rider 3	M	Adult	Dome	Had some formal education. Used to supply indomie (a brand of noodles) with low salary. Stopped and stayed home for two years without a job and later started riding the trike.
Rider 4	M	Young Adult	Oyibi	Was unemployed after Secondary school for one and a half years. Worked as a mason to gather funds to buy a trike. Had been riding for two and a half years and a tertiary student as well.
Rider 5	M	Adult	Oyibi	Used to work with Ghana police service. He left the work and stayed home a bit. Started by renting a trike until he was dashed an old trike that he owned
Rider 6	M	Young Adult	Oyibi	Formerly a coconut seller. Owned a trike with a bucket (<i>Aboboyaa</i>) for the coconut business. He switched to a passenger trike (<i>Pragiya</i>) while selling coconut at one of the <i>Pragiya</i> stations.
Rider 7	M	Middle Aged	Pokuase-Amasaman	He used to ride the <i>Aboboyaa</i> but stopped because the rain beats him. He switched to <i>Pragiya</i> and had ridden for three years, six months.
Rider 8	M	Adult	Pokuase-Amasaman	Used to be a building contractor but lost it all through politics. He used to advocate for riders. Then started working with <i>Aboboyaa</i> and then later <i>Pragiya</i> . Established a union through his advocacy work with riders
Rider 9	M	Adult	Pokuase-Amasaman	Nigerian. Businessman. Used to ride motorbike and <i>Aboboyaa</i> when business collapsed. Part of those who established the <i>Pragiya</i> Station.
Rider 10	M	Middle Aged	Pokuase-Amasaman	Had ridden for three years. Used to be a <i>trotro</i> driver without a license. Moved on to ride <i>Aboboyaa</i> and later <i>Pragiya</i> because it works in similar ways as <i>trotro</i> .
Rider 11	M	Aged	Pokuase-Amasaman	Was a taxi driver for 30 years. He was a farmer and used to work in a wood company. Started by renting until he bought his.
Rider 12	M	Aged	Pokuase-Amasaman	Used to be a taxi driver
Total number of participants = 24.				

Source: Field data, April 2022.

Table 4.3 summarizes the backgrounds of KII participants. It was made up of five station masters, five owners, and six officers of government transport agencies. The majority of

participants were in their forties and fifties (middle-aged), with the remaining being adults.

They were all males except one. In all, sixteen participants were engaged in the KIIs.

Table 4. 3: Characteristics of participants for key informant interviews (KIIs)

Number and Type of Participant	Sex	Age range	Study Site	Any Relevant information
Station Master 1	M	Middle Aged	Pokuase-Amasaman	Station started with him and two others with a total of three trikes. Used to ride motorbike and has a trike
Station Master 2	M	Middle Aged	Pokuase-Amasaman	Started the trike station with a few trikes but had about 80 active riders at the time of data collection. He started with an older man in his 70s. He owns one trike
Station Master 3	M	Young Adult	Oyibi	Was a student. Started the station alone with a motorbike and later switched to tricycle because clients were afraid of motorbikes
Station Master 4	M	Middle Aged	Dome	Started the station in 2019 but not as a union with a couple of other men who formed the leadership of the group.
Station Master 5	M	Young Adult	Oyibi	He stopped work as a construction worker because it was stressful. Started the station in 2018. Could drive a car and ride Aboboyaa before riding the passenger tricycle
Owner 1	M	Adult	Oyibi	Had owned a trike since 2019. He owned two at the time of data collection. Bought trikes with savings
Owner 2	M	Adult	Pokuase-Amasaman	Became an owner in 2019 and owns two trikes. Bought first trike with personal savings from riding Okada
Owner 3	M	Adult	Pokuase-Amasaman	Owned a trike since 2019 and owned two at the time of data collection
Owner 4	M	Adult	Oyibi	Had owned a trike since 2020 and owned two trikes at the time of data collection. Bought them as home use from personal savings
Owner 5	M	Middle Aged	Dome	Owned a second-hand trike since 2020
Transport Officer 1	M	Middle Aged		Head of Transport in one of the municipalities in Greater Accra Metropolitan Area
Transport Officer 2	M	Middle Aged		Head of Transport in one of the municipalities in Greater Accra Metropolitan Area
EPA (KII 1)	M	Middle Aged		Senior Officer at EPA, Headquarters
DVLA (KII 2)	M	Middle Aged		Senior Officer at DVLA, Headquarters
NRSA (KII 3)	F	Adult		Senior Officer at NRSA, Headquarters
MTTD (KII 4)	M	Middle Aged		Senior Officer at MTTD, Headquarters
Total number of participants = 16				

Source: Field data, April 2022.

Regarding the station masters, three out of five were young men in their late twenties to early thirties. The other two were older and possibly in their mid-forties. All of them (except one who had formal work) had trikes with which they worked. However, they all owned trikes, with some as many as four. They were the first point of contact regarding issues about the station, even though there were other executives or leaders in all cases. All the station masters

attended church and were mainly unmarried. They also reported having children and other dependents. Four of the station masters were Ghanaians, and one was Nigerian.

4.4 The types of tricycles for public transport in GAMA

Qualitative data from observation and KIIs, as well as field notes, were used to delineate the types of tricycles. The data indicate that riders used different brands of three-wheelers for public transport. They also used specific brands for certain reasons. Two main types of tricycles were identified in the study sites, namely Type A and Type B, as Figure 4.1 shows.

Figure 4. 1

Two main types of tricycles in GAMA



Source: https://www.alibaba.com/product-detail/Hot-Sell-Passenger-Canopy-Apsonic-Motor_1600295141795.html?spm=a2700.7724857.0.0.6bbf353ddNchto and <https://www.motodeal.com.ph/motorcycles/bajaj/re/standard>

The Type A tricycle is rugged partly because of its wider tires and higher height. It is intended for four passengers and a driver, with additional cargo space under the passenger seat and on the carriage above the passenger cabin. There is also a rain tent over the driver's seat, which is

separate from the passenger cabin. An ignition switch is located on the handlebar, and crash guards are available to safeguard riders in the event of a collision. They run on twin-spark four-stroke engines and on fuels such as CNG, LPG or petrol. This type is open on both sides and has four passenger handle grips (Jack et al., 2021). Additionally, Type A tricycles include the Chinese Huahai and Apsonic as well as the primarily Italian Piaggio. Kumar et al. (2016) have observed that automobile manufacturers like Bajaj Auto Limited (Ltd.), Piaggio Vehicles Private Ltd., Atul Auto Ltd., etc. produce three-wheeled auto-rickshaws with seats for up to three passengers that are frequently used as low-capacity informal public transport vehicles.

On the other hand, the Type B tricycle is intended to transport three people, a driver, and an additional payload. It has two cabins, one for the driver and one for the passengers. The driver's cabin has the handlebar (steering wheel, which is comparable to that of a motorcycle), the ignition switch and the driver's seat. A front dome protects the driver's cabin, which houses the windshield and driving mirrors. Both cabins are covered in a leather/canvas material that shields people from the weather elements. It has a twin-spark four-stroke engine and can run on CNG, LPG, or petrol. They are open on both sides but have handle grips for passengers to hold on to (Elmardi Suleiman Khayal, 2019; Jack et al., 2021). These handle grips are to ensure that passengers stay seated and not get overly tossed around in the passenger cabin or worse of all, through the open sides. Furthermore, the brands observed were Bajaj and TVS, which have origins in India (Elmardi Suleiman Khayal, 2019). Importers, distributors, assembling, and retail businesses made up the supply chain. However, many of these miniature vehicles share the same traits. Some of these traits have been included in Table 4.4.

Table 4. 4: General characteristics of tricycles found in GAMA

Aspect	Range of Specification
Engine	4-Stroke Forced Cool Air
Battery	12v
Maximum Speed	60-65 Kmh
Type of Fuel	Petrol Or Diesel
Steering	Handlebar
Fuel Capacity	8-10.5 Liters
Engine	1 Or 2 Cylinders
Maximum Weight	670-747 Kg
Kerb Weight	348-420 Kg

Source: Field Data, April, 2022 and https://theicct.org/sites/default/files/publications/Iyer_two-three-wheelers_India_August2012.pdf

Most Type A and B tricycles used 4-stroke forced cooling air engines with 12 Volts batteries and had a maximum speed limit of between 60-65 kilometres per hour (Kmh). In all the trikes observed, handlebars were used for steering, the fuel type was either diesel or petrol, with a capacity of 8-10.5 litres, and they had a maximum weight of 670-747 kilograms (kg). It is worth noting that based on the curb weight of about 348-420 kg, the passenger tricycle can carry an equivalent of between 7-8 Ghana cement bags of load where a bag weighs 50kg. Further, most tricycles were single-cylinder engines rather than double. Jack et al. (2021) made a similar observation in their study on the legalization of tricycles in Ghana.

Apart from these somewhat technical characteristics, most tricycles maintained their factory colour of yellow or blue. Consequently, some people sometimes call them *Yellow Yellow*. Nonetheless, a few had repainted theirs with army green and red colours. Moreover, even though they operate commercially, they all have blue background number plates different from those of commercial vehicles. This difference is because the DVLA provides blue background and white inscription number plates to motorbikes and tricycles for private use only and yellow background with black inscription number plates for commercial vehicles. Aside from that, LI 2180 prohibits using three-wheel vehicles as commercial passenger vehicles. Thus, the tricycles are registered for private use as far as the DVLA is concerned.

It must be noted that Type A was primarily used in Dome, Oyibi, and Pokuase partly for the uneven nature of the roads and the heavy market loads they carried. However, at Pokuase - Amasaman, several Type B trikes were seen. According to Station Master 2, a middle-aged man stated that “*we [the Pokuase-Amasaman Station 1] do not admit the TVS type (Type B) because the road is rough. [The road potholes were filled with quarry stones and chippings, making it bumpy when riding on it] which is why it [Type B] could not be used in the community even though they are more comfortable, and people preferred it to Royal and Apsonic [Type A]*”. He further added that “*they [Type B] are unsuitable for business because the road will accelerate its deterioration. Also, the Royal and Apsonic trikes have slightly bigger tires, ideal for the roads at Teacher Kope and Domeabra... which are some of the communities we serve*” (Station Master 2, Pokuase-Amasaman). Juxtaposing this argument by the honourable Station Master with RCT, it could be debated that the provision of tricycle transport in the area was more of a business venture to Station Masters than addressing the need of commuters in the area. That is, considering the rutted nature of the road and linking it to RCT, the use of Type A tricycle by the Pokuase-Amasaman Station 1 could save them money from constant repairs and breakdowns than if it were Type B. This resulted in users losing out on achieving their transport need of comfort and having to manage what was accessible.

Type B tricycles had more comfortable passenger and driver cabins, which are more suitable for tarred roads. However, Type A tricycles were ideal for rutted and potted roads because of their make. For example, Type A has more height than Type B but both are adaptable to poor road networks and can carry people and loads. Whereas Type B tricycles have a front dome to protect the driver from weather elements, Type A does not have a dome. Instead, they have a tent or canopy above the driver’s seat to at least protect the driver from the sun but not rain or excessive wind. Being the most common type in all three sites, a cross-section of the riders

admitted to how the rains beat them till their “*shoes collect water*” when it is a heavy downpour.

The tricyclists displayed stickers of their association and or Municipal registration numbers. These numbers served as a means of identification and further helped with revenue collection within the association and beyond. Besides Association stickers, the riders displayed other forms of identity through stickers. For example, the football clubs they supported. Nevertheless, most of the other stickers were religious and were posted at the back or on the side of the tricycle: a few were posted at the windshield's lower right corner. Some of these stickers indicated whether the rider or the owner was a Muslim or a Christian. Regardless of how decorative the stickers were, the placement could be described as obstructive. For example, Figure 4.2 shows how a rider used stickers to cover his driving mirror.

Figure 4. 2

Driving mirror with stickers



Source: Fieldwork, April 2022

Posting stickers on the driving mirror may impede the driver's sight when riding. Although this might get riders in trouble with law enforcement agencies like the GPS-MTTD and District Assembly Task Force, the practice was not widespread and hence very likely to be ignored. This may reflect poor regulation by the government transport agencies and could be an area to be monitored in any attempt for regulation.

Furthermore, there were other decorative materials in the passengers' and the drivers' cabins. Those in the passengers' cabins included colourful curtains, more comfortable and bright upholstery, and doormats. In addition, a few riders had air fresheners in the passengers' cabins. In the drivers' cabins, there were fluffy balls stacked on the inner side of the windshield, and there was the presence of music in the form of improvised loudspeakers. The decorations included flags of different prominent nations and those of their favourite European football clubs. Above all, some riders had customized their canvas cover with images of notable people. In contrast, others had their nicknames or famous allegories written behind the vehicle or on the canvas cover. According to the riders, the tricycle served as their office; hence, they are responsible for making it attractive and welcoming to their customers and themselves.

Even though riders often left the passengers with a limited choice of which trike to board and passengers did not consider the decorations intensely when selecting a ride, the riders were usually confident that the uniqueness of their trike attracted passengers and made them comfortable.

Essentially, these numbers, colours, and practices of introducing art pieces in their workspace, to some extent, valorise and give them a sense of belongingness, identity, and uniqueness as individuals and a group. They prepare the grounds for unionization, which can further impact their beliefs and work environment as well as leapfrog them towards their quest for recognition and acceptance. These findings validate Jack et al. (2021). They found that to reduce the

nuisance of motorbikes and tricycles when accepted for commercial operation, respondents asserted the formation of associations, embossment of identification numbers, and unique bike colours for specific associations. Additionally, not having identification could create negative consequences (Jack et al., 2021).

Regarding space for load, both types have ample space for passenger luggage. For Type A trikes, the top carriage and under the passenger seats are available; for Type B, the passenger cabin behind the seats can carry some load. Managing space is key to optimizing the full capacity of tricycles due to their compactness. For example, in Type A, one of the seats can be collapsed to create room for more load. Thus, it can carry considerable amounts and different loads, including firewood, charcoal, bags of rice, sugar, cement, corn and cassava dough, and baskets of farm produce. Additionally, although riders of Type B tricycles frequently manage to fit a fourth passenger in the driver's cabin, it is intended to seat the driver and three extra passengers in the back: another practice often ignored by authorities.

Despite being the result of strain, these show the agency and creativity of riders in finding room in an already constrained area to maximize usage. It is reasonable to commend their efforts in putting information from prior employment or education to use to extend the life of the trike and help them navigate the difficulties of tricycle operation. However, the waste that some of these trikes will produce over time, given their short lifespan and the strain some riders put trikes through to work, is an environmental concern whose reality will soon hit.

From the appearance of the tricycles, a few were relatively new, as in less than four weeks in operation. These were often covered with plastic from factory packaging; the body was smooth and shiny, while the canvas over the metal frame and the zips were new and intact. Moreover, the riders were constantly dusting it to maintain its newness. Additionally, the majority were relatively new and not very old either. Those in this category are usually about one to two years

in operation. These had no factory rubbers covering them, and they looked dusty from extended usage even though they were maintained occasionally. Some had a few slight dents and scratches on the body. They also had some fittings falling out of place and needing replacement. However, quite a few were very old, aged two years and above. A few of such had been repainted with patches of the old paint. Old trikes mostly had dents and scratches and were often dusty, smoky, and greasy. Furthermore, old tricycles had parts of the headlights and flash taillights smashed, and the vehicle generally looked run-down. Consequently, some had re-welded the chassis and introduced iron rods, wood, and empty plastic bottles to firm it up at the top to hold the canvas/leather cover. Figure 4.3 shows images of relatively new and old tricycles.

Figure 4. 3

Images of old and fairly used trikes



Source: Fieldwork, April 2022

Figure 4.3 depicts a relatively new 2022 Type A tricycle and a somewhat old 2020 Type A tricycle. Because tricycles deteriorate quickly, newly registered vehicles appeared fresher than ones with older registration numbers. However, there were a few instances where older registered trikes seemed newer than they should have due to the rider's consistent maintenance practices.

Finally, the qualitative data showed that how a rider uses the trike determines how fast it deteriorates. Thus, exceeding the weight limits or using the machine for *lapping* (that is when the rider does not load from the station or loading point) rather than loading at the station has severe consequences for the trike as far as the engine and the body are concerned. On the other hand, a well-kept trike can remain efficient for at most three years. After three years, riders spend a lot on maintenance, so riding an old trike seemed relatively unprofitable to riders compared to those with relatively new trikes. Regarding the cost of maintenance, intensity of use and age of tricycles, Rider 5, an adult rider who used an old tricycle, lamented that “[when the trike is old] *we spend continuously on repairs. Last week, for instance, I spent GHC2000 (about \$260) on this trike and it is spoilt this week. I have to repair it on credit... My trike is four years old ... definitely, a new trike will not be like that but you cannot always have a new trike*”. The qualitative data showed that the majority of riders obtained their tricycles through renting, *work-and-pay* and occasionally self-purchase as mentioned by Diaz et al. (2016). *Work-and-pay*, unlike hire-purchase contracts, involves ownership transfer after a specified amount of time, and renters are not obliged to purchase the vehicle at the end of the term. In exchange for daily use of the motorcycle, the driver pays the owner a set amount for a predetermined period of time. During the term of the contract, the driver must maintain a level of activity sufficient to pay the instalments on time, cover operating expenses (fuel, maintenance, and repairs), and earn his own revenue.

Furthermore, in work and pay arrangements, the owner is exclusively responsible for the expenditures associated with vehicle ownership (licences, taxes, and insurance). When the contract expires, the driver acquires ownership of the motorcycle. To satisfy the contract's requirements, the work-and-pay hirer must utilize the motorbike extensively, putting riders under time and financial strain. Because of this heavy use, the equipment is frequently in poor condition towards the conclusion of the contract. In the event of a missing or late payment, the owner can terminate the contract and reclaim the machine. These types of situations are routinely brought to the attention of the police or even the courts (Diaz et al., 2016; Ehebrecht et al., 2018).

In contrast to how trikes were typically acquired, one rider had an old trike for free.

4.5 Evolution of tricycle transportation

The analysis of responses from the interview of five station masters, 12 riders, five owners, 12 users and field notes was used to develop this subsection. From the extensive statements narrating how tricycle stations began, sub-themes viz, year or time, other agents or actors, roles of other agents or actors, motivation or reason, contestations, police harassment, and processes were created with evolution as the key theme. These helped to contextualize the evolution process. Stations are similar to stages in Doherty (2020), and they are critical in the evolution of tricycles because they form the loose framework within which riders operate. Stations are the designated places where the riders park and wait for their clients. It was deduced from the analysis that while some stations formed over time and as an afterthought, others had the idea of a station from the start. A station's formation clearly involved other actors who either helped or hindered the process.

Additionally, the narrations and motifs from the qualitative results hinted at rivalries between different networks and riders, on the one hand, and station masters on the other. Finally, along

with police intimidation because of licensing and permit violations, there were disputes over authority and protocol in the tricycle groups. Some of the concepts mentioned above are illustrated in the narrations from two of the station masters in the following narrations.

Station Master 2, a middle-aged man, narrated how he started his station to help a community that had transportation challenges and the opposition he faced within the group he co-founded. He said, *“before you start a business, you must think through and know where the business will do well and site it well. So, we saw that on the route that we serve, [Domeabra-Katapor], the people there struggle with transportation. Many of them were using the motorbike, but that was not what they actually wanted. You understand, right? They didn’t like the motorbike but didn’t have an option either. So those who were scared to get on the motorbike walked while the courageous ones used the motorbike. And when it rains, whether you like it or not, you must get on a motorbike because of the nature of the road [There are large potholes covered with quarry stones and chippings. It is bumpy and dusty. It was obvious that when it rains, the potholes will collect water and the road will be muddy].*

Moreover, the motorbike splashed muddy water on passengers when it rained. Considering all these, we realized that if we introduced the trike, most that used the motorbike would switch to this one [tricycle]. That is, this one [tricycle] is safer than the motorbike. So, this is why we started this station. And even when we started, the motorbike riders were teasing us; they felt we would not survive in the market, but they soon realized that most of the people who used the motorbike switched to Pragiya... They prefer the Pragiya because it is fast and airy.

When we started, we were four, and the older man among us began with three work-and-pay trikes. When he recovered his investments, he left for his sons to continue. He was very old at the time... about 70 years... When we started, we had a lot of confrontations with the taxi drivers and the motorbike riders because we were all serving the same route and people

preferred us to them. Now we have over 100 trikes, and in a day, you can get about 70-80 trikes working... We are usually very busy in the morning because people will be going to work, so we move fast. This early morning rush can continue from around 10 am until 2:00 pm when schools have closed... This one will take us into the night, around 9:00 pm. After 9:00 pm, only a few people [riders] work...

There was a misunderstanding about leadership and the group split in two, Group A and B. So now we have two groups in this Station. I am the leader of Group B. As you can see, I limp [Station Master limped]. I wasn't like this. They [other riders from Group A] put a curse on me because of this work. They told me they would paralyze me when the group split" (Station Master 2).

Another station master recounted how his station was formed as an afterthought and stated that "I am a task force. As a task force, I used to work with taxi and trotro drivers, but trikes were missing in the system. The first time I saw the Pragiya, I seized it. When the owner came, I realized he was a policeman. He asked me to allow the boys to operate. Later the boys wanted to team up, but I disagreed. They brought prominent people to come and see me, but I disagreed. Along the line, the bridge leading to the market broke down, so passengers could not cross to either side unless they got down and walked. The trikes were loading on both sides. At the time, a few more riders had joined; we [some of the people who have become the leaders of this group] used to collect money from the boys and share it weekly... Based on a tipoff, the police carried out an operation and arrested about thirteen boys. When we finished addressing the problem with the police, some friends encouraged me to organize them because it was still not a union. With the help of a friend from GPRTU, I fought for a permit for the group, and we were given that side of the market [pointing to a narrow, bumpy lane that leads to the back of the market] from where to operate. The land there is uneven, so we had to fill it with silt from the gutters. I later had an idea to put concrete where we are sitting [a concreted floor close to

the roadside] so that some boys can load from here. I do all this to have control because if you are taking money from them, there must be something to show... I realized that I could become a target for attack, so I surrounded myself with strong boys so that if someone wanted to fight, the person would rescind when they saw the boys... The first time we organized ourselves into a union, we had about 61 trikes. The boys came from different backgrounds; some were wheelbarrow pushers in this market, electricians, ghetto boys, students, and even taxi drivers were joining us... Some are also thieves; I know them... Currently, the friction [between trotro and taxi drivers] is still there but not as before... It is against the law to ride through the middle of the road, but because the Pragiya has that advantage, it pains the taxi drivers. And they can go anywhere. Check the routes for yourself [handing over a sample ticket, the routes indicated that this Pragiya group could serve all the communities around the market]” (Middle-aged Station Master 4).

The narrations above show how two station masters described how their stations began and worked. Before the appearance of tricycles in parts of southern Ghana, they had been in operation in the northern parts of Ghana for much longer (Obiri-Yeboah et al., 2021). Most of the Pragiya stations in this study started in 2017-2019 but picked up momentum during the peak of COVID-19 in early 2020. Usage of tricycles increased probably because of the fear of getting the disease outside the home or the necessity to arrive home early for safety.

It is important to note that many of the tricycle stations were the innovation of locals. These locals were aware of the challenges and opportunities in the area and could take advantage of them because they lived and worked in the area. But it was not carried out by one person. Instead, they worked along with other operatives, occasionally even a member of the security forces like a police officer. Other actors that were mentioned by participants included a task force from the local government, a chief, a market queen, other well-known community figures, or a member of an already established transport cooperative.

These individuals supported the process by taking on various responsibilities. The Chiefs, for example, facilitated the release of physical space for the tricycle stations in three of the sites and helped to arbitrate disputes among riders. The market queens helped maintain cordiality among tricycle riders and other networks that worked around the market; and the policemen helped to resolve disputes with other networks or riders and ultimately assisted in acquiring a 'permit' for the groups to operate.

Nevertheless, to avoid frequent casual arrests, the riders organize an excellent sum of money to go and see these law enforcement agencies to unofficially announce their presence and impress upon the officers to allow them to operate and to be recognized as a group. This is not in any way to allow reckless riding but to enable them to operate even though the law forbids their activities. The riders prevented these frequent arrests by sharing information on the location of the police with other riders who either turned back or changed their routes. Similar observations have been made by Doherty (2020), who indicated that riders shared information on traffic and the location of the police. According to Jack et al. (2021), fleeing from the police can result in reckless riding. Therefore, establishing a clear approach, such as strictly enforcing LI 2180 or revising it to permit riders to operate within specific parameters, could be beneficial to all parties involved.

Some of the station masters might have identified real transportation problems, as the vignettes above suggest. Further, they might have seen opportunities through which they could have some control and financial gains both in the short and long term. These station masters masterminded the establishment and continuation of tricycle stations and could well be described as the *early birds*. Consequently, they have become targets of attack from other network operators like *trotro* and car taxi drivers, and group members who may feel more entitled to run affairs.

Station masters were observed to command a lot of respect from the riders, which stems from their sacrifices to ensure that work continues at these stations. Or perhaps when there was a challenge, station masters were able to make it go away. In most study sites, the station masters had faced some form of police harassment, while some riders had been arrested several times and put in jail for riding the tricycle without a license or permit. Nevertheless, station masters have often come through for many of these riders who have made the tricycle group their new family. But it was difficult to attribute riders' unflinching support for station masters to respect only.

Similar to other well-established transportation networks, different crosscutting actors may or may not be directly engaged in tricycle transportation. The subsequent sub-sections attempt to describe some of these actors and answer the Where, How, Why, and When questions of tricycle transportation.

4.6 Tricycle transportation in Accra: Structure, practices, and discipline

Extracting significant statements from the transcripts, data from observation, and field notes, themes were formulated regarding the organization, practices, and ethics or discipline in tricycle transportation. The themes that emerged are group/union name, leadership, fees/dues, membership procedures, discipline/ethics, welfare/recreation, and loading procedures (board keeping, station loading, lapping, hailing). This analysis explained the structure and some of the practices in tricycle transportation. The data suggest that tricycle stations have some form of structure and accepted practices with which they operate. Thus, there is some level of understanding between actors based on these arrangements.

4.6.1 Group name and leadership

Essentially, all the stations visited had a working group name, and some had registered their group and obtained a route permit. They also had noticeable leadership with some responsibilities at all the tricycle stations. Leadership in all the sites ensured orderliness among riders and punished riders who went wrong. However, the structure of leadership was different in all the stations. For instance, in one of the sites, they had an executive committee comprising a chairperson, vice chairman, secretary, treasurer, and other members, with the chairman acting as the station master. Apart from the station master, who supervises the day-to-day activities of the station, the others were there for other supervisory roles. Unlike Dome, tricycle stations in Oyibi and Pokuase-Amasaman, however, had a station master, a deputy, a *bookman*, or a ticketing officer who may not be part of the leadership. The employed bookman or ticketing officers were paid from the daily booking fees that the riders paid at all the stations to ticketing officers. Bookmen were expected to collect the daily booking fees and keep the *loading board*² by recording and showing the order in which tricyclists loaded and moved out of the station. Conversely, Dome did not have a bookman so the station master did the collection of fees while other riders kept the board. All these examples show how the riders can structure their operations and create jobs by directly employing individuals from outside their group. With improved training and support from government transport agencies, they could organize themselves more effectively, similar to drivers of other transport modes.

² A "loading board" is a designated area or platform at a transport station where passengers and cargo are loaded onto vehicles such as buses, vans, or trucks for their destinations. The loading board ensures orderliness, safety, and effective management of the loading process at transport stations. Most stations use Formica or chalkboard to order the vehicles systematically.

4.6.2 Fees and financial contributions

It was observed that riders made specific financial contributions to the group or station. For example, they paid a one-time station admission fee of GHC300-500.00 (\$39-65) depending on the station to which they belonged. This fee was highest at Dome where they had a full-fledged executive committee, and riders paid that amount to the leaders of the *Pragiya* group before joining the station. In some informal conversations with a cross-section of the leaders and the riders, the riders explained that the amount was used to develop the station or added to the funds for the welfare of members. Aside from this amount, riders paid a daily booking fee of GHC2-5 (\$0.26-0.65), and the amount was managed differently at all the stations. But the only similarity is that they all had some form of welfare instituted for the group and some facilities were provided for riders using these funds. Some of the facilities included sanitation services, benches and in one of the sites, a concreted floor for loading passengers. The statements below show some of the fee-paying practices in tricycle groups.

Confirming fee-payment practices at his station, the middle-aged Station Master 4 stated that *“our station fee [admission fee] is indeed GHC500.00. But it used not to be like that. As of last year [2021], it was GHC300.00. ...Our daily booking fee is GHC5.00. GHC2.00 goes to the rider’s daily savings, GHC2.00 to the Union, and GHC1.00 to the leaders of the Union. From the amount that goes to the Union, welfare is paid to members. The GHC1.00 is shared among the leaders of the Union, but some also go to the Market Queen.*

A rider mentioned that *“when we were forming the station in 2017, we were three. That was when we decided that before anyone joined us, they would pay a station fee of GHC100.00, which has increased to GHC200.00 now”* (Rider 3, an adult rider who was formerly a salaried worker in a supply company).

Regarding fee payment, another rider explained that, *“in this Union, every day, you pay for a ticket of GHC5.00, and I do that with all my energy because GHC2.00 is for my daily savings*

and GH2.00 for the Union. From there [accumulated GHC2.00), they use some to support you when something happens” (Rider 1, a former wheelbarrow pusher and an adult). This practice of fee payment for welfare and provisioning of facilities has been reported by Diaz et al. (2016).

The analysis indicated distinct membership procedures. For example, besides the station fee, riders needed to be vouched for at the Oyibi and Dome stations. Thus, the payment of the station fee was not enough to get admitted. Others had to complete membership agreement forms and purchase membership cards where daily booking fees were recorded. Yet, for Oyibi and Pokuase-Amasaman Station 2, payment of the station fee was enough to be admitted as a member.

4.6.3 Ethics and discipline

All the stations tried to instil discipline in ridership as they usually cautioned each other about safe riding. In some stations, for instance, one side of the trike was blocked to disallow passengers from getting in or out of the tricycle where there are oncoming vehicles (the driver’s side). This was mainly to ensure the safety of passengers when entering or exiting a trike. It must also be noted that riders were often cordial with each other. They ate, slept, or larked around while waiting for their turn. There was never a real fight at any station during data collection even though some heated arguments occurred; and all the riders waited in designated places until it was their turn to move, as shown in Figure 4.4.

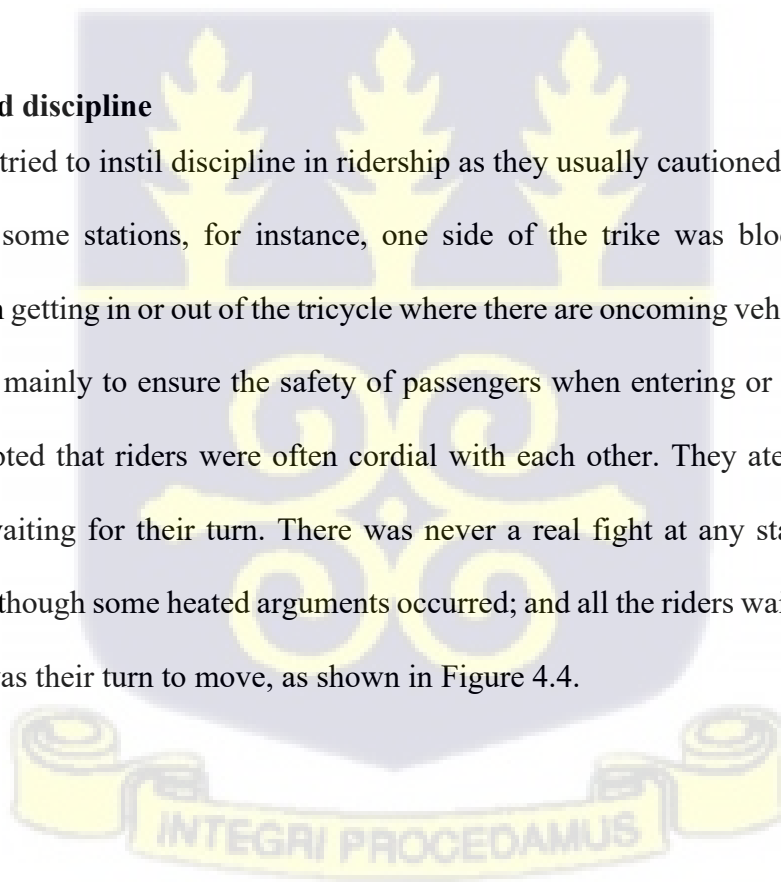


Figure 4. 4

Tricycles waiting to load passengers



Source: Fieldwork, April 2022

Figure 4.4 shows how the riders park while waiting for their turn to load. Nonetheless, on a few occasions, riders were spotted near the roadside where other transport networks stopped and picked up passengers. In such instances, riders got into the road purposely to compete for passengers when business was down.

Further, on discipline, riders in Dome needed to wear a full shoe or a sandal with a buckle to be allowed to load from the station. If a rider was caught riding with slippers, his slippers were seized. The seized slippers were kept and thrown away after some months. Nonetheless, before they were thrown away, an opportunity was given to those whose slippers were slightly new to pay a token of GHC5.00 in exchange for their slippers if they were still good enough. Unfortunately, many of the slippers were in a bad state because of how they were stored. Dome

Station had an association t-shirt mandatorily worn for quarterly meetings but on other days, attire was based on riders' preference. Figure 4.5 shows some seized slippers to be thrown away and riders wearing their group t-shirt.

Figure 4. 5

Seized slippers and riders wearing group t-shirt



Source: Fieldwork, April 2022

From these discussions, and as previously mentioned, a bit of recognition, support, and training from government transport agencies could address several challenges in tricycle transportation. It was quite clear that the riders were willing to do the right thing.

4.6.4 Welfare, group support and recreation

As hinted at already, another strong theme that emerged in the analysis was welfare or group support. Welfare at the various stations covered financial support given to members when they are bereaved or celebrating a marriage, for example. The depth of the welfare processes or structure was not delved into but all the stations had instituted some form of *welfare*, which was more robust in some stations than others. For instance, it was stronger among stations with more than 100 trikes than those with less than 50. These financial supports came from monetary contributions that riders make on a regular basis. Station Master 4, for instance, stated that *“for a deceased parent, we support the bereaved member with GHC1000 (\$129) and GHC500 (about \$65) for marriage and child naming”*. According to Station Master 4, the rationale is that most of the riders are young with living parents and the majority are yet to marry and have children. Thus, these are measures that can help the riders to be committed to providing good services at the station. Corroborating Diaz et al. (2016), welfare practices seemed to reinforce group solidarity.

Apart from this, riders supported each other by riding their trikes to funerals if it was within Accra and nearby towns to commiserate with the bereaved member. Riders also demonstrated care for one another on the road by providing information about the police task force and coming to the help of riders who may be in difficulties on the road. According to Rider 5, *“when a rider gets into trouble while riding, other riders gather at the scene within minutes to show their concern and help with the situation”*. This act of looking out for one another among riders was also found by Doherty (2020), where in Kampala, riders pulled other forms of resources together to help members.

Recreation was not a significant theme as it was identified in only one station. Thus, to eliminate the friction between the riders and other networks, leaders of the tricycle station at Dome organized friendly football matches and a night party every year. Rider 1 indicated that

it is one of the means they used to establish cordial relations with other network operators because they attended Christmas parties organized by the different transport networks. Above all, tricycle groups took responsibility for the tidiness of the places from where they loaded. Some of their internally generated funds went to garbage collectors while they also took turns to tidy up the station. During fieldwork, a station master was observed to have mobilized some riders to use silt to fill some of the potholes in their parking space.

All these practices, support, and structure demonstrate self-organization among a group of informal workers in an urban setting caught in the blurry nature of (in)formality conundrum. These are attempts to formalize, unveil and streamline an amorphous informal enterprise paving the way for approval, acceptance, or legalization. These validate Suryanto et al. (2020), who believe that self-organized systems frequently have a finite capacity and require collaboration with other parties to succeed. Thus, an attempt to marry formal and informal economies is crucial since both have blurred distinctions but become intertwined. The findings validate the observations of Diaz Olvera et al. (2020) who indicated that public authorities permit informal service provision due to public demand and the invaluable role they play. Above all, when these permits are granted, self-regulation is unavoidably necessary to secure some type of internal organization and sector control. Diaz et al. (2016) further added that the cooperation of drivers to organize local or supra-local drivers' groups is a key type of self-regulation. In their view, self-regulation aids in the planning of daily operations in the delivery of services, imposes disciplinary measures against drivers and can offer some type of institutionalized social security as this study reflects. All these could eventually lead to the recognition of tricycle groups in the urban South of Ghana.

4.6.5 Loading at tricycle stations

Loading is a major aspect of tricycle transportation. It involves getting passengers to fill a trike and securing their luggage if they are in the trike. The procedures involved board keeping, station loading, *lapping*, and how passengers were enticed to the trike. All the sites had *loading boards* where the trike numbers were arranged for loading. The purpose of board keeping was to prevent arguments about who was next to load. Thus, all riders listed their trike numbers according to the order in which they arrived at the station on the board and loaded in that order. As a trike loaded and moved, the number was wiped and put back on the queue when it returned to the station. Boardkeeping usually started around 8:30 am and 9:00 am because, around this time, many of the riders had arrived at the station to work; therefore, the need to order loading to avoid confusion and disputes.

It is important to mention that before the board is mounted for the day's work, riders load any way they please in no particular order or coordination. The queue is followed when the board is mounted. For example, in Pokuase-Amasaman Station 1, only six trikes are allowed at the loading point, however, before the loading board is mounted, there is often a few more than six. The rest of the trikes park at a distant place designated for parking the bulk of tricycles at Pokuase-Amasaman station 1. So, when the board is mounted around 8:00 am, six trikes remain in a queue at the loading point while all the remaining trikes go back to park at their bigger station and wait for their turn to load. When it is their turn, they are called to the loading point by the *bookman* with the Union's mobile phone. These practices generally helped to make loading incident-free.

All these are based on simple agreements that inure to the benefit of members of the tricycle station. Without such agreements and structures in place, the tricycle stations will be chaotic and congested. They also provide evidence of existing unwritten rules which govern the operation of the riders suggesting that riders acknowledge authority, structures and

relationships built over time, even the informal ones (Suryanto et al., 2020). It also implies that riders are not as unmanageable as perceived by others since they do not require an outsider to instruct them on what to do. These arrangements and leadership structures often form the foundation or gatekeepers for interactions with outsiders. Supporting Bamidele (2016) and Doherty (2020), the ability of tricycle groups to organize themselves has given them a voice which can be leveraged for political gains.

Moreover, even though some riders belonged to the tricycle unions, they did not load at the stations. Instead, they do *lapping*, which means they load as they move rather than at the station. The lapping concept is also practiced in Kampala. Yet, unlike Accra, in Kampala, it is frowned upon, possibly because locating those riders may be challenging and they may be perceived as rogues (Doherty, 2020). However, *lapping* riders in this study mostly belonged to a station. They were committed to paying their daily booking fees as well as participating in other group activities because of the benefits they got from the group. According to Station Master 4, there is only one station, and they took all the necessary steps to ensure that all lapping riders and new riders are enlisted in the association for uniformity and easy identification.

Soliciting for passengers was through hailing (shouting and announcing the route or destination). This was however done at stations with high competition from other transport networks like Dome and Pokuase-Amasaman Stations, where different transport networks loaded from the same spot. For example, at Dome tricycle station, riders often shouted “*village, village*”. There was no hailing at the two stations in Oyibi because passengers approached the trikes by themselves or hailed for the riders to come over with their trikes. Although they

offered ³*dropping* only, at night sometimes, when there were more passengers than trikes, *passenger loading*⁴ was done so that all the clients could be served.

4.7 When and where does tricycle ridership take place?

Tricycle stations are crucial in the evolution of tricycle transportation because they embody the space, actors as well as processes of ridership. The study used data from five stations, one at Dome, two at Oyibi (stations 1 and 2), and two at Pokuase-Amasaman (stations 1 and 2). Data from observation and field notes from the five stations visited were used to ascertain how the stations were located and how they animate ridership generally. Some quantitative data were used to assess users' frequent places of origin and destination.

It was observed that the local assembly and/or traditional leaders influenced the location of the stations at all sites except Oyibi. Nonetheless, the stations were strategically located inside foodstuff markets, as in the case of Pokuase-Amasaman Station 1 and Dome. In the case of Oyibi Stations 1 and 2, and Pokuase-Amasaman Station 2, the stations were located at major intersections that led to communities farther away from the road. Apart from Dome, the road networks in all the served communities were rough, bumpy, dusty, and muddy when it rained. Ultimately, the stations were all located close to the road, allowing easy embarking and offloading as well as economic and social transactions. In urban contexts, markets and crossroads frequently serve as natural convergence places. They bring together a diverse group of people from various origins, communities, and economic strata. This confluence fosters interactions, transactions, and social relationships, adding to the energy and

³ *Dropping* is a general term used to describe an individual public transport service in which one person pays to be sent to a particular destination. Unlike shared public transport, these do not follow predetermined routes. The service involves pick up and drop off of customers as they want. See Ghana Statistical Service (2013).

⁴ *Passenger loading* is a form of shared public transport in which many people, except the driver, pay and board to get to their destination. They often have predetermined routes. See Ghana Statistical Service (2013).

dynamism of urban life. Tricycle stations and other transportation hubs are not just commuting spaces, but also active economic locations because of the frequent influx of commuters and travellers. Some vendors and entrepreneurs take advantage of the potential client base that gathers at these locations and set up businesses (Recio et al., 2019). Commuters' presence as a captive market creates an economic potential for a wide range of individuals and enterprises. For example, food, beverages, snacks, and other convenience goods were among the products that vendors sold at the tricycle stations. A number of shops as well as vendors sold different and related products at different levels within the tricycle stations. These activities could facilitate the growth of the station and the businesses operating within the tricycle space. The reason being that transportation hubs function as social venues where people interact, share information and make connections. These connections not only aid commercial transactions but also develop a sense of community and belonging, which contributes to the local culture and social fabric of the area (Doherty, 2020).

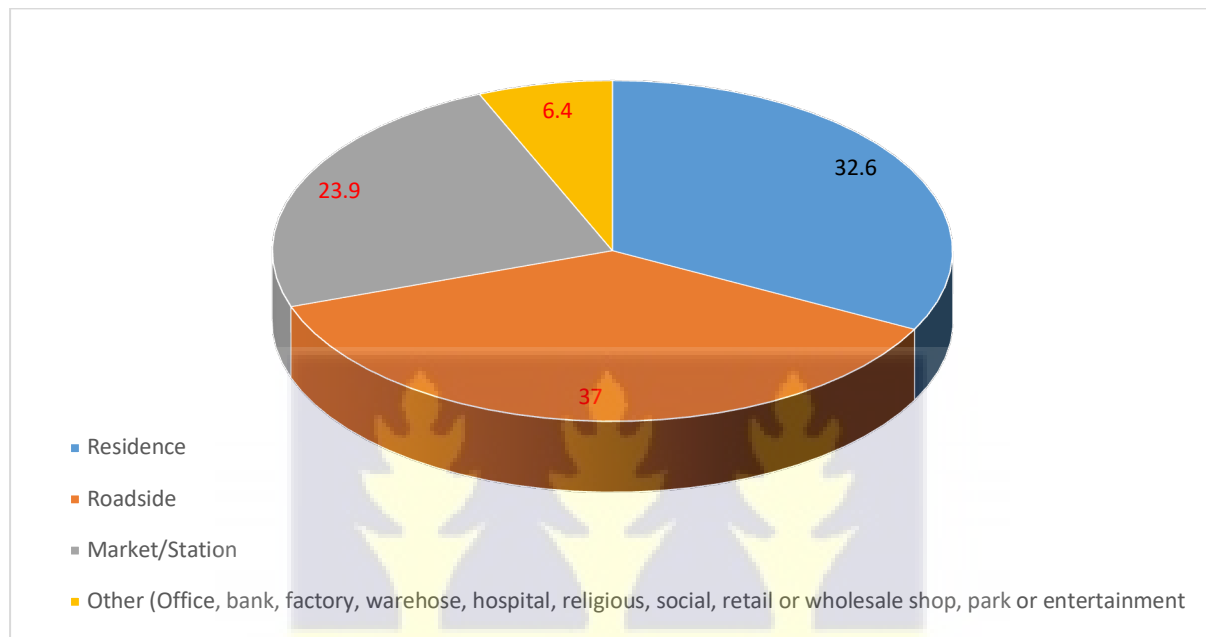
Moreover, tricyclists were willing to carry any type of load, as long as it could enter the trike, especially the kind of load car taxis were unwilling to pick because they were malodorous, unkempt, or small for a mini-truck (Aboso-Okae Macho). One of the users admitted that *“Pragiya riders are not fussy with loads; they take anything”* (User 9, middle-aged female cassava, and corn dough retailer). Thus, the market, significant intersections, and bus stops provide them with good opportunities to meet clients with different kinds of loads. This finding is in line with Diaz et al. (2016), who mentioned business districts and major intersections as some of the places where tricycle stations could be spotted.

Based on the quantitative data analysis, the most frequent origins or places where trips were started are roadside (37%), residence (32.6%), and market/station (23.9%), as shown in Figure 4.6. On the other hand, other trip origins like office/bank, public office, factory/warehouse,

school, medical/welfare, and religious/social were among the places where a few people started their trips.

Figure 4. 6

Trip origin of tricycle transportation among users



Source: Fieldwork, April 2022

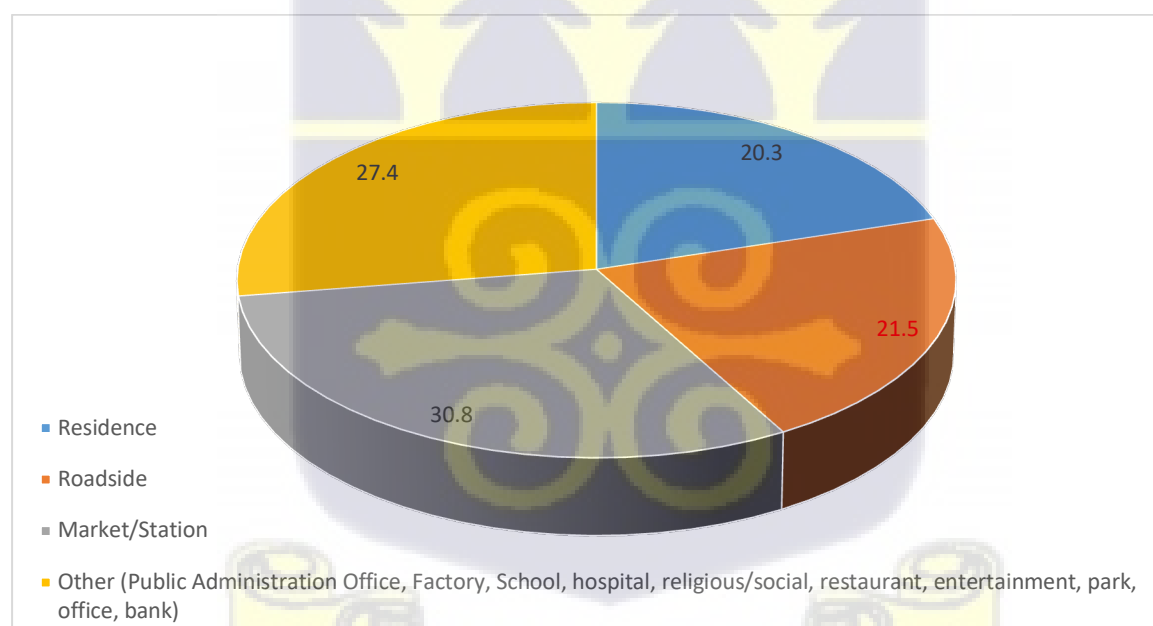
Figure 4.6 suggests that fewer than 7% of respondents started their journeys at places other than a residence, roadside (includes bus stops and anywhere by the road where people stop or pick the tricycle), or market/station, implying that most of these minority trip-origins are off the roadside. Thus, users need to walk to the roadside or station to access a tricycle, and this could be attributed to why most of the respondents started their journeys at the roadside or station.

Similarly, the most frequent trip destinations included the roadside (21.5%), residence (20.3%), and market/station (30.8%) with other minor destinations constituting 27.4%, as shown in

Figure 4.7. This means that respondents are more likely to end their trips at the station or market than anywhere else. Further, comparing less frequent origins like religious places and hospitals which constitute about 7% to less frequent destinations of about 27% implies that tricycles are often not available in these locations. What this means is that some tricycle users could take the trike to those destinations with *dropping* because those locations are not on regular (passenger *loading*) routes. Usually, users in unserved areas walk to the nearest stop where they could access a tricycle or other means. However, because other users end their trips in such locations using *dropping*, a few other users are able to start their trips from such locations when the tricycles happen to be available.

Figure 4. 7

Trip destinations of tricycle transportation among users



Source: Fieldwork, April 2022

To determine the time that tricycle ridership takes place, respondents were asked how often they used the tricycle and how much time it took. The majority of respondents (72.5%) started

their first trips after 5:00 am, while more than half (61.8%) of respondents took their last trips between late afternoon (after 4:00 pm) and in the evening after 7:00 pm. Thus, only 32.6% took their last trips after 7:00 pm. Additionally, most trips were made within 6-15 minutes, indicating that tricycles are used for short-distance trips.

4.8 Mapping usage with the most recent travel log

To ascertain the social groups that use the tricycle and how they use it, mapping of usage was done using quantitative data on the most recent travel log of respondents. The essence was to identify the common places where tricycle trips begin and end as well as the time and other conditions that surround tricycle trips. The log included the origin, destination, duration of the trip, purpose of the trip, and trip type (*passenger loading or dropping*). Finally, using data from the travel log and the socio-economic data of respondents, cross-tabulations were used to determine the relationship between the variables.

Cross-tabulation is a statistical tool used to analyse the relationship between two or more categorical variables. Though the minimum expected cell count is 5, a more flexible approach to data assumptions was adopted because the focus was on identifying patterns and relationships rather than testing specific hypotheses. Most importantly, some of the categories were transformed and aggregated in an attempt to reduce the incidence of empty cells or small cell sizes. Additionally, chi-square tests were used to determine the degree of difference between the variables (Mindrila & Balentyne, 2013; Momeni et al., 2018). As indicated, roadside, residence, and market/station are the most popular origins and destinations; Table 4.5 shows the number of cases for the major trip origins and destinations.

Table 4. 5: Cross-tabulation of origin and destination

Destination			Origin							
			Residence	Office/Bank	Roadside	Market/ Station	Rel/Soc	Others	Total	
	F		199	13	226	146	4	22	610	
	Residence	124	Count	13	4	42	56	2	7	124
			% Within Destination	10.5%	3.2%	33.9%	45.1%	1.6%	5.7%	100%
			% of Total	2.05%	0.7%	6.9%	9.2%	0.33%	1.15%	20.33%
	Office/Bank	44	Count	25	0	8	9	0	2	44
			% Within Destination	56.8%	0%	18.2%	20.5%	0%	4.5%	100%
			% of Total	4.1%	0%	1.3%	1.5%	0%	0.3%	7.2%
	Roadside	131	Count	52	0	40	36	0	3	131
% Within Destination			39.7%	0%	30.5%	27.5%	0%	2.3%	100%	
% of Total			8.5%	0%	6.6%	5.9%	0%	0.5%	21.5%	
Market/ Station	188	Count	64	6	92	20	2	4	188	
		% Within Destination	34%	3.2%	49%	10.6%	1.1%	2.1%	100%	
		% of Total	10.5%	1.0%	15.08%	3.21%	0.33%	0.7%	30.82%	
Religious/ Social	42	Count	15	1	16	8	0	2	42	
		% Within Destination	35.7%	2.4	38%	19.1%	0	4.8	100	
		% of Total	2.5%	0.16%	2.6%	1.3%	0%	0.33%	6.89%	
Others	81	Count	30	2	28	17	0	4	81	
		% Within Destination	37%	2.5%	34.6%	21%	0%	4.9%	100%	
		% of Total	4.9	0.33%	4.6%	2.75%	0%	0.7%	13.28%	
Total	610	Count	199	13	22.6	146	4	22	610	
		% Within Destination	32.6%	2.13%	37%	24%	0.66%	3.61%	100%	
		% of Total	32.6%	2.13%	37%	24%	0.66%	3.61%	100%	
Pearson Chi-Square =			0.000***							

Source: Researcher, survey data, April 2022. *** $p < .01$, ** $p < .05$, * $p < .1$

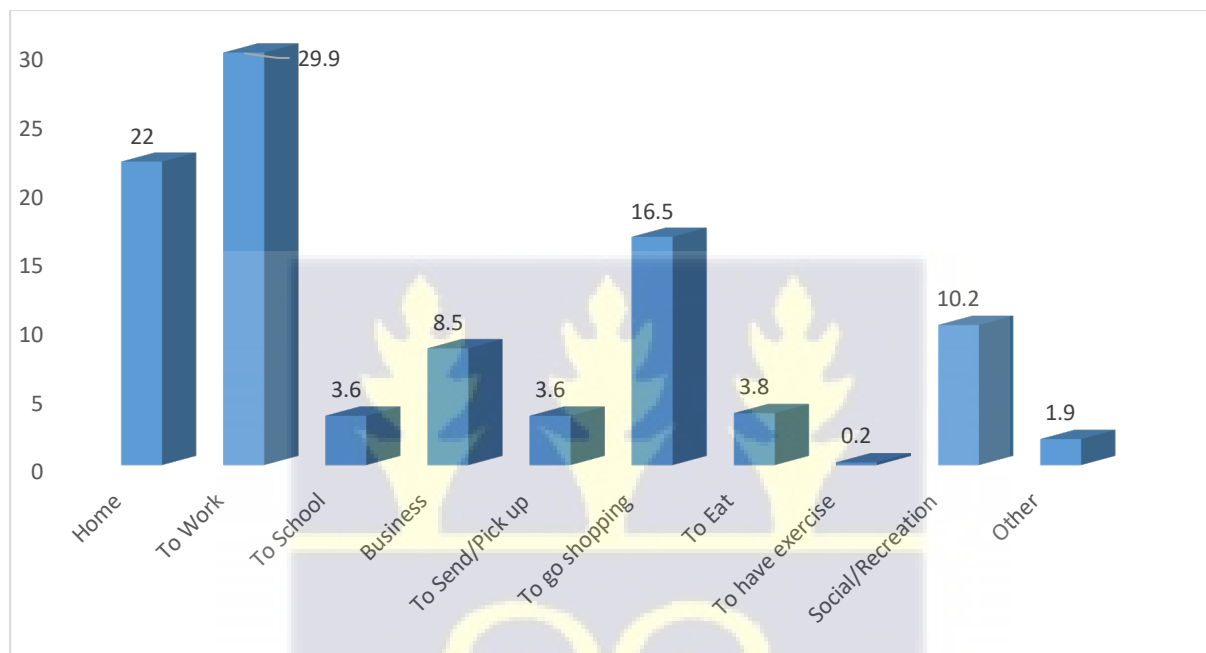
The data summarized in Table 4.5 further suggests that of the people who started their trip from the market/station, about 45%, constituting 9.2% of total respondents, went to their residence; and 27.5%, equivalent to 5.9% of total respondents, ended their trips by the roadside. In comparison, 20.5%, which is about 1.5% of respondents, went to the bank or an office. Further, 15.1% of total respondents or 49% of respondents who ended their trip at the market/station started their trips from the roadside. This further substantiates the use of tricycles as a means for short-distance trips and the fact that when people start their trips from the roadside, they are more likely to end their trips at the market/station than anywhere else. However, the market/station is the dominant origin and destination, making it respondents' most likely place to start or end a trip.

4.8.1 Purpose of trip

The purpose of the trip varied among respondents. For example, the purpose included (returning) home, (going to) work, (going to) school, business, sending or picking up other family members, and others. Figure 4.8 presents the purpose of the most recent trip by users.

Figure 4. 8

Purpose of trip for most recent travel log



Source: Fieldwork, April 2022

Figure 4.8 depicts the majority of the purpose of trip falling between work (29.9%), home (22%), shopping (16.5%) and social/recreation and religion (10.2%). Thus, commuters used the tricycle more in relation to work than any other. On the other hand, purposes relating to school, picking up, exercising, and eating outside the home were among the least mentioned.

This implies that commuters use the tricycle to the common places they go to in their communities and not-too-distant locations. As a result, their utilization at the community level where they can be given a deliberate consideration. Regarding the trip type, the study identified

two main trip types, namely *passenger loading* and *dropping*. The data shows that 61.1% of the respondents took *passenger loading*, and 38.9% took *dropping*. Factors influencing trip type include location, type of alternative, cost of the alternative, cost per person, and whether there was luggage (payload) or company (whether the user was travelling with another person they need to pay for). In Table 4.6, the chi-square table shows these variables' significance levels.

Table 4. 6: Variables associated with trip type

Variables	Pearson Chi-Square Value
Trip Type- Had Luggage (pay-load)	0.000***
Trip Type- Location	0.000***
Trip Type- Alternative	0.000***
Trip Type- Cost of alternative	0.000***
Trip Type- Cost per person	0.000***
Trip Type- Had Company (accompanied by someone)	0.000***
Source:, Fieldwork, April 2022.	*** $p < .01$, ** $p < .05$, * $p < .1$

Table 4.6 shows that apart from the cross-tabulation between *trip type* and *had company*, which was significant at 0.1, all the other variables were significant at 0.001, denoting that trip type has a strong association with the other variables mentioned.

Apart from trip type and its associated variables, other contexts determined tricycle use, including whether there was luggage, or the respondent had company. Others included the type of alternative network and the cost involved. The data shows that 77.8% of respondents did not have a load during their most recent trip. Moreover, it was expected that those who took *dropping* were more likely to have luggage. However, this was not the case as only 39% of those who took *dropping* had a load. This could be attributed to the loading modalities at Oyibi, where all passengers took *dropping* because *passenger loading* was unavailable except at night.

Thus, Oyibi accounted for 51.1% of all the *dropping* compared to 16.9% and 32.1% from Pokuase-Amasaman and Dome, respectively. Furthermore, only 39% of respondents had company (someone the user travelled with). Among these, only 8.4% had at least one child with them.

4.9 The reasons for the proliferation of tricycles

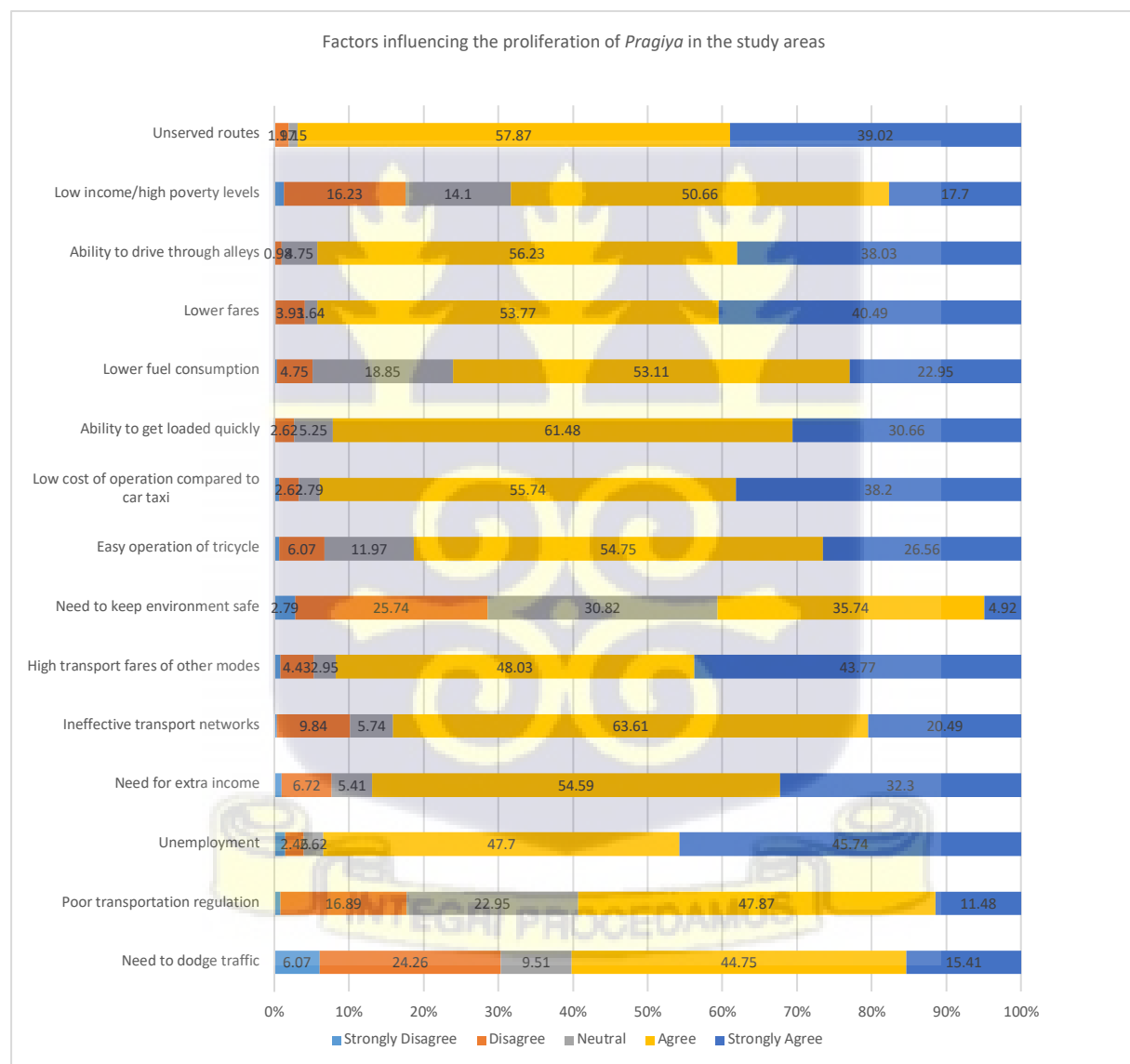
As part of the evolution process, tricycles have proliferated in all the study sites. This section primarily used quantitative data to generate the frequencies of variables b1 to b19, supported by some qualitative data from IDIs and KIIs to provide significant evidence of the proliferation of tricycles in the study areas. About 93% of riders and passengers agreed that *Pragiya* was the newest transportation system in their communities, and 98% agreed that there was increased usage of *Pragiya* in those areas. However, the reasons for proliferation are varied, and linking them to the hierarchy of walking needs, tricycles have proliferated because commuters sought to address certain transport problems and be circumspect in their choices as well. For instance, in terms of the hierarchy of walking needs, accessibility manifests as unserved routes while feasibility could be seen from drives through alleys, dodges traffic and easy to operate.

Thus, 88.3% of the respondents indicated that the proliferation of tricycles is driven by private businesspeople like retailers and trike owners who were interested in making profits. Another 91.7% agreed that patronage by urban commuters is what has caused the sudden increased usage. Institutions like DVLA and the District Assemblies seemed to have least influenced the process, as only 43.5% of respondents agreed to their influence. This implies that the proliferation of tricycles arose from the need for users and operators to survive in an urban environment where service provision may be inadequate. Consequently, authorities face the dilemma of either halting the use of tricycles or permitting them to reap the associated benefits.

This is however, in contrast with Diaz Olvera et al. (2020) who believe that the dynamics governing the growth of motorcycle taxis and the informalisation of urban transportation in Lomé have both strengths and weaknesses that are related to the hesitant nature of public governance as well as the structural interdependency between highly compartmentalized socio-occupational groups, and the close ties between formal and informal activities. These are presented in Figure 4.9.

Figure 4. 9

Factors influencing the proliferation of tricycles



Source: Fieldwork, April 2022

Regarding the factors that caused the proliferation of tricycles in Accra's outskirts, respondents were asked to indicate the extent to which they agreed or disagreed with some causes of proliferation. The results presented in Figure 4.9 show that environmental safety concerns emerged as one of the least causes, with 40.7% of respondents agreeing with the statement. This is suggestive of the fact that not too many people consider the environmental sustainability aspect of the tricycle.

As compared to unserved routes and low fares, the ability to dodge traffic was another weak cause of proliferation, with 60.1% of respondents agreeing or strongly agreeing with the statement. The reason is that except for Domi, which experiences traffic throughout the day because of the Dome market, all the other stations although located close to major roads and interchanges, did not experience any form of traffic. The tricycles served as gap fillers and connected people to major transport networks and their homes rather than beating the traffic. Additionally, 59.4% of respondents largely concurred that the proliferation of tricycles in the research areas resulted from inadequate transportation regulations.

This notwithstanding, more than 90% of respondents attributed proliferation to unserved routes, ability to drive through alleys, low fares, unemployment, high fares of other alternatives, easy entry and operation, ability to load quickly, ineffective transport network, and need for extra income. These findings corroborate previous studies (Doherty, 2020; Evans et al., 2018; Obiri-Yeboah et al., 2021; Onyango, 2018) and it also indicate that transport poverty exists even in urban areas where commuters have access to various transport modes. Additionally, young unemployed males have leveraged this situation to earn a livelihood through tricycle transport, effectively addressing two problems simultaneously.

4.10 Summary and conclusion

In summary, this chapter has looked at the nature, evolution and proliferation of tricycle transportation. It has also described the characteristics of both users and riders as well as other key stakeholders directly involved in the tricycle transportation business. Qualitative and quantitative data were employed to identify the main characteristics of the tricycle, its evolution process, usage, and reasons for proliferation.

Two main types of tricycles with similar capacities were used for public transport in Accra, and Type A was the primary type used at all the sites. Trikes often maintained their factory colours although a few had been repainted for maintenance purposes while older and less efficient trikes were maintained and propped up for continuous usage. Riders and their trikes had some sort of identity and distinct numbers from DVLA and their association; and stickers and other decorative items were used by riders mainly for decorative purposes and distinction.

The main actors in tricycle transportation included the more visible and predominantly youth users and riders. Other key actors included the station masters, who commanded tremendous respect from the riders. In addition, there were the market queens, police, and task force who played crucial roles.

Although some stations were created as an afterthought, stations are crucial in the evolution process because they provide structure both formally and informally to the activities of tricycle riders. In that, all the stations had a physical operation space, working name, some form of leadership, and some arbitrary but working rules. This makes them visible to authorities even though they are still illegal. In addition, it was found that they were strategically located at markets and major interchanges, often close to an already existing transport networks. Station masters, who were community members, took advantage of a niche to address their own economic needs by initiating these stations with the help of other actors and were the face of

these tricycle stations. They ensured adherence to fee payment as well as order and acted as intermediaries between riders on one side and other actors on the other.

Regarding *trip type* and other trip contexts, it was noted that users often travelled alone and without load. Furthermore, many of the trips were *passenger loading*, which was highly associated with location, alternative network, cost of alternative, cost per person, and whether a user had company or luggage.

As part of mapping usage of tricycles, it was found that the most frequent origins and destinations included a residence, office/bank, roadside, market/station, and social/recreation. Nonetheless, the results showed that access/availability was still a probable challenge in some locations despite the increased usage of tricycles. The reason is that, for example, many more people ended their trips at an office/bank, but in contrast, a few people started their trips at the office/bank because it is not a regular route. Moreover, the tricycle was used for short-distance trips as the results indicate that trips that were started by the roadside more often ended at the market/station, but for those that started at the market/station, the majority ended at a residence.

Further, even though most first and last trips were made in the rush hours of the mornings (after 5 am and evenings after 4 pm) when vehicular traffic was intense, tricycles in this study were more of gap fillers than traffic dodgers as many sites did not have serious traffic issues.

The study also found that the tricycle was used more in relation to work than any other purpose. Above all, unserved routes, easy entry and operation, ability to drive through alleys, unemployment, high fares of other alternatives, ability to load quickly, and ineffective transport networks are some of the reasons for proliferation in this study.

As an emerging complementary means of transport in some conurbations in the GAMA, the nature and evolution of tricycle transportation provides an exposition into the diverse

transportation needs of urban dwellers as well as the potential of informal associations through self-organization and discipline.



CHAPTER FIVE

DETERMINANTS OF TRICYCLE ADOPTION AND PERCEPTIONS OF ITS SUSTAINABILITY IN GAMA

5.1 Introduction

The previous chapter was dedicated to the characteristics of some actors in tricycle transportation and how they generally operate. It also touched on the reasons for the proliferation of tricycles. Moreover, selecting a mode of transportation is always contingent on a myriad of decisions the user must make. Thus, this chapter focuses on the determinants of tricycle transportation adoption and perceptions of its sustainability.

Generally, the decision process of choosing a tricycle is transient. Just as in other modes, several short-lived and latent factors embedded in the users' characteristics and environment are considered (Kumar & Ganguly, 2018; Neely, 2016). Some of these characteristics pertain to the individual's preferences, and others to the nature of the need (Alfonzo, 2005). However, the environment influences them all. It is important to note that this chapter does not attempt to show users' behaviour regarding using the tricycle. However, it tries to outline considerations users make in the decision-making process. The determinants of tricycle adoption, challenges, and respondents' perceptions of the sustainability of tricycle transportation are thus presented in this sub-section.

5.2 Determinants of tricycle adoption in GAMA

There is an enormous need for urban transportation because mobility is crucial to developing a sustainable city (UN-DESA, 2016). However, different factors contribute to the use of transport modes, including tricycles. These factors include the transport need the psychographic features of the mode of transport, socioeconomic background of users and trip

contexts, (Alfonzo, 2005; Nutsugbodo et al., 2018). This study defined adoption as tricycle usage, at least in the past month and this was used as a criterion for selecting users.

5.2.1 Transport need and user characteristics as determinants of tricycle adoption

Alfonzo's (2005) hierarchy of walking needs proposes that a person's mobility needs are hierarchical. In this study, the hierarchy involved feasibility (suitability), accessibility (always available), safety (physically strong, avoids injury), comfort (ease of entry and exit), and pleasurable (enjoyable).

Respondents were surveyed to discover the key reasons behind their adoption of the tricycle using the hierarchical framework of five needs. According to the results of the data analysis, 48.6% of passengers used the trike for accessibility reasons, followed by about 29% for feasibility and 14.2% for comfort. Pleasure (7%) and safety (0.66%) were the least common reasons. Feasibility and accessibility were therefore the most common determinants of mode selection. In line with a related study on determinants of tourists' mode choice by Nutsugbodo et al. (2018), tourists chose specific transport modes often because of their feasibility and availability. The results are presented in Figure 5.1.

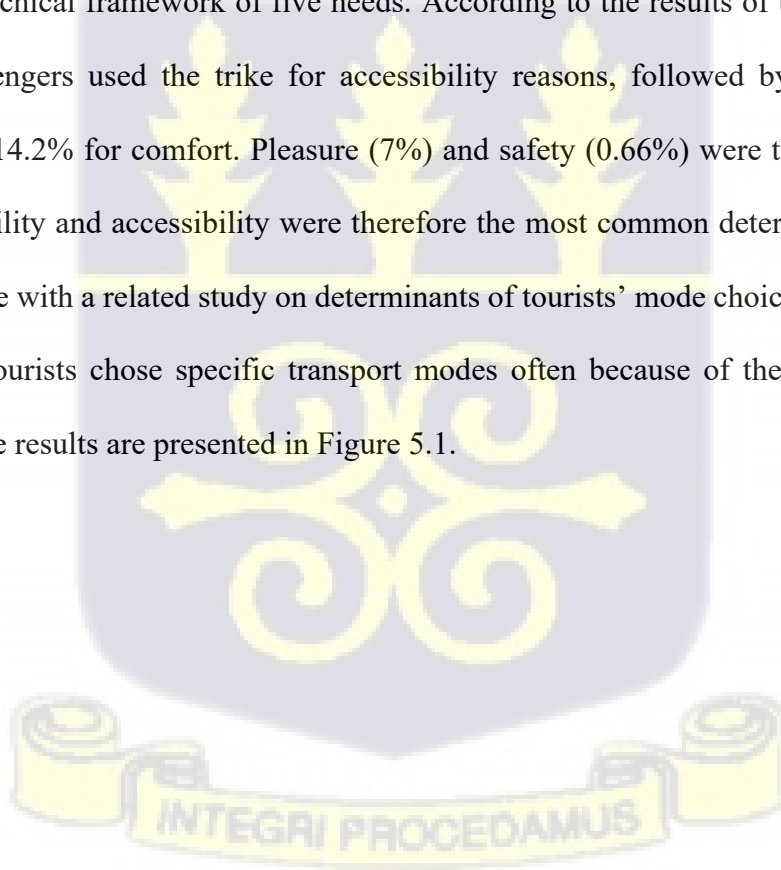
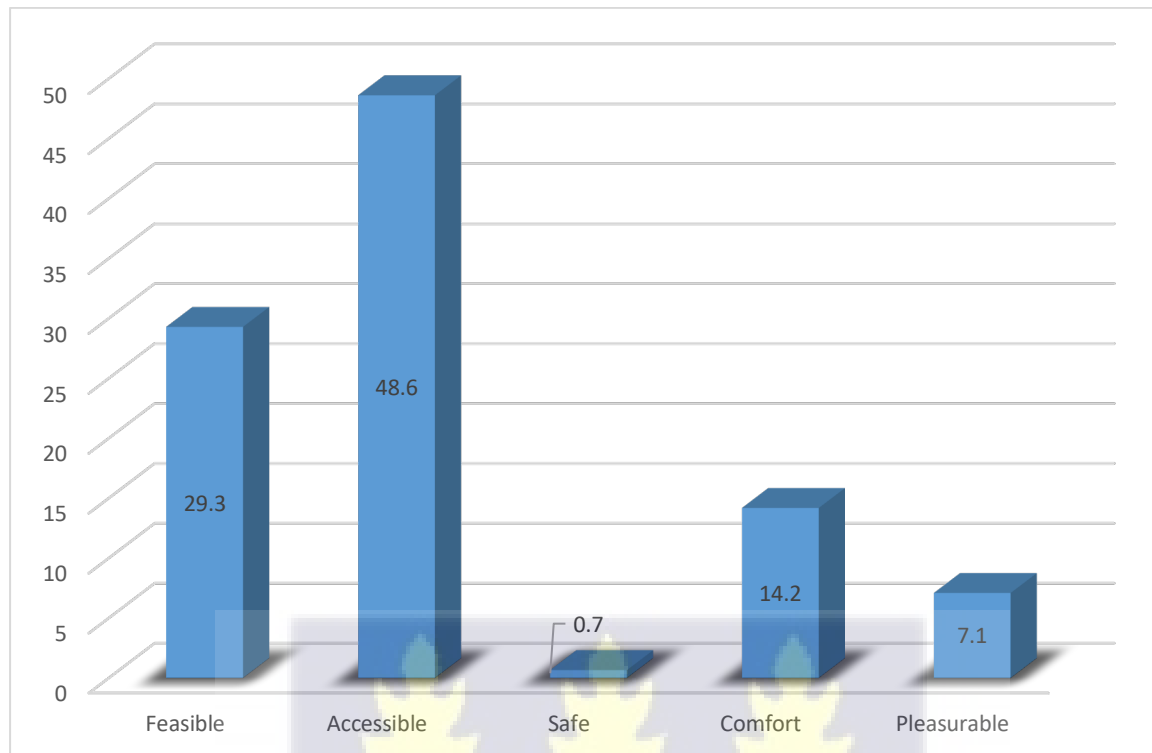


Figure 5. 1*Transport-need-induced reasons for tricycle transportation*

Source: Fieldwork, April 2022.

Figure 5.1 implies that with 48.6%, accessibility was the fundamental reason for tricycle usage. This means that tricycles were used by some passengers mainly because of their availability and short waiting time but not necessarily because they were suitable or feasible for the trip. This finding is supported by the qualitative results as a male user from Pokuase indicated that it took less time to access Pragma, from the roadside to town compared to other modes. He stated, “it will take 30 to 40 minutes for me to get a car taxi or trotro if I want to go to town from the roadside. However, tricycles pass every three to five minutes” (User 10, a middle-class adult male).

Feasibility was also identified as a significant factor influencing tricycle usage and 29.3% users found tricycles adequate for their specific *trip type* and *purpose*. Supported by the qualitative results, a user who is a petty trader in Pokuase-Amasaman indicated that “for our trips, car

taxis are the best means of transportation. However, car taxis are more expensive. Apart from that having poor roads and occasionally having unpleasant smelly market goods, car taxi drivers refuse to pick us up, which is why we use the tricycle” (User 3, adult female petty trader). This finding is consistent with Kandt (2018) and Oteng-Ababio and Agyemang (2015), who stated that people could switch modes due to the inefficiencies of other modes.

Additionally, safety which is third on the hierarchy of walking needs, accounted for 0.7%, the least of the reasons, suggesting that safety is not given much consideration when choosing to use tricycles. Thus, in conformity with Dike (2012), safety is the least felt transport need or consideration in transport mode selection. They would instead opt for taxis and buses for safety reasons. Additionally, Konkor et al. (2019) opined that users of motorbikes in Wa of the Upper West Region of Ghana had sociocultural misconceptions about safety hence downplayed safety measures like the wearing of safety clothes. The study suggested that these misconceptions of the subjects overrode rational explanations for safety. Thus, safety was considered more as a spiritual concept than a physical or rational concept. It is therefore not unexpected that passengers did not consider safety as a significant transport need in selecting tricycles as a mode of transport even though they largely considered it unsafe. This suggests that commuters in the study areas were primarily focused on fulfilling their basic transport needs of accessibility and feasibility, rather than prioritizing higher needs such as safety and comfort. This focus is justifiable because if a mode of transport is not feasible or accessible, safety concerns become irrelevant. These findings align with Alfonzo’s hierarchy of walking needs, which suggests that basic or lower needs should be met first. However, it does not imply that higher needs should be ignored if they can be achieved despite the unavailability or inadequacy of basic needs. The argument here is that even though users struggle to meet their basic transport needs, higher transport needs should not be completely disregarded. They can still be prioritized by ensuring that riders operate carefully and adhere to road traffic regulations.

Based on the results, using the highest frequencies of the five hierarchy of walking needs selected by tricycle users, the data does not align with the established five hierarchy of walking needs. The order that was observed in this study is accessibility, feasibility, comfort, pleasure and safety suggesting that transport needs may be similar in terms of the elements but contextual because the ordering may not always follow the hierarchy of walking needs. The finding can be explained in two dimensions. First, the feasibility of using tricycles as a mode of transportation is relatively low because there are other viable and appropriate transportation options available to users. Rather, accessibility of the feasible modes is a problem because the existing suitable modes were unavailable when needed.

Second, the results further suggest that even though the basic transportation need (feasibility) may not have been attained by users, other higher-level needs could be satisfied because of the power of demand and supply. Simply, when the supply of suitable modes does not meet users' expectations or needs, users tend to switch to other alternatives. Although these options may not necessarily meet passengers' expectations or serve their needs, they become the best alternative due to their availability.

Nonetheless, the five hierarchical needs as discussed above are influenced by various socio-demographic factors, including location, income, education, primary mode, and age which play a role in shaping individuals' transportation mode preferences. To assess the relationship between transportation, need and some demographic characteristics, a cross-tabulation was performed to see how transportation need varied across respondents' primary modes, locations, and income levels. Table 5.1, for instance, shows that 89% of respondents who rely on *Pragiya* as their primary mode of transportation are more inclined to consider accessibility as a significant transport need since it is known for its reliability and accessibility. Conversely, respondents (60%) who primarily use *trotro* as their mode of transportation are more likely to prioritize feasibility as a transport need due to the sporadic availability and potential

overcrowding of *trotros*. Lastly, *trotro* primary mode users (0.7%) exhibit a lower inclination to consider safety as a transport need (Table 5.1). The qualitative results confirm this finding. According to User 9, a female trader at Pokuase-Amasaman, “*tricycles are safer than trotros or, at worst, are equally unsafe*”, thus, in her opinion “*he that is on the ground fears no fall.*”

Table 5. 1: Variations in transportation needs based on respondents' primary mode, location and income

Variables	Transportation Need/Reason (%)					
		Feasibility	Accessibility	Safety	Comfort	Pleasurability
Primary mode p-value – 0.033**	<i>Pragiya</i>	56	89	2	25	16
	<i>Trotro</i>	60	91	0.7	24	15
	Car taxi	50	94	0.8	32	9
	Personal Car	42	92	7	29	7
Location p-value 0.000***	Oyibi	69	96	1.5	34	7
	Dome	54	81	0.8	29	24
	Pokuase-Amasaman	42	97	0.7	18	10
	Average	53	91	2	28	12
Monthly Income (GHC) p-value – 0.011**	501-1000	59	91	0	20	9
	Above 1000	54	94	2	35	21
	Average	53	91	2	28	12

Source: Fieldwork, April, 2022

*** $p < .01$, ** $p < .05$, * $p < .1$

This is because Accra's short-distance *trotro* vehicles are quite often rickety, rusty, dilapidated, and smoke-filled (Cervero, 2000; Poku-Boansi, 2020; Poku-Boansi & Cobbinah, 2017). As a result, *Pragiya* users who used *trotro* as their primary mode of transportation may be accustomed to the risky nature of *trotro* and not give tricycle safety much thought.

According to key informants from GPS-MTTD and NRSA, cars provide more safety and comfort than tricycles (Akhmetshin et al., 2019; Masoumi, 2019; Schubert et al., 2020). As a result, it was anticipated that *Pragiya* users using their private cars as their primary mode of transportation would exhibit a lower inclination to opt for tricycle usage due to safety concerns, given that the safety standards of tricycles are inferior to those of cars. However, among all primary modes, personal car users (7%) were more likely to use the *Pragiya* for safety concerns

than *trotro* primary users (0.7%), and car taxi primary users (0.8%). Despite the fact that the majority of respondents did not use the trike for safety concerns, the majority of those who did were personal car primary mode users.

Furthermore, while this study does not appear to imply that trikes are as safe as car taxis, 64.3% of personal car primary mode users regarded the simplicity with which the trike may be boarded and exited while utilizing the tricycle. According to KII data, the open sides of tricycles, which make it simple to enter and exit, place passengers in a precarious position when onboard. Moreover, from the qualitative results, according to User 2, a shopkeeper at Oyibi, (where about 69% of those whose main means of transportation is a personal car are located), *“using tricycles is safer than using a trotro, for instance, because the rider brings you to your doorstep and because tricycles are often brand new, they pollute less and are simple to board and dismount”*. So, while this finding verifies Ehebrecht et al. (2018) who discovered that tricycles and motorcycles were utilized for door-to-door community transport services, it was usually seen as risky (Bradley, 2014; Obiri-Yeboah et al., 2021; Tuffour & Appiagyei, 2014). According to the LI 2180, public vehicles must be enclosed, that is, they must have doors that can shut in passengers. Thus, while the absence of doors in tricycles is perceived to be a safety concern for some users, it is considered an advantage by others because it makes entry and exit much easier.

Furthermore, comfort was more likely to be a transport need for 32% of car taxi and 29% of personal car primary mode users than *trotro* and *Pragiya* primary mode users. According to Nutsugbodo et al. (2018), comfort is a higher order need that is associated with money. These findings are consistent with Masoumi (2019) and Nutsugbodo et al. (2018), who discovered that the lack of comfort is a disincentive to using public transport.

In terms of location, 97% of Pokuase-Amasaman and 96% of Oyibi respondents used trikes for accessibility reasons, compared to 42% and 59% for feasibility reasons, respectively, for the same locations. Regarding safety transport needs, more (1.5%) Oyibi respondents used the trike for safety reasons than the other locations, despite the fact that safety was not typically a reason for tricycle usage. As a result, while accessibility was a general transportation need, it was proportionately higher in Oyibi and Pokuase-Amasaman than in Dome which is expected because Oyibi and Pokuase-Amasaman had a lot of communities which were far from main roads. These findings demonstrate how the three different sites interact with transportation needs and support the findings of Fillone and Mateo-Babiano (2018), who discovered that built environment elements such as safety and accessibility influence pedestrian travel decisions.

Respondents' average monthly income was shown to be significantly related to transportation need, with 59% of those earning GHC 501-1000.00 monthly identifying feasibility as their transportation need whereas 94% of those who mentioned accessibility had an income of GHC1000 or above. Still, GHC1000 or above income group recorded the highest proportions for comfort (21%) and pleasurability (35%) as reasons for trike adoption. These analyses imply that different income groups use the tricycle to address different transport needs.

Contrary to Neely (2016) and Nutsugbodo et al. (2018), gender, age and education did not have a statistical association with reasons/need for tricycle adoption. However, there was a statistical association with average monthly income, location and primary mode with p-values of 0.011, 0.000 and 0.033, respectively (see Table 5.1). The subsequent sub-sections focus on the rational considerations users make when adopting tricycles.

5.2.2: Monetary considerations as a determinant of tricycle transportation

As already intimated, mode adoption is contingent on socioeconomic factors, including income levels as well as other transport-related factors like trip type and purpose. It is also influenced by how users rationalized transport fares and the utility to be derived. For example, during an IDI with one of the users at Dome, a user indicated that even though the fares for *trotro* and *Pragiya* are not significantly different for short-distance trips, and considering the regular transport fare increments, they used the *Pragiya* because “*every pesewa counts*”. Aligning with RCT, this is suggestive of a user rationalizing the selection of a transport mode based on the fares charged by tricycles as well as other modes. Another key informant also stated “*As you can see, transportation fares have been increased all over because of the fuel price increases, but we are yet to increase our fares. It is intentional but we are consulting*” (Station Master 4, KII, 2022). Therefore, recognizing that users choose transport modes based on fares, some Station Masters were hesitant to increase tricycle transport fares. They feared losing clients who use tricycles primarily because of the low fares to other transport networks. In effect, transportation fare is crucial in mode selection, and weighing the fare in this process is critical in making a simple rational decision.

Amid regular fuel price and fare increases (Acquah, 2022; Okine, 2022), the *Pragiya* fare has been reviewed once compared to other modes in all the study sites. Consequently, users were asked whether they would still use the tricycle if they could have the same service from another type of mode like *trotro* or car taxi, given that based on RCT, users were likely to make monetary/rational considerations when choosing a mode (Jittrapirom, 2015; Nutsugbodo et al., 2018). This became the stillPragiya variable. Some variables used in the cross-tabulation and chi-square tests to determine association with stillPragiya are monthly income, primary transport mode (which is adoption based on respondents’ primary mode), location, destination, trip purpose, and some demographic features. Table 5.2 shows the results.

Table 5. 2: Monetary considerations and related determinants of tricycle adoption

Still use <i>Pragiya</i>	Yes, will still use <i>Pragiya</i> (%)	No, will not use <i>Pragiya</i> (%)	Cases
Age (recoded)	62.62	37.38	404
young adults (15-24)	50.49	49.51	103
young adults (25-39)	68.30	31.70	265
Adult	58.82	41.18	34
Aged	0.00	100	2
Chi-square	0.003***		
Destination (recoded)			
non-market/roadside	45.06	55.63	198
market/roadside	54.94	44.37	206
Chi-square	0.040**		
Purpose of trip (recoded)			
social activity	41.9	50.9	183
economic activity	58.1	49.1	221
Chi-Square	0.076*		
Location			
Oyibi	21.43	52.98	134
Dome	41.67	15.89	129
Pokuase-Amasaman	36.90	31.13	140
Chi-square	0.000***		
Primary transport mode			
<i>Pragiya</i>	29.25	27.81	116
<i>Trotro</i>	46.64	22.52	152
Car taxi	22.13	44.37	123
Personal car	1.98	5.30	13
Chi-square	0.000***		
Cost of alternative			
Below GHC 4.00	62.45	41.06	220
GHC 4-10.00	22.92	39.74	118
Above GHC 10.00	14.62	19.21	66
Chi-square	0.000***		
Gender			
Male	48.2	40.4	183
Female	51.8	59.6	221
Chi-square	2.3361		
Average monthly income (GHC)			
0-500	37.6	42.4	159
501-1000	37.9	33.8	147
Above 1000	24.5	23.8	98
Chi-square	1.0307		
Education			
No education	5.1	5.2	21
Primary	14.6	16.6	62
Junior High School	30.8	32.5	127
Senior High/Technical/Vocational	37.6	35.8	149
Tertiary	11.9	9.9	45
Chi-square	0.7098		

Source: Fieldwork, April 2022

*** $p < .01$, ** $p < .05$, * $p < .1$

To do this, age was re-categorized into young adults (15-24), young adults (25-39), adults, and aged. 'Destination' was recoded into non-market/roadside (destinations other than market, station, and roadside) and market/roadside; and 'Trip purpose' was re-categorized into two

social and economic activities. Social activity included ‘home’, ‘pick up family’, ‘eat at home’, ‘have an exercise’ and ‘recreation/religion’. Economic activity included ‘work’, ‘business’, and ‘market’. Finally, the ‘fare for the alternative ride’ was recoded into ‘below GHC4’, ‘GHC4-10’, and ‘above GHC10.00’. The re-categorizations were necessary to develop enough cell counts for the cross-tabulation analysis. The cross-tabulation and chi-square test results indicate that holding cost constant, most respondents (62.6%) were more likely to still use *Pragiya* even though they could get the same service and fares from other networks compared to 37.4% who will not. These results imply that those who said Yes probably use *Pragiya*, not for the low fares, but for other reasons such as accessibility, unserved routes, waiting time, and many others. These findings support Afukaar et al. (2017, 2019), Ehebrect et al. (2018), Jack et al. (2021), Obiri-Yeboah et al. (2021) and Tuffour and Appiagyei (2014) who have emphasized the invaluable services tricycles provide as an intermediate form of transportation in both urban and rural areas. The results are presented in Table 5.2.

However, those who said ‘No’ may probably use it solely for its low fares rather than other reasons. This is because they preferred other options if those transport networks had the same low-cost fares as *Pragiya*. It further shows that those who said ‘Yes’ used it to address different transport needs irrespective of the low fares while those who said ‘No’ made a simple rational (monetary) choice. For instance, most of those who responded affirmatively were from Dome, where tricycles were primarily used to avoid traffic. As a result, even when other modes charged the same fares, they still preferred tricycles because they could bypass traffic. These findings agree with Jensen (2016) who opined that people consider their options and select the option that optimizes utility and in effect produces the highest satisfaction.

Table 5.2 further indicates that, with the exception of the aged, the majority of respondents across various age brackets provided affirmative responses. Notably, among these groups, young adults (aged 25-39 years) exhibited a higher likelihood of responding positively

compared to both adults and the aged. The chi-square test also showed a strong association between age and whether a person will still use *Pragiya* at 0.003. Apart from the explanation provided above, this could be attributed to the fact that older people prefer safer rides, as found by (Nutsugbodo et al., 2018).

Further, 'destination' showed some statistical association at 0.040. For those who said 'Yes', the majority, representing 54.9%, went to the market or station, suggesting that users were more likely to use tricycles for trips to the market or station than other destinations. However, the majority of those who said 'No' went to places other than the market/roadside.

For '*trip purpose*', the majority (58%) of those who said 'Yes' used it for economic activities like going to work and doing business, while the majority of those who opted for other networks used it for social activities like going to a religious place or restaurant. It must be noted that the difference was not significant, but the chi-square test suggests some association between purpose of trip and whether a person will still use *Pragiya* with a 0.076 p-value. This finding suggests that passengers who used the trike in relation to work or business are not likely to switch even if other modes offered the same fares. By extension, it also means that the trike meets the purpose of their trip irrespective of the transport fare unlike those who said 'No'. It is possible that the trike does not meet the purpose of their trip but they used it fundamentally for it being cheaper.

Further, 'location' was strongly associated with 'stillpragya' at a significance level of 0.000 and presented some dynamics based on the different contexts of the study sites. For example, the majority, which comprises 41.67% of those who said 'Yes', were from Dome, where the tricycle was used as a traffic dodging mode. The majority of those who said 'No', making up 52.98% of respondents, were from Oyibi, where there is no problem with traffic and many sparsely located residential facilities far from the main Adenta-Oyibi highway.

Additionally, the association between stillpragya and the respondent's primary mode was statistically significant at 0.000. The findings indicate that approximately 29% of respondents who answered 'Yes' also used *Pragiya* as their primary mode, implying that about a third of respondents did so and were likely to do so even if other networks offered roughly comparable fares. Therefore, the tricycle is ideal for meeting this group's transportation needs. The results further indicated that 46.6% of those who responded 'Yes' used *trotro* as their primary mode. Additionally, more *trotro* primary mode users said 'Yes' because, similar to *Pragiya*, they offered lower fares than car taxis. For car taxis, those who said 'No' were the majority, with approximately 44.4%. This category of respondents used car taxis as their primary mode such that under certain circumstances, if car taxis could charge as low as *Pragiya*, they would opt for car taxis instead to optimize their resources.

Finally, the 'cost of alternative mode' had a strong statistical association with stillpragya with a p-value of 0.000. About 62.5% of respondents who said 'Yes' paid less than GHC4.00, and 14.62% paid more than GHC10.00 for their alternative ride. This suggests that most people generally prefer to pay less for transportation services unless it becomes necessary to spend more. These findings are consistent with Jensen (2016), Fillone and Mateo-Babiano (2018) and Muro-Rodríguez et al. (2017) who asserted that a rational decision-maker will systematically assess all the alternative choices and choose the best one from the available options to optimize utility.

Nonetheless, it was anticipated that variables like 'income', 'gender', and 'education' might affect 'Stillpragya' but none showed a statistical relationship because, for example, fares were not determined by how much a person earned or spent on transportation. The amount spent on transportation and monthly income was therefore not directly correlated. Nevertheless, because all respondents had access to the same modes at similar prices regardless of their income level or the amount they spent on transportation, there was less likelihood of a link between these

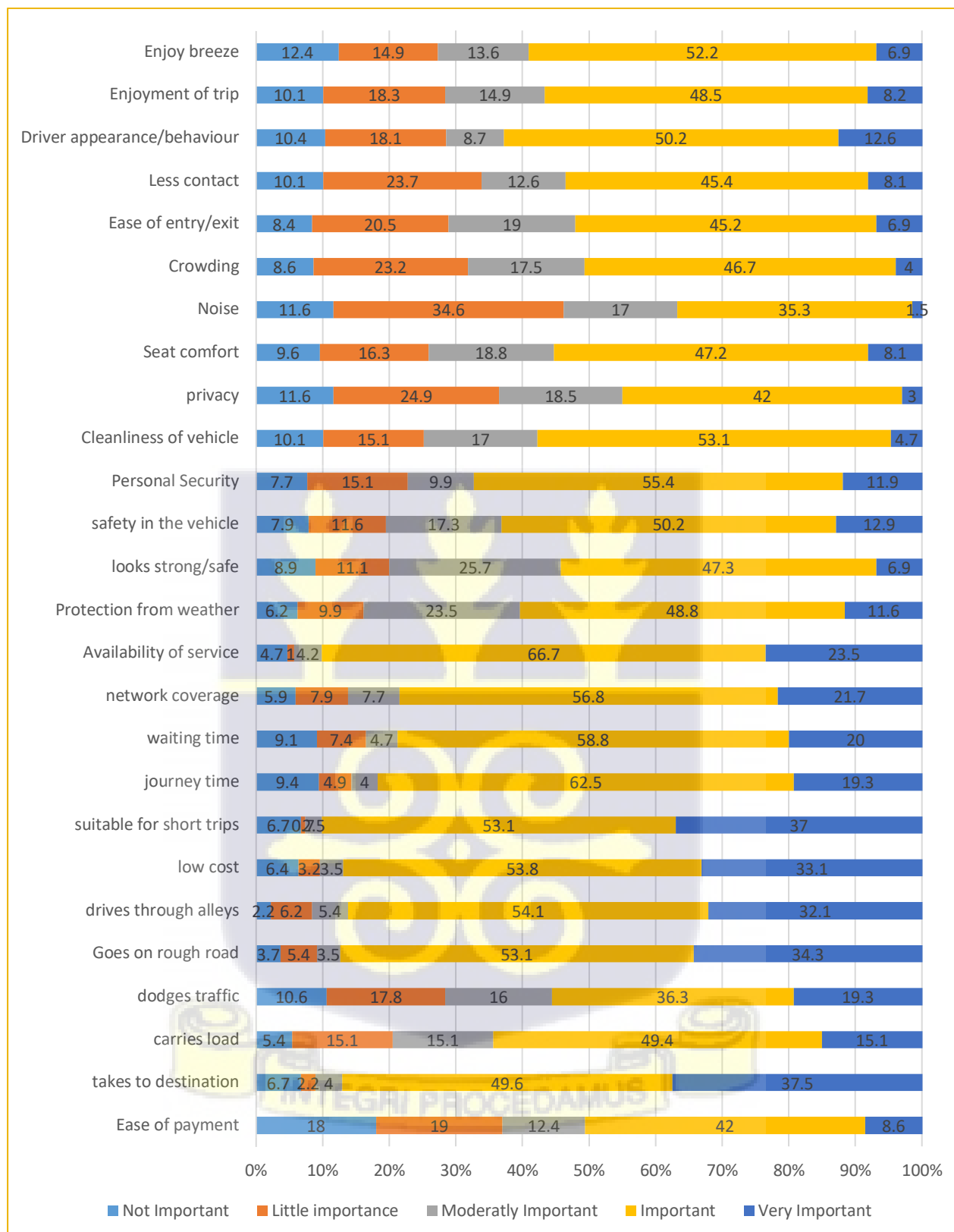
variables. This is in contrast with Neely (2016) and Nutsugbodo et al. (2018) who found close associations between age, education and income as regards determinants of mode selection.

Moreover, comments from users during IDIs suggest that some petty traders who bought their goods from nearby markets used *Pragiya* since it was less expensive and available. On the other hand, the women claimed that using a car taxi would be more costly given the distance and type of routes they took. However, they admitted that they might not even have access to a car taxi to take them in the most unlikely situation. Therefore, *Pragiya*, which is less expensive and somewhat riskier than other options, was the only mode that was accessible.

5.2.3 Psychographic considerations in tricycle adoption

While basic demographic and socioeconomic indicators provide valuable insights, psychographic elements dive deeper into people's attitudes, beliefs, values, and lifestyle choices. This assessment offers a better understanding of why individuals prefer tricycles as a mode of transportation by investigating psychographic characteristics such as preferences, motives, and perceptions. According to the RCT, people make decisions based on their preferences and what is available (Levin & Milgrom, 2004). But Fillone and Mateo-Babiano (2018) believe that after the choice process, the decision maker often selects the option with the greatest utility or offers the highest satisfaction. However, utility may be as varied as there are decision makers. In this study, respondents chose tricycles to meet different transport needs. To assess the decision-making process of the respondents, this section spotlights the various considerations users made to settle on using a tricycle.

Using a Likert scale with responses ranging from "Not Important" to "Very Important", the importance levels of several tricycle characteristics were rated by respondents. Figure 5.2 summarizes the findings and provides insights into the variables that affected respondents'

Figure 5. 2
Psychographic reasons for mode choice


Source: Fieldwork, April 2022

decisions to adopt tricycles. The findings indicate that *noise, privacy, and the perception of strength of vehicle* (captured as ‘looks strong’) were among the least influential aspects in the decision to use tricycles. The implication is that in line with Alfonzo’s (2005) hierarchy of walking needs, lower needs like accessibility should generally be met first before higher needs. Hence, the users did not concern themselves with how old or rickety a tricycle appeared. Instead, as long as it could move and take them to their destination, they considered it sufficient, as the results indicate by accessibility reasons. Thus, just 36.8% of respondents said noise was important to their decision, while 45% said privacy was important. Additionally, 54.2% of respondents said the vehicle's strength (how strong the trike looked) was important in their decision-making. This suggests that tricycle noise, shared or crowded trikes, and shabby-looking vehicles were not key factors in the decision to use trikes.

This is due to the fact that most trikes begin operation when they are brand new, have efficient fuel usage, and pollute less. Although *passenger loading* trips can be congested owing to other passengers' companions and luggage, the capacity is normally three to four people, excluding the driver, as previously stated.

Figure 5.2 further shows that respondents considered *service availability* and *suitability for short trips* most in their decision to adopt tricycles. About 90.2% considered service availability as important or very important while 90.1% of the respondents considered suitable for short trips as important or very important. These results prove that accessibility regarding short-distance trips is a primary transportation need that must be addressed. It is consistent with Mbara (2016) who has established that people used tricycles because it was ideal for short-distance trips.

Other factors that were considered as important or very important included the *ability to drive through rough roads*, with 87.5% preponderance. Additionally, regarding *drives through alleys*

and *takes to destination*, 86.2%, and 87.1%, respectively, viewed them as important or very important in their decision to use the tricycle. Because many of the respondents resided in distant communities where roads were untarred, muddy and rutted, these choices were critical to reaching their destinations. Finally, *low cost* was the fifth highly considered factor, suggesting that even though the cost may be important, other factors, as discussed above, may be much more important. It is in congruence with Onyango (2018) who has indicated that the tricycle is used in Kisumu, Kenya for its ability to move through alleys. According to Onyango (2018), the roads leading to the slum community are rutted and narrow.

Further, only a little over half (56%) of respondents mentioned that they considered dodges traffic as important or very important. It shows that the traffic-dodging ability of the trike was not very crucial in all the sites considering the different contexts and needs of the respondents in the various study sites. This finding is in contrast with Obiri-Yeboah et al. (2021) where the traffic-dodging capacity of tricycles was profound.

5.2.4: Other travel situations that may influence tricycle adoption

As shown in the preceding sub-sections, demographic and psychographic variables influence the decision to use tricycles to a large extent. However, aside from these, other trip contexts or travel situations were perceived to influence the adoption of tricycles. Besides, the cost analysis passengers make regarding mode choice cannot be described in monetary terms only, because of other prevailing factors. For example, at Dome, it was observed that female shoppers with lots of luggage took *dropping* trip type after shopping purposely because of their load. To adequately serve such clients, the tricycle station had a separate designated place for trikes that offered *dropping* trip type only.

On the one hand, shoppers with handy loads used the *passenger loading* trip type while carrying their load on their laps or where passenger loads were kept on the trike, such as under the seats or on the carriage. At the same location, shoppers with their private cars parked farther from the market and used the tricycle, wheelbarrow pushers or head porters to carry their wares to their cars. At Oyibi, night food vendors took *Pragiya* because it was the only means available at night. Based on these different contexts, the study employs variables such as ‘had company’, ‘had pay load’, ‘time of trip’, ‘trip type’, and ‘cost of alternative’ to connote other trip contexts or situations that may influence adoption. Akin to socioeconomic and psychographic variables, it is expected that these trip contexts can influence users to make circumstantial adoption of the tricycle. Therefore, cross-tabulation and chi-square tests were done with these variables and the dependent variable, which is the adoption of tricycles.

It must however be noted that the dependent variable is a categorical variable based on respondents’ primary mode of transportation as explained earlier. For the categories of adoption, there are *pragiya*, *trotro*, car taxi and personal car primary modes. To do the cross-tabulation, the cost of the alternative mode was recoded into less than GHC4.00, GHC4-10.00, and above GHC10.00 and named *altcost*. Regarding destination, it was recoded into Market/Roadside (MR) and Non-market/Roadside (N-MR). Market/roadside represents market, station and roadside destinations while Non-market/roadside represents all the trips ending at places other than the roadside including school, hospital, and restaurant. This new variable was named ‘des’. The remaining variables remained the same except for ‘had luggage’, where the two yes responses (yes, with a child and yes, with an adult) were put together. The results are presented in Table 5.3.

Table 5. 3: Trip situations or contexts that influence the use of tricycles

Primary Mode	Type of Trip		Was there company?		Had Luggage		Cost of Alternative (GHC)			Destination	
	Pass. L.	Drop.	Yes	No	Yes	No	<4	4-10	>10	N-MR	MR
<i>Pragiya</i>	78.5%	21.5%	40.5%	59.4%	19%	81%	61.2%	31.9%	6.9%	45%	55%
<i>Trotro</i>	90.1%	9.9%	32.9%	67.1%	17.8%	82.2%	84.9%	13.1%	2%	43.4%	56.6%
<i>Car Taxi</i>	46.3%	53.6%	48%	52%	30.9%	69.1%	14.6%	46.4%	39%	60.2%	39.8%
<i>Personal Car</i>	14.3%	85.7%	14.3%	85.7%	21.4%	78.6%	14.3%	28.6%	57.1%	50%	50%
Cases	287	118	158	247	90	315	220	118	67	199	206
Chi-Square	0.000***		0.081*		0.050*		0.000***			0.032**	

Source: Fieldwork, April 2022

*** $p < .01$, ** $p < .05$, * $p < .1$

From Table 5.3, most (78.5%) respondents whose primary mode was *Pragiya*, and about 90% of those whose primary mode was *trotro* used *passenger loading* trip type. On the other hand, most of those whose primary modes were car taxi (53.6%) and personal car (85.7%) were more likely to use *dropping* trip type. This was significant at 1% and it implies that *trotro* primary mode users used the *Pragiya* in similar ways as they used the *trotro*; for *passenger loading*. Again, car taxi and personal car primary mode users used the *Pragiya* for comfort and convenience as they used their primary modes.

Regarding whether there was a companion (adult or child), respondents were more likely to say ‘No’ for each primary mode category, but it was highest for ‘personal car’ at 87.5%. The implication is that people whose primary mode was their personal car were less likely to use the *Pragiya* with a companion, whether an adult or child. The results of these statistical associations were significant at 10%.

Still, from Table 5.3, the chi-square test of association between primary mode and ‘had luggage’ showed a statistical significance of 0.05. Generally, respondents revealed that they had no luggage. However, those whose primary modes were car taxis (30.9%) and personal vehicles (21.4%) were more likely to have a load than those whose primary modes were

Pragiya and *trotro*. This suggests that these two categories probably used tricycles because of their load when it was not convenient to use a personal car or *trotro*. For example, when there is heavy traffic. A passenger at Dome indicated “*I use the trike after shopping because trotro was inconvenient due to my load*”. She also added that “*car taxis services such as Bolt and Uber have issues with carrying loads. Thus, I use the trike for convenience and to get to my car faster*”. As indicated earlier, these two categories (car taxi and personal car) were more likely to use *dropping* trip type than *passenger loading*.

Additionally, those whose primary modes were *Pragiya* (61.2%) and *trotro* (84.9%) paid less than GHC 4.00 for their alternative ride. However, a minute proportion of these categories paid more than GHC 10.00 for their alternative ride. Meanwhile, most of those whose primary modes were car taxi or personal car paid more than GHC 4.00 for their alternative ride. For example, 39% of car taxis and 57.1% of those with personal cars paid more than GHC10.00 for their alternative mode. Thus, if the alternative is less than GHC4.00, users may be considering less expensive but tedious and risky options such as walking or using a motorbike. However, when it is greater than GHC10.00, the alternative modes to tricycles include more expensive personal car and car taxi, which are justifiable reasons for users to choose the tricycle.

Regarding destination, many of the trips were to the market/roadside. The proportions for all the categories were higher for market/roadside than non-market/roadside, except for the car taxi category, where 39.8% went to the non-market/roadside. The implication is that people whose primary mode was car taxi were less likely to use the *Pragiya* to the market, roadside, or station than other categories. However, 60.2% of people with car taxis as their primary mode went to places other than the market or roadside. Thus, they were more likely to go to places like churches, hospitals, banks, or public administrative offices. This implies that those whose primary mode was car taxis were more likely to use the *Pragiya* to less common destinations,

which tended to be off regular routes. These off-route trips were made with *dropping* trip type validating earlier findings about car taxi primary mode users and *dropping* trip type.

The statistical significance of these contexts in *Pragiya* adoption suggests that these are ‘costs’ or factors that are considered in the decision-making process. This validates Boudon (1998) and Scott (2000) who have attested that some rational decisions could be based on what is true, good, fair or unfair rather than on cost or reward. In other words, money is not the only basis for making a rational decision as other factors have evidently influenced tricycle adoption in this study.

5.3: Multinomial Regression Analysis of tricycle adoption

A multinomial logistic approach was used to estimate how psychographic transport needs and other factors like respondents’ socioeconomic backgrounds influenced the adoption of tricycles. The dependent variable, which is the adoption of tricycle with four categories, namely *Pragiya* primary mode users, *Trotro* primary mode users, Car taxi and personal car primary mode users, were regressed with the psychographic factors, namely feasibility/flexibility, accessibility/availability, safety, comfort and pleasurability (composite variables calculated using the principle component analysis). The socioeconomic continuous variable was average monthly income. On the other hand, the socioeconomic categorical variables included age and gender. Other regressors included the time of first trip, average trip length and number of trips per day.

The essence of this model is to determine the extent to which these regressors influence tricycle adoption and the post-estimation results of the multinomial regression analysis shows that the model is correctly specified. In that the log-likelihood ratio which is a metric that indicates how well the model matches the observed data was used to show the fitness of the model. The better the fit, the bigger the log-likelihood. When the log-likelihood of the intercept-only model and the entire model are

compared, the full model has a higher log-likelihood, suggesting a better match. A low p-value (0.000) indicates that the entire model exceeds the intercept-only model in terms of fit. According to the table, the LR statistic is 226.397, and the related probability (Prob > LR) is 0.000, showing that the complete model improves the fit considerably (See Appendix VII). Moreover, the pseudo-R squared value explains about 23% of the variance in the choice of transport mode explained by the independent variables. The LR chi2 statistic of 226.40 and the probability value of 0.0000 suggest that the model is significant and provides a good fit for the data.

The results show that feasibility/flexibility has a negative effect on choosing the car-taxi and personal car models but is only significant at 0.05 level in the car taxi model. Thus, a unit increase in feasibility/flexibility score decreases the log odds of choosing a car-taxi over the *Pragiya* primary mode given the negative log-odds coefficient of -3.7. This suggests that people in this category do not consider the tricycle to be feasible/flexible and are likely not to choose the tricycle for their trips if flexibility is a major deciding factor. Thus, the more feasible the tricycle becomes, the more it will be preferred over other modes. The results of the model are presented in Table 5.4.

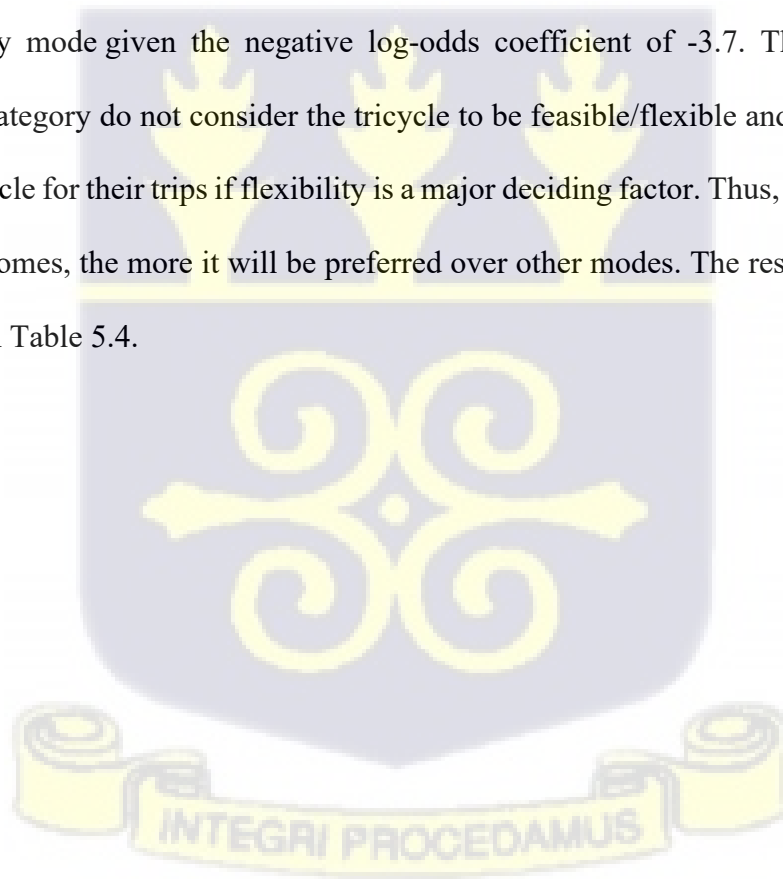


Table 5. 4: Multinomial logistic regression model for tricycle adoption

Variables	<i>Trotro</i> model	Car taxi model	Personal Car Model
Perceived Feasibility/Flexibility	-1.611	-3.729**	-4.118
Perceived Accessibility/availability	2.809**	1.826	2.626
Perceived Safety	-1.537	-1.001	3.418
Perceived Comfort	0.54	-2.288*	3.35
Perceived Pleasurability	0.952	3.62***	-6.316*
Average monthly income	-0.095	0.273*	1.393**
Number of trips per day	-0.562*	-0.548	-15.018
Gender (Male)	0	0	0
Female	0.539**	1.028***	-0.705
Average trip length (less than 5 minutes)	0	0	0
6-10 min	0.667	0.833	-3.988**
11-15 min	0.805	0.975	-5.356**
Above 15 min	1.673***	1.216*	-2.356
Purpose of trip (social activity)	0	0	0
Economic Activity	0.0004	-0.238	4.123**
Time of first trip (Morning (Before 5am))	0	0	0
Morning (After 5am)	-0.047	-1.894**	-3.664**
Afternoon (After 12pm)	0.378	-2.556**	-2.244
Late Afternoon (After 4pm)	-0.243	-0.85	-13.67
Night (After 7pm)	1.076	-45.888	3.42
Any time of day	-0.281	-2.247**	-5.418**
Trip type (Passenger Loading)	0	0	0
Dropping	-0.672*	1.221***	5.121***
Age (Young adults (15-24))	0	0	0
Young Adults (25-39)	0.653**	0.93**	-0.195
Adults (40-54)	0.51	1.495**	2.748*
Aged (55 and above)	-28.344	-28.396	7.83**
Constant	-1.316	-1.458	4.461
Number of observations:	404		
Pseudo R ²	0.234		
LR chi2(63)	226.397		
Prob > chi2	0.0000		
NB: Base category: Pragiya primary mode. *** $p < .01$, ** $p < .05$, * $p < .1$			

Source: Fieldwork, April 2022.

The results also show that whilst accessibility has a positive effect on all three models, it is only significant at 5% in the *Trotro* model. This means that a unit increase in accessibility score increases the log odds of choosing *trotro* mode over *Pragiya* primary mode (positive log-odd coefficient of 2.8). Simply, it insinuates that if accessibility increases, *trotro* will be preferred by most users.

Although comfort has a significant positive effect on choosing the *trotro* and personal car models, the model also showed a significant negative effect on choosing the car taxi

over *Pragiya* at a significance level of 10%. Thus, a unit increase in comfort score increases the log odds of choosing *trotro* mode over *Pragiya* primary (positive log-odd coefficient of 0.54) and decreases the log odds of choosing car taxi mode over *Pragiya* primary mode (log-odd coefficient of -2.28). This means that when comfort increases, users will prefer *trotro* over *Pragiya* but also choose *Pragiya* over car-taxi maybe for reasons related to cost because car-taxis cost more in terms of fares.

In addition, a unit increase in pleasurability score increases the log odds of choosing a car-taxi over *Pragiya* (positive log-odds coefficient of 3.6) at a 0.01 significance level. This indicates that pleasurability has a significant positive effect on choosing the car taxi over *Pragiya* suggesting that people value enjoyable transportation experiences with car taxis more than *Pragiya*. This is expected since several users complained about shaking, tossing and vibration when using the trike. However, pleasurability has a negative effect on the personal car model with log odds of -6.3 at a 10% significance level suggesting that a unit increase in pleasurability reduces the log odds of choosing a personal car over the tricycle.

The results also show that average monthly income has a significant positive effect on choosing a car-taxi and personal cars. This means that a one Ghana Cedi increase in average monthly income increases the log odds of choosing car taxi mode (positive log-odds coefficient of 0.27) and personal car mode (positive log-odds coefficient of 1.4) over *Pragiya* primary mode at ten and five percent significant levels respectively. This implies that if users earn more, they will prefer car-taxis and personal cars, which would be more affordable because of the extra income.

The average trip length has a significant positive effect on choosing *trotro* and car taxi over *Pragiya*. Thus, a unit increase in average trip length increases the log odds of choosing *trotro* car taxi modes over *Pragiya* primary mode with positive log-odds coefficient of 0.66 and 0.83, respectively, for less than ten minutes trips. At a 1% significance level, average trip length had a positive coefficient of 1.7 on *trotro* mode for above 15-minute trips.

This reiterates the fact that tricycles are often used for short-distance journeys rather than long ones.

However, average trip length had a significant negative effect on the personal car model with a coefficient of -3.9 and -5.4 for 6-10 minutes and 11-15 minutes trips, respectively. These were significant at 5%. The number of trips per day also has a significant negative effect on choosing all modes over the *Pragiya* mode. Although not significant for car taxi and personal car models, it shows that a unit increase in the number of trips per day will decrease the odds of choosing all other modes over *Pragiya* primary mode. This also means that when there are more trips to be made, users prefer to use the tricycle rather than other modes because users had indicated that the tricycle is good for making rounds or for doing several short trips at a particular time.

The study also considered demographic characteristics and the findings suggest that different age groups and gender have varying preferences for transportation modes. In terms of age, being a young adult (25-39) has a significant positive effect on choosing *trotro* and car-taxi modes over *Pragiya* primary mode. This is significant at 5%. Compared to young adults aged 15-24 years old, being an adult (40-54) increases the log odds of choosing car taxi with log odds of 1.5 and personal car mode with log odds of 2.7 at 5% and 10% significance levels respectively. Being aged reduces the chances of choosing *trotro* and car taxi mode over *Pragiya* except for personal cars. Thus, being aged had a significant positive effect on choosing the personal car model with a positive log-odds coefficient of 7.8 at 0.05 significance level. This indicates that being older increases the tendency to choose modes that are less crowded and can be used for individual travel purposes than being younger.

Gender had a significant positive effect on choosing the *trotro* and car taxi models for females. Thus, being a female increases the log odds of choosing *trotro* primary mode with a log odds coefficient of 0.5 and car taxi mode with a log odds coefficient of 1.0 at a significance of 0.05

and 0.01, respectively, when compared to being a male. Moreover, being female in this study had a negative effect on personal car mode suggesting that females prefer to use means perceived to be cheaper.

Moreover, the type of trip had a significant positive effect on choosing car-taxi and personal cars for *dropping* trip type. When compared to *passenger loading* trip type, choosing a *dropping* trip type increases the log odds of choosing car-taxi over *Pragiya* (positive log-odds coefficient of 1.2) and increases the log odds of choosing a personal car over *Pragiya* (positive log-odds coefficient of 5.1). Thus, when the trip type is *dropping*, users prefer to make the trip with a car taxi or personal car than the tricycle. These statistics intimate the desire users may have for safer modes but due to availability issues, (which is in alignment with the hierarchy of walking needs) and cost-related issues (which are chiefly rational), may stick to what is readily accessible and affordable. However, it had a negative effect on *trotro* primary mode users. This means that when users want a dropping, instead of *trotro*, they will choose the tricycle because the *trotro* is rarely used for individual public transport unlike the tricycle and car taxi.

The purpose of the trip has a significant positive effect on choosing personal car for economic activity at 5%. Choosing economic activity as the purpose of a trip increases the log odds of choosing a personal car and *trotro* over *Pragiya* primary mode (with positive log-odds coefficient of 4.1 and 0.0004 respectively) compared to social activity as the purpose of the trip. This suggests that for economic activities, users preferred personal cars and *trotros*.

Finally, other trip attributes considered in this study included the time of first trip. The findings suggest that the time of the first trip has a significant negative effect on choosing car taxi and personal car over *Pragiya* mode for ‘morning’ (after 5 am) and any time of the day categories, respectively. The findings further show that there is a significant positive effect on choosing the car taxi over *Pragiya* for the afternoon (after 12 pm) category. For instance,

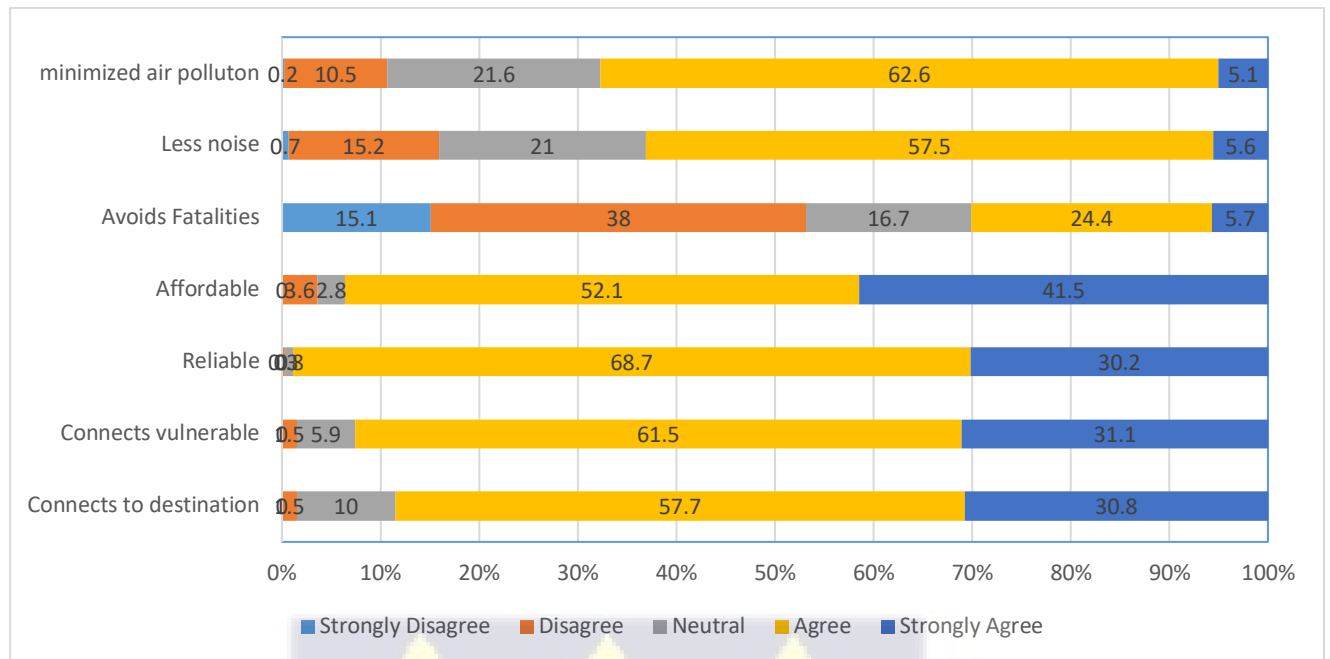
starting a trip at 5 am in the morning reduces the log odds of choosing a personal car or car taxi over *Pragiya*. This reiterates the fact that commuters preferred tricycles in the early hours of the morning when car taxis or other modes of public transport may not be available, and to get through the morning rush.

Overall, the findings of the study provide valuable insights into the factors that influence the choice of transportation modes in Accra. The study suggests that different factors have varying impacts on the choice of tricycle as a transportation mode, and policymakers should consider these factors when developing transportation policies and strategies.

5.4 Perceptions of tricycles as sustainable means of transport

A sustainable transport system has been defined in this study as a transportation network that allows shared usage and is generally cost-effective, environmentally friendly, physically safe, and accessible. Respondents' perceptions of sustainability were obtained from seven indicators/variables that include social, economic, and environmental aspects of sustainability (See Table 3.2). For example, social sustainability indicators/variables included 'conveys to destination', 'conveys vulnerable', and 'avoids fatalities'. On the other hand, economic variables included 'affordable' and 'reliable', while environmental sustainability indicators comprised 'less pollution' and 'less noise' (Litman, 2019; World Commission on Environment and Development, 1987). Respondents' perceptions are presented in Figure 5.3.



Figure 5. 3*Respondents' perceptions of tricycles as sustainable means of urban transport*

5.4.1 Perceived social sustainability of tricycles

Generally, respondents perceived the tricycle as sustainable. Regarding social sustainability, 92.6% agreed or strongly agreed that tricycles convey vulnerable people like the poor, children, and women to various destinations; and 88.5% agreed or strongly agreed that trikes generally conveyed people to their destinations. It also provides first and last-mile transport services and door-to-door services to users who may be classified as vulnerable, for example, women constituted 54.6% of users in this study. This is in congruence with Ehebrecht et al. (2018), Jack et al. (2021) and Tuffour and Appiagyei (2014) who have reported on the tricycle as a vehicle that conveys people to various destinations. In Hasan (2013) and Mbara (2016), for instance, the majority of the users were women.

Nonetheless, only 30.1% agreed or strongly agreed that it can avoid fatalities. This finding is not entirely unexpected. Jack et al. (2021), Obiri-Yeboah et al. (2021) and Tuffour and Appiagyei (2014) have all indicated that the tricycle is generally perceived as unsafe despite

its diverse usages. Moreover, from the qualitative data, a cross-section of users and riders, as well as some key informants, indicated that the tricycle is not a heavy vehicle. Therefore, tricycles are not very likely to be involved in fatal accidents unless there is an impact from a bigger vehicle. As further confirmed by cross-sections of users and riders, the worst that could happen with a tricycle by itself is to summersault with passengers falling out with no fatalities. Thus, irrespective of the invaluable services rendered by tricycles in some enclaves of the GAMA, its tendency to turn turtle, makes it unsafe as compared to car taxis, which are more enclosed. Key informants 3 and 4 discredited the obliviousness of riders and users regarding their safety claims about the tricycle. They stressed that the data on road accidents in Ghana does not present the tricycle as a less fatal vehicle as users and riders claimed.

Additionally, according to data on motorbike accidents (Ghana Police Service (Motor Traffic and Transport Department) (GPS-MTTD), 2022) and reports of the Key informants from DVLA and NRSA indicated that even though all cycles including motorbikes and trikes constituted a minor (21%) proportion of all vehicles that were involved in a motor accident in Ghana between January and September 2022, more of the injured (27%) and deaths (41.1%) were in this motorbike and tricycle category. These national reports reflect the data at the regional level. Thus, in Accra (excluding Tema), although all cycles constituted 15.8% of all the vehicles involved in an accident in the referenced period, 41.1% of the injured and 45.5% of fatalities involved motorbikes or tricycles. These proportions from Accra constituted 22.8% of the injured and 16.9% of fatalities at the national level (GPS-MTTD, 2022). These data further reflect the perception of respondents regarding the safety of tricycles as presented in Figure 5.3 where only about 31% of respondents agreed that the tricycle avoids fatalities.

5.4.2 Perceived economic sustainability of tricycles

For economic sustainability, 98.9% of respondents perceived it as reliable, and 93.6% agreed or strongly agreed that it was affordable. This is to say that tricycles provide quick, affordable and reliable transport services to a cross-section of Ghanaian urbanites with diverse income levels. These findings corroborate Ehebrect et al. (2018), Hasan, (2013) Jack et al. (2021), Mani (2012), Obiri-Yeboah et al. (2021) and Onyango (2018).

It was found that tricycles were mostly used during the early mornings and late afternoons. Thus, the quantitative data analysis suggests that about 80.7% of respondents made their first trips in the early hours of the morning, around 5 o'clock am and before 7 o'clock am. Regarding the last trip, about 29.2% of respondents took their last trip in the late afternoon after 4 o'clock pm while about 32.6% took their last trip after 7 o'clock in the evening. Moreover, only about 12% and 23% of respondents made their first and last trips, respectively, at any time as shown in (See Appendix VIII). Thus, *Pragiya* was significantly used during the morning and evening rush hours to help users to go to their workplaces, get home from work or engage in other transactions. These are validated by Obiri-Yeboah et al. (2021) and Tuffour and Appiagyei (2014) who have emphasized how motorbikes and trikes are used to dodge traffic during rush hour in some urban areas in Ghana. The study further confirms Mbara (2016) and Talamini and Pires Ferreira (2019) who found that trikes and e-bikes, respectively, connect commuters to bigger transportation networks by providing the first and last miles.

5.4.3 Perceived environmental sustainability of tricycles

For environmental sustainability, 63.1% of respondents agree that tricycles produce less noise, while 67.7% believed their pollution levels were low. This aspect is another debated aspect even though the tricycle is constantly being researched for being more environmentally efficient (Chidiebere et al., 2014). While some stakeholders agree that the tricycle uses energy

efficiently and therefore does not pollute much, others are of the view that the small quantities from several of the trikes will produce high polluting thresholds, which can be equally unsafe. These are in line with Mani and Pant (2012) and Melo and Baptista (2017) who believe that tricycles can use energy efficiently and pollute less to some extent; and Harding et al. (2016) who are of the view that trikes have contributed heavily to the pollution in India's cities.

5.4.4 Ordinary Least Squares (OLS) Regression Analysis of sustainability of tricycles

An OLS regression analysis was done to ascertain the factors that influence the sustainability of tricycle transportation. First, a composite index was constructed based on respondents' responses to sustainability questions. The dependent variable, which is tricycle sustainability, was regressed on the following independent variables, namely monthly income on transportation, a combination of tricycles with others, fuel efficiency, unmotorized routes, the persistence of low income, lower *Pragiya* fares, rivalry from other networks, prohibition by LI 2180, short-distance services, minimizes crime rate, gender, education, age and employment status. The post-estimation tests suggest that the model is correctly specified. Multicollinearity for example is the occurrence of significant correlations among independent variables in a regression model, which can confound the interpretation of the model's results and impair its reliability. The Variance Inflation Factor (VIF) is a metric for determining the degree of multicollinearity. A VIF score of 10 or above indicates a significant degree of multicollinearity, implying that the variance of an estimated regression coefficient is exaggerated due to strong correlations between variables. The post-estimation test for this OLS model revealed that both individual variables and the mean VIF are all less than 10. This is a positive result since it indicates that the variables in the model do not display substantial multicollinearity. See Appendix IX.

Table 5.5 presents the OLS results on the sustainability of tricycles. It shows that the variables that strongly influence the sustainability of tricycles include a combination of *Pragiya* with other modes, unserved routes, low incomes, low fares, provision of short-distance services, awareness of LI 2180, and rivalry from other networks. However, fuel consumption had a positive relationship with tricycle sustainability but it was not significant.

Furthermore, using only *Pragiya* as a means of transportation has a positive significant influence on sustaining the tricycle transportation system more than using a combination of *Pragiya* and other modes of transportation.

Table 5. 5: The results of OLS regression for tricycle sustainability

Dependent Variable: Sustainability of Tricycle transportation (Composite index)				
Explanatory variables	Coefficient	Robust Std Err	t	p-value
Monthly Income on T&T	-0.0000399	0.000051	-0.78	0.435
Combination of <i>Pragiya</i> with other mode	0.0543046	0.0249763	2.17	0.030**
No				
Fuel efficiency	0.0157565	0.0101207	1.56	0.003
Unserved routes	0.0425952	0.0141355	3.01	0.003***
Low income	0.0348511	0.0074535	4.68	0.000***
Lower fares	0.0820745	0.0099189	8.27	0.000***
Rivalry from other networks	0.0109104	0.0064101	1.70	0.090*
Awareness of LI 2180	-0.0249937	0.0137621	-1.82	0.070*
Short distance services	0.0350205	0.016141	2.17	0.031**
Minimizes crime	0.0132097	0.0086217	1.53	0.126
Gender	-0.0079366	0.0124887	-0.64	0.525
Age (Young Adult (15-24))				
young adults (25-39)	-0.0021588	0.0168984	-0.13	0.898
Adult	-0.0010099	0.0275507	-0.04	0.971
Aged	-0.0322635	0.0506545	-0.64	0.525
Employment Status				
Employed	-0.0086225	0.0193486	-0.45	0.656
Inactive/student/ill	-0.0113122	0.0247948	-0.46	0.648
Education (Tertiary)				
No education	0.0729541	0.0337737	2.16	0.031**
Primary	0.0034199	0.0269758	0.13	0.899
JHS	-0.0045569	0.0241915	-0.19	0.851
SHS/Technical/Vocational	0.0070949	0.0235906	0.30	0.764
Number of Observation: 405				
F(20, 384) = 17.93				
R-squared = 0.4950				
Prob > F = 0.0000				

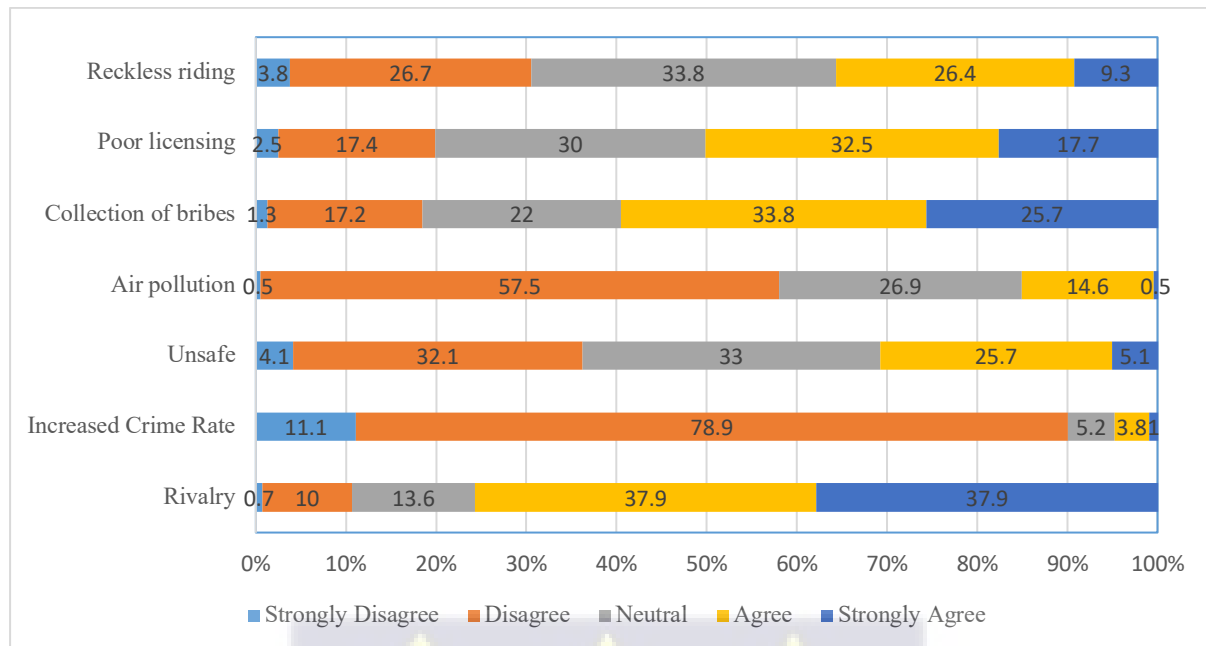
Source: Fieldwork, April 2022

This has implications for those who use it as their main source of transportation because generally, the tricycle is used in combination with other modes. Fuel efficiency is another important determinant of the sustainability of tricycles and as the result shows, it has a positive relationship with the sustainability of tricycle transport even though not significant. This finding supports Jittrapirom's (2015) claim that fuel efficiency makes motorcycles environmentally friendly, but only in the short term.

Similarly, unserved routes, low income, and cheaper transportation costs are all positive significant determinants of the sustainability of tricycles at a level of 1%. Although in the study, rivalry was perceived as more of a challenge than an advantage, the results of the OLS indicate that at a statistically significant level of 10%, rivalry from other networks increases/positively affects sustainability. Moreover, the legal instrument (awareness of LI 2180) reduces/negatively affects the sustainability of the adoption of tricycles. An influencing factor in the sustainability of the adoption of tricycles is the short-distance services. The result highlights that short-distance services have a positive significant influence on the sustainability of the adoption of tricycles at a statistical significance level of 5%. This is to say the need for short-distance services will continually create a ready market for tricycles.

5.5 Users' and riders' perspectives of challenges with tricycle transportation

Riders and users alike have issues regarding the use of tricycles. Some of these challenges have been heightened by hearsay about tricycles while others are supported by national statistics. Respondents were therefore asked to state the extent to which they agreed with specific challenges they encountered with tricycle adoption in the questionnaire administration. The results are shown in Figure 5.4. In the IDIs and KIIs, participants were asked to express their views on some of the challenges in the adoption of tricycles as a means of public transport and the responses are presented in the ensuing sub-sections.

Figure 5. 4*Challenges of tricycle transport*

Source: Fieldwork, April 2022

Figure 5.4 shows that rivalry recorded the highest; 75.8% of the respondents either agreed or strongly agreed that rivalry was a major challenge in tricycle transportation. Conversely, safety was generally not perceived as a severe challenge by neither users nor riders. Thus, only 25.7% agreed, and 5.1% strongly agreed that tricycles were unsafe. This was confirmed by the qualitative data and according to Rider 1 for example, *“since the tricycle is a machine, occasionally, it can develop a fault... but many riders did not know how to handle curves when tricycle transportation first began, leading to frequent, though not invariably fatal, tumbles. However, these tiny mishaps have stopped with practice”*. This suggests that rivalry and collection of bribes by police were more common challenges than safety. These findings regarding rivalry and little concern for safety are corroborated by Konkor et al. (2019) who observed that rivalry exists between different transport networks but safety as a challenge was left in the hands of God.

Additionally, police bribery was another challenge with 59.5% preponderance. This occurred when riders were arrested for breaking traffic rules. Other times, such bribes were taken after the riders were arrested indiscriminately. According to Rider 1, *“Because the police were familiar with us, this was considered a routine arrest as it was often resolved with a green card, which is a payment of GHC10.00 [to the police]”*. To stop these arrests, rider associations often met with officers to persuade them to allow their operation. As explained earlier, this is not to permit reckless riding but for riders to give an assurance to ride carefully. This was some kind of unauthorized fee collected by the police validating Doherty (2020) and Jack et al. (2021) who have similarly observed that some transport authorities, including the police, took bribes from riders.

Reckless riding is strongly related with safety, and it has serious consequences for safety. Only 35.7% of those surveyed agreed or strongly agreed that reckless riding was a problem. This suggests that around 36% of respondents considered that riders rode carelessly, confirming the findings of Jack et al. (2021), Obiri-Yeboah et al. (2021) and Tuffour and Appiagyei (2014), who identified reckless riding as a challenge that deters certain non-users.

Furthermore, about 50% of the respondents agreed or strongly agreed that licensing among the riders was poor and, therefore, a challenge. The qualitative data further iterated this anomaly with Rider 1 stating that *“as for that one [license], most of us are guilty, even me”*. Riders admitted that because they did not have licenses, they sometimes rode at high speeds and recklessly when they encountered the police in order to avoid being detained.

Contrary to public opinion that motorbikes and tricycles have increased crime rates, respondents strongly disagreed with the statement with less than 5% agreeing or strongly agreeing that tricycles increased crime rates. A cross-section of participants mentioned that tricycles have rather reduced crime rates around the commercial hubs where they operated. For

example, from the qualitative data, Station Master 3 reported that *“there used to be frequent robbery attacks on early dawn shoppers, but all these have stopped in recent times because of our [the tricycle station] presence here.”* Another rider stated that *“Sometimes we even call the police to alert them on crime issues. ...In the past, people could not cross this community to the next one at night due to robbery. But these days, robbers don't bother people since they [robbers] know we know who they are. We also work till 11 p.m.... in any case, people rather steal the tricycle from riders”* (Rider 3). Furthermore, a rider explained that tricycle operation has rather reduced crime in the market because *“there are trikes to take shoppers right into the market and back home without being exposed to robbers”* (Rider 1). These statements contradict Tuffour and Appiagyei (2014), who reported that tricycles and motorcycles were used to commit crimes. Riders, on the other hand, presumed that the presence of energetic young men along the roadside and stations served as a deterrent to thieves, supporting Doherty's (2020) belief that the presence of riders helps to prevent social crimes in the commercial area in which they operate. Given the speed limits of a tricycle, riders further believed it is almost impossible to rob with a tricycle.

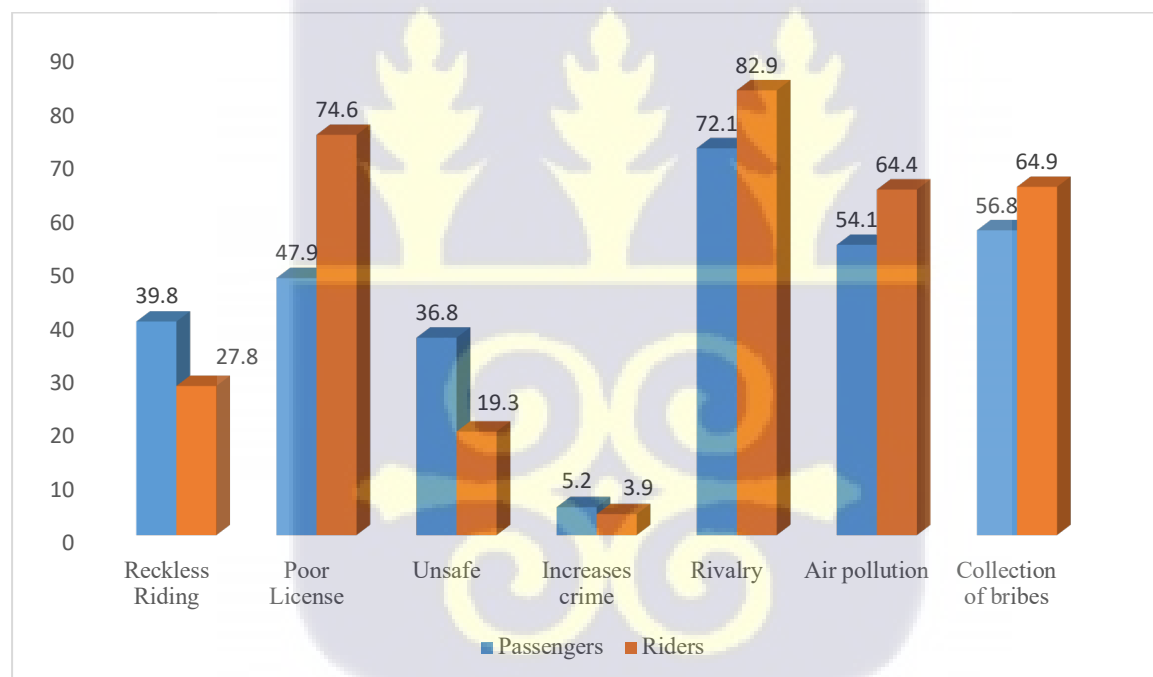
Congestion is another challenge tricycle transportation was observed to have created. Although riders made an effort to keep to their workspace, the challenge of congestion is often heightened by narrow roads and competition among other network operators like *trotro* and car taxi drivers. This further exacerbates the already existing pedestrian safety issues. These further the views of Oteng-Ababio and Agyemang (2015) who have argued that the use of motorbikes creates congestion and compromises public safety.

Furthermore, a cross-tabulation of challenges was performed with ‘type of respondent’ (user or rider) to ascertain the skewness of the responses on challenges. The analysis gave an insight into what users and riders considered jointly as a challenge and those that were biased. The different perspectives on these challenges additionally provide an entry point to how the

challenges could be addressed because of the exposition on the perspectives of users and riders. To do this, the focus was directed at only ‘Agree’ and ‘Strongly agree’ responses or the right side of the Likert scale as seen in Figure 5.4. The responses that showed disagreement and neutrality were excluded because the intention is to demonstrate the extent to which respondents agreed with statements on challenges (See Figure 5.4). Finally, the proportion of responses on ‘Agree’ and ‘Strongly agree’ for both passengers and riders in each variable was analysed, and the results are presented in Figure 5.5.

Figure 5. 5

Variations in respondents' perceptions of tricycle transport challenges



Source: Fieldwork, April 2022

Figure 5.5 focusses on the extent to which riders and users agreed with the challenges of tricycle transport and it is evident that regarding safety, more passengers (36.8%) than riders (19.3%) agreed that tricycles were unsafe. In terms of reckless riding, more passengers (39.8%) than riders (27.8%) agreed that riders rode carelessly. On whether trikes increased crime rates,

fewer riders (3.9%) than passengers (5.2%) agreed that tricycle proliferation has resulted in a rise in crime rates. Therefore, passengers are more likely to allude to reckless riding, unsafe, and increased crime as challenges than riders. These proportions are based on the total sample size of 205 for riders and 405 for users.

Additionally, Figure 5.5 shows that more riders perceived rivalry, air pollution, and collection of bribes as a challenge than passengers were likely to. However, the difference between passengers and riders within these variables are not quite as high as the difference in ‘poor license’, where 74.6% of riders, compared to 47.9% of passengers, agreed that it is a challenge. Poor licensing was widely admitted as a challenge but more among riders than passengers. The qualitative data suggest that not having appropriate licenses was not a source of worry for riders because they did not ride on major roads. Rider 5 mentioned that *“we provide door-to-door services in the community so providing safe rides to passengers mattered more than license... no one talks about a license once we provide safe rides”*. Other riders admitted that they did not have a license because it was expensive and time-wasting. These findings were also observed by Jack et al. (2021) who attributed the lack of license among riders to bureaucratic bottlenecks.

Rivalry was the most agreed challenge for both passengers and riders, with 72.1% and 82.9% preponderance, respectively. This is supported by the qualitative results and for instance according to Rider 9, *“taxi and trotro drivers do not want to see Pragiya because we are all interested in passengers”*. Moreover, Rider 5 admitted that *“we compete with taxi and trotro drivers for the same passengers, that is why they do not say anything good about Pragiya drivers”*. Furthermore, comparing the proportions for ‘increases crime’, that is 5.2% for passengers and 3.9% for riders, Figure 5.5 further suggests that passengers and riders alike do not accept the idea that tricycles increase crime rates even though it is more likely for

passengers to oppose the statement. Indeed, the qualitative data indicated that trikes were not used in committing crimes as discussed earlier in this sub-section.

In addition to these challenges, other challenges emerged from the qualitative data. The prominent ones are the issues of otherness, bad reports on safety of the tricycle, legalization and health issues.

Regarding otherness, some riders believed that passengers and other transport operators regard them as undeserving of certain benefits in transportation. For example, while all road users have rights to the road, some riders felt they were being bullied, even on the road. According to Rider 1, *“it is not right for us to ride in the middle of the road... but other drivers intentionally block and hamper our [tricycle riders] movement when we try to dodge traffic getting us stuck in the process. Meanwhile, we do that to beat traffic”*. Rider 3 added that *“drivers of car taxis purposely push us to the edge or shoulders of the road such that it becomes impossible to move forward unless we [riders] join the lane”*. It is unacceptable for riders to ride in the middle or shoulders of the road, but they perceive this reaction from car taxis and trotros as bullying.

Still, on otherness, tricycles are considered the cheapest motorized form of transportation by many people. Rider 10 mentioned that *“passengers always want to cheat us... Because the fares are already low, even if you want to charge more, like GHC15.00, they want to pay less regardless of the distance travelled”*. In other words, passengers have the perception that Pragiya riders should not charge beyond a certain limit. Rider 5 stated that *“when fuel prices go up, and riders decide to increase fares, users make deprecating remarks to presuppose that they do not have the right to increase fares”*. This is confirmed in the quantitative data where about 37.4 % of users admitted that if other modes offered the same fares for the same distance, they would rather not use the tricycle.

Legalization was a major issue that both riders and users raised. According to LI 2180, it is illegal to use motorbikes and tricycles for public transport. However, users and riders were generally of the view that LI 2180 should be reviewed, arguing that the model of the passenger tricycle is unique from the type with a bucket (Aboboyaa); hence, the passenger tricycle was made for carrying people and not goods. This debate extends to the motorbike, which users and riders considered not to have enough balance and more fatal than the passenger tricycle. Rider 4, an adult rider and a tertiary student, for example, argued, *“Why is it that private individuals can use it and we cannot use it for commercial purposes?”* According to Rider 8, an adult and advocate for tricycle riders, remarked that *“The politicians give them [tricycles] out to constituents when campaigning. Should we feed it or watch it as TV? The government should do something about the law and allow riders to work freely”*. Riders and users further questioned how some people will meet their transport needs to work and other places if the tricycle was banned. The economic benefit of providing jobs to the teeming youth through riding and other spillover jobs like welding, spraying, mechanical repairs, and the sale of spare parts were emphasized by both users and riders (Diaz Olvera et al., 2020). Thus, both riders and users presumed that legalizing tricycle transportation will streamline the activities of tricycle operation and increase orderliness. These findings are corroborated by Jack et al. (2021) who are of the view that legalization could reduce reckless riding and, to a large extent, injuries and fatalities thereby improving the sustainability of tricycle ridership.

Other challenges included negative reports and fears about the safety of tricycles. Rider 1, an executive, former wheelbarrow pusher and hearse driver, reported that there was a rumour about a tricycle that capsized and killed three people in their area, but he had never heard about the accident, even though he was a rider and an executive in the same area. Nonetheless, confirming such rumours and fears, Rider 9, a Nigerian and a leader at one of the stations, indicated that *“Pragiya is too light and can fall when not driven with care”*. Rider 1 further

admitted that *“from my experience as a hearse and ambulance driver, the trike can fall if the rider is not careful. I know the gears to use when I’m turning. If you [rider] don’t know such basics, you [rider] will fall... Because of this, at our station, we [leaders] do not allow inexperienced riders to carry a heavy load to avoid accidents”*. Those fears are justifiable, which is why riders took measures to prevent such occurrences. Nevertheless, in riders’ opinion, these rumours tarnished their image and undermined their work.

Passengers and riders also complained about shaking and vibration, but according to User 9, a corn and cassava dough retailer, *“shaking should not be a problem because even cars shake”*. User 3, an onion retailer who lived at the base of a mountain, in a community with undefined roads mentioned that *“the roads are rutted; therefore, the shaking is inevitable”*. Furthermore, according to Rider 9, *“the vibration gives us body aches... sometimes I am unable to perform my marital duties as I used to. To alleviate the pain, I take a shot of concoction and hard liquor”*. Rider 1 indicated that *“I experience the growth of bumps on my backside. The bumps appear when you ride for a long time... I use painkillers and hot ointment to reduce the pain and stress caused by riding”*. These statements confirm some of the difficult conditions under which some riders work validating Ehebrecht et al. (2018) and Diaz et al. (2016) who have reported shaking, vibration and other health-related challenges of tricycle transportation. Meanwhile, health issues were confirmed by Akese (2021) who stated that the heat from the engine of motorbikes is unhealthy for sperm production.

Another issue of concern was the stealing of tricycles. The study found that tricycles were less likely to be used to steal or rob due to their low speed and the amount of space it occupies compared to motorbike. This means that the tricycle cannot go through small spaces that motorbikes can. However, as indicated earlier, tricycles instead get stolen and several measures must be taken for their retrieval, although with no success sometimes. Rider 1, an executive and former wheelbarrow pusher, explained that *“when a tricycle is stolen, leaders of the*

association write letters to nearby police stations to help with the search. Some also go to fetish priests or mallams⁵ to find the lost trikes... it works if only you [the inquirer] do what the fetish priest or mallam asks you to do. I can testify about people whose trikes have been found through the fetish priests and mallams when the police could not help”.

The cost of repairs and stresses from ‘*work-and-pay*’ resulted in some financial pressure on some riders. A cross-section of riders as well as a user who runs a spare parts shop attested that tricycle spare parts were not expensive compared to car spare parts even though prices keep increasing. A user (User 2, a spare parts shop keeper) stated that “*with the money riders make in a day, purchasing spare parts is not a challenge. However, those who operated old rickety trikes had issues with hikes in spare part prices due to the frequent need to change parts*”. These confirm the observations of Diaz Olvera et al. (2020) who mentioned financial stresses and riders’ experiences through mechanical repairs and ‘*work and pay*’.

5.6 Summary and conclusion

The previous chapter looked at the nature of tricycle transportation and outlined the factors influencing its proliferation. In this chapter, the focus was to elucidate the factors that influence tricycle adoption, the perceived sustainability of tricycles, and the challenges riders and users encounter in tricycle operation in the GAMA. In addition, the chapter identified transportation need-induced determinants, cost-related factors, and psychographic determinants, as well as the role of other travel contexts in adopting tricycles as a means of urban transportation. It has also looked at the perceptions of the sustainability of tricycles and identified some challenges both riders and passengers encounter in using trikes. The key findings were that commuters

⁵ Mallam in Islam is a learned person with outstanding knowledge in the Quran. However, in Ghanaian parlance, it is a local name given to a Muslim spiritualist or diviner believed to have supernatural and occultic powers. See Tonah (2006).

often used the tricycle for short trips and in combination with other modes to complete travels because it is affordable and accessible. It was generally perceived to be sustainable environmentally, and economically. Social sustainability was partial because the majority of users perceived it to be unsafe. Some of its challenges include rivalry, bribery and health problems. The next chapter will focus on the role and limitations of government transport agencies in providing sustainable urban transportation in the city, especially in the peripheries.



CHAPTER SIX

SUSTAINABLE TRICYCLE TRANSPORTATION: POLICIES AND THE ROLE OF GOVERNMENT TRANSPORT AGENCIES

6.1 Introduction

According to UN-Habitat (2022), cities are here to stay, and the world will experience more urbanization, especially in Asia and Africa in the next few decades. Being a focal point for economic growth, urban places will continue to attract people looking for life-changing opportunities in cities which need to be safe for all (UN-Habitat, 2022). As a result, transport needs will also continue to grow (Evans et al., 2018; Sustainable Mobility for All, 2019). However, this expansion needs to be approached sustainably.

Sustainability connotes inclusivity (WCED, 1987). Moreover, sustainable transportation has transposed into a more collective access (UN-DESA, 2016) for women, children, the disabled and the aged especially (UN-Habitat, 2022). The UN, through SDG 11, seeks to make cities and human settlements inclusive, safe, resilient, and sustainable and is committed to ensuring that no one is left behind. As part of the innovative ways to live sustainably amidst high population growth and urbanization, target 11.2 aspires to achieve affordable and sustainable transport systems by 2030. Specifically, target 11.2 seeks to improve road safety, particularly by expanding public transport, and making sure that everyone has access to safe, affordable, accessible, and sustainable transportation systems by the year 2030; particularly paying attention to the needs of those most at risk, such as women, children, people with disabilities, and the elderly (United Nations, 2022a).

This global agenda for inclusive and sustainable transportation reflects regional and national agenda on urban transportation. By extension, the impetus of an inclusive city provides better opportunities to navigate the city, especially for youths in search of jobs and vulnerable groups

who are impacted more by the adverse events of cities while safeguarding the environment (UN-Habitat, 2022). Using mostly qualitative data in this chapter, the aim is to examine the policies, strategies and actions taken by government transport agencies to achieve sustainable and inclusive urban transportation paying particular attention to tricycle transportation and its implications for policy and the future.

6.2 Streamlining the roles of government transport agencies in tricycle transportation

The management of tricycle operations in Ghana is multisectoral in nature, cutting across ministries and departments. The five major government institutions that are involved in tricycle transportation are the Driver and Vehicle Licensing Authority (DVLA), National Road Safety Authority (NRSA), Ghana Police Service-Motor Traffic and Transport Department (GPS-MTTD), Environmental Protection Agency (EPA) and the Transport departments of the District Assemblies. These are often mutually interactive but not exhaustive.

Different Acts of Parliament define the responsibilities of these government agencies and by extension how to carry out their mandates. The execution of their mandates are crucial for the sustainability of transportation in Ghana to a large extent. This sub-section touches on their mandates, Acts that established them, institutions they work with and how they collaborate in the performance of their mandates relative to public transport. The section is fundamentally qualitative, and it uses reports of key informants from government transport agencies regarding their mandates and how they relate to tricycle transportation.

6.2.1 The DVLA

As indicated in section 2.2.6, DVLA was established by Act 569 of 1999 to ensure standards for both drivers and vehicles are adhered to in Ghana through registration and the issuing of

licenses. It comes directly under the Ministry of Transport (MoT) but works closely with other institutions. As a public institution, it adheres to public policies such as Legislative Instrument (LI) 2411 of 2020, which is the public financial management regulations. This LI guides public institutions including the DVLA on their financial decisions. Apart from LI 2411, the DVLA has the Traffic Regulatory Act, LI 2180, at the core of its functions. In terms of training on traffic rules, the Highway Code is the principal material to the work of DVLA as far as the registration of vehicles and licensing of drivers are concerned.

As a government transport agency, it has a responsibility to transact business, do research and represent the government as far as transport standardization issues are concerned. Accordingly, the key informant at DVLA explained that *“as a way of ensuring standards, the DVLA undertakes corporate planning and evaluates projects and programmes which are internally or donor-funded as a new requirement by LI 2411 of 2020... The LI2180 is a significant legal framework which contains all the work of DVLA. For instance, it shows how drivers and vehicles should be tested as well as speed limits.”* (KI 2, a male senior officer at DVLA head office, Accra). Adherence to transport standards corroborates Agbevade (2021) and the implication is that tricycle owners are unable to register their tricycles with the DVLA for public transport because of the limitation LI 2180 enforces. Eventually, they get registered as private vehicles with blue number plates instead of yellow number plates. Since the registration comes at a cost, a cross-section of users and riders misinterpreted that for legitimacy or the right to operate tricycles on a commercial basis. This notwithstanding, the DVLA maintains its position of ensuring standards.

Speed limit is another domain of the DVLA and a debated phenomenon in tricycle transportation with riders claiming not to over speed because the nature of the tricycle makes it impossible to do so. Admitting that speed limit regulations are covered in the LI 2180 and the Highway Code, which are clear on the speed limits of highways and densely populated

areas, the DVLA key informant explained that these regulations play a critical role in ensuring road safety and reducing the risk of accidents. According to the informant, obeying speed restrictions not only prevents accidents but also adds to better traffic flow and decreases environmental effect. He explained that *“vehicles do not prescribe speed limits, the law does, and it is relative to location. Thus, in a town or a densely populated area, for instance, the limit is 30 kilometres per hour (km/h). The motorbike may have the capacity to speed for 100 km/h but the speed limit for the area/road determines its speed limit”* (KI 2). Accordingly, the DVLA believes that reckless riding and accidents could be curbed when speed limits for various locations are observed. This finding aligns with Dapilah et al. (2017).

As a multisectoral agency, the DVLA collaborates with certain institutions to ensure proper transport standards. Some of the key stakeholders the DVLA works with include the GPS-MTTD, NRSA, Ghana Standards Authority (GSA), the Ministry of Transport and others (Agbevade, 2021). Just as standards are crucial to the work of the DVLA and for the sustainability of tricycle transport, periodic reviews of these standards are equally important. As pointed out by Boateng (2021), making room for innovation and the review of LI 2180 for example, could have the potential to address some of the emerging issues that tricycles have introduced into the transport industry. Thus, collaborations could lead to more innovations in enforcing road transport standards. He stated, for example, that *“the standard for roadworthiness inspection outlines the standards for continuous certification for every kind of vehicle. It also shows what needs to be tested. However, another standard is being developed by the GSA for DVLA to be used for periodic inspections of vehicles”* (KI 2). The DVLA registers the tricycles for private use and provides the riders with license A.

6.2.2 The NRSA

NRSA, established by Act 993 of Parliament in 2019, has the mandate of planning, developing and coordinating policies concerning road safety (Ministry of Transport, 2021b). Similar to the DVLA, it is an agency directly under the MoT. Aside from research that informs government policy on safe transport systems, its major mandate is on education and sensitization on road safety issues. The key informant, a female senior officer, indicated that *“before NRSA transitioned from a commission to an authority, National Road Safety Commission was responsible for educating and sensitizing road users on road safety. However, as an authority, the mandate has morphed into planning, research and coordination. So now we [NRSA] do research”*. She added that *“the research wing of the authority for instance is responsible for generating annual reports, analysing data to make policy recommendations to the MoT as well as monitoring and evaluating of road safety programs and activities. We are also in charge of developing strategies or policy documents for the institutions we collaborate with... hence we [NRSA] have recognized the increased usage of tricycles and it is being discussed”* (KI 3, senior officer, NRSA). All these narratives show the importance of education and research in road safety issues because they influence road safety policy formulation and implementation.

In terms of policy formulation and recommendations, the key informant explained that *“all the policy items are handled by the MoT while NRSA as an agency under the ministry comes up with recommendations... For a policy recommendation to transform into policy, it has to go through the ministry, which also works in line with the business of the government of the day”* (KI 3). However, as already intimated, the NRSA does not work in isolation but closely with other government transport agencies like the GP-MTTD regarding sensitization on road accidents and the District Assemblies as far as regulating public transport is concerned. Since adherence to standards is crucial to safety, the NRSA works closely with the DVLA in that regard. Hence, according to the key informant, *“the Act that establishes the NRSA, specifically*

mentions the constitution of the NRSA board of directors and those the authority can work in close collaboration with though we [NRSA] has a broader stakeholder network... Some of the key stakeholders within the network of the NRSA are the insurance industry, GPS-MTTD, formerly with Ghana Education Service, research institutions such as Building and Road Research Institute (BRRI) and transport operators like GPRTU, and STC” (KI 3).

It was evident from the qualitative data that the work of the NRSA has extended to district assemblies because of its new function of public transport regulation. The informant explained that *“as a commission, the work with district assemblies was negligible but now being an authority, NRSA works more closely with District Assemblies. This is because as an authority, it has a greater responsibility of regulating public transport, which hitherto was the responsibility of district assemblies... if so, the case of tricycles as a means of public transport falls within our [NRSA] domain”* (KI 3). This is an indication of better partnership between the NRSA and the District Assemblies which have been the main implementers of public transport policies at the local level.

6.2.3 The District Transport Office

Key informant interviews with transport officers revealed that the Local Government Act 936 of 2016 is the main law that establishes the district assembly system. There was also the LI 1961, which shows the departments of the district assemblies that includes the transport department. LI 1961 also outlines the government agencies the transport department works with, and this forms the bedrock of their partnership with other state institutions to provide sustainable transportation to the public. The key informant in-depth interviews also mentioned that although the transport office works with the MoT and NRSA mainly because of their mandate, the transport office falls under the Ministry of Local Government. Moreover, it

operates from units at the District Assembly level and its main task is to regulate public transport including tricycle transportation.

As part of public transport regulation, transport officers indicated that they issued route permits and assembly licenses to public transport operators like *trotros*, taxi drivers and operators of lorry stations or bus terminals. According to Transport Officer (TO) 2, a middle-aged male planner by profession, *“these permits sometimes come in the form of stickers and embossments which are sold to generate income internally. We also group them [operators] and collect data on their location, number of vehicles, drivers, etc. and ensure that the service public transport operators provide does not affect the communities' safety... Aside from daily tolls which have been ceded to the zonal councils to generate income for repairs, all these services are provided for a token fee”* (TO. 2). This implies that as public transport operators, tricycle stations require route permits as well as assembly license to operate legitimately. The transport officers explained that a route permit gives rights to the operator to operate on a defined route while an assembly license recognizes the operator as a public transport operator in the assembly.

In this respect, it was observed that some of the stations had secured these permits but often reported that *“they could go anywhere”*, regardless of their defined routes, and this could be a contributory factor to the rivalry between public transport operators.

It was further revealed that apart from working directly with public transport operators, transport officers worked closely with the MoT. TO 2 remarked that *“we advise management on everything about transport... we carry out sub-functions such as transport planning, operation, enforcement, traffic management and safety... The planning unit deals with the planning of mobility in the district by recommending and providing access roads and operations deal with wrong parking... Operations are carried out by city/municipal guards. They clear walkways in public places as part of transport by-laws which must be enforced.*

Additionally, they ensure that public vehicles operate with commercial transport items like stickers, embossments, and assembly licenses. Regarding safety, the transport office notifies the GPS-MTTD of traffic light dysfunction and traffic jam” (TO2). Thus, it was observed that most of the tricycles had assembly embossments, which implied that the assembly was aware of their operation. However, their validity or expiration periods were not investigated. This meant that even though they were not fully recognized due to the limitation of LI 2180, the assemblies, through the sale of embossment stickers alone, generated some internal funds.

Additionally, by mandate, transport officers worked closely with other government transport agencies essentially to ensure the adequate and safe provision of public transport. Transport Officer 1, for instance, indicated that *“apart from the GPS-MTTD, the transport department works with the Department of Urban Roads (DUR) and NRSA. There is also the safety management committee made up of thirteen members coming from different departments and units such as transport, urban roads, Works, Education, Health, Fire, Municipal guards (locally known as Abaye), and administrative representatives like the Municipal Chief Executive (MCE). The committee discusses driver safety which includes planning, development of road safety issues, education and sensitization as well as monitoring and enforcement”* (TO 1, a middle-aged male with administrative background). All these represent the broader formal framework of institutions within which tricycle transportation is established. It further shows that the local Assembly as an institution, has the capacity to supervise the operation of tricycles because first, they operate in local communities and second the Assembly the provider of similar services to other public transport operators.

6.2.4 The GPS-MTTD

The GPS-MTTD, as discussed in section 2.2.6, was established in 1952 and mandated to enforce traffic regulations. This mandate involves working with other institutions to achieve a

complete road safety result. The qualitative data revealed that to achieve a holistic impact of traffic regulation enforcement, GPS-MTTD works in blocs or networked agencies. For instance, key informant 4, a middle-aged senior officer at GPS-MTTD head office, mentioned that *“the institutions GPS-MTTD works with are organized in blocs/networks called the ‘4Es’ or ‘5Es’, in some cases. The Es represent Engineering, Education, Enforcement, Emergency Response and Economics. This is because road safety is a multi-agency and inter-ministerial task requiring integrated processes for management”*. These were confirmed by the NRSA and all these blocs interact with specific state institutions. The informant further explained that *“the engineers in the road sector are the Ghana Highway Authority and the Departments of Feeder and Urban Roads and they check overloading, axle weight, bridges, height management and prevent abuses that damage the roads”* (KI 4). It is therefore not out of place to see GPS-MTTD officials along various routes ensuring compliance to road traffic rules.

The study also revealed that they require data on operators and other road users in order to inform policy with some precision. Thus, on education, the informant reported that *“GPS-MTTD shares information and experiences and updates key stakeholders like NRSA regularly [with information on road offences”*. The intention is to inform policy and implement strategies that will curtail traffic offences. Therefore, he explained that *“... road accidents are mainly caused by human factors and data is required to make policies as it forms the basis of policies”*.

Furthermore, it was reported that NADMO, Ghana National Fire Service (GNFS), and Ambulance Service formed the emergency response bloc and according to KI 4, they assisted with information on accidents and helped to save lives. *“Other institutions or agencies also provided community support for community policing and Transport operators (Unions, for example, GPRTU) have a responsibility over commercial drivers”* (KI 4). This is to say, leadership of public transport cooperatives and associations exercise some authority over its members as reflected in all the tricycle stations in this study.

Some of the policies that back their mandate, according to the informant, include *“the 1992 constitution which establishes the Ghana Police Service, Act 350 of 1970 [the police service act which deals with the functions and conditions of service of the Ghana Police Service], Act 683 (Road Traffic Act of 2004), and LI 2180 of 2012 [the traffic regulation Act]. All these profess a responsibility to enforce vehicle ownership and use regulations. Moreover, there is also the Ghana Highway Code of 1974 which enjoins the Ghana Police to train and provide road safety services required in the country”* (KI 4). All of these narratives of how the GPS-MTTD functions describe its scope of responsibilities for public transport, but it is apparent that they require data on operators in order to make informed decisions about regulations on road traffic offences, of which tricycle riders are the greatest offenders.

6.2.5 The EPA

The Environmental Protection Agency was established by the Environmental Protection Agency Act, of 1994 (Act 490). As stated by the key informant, (KI 1, a male senior officer at EPA head office in Accra), *“it offers protection against particular hazards and operates through several departments, one of them being the built settlement unit... we are responsible for addressing development and settlement issues in both urban and rural areas”*. However, because the tricycle has not been confirmed to have any harmful effect on people and the environment, KI 1 admitted that it has not been considered as an issue of concern in high-profile stakeholder discussions. He instead indicated that *“aside from developing guidelines for waste management, EPA monitors public health and environmental issues in the built-up environment”* (KI 1). The EPA partnered with certain institutions to deliver this mandate. In his submission, he stated that *“the key institutions we fall on for collaboration include the DVLA, customs service, district assemblies, Water Resources Commission and the Ghana Standards Authority (GSA)”* (KI 1). The key informant also revealed that new equipment is

being developed to ascertain pollution levels. This means that although the EPA has had limited interactions with tricycle operators since tricycles have not posed serious environmental threats, the EPA acknowledged the existence and operation of tricycles in urban areas. Therefore, the limited interaction does not imply a lack of awareness.

6.2.6 Dovetailing the roles of government transport agencies in tricycle transportation

As explained in the previous sub-section, various stakeholders play different roles in commercial transportation. This section explains how their duties intersect in tricycle transportation and highlights places where they may collaborate. The information in this section is based on reports from in-depth interviews with key informants. It should be noted that there are no legal procedures for commercial tricycle operation. However, this section aims to highlight the different stages tricycles, like other modes of public transport, might take in order to demonstrate the function of each institution and how they feed into others in the process.

Essentially, to have and operate a commercial vehicle, the DVLA takes care of the registration. KI 2, in the elaboration of the process of registration said that *“first, the DVLA registration officers ensure that the owner has paid the appropriate duty on the vehicle to customs. The owner is subsequently issued with custom documents containing the vehicle or tricycle’s details and how much was paid. Additionally, the owner is issued a clearance to show that the vehicle in their possession is not stolen and that the documents are not fake. After this, the vehicle is released to DVLA testing officers for inspection. They typically inspect the light, steering condition, suspension, body and all the attachments which should be in good order. Vehicle examiners test the functionalities to see whether it is strong, can move, and meets the minimum specifications. If it is found fit, a number is allocated to the vehicle. However, after registration, the vehicles have to be re-tested every six months for commercial vehicles and twelve months*

for private vehicles. This confirms why trikes have blue number plates and not yellow as expected for commercial vehicles... private vehicles do not state the purpose because they are private but a vehicle for commercial use has to be declared. Thus, a tricycle registered for private purposes does not have any specific use stated during the vehicle registration” (KI 2).

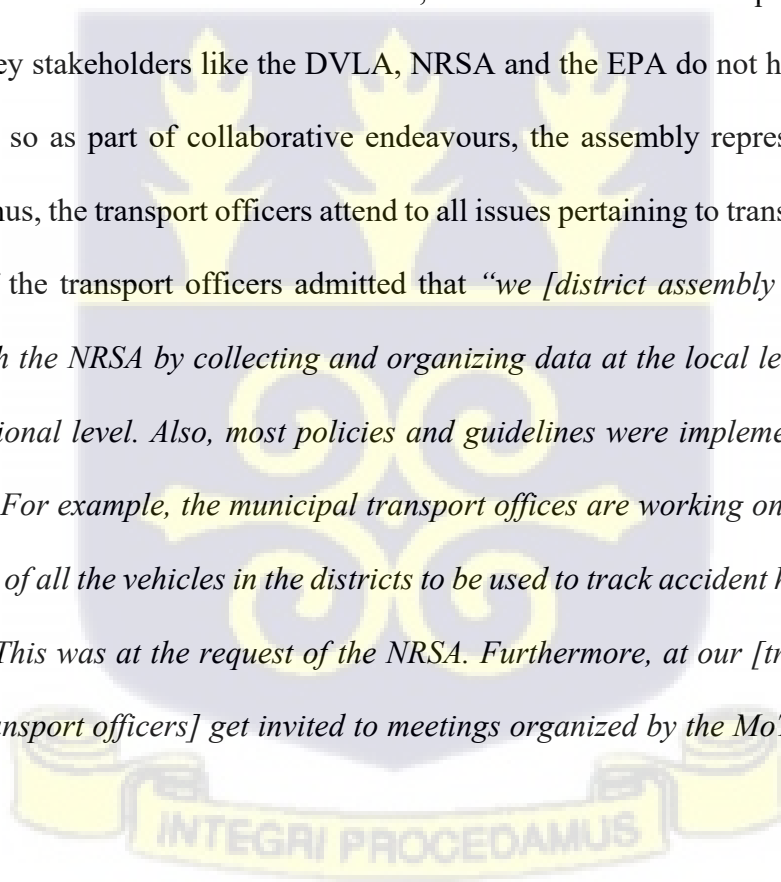
Because passenger tricycles cannot be registered for commercial use, they are registered for private use, which has implications for registration charges and periodic checks.

Additionally, despite the standards to be met at the DVLA for commercial vehicles, the driver needs to obtain a license from the DVLA as well. Regarding driver licensing, KI 2 mentioned that *“drivers are supposed to do a theory test, eye test and practical or intrepid test before a license can be issued whereas Act 683 gives further prescriptions on the areas to consider when testing drivers”*. Meanwhile, permits to operate commercially are obtained at the local assembly level for both driver and vehicle as part of local governance economic activities. The insurance industry provides insurance for the registered vehicle as a vehicle for private purposes because some of the riders claimed to have acquired insurance for their trikes. The GPS-MTTD primarily acts as an enforcer of road safety regulations to prevent accidents and ensure proper post-accident management in the incidence of an accident. They inspect riders’ permits on a regular basis. The transport office, through city guards, carries out operations to ensure commercial transport operators have the right permits to operate. The work of the NRSA comes in as an intermediate for road safety policy formulation and potentially coordinates between all these stakeholders by creating awareness on road safety. The work of the EPA rather comes in at the early stages regarding standards on which vehicles can be imported.

Consequently, without a certification of registration for commercial purposes, tricycles are not able to engage all the parties from whom they can acquire further permits and legal documentation for operation. KI 2, for example, stated that *“tricycles are registered for private purposes generally, but people end up using them for commercial purposes. When we say*

commercial, it is when the passenger is carried for a reward. What is more, riders are unable to receive permits from local assemblies, obtain insurance and other permits that can allow them to operate commercially. Albeit they can acquire driver's license A which is for two and three-wheelers. The result is that most riders ride in fear of getting caught because they lack the necessary permits and license to ride". Despite these regulations, some riders manage to operate without adequate documentation, which certain tricycle stations intend to solve at the station level by assisting riders in the licence collection process. Without this documentation, they inadvertently ride in fear of getting caught, creating further problems for themselves and other road users.

Moving on to consider avenues of collaboration, it was evident from the qualitative data that most of these key stakeholders like the DVLA, NRSA and the EPA do not have offices at the local Assembly so as part of collaborative endeavours, the assembly represents them at the district level. Thus, the transport officers attend to all issues pertaining to transportation in their district. One of the transport officers admitted that *"we [district assembly transport office] collaborate with the NRSA by collecting and organizing data at the local level for use at the regional or national level. Also, most policies and guidelines were implemented at the local assembly level. For example, the municipal transport offices are working on a document that contains details of all the vehicles in the districts to be used to track accident history and issues of that nature. This was at the request of the NRSA. Furthermore, at our [transport officers] request, we [transport officers] get invited to meetings organized by the MoT and the NRSA"* (TO 2).



6.3 Limitations and challenges of government transport agencies regarding tricycle transportation

From earlier discussions, government transport agencies in tricycle transportation have distinct responsibilities but face common problems in the provision of public transport. It has also been established that tricycle transportation is illegal yet widespread, posing a challenge to the functioning of government transport agencies. These challenges revolve around poor coordination, lack of data, high traffic accident rates, planning crises and lack of a regulative framework that can enable key institutions to engage riders. These issues were elaborated on as revealed by key informants recognizing that resolving these institutional constraints opens up discussions about the future of tricycles and how they may be institutionally absorbed into the public transport system with minimal problems or otherwise.

The study discovered that the lack of coordination was a primary problem. Although the responsibilities varied for each institution, they were not conclusive; rather, the success of the process was determined by how effectively the other functions were carried out. Implying that there was a need to foster more collaboration by clearly outlining areas of fusion and partnering. TO 2 recounted that *“the district assembly is expected to cooperate with the EPA, which sets the emission standards and the district assembly is required to implement at the local level. But they [EPA] do not have any guideline documentation to help with implementation... there is also a special planning committee that excludes the department of transportation”*.

Additionally, the qualitative data shows a dearth of information on tricycles and riders, making it challenging to locate them. Unlike car taxis and *trotro* drivers who can be identified in clear groups, the TO 2 indicated that *“it is difficult to get hold of them because they are very smart... even the police are unable to apprehend them. The police are occasionally able to locate them and track them down. But, in our situation, we merely pick the trike number and submit it to the police so they can find them [culprits] in case of any irregularity”*. Transport officer 1 also

reported that *“if you go to the place where they work [tricycle station], they flee”*. Riders flee primarily because first, their operation is illegal, second, they usually do not have any proper documentation or identification and third, they fear being asked to pay a bribe. Meanwhile, these officers often approach them to interact and know who the riders are since they work in the local community. These findings are validated by Obiri-Yeboah et al. (2021) who identified the inadequacy of information on tricycle riders in Kumasi.

Furthermore, data from KIIs indicate that tricycles have created a planning crisis as they seem to affect the aesthetics of the city and create congestion as well as accidents. Some of the key informants have observed through the discharge of their duties that the city's aesthetic appeal will suffer as the number of trikes increases. TO 2 stated that *“I visited Koforidua and saw how the beauty of the city's northern section had been impacted. The riders received printed stickers the same way that car taxis do. I think the city will become more chaotic as its numbers grow. Security is a major problem. With so many vehicles, an urban environment can become quite chaotic, which, as already mentioned, can lead to accidents”*. As much as transport inclusion is desired, it should not create congestion or worsen the aesthetics of the city as is the worry of some key stakeholders in this conundrum. These observations corroborate Jittrapirom (2015), Obiri-Yeboah et al. (2021), and Recio et al. (2019) who have talked about the relatedness of transport hubs, informal transport and congestion. But the key informants mentioned that tricycles can be allowed to operate in the peripheries, not within the main cities as is the case in some cities in Nigeria (Agheyisi, 2021).

Another challenge that came out strongly was the financial loss of the operation of tricycles caused by some district assemblies. Although the operation of tricycles brings financial liberation to a number of unemployed young men, it also deprived some district assemblies of opportunities to expand their internally generated funds. From the perspective of transport

officers, tricycles have caused the collapse of legitimate car taxi businesses because trikes attract most commuters and pay nothing to the assembly from their profits.

Aside from the planning crisis and the loss of revenue to the local Assemblies, the transport officers complained about the financial effect tricycle transportation was having on taxi and *trotro* operators. TO 1 explained that *“they collapse the car taxi business everywhere they operate because it is cheap. Meanwhile, the assembly receives income from the traditional modes through the sale of stickers, road tolls, embossments and renewal of their assembly permits”*. TO 2 added that *“drivers of traditional modes frequently voiced their complaints, all of these can be explained by difficulties with enforcement. In this instance, they [tricycle riders] are unstoppable. When you succeed at clearing them, because you are not always present at the site, they reappear... meanwhile their activities do not bring any monetary benefit to the assembly and whatever they get is for their pocket”*. This was attributed to the fact that the assembly finds it difficult to engage them because the law does not recognize riders. These statements confirmed IDIs with riders and users and further corroborated Ehebrecht et al. (2018) who talked about riders having conflicts with other riders. They further suggest that tricycle ridership as it is could be managed if certain institutions could be given certain directions. At the moment, no one wants to get into legal problems in an attempt to bring some level of sanity. TO 2 for example, admitted that *“we are afraid of the national law, so we don’t engage them... otherwise, it is an easy way of making money for the district. And the riders are also prepared to pay but because of the law, we find it difficult to engage them”*.

Nevertheless, related to the above challenge is the lack of a regulative structure. It is therefore difficult for regulatory agencies to regulate tricycle operators because there is no framework in place to regulate an illegal activity. Being an informal illegal activity, it could be thought of as something unwieldy. However, all the key informants from government transport agencies indicated that it was due to LI 2180, which prohibits the commercial use of tricycles. Although

the government can utilize state funds to train young and inexperienced riders to prevent traffic accidents, key informants believed that it is unlawful to engage them for financial gain. In this regard, TO 2 iterated that *“we don't venture to collect any fees from them because the law doesn't permit that. They don't pay any taxes apart from the taxes they pay on fuel and the importation of the machine itself... and until they change the position of the national law, a lot of the assemblies want to engage them, but we are still scared”*. On the contrary, another key informant noted that *“some local authorities gained financially through registration fees, by imposing certain taxes and, some obtained papers for road-worthy and insurance which were persistently increasing. They also paid daily tolls as part of IGFs for the local assemblies”* (KI 3). It is evident that although some district assemblies follow the rules, others do not. This demonstrates that there is no consistency in the operation of tricycles across all districts.

Additionally, data analysis revealed that road safety practitioners were concerned about the high risk of accidents among riders despite being the mode with fewer vehicles. They blamed it on government negligence, interference, a high mix of traffic, disobedience, and unemployment. Key informants claimed that high accident rates put a strain on the few resources that are available. KI 4, for example, affirmed that *“generally, there is a systematic road user indiscipline among riders and the urge for more trips to make more profit drives their potency to violate traffic rules. Thus, they end up speeding... there are about 19000 accidents a year and motorbikes and tricycles account for about 20% and 48% of the deaths involved respectively. We have to deal with crowded lanes where they operate and the open sides as well as the high traffic mix also make occupants more vulnerable... Meanwhile, when arrests are made, the process is manipulated for the rider to be released. The police are not at all pleased about these occurrences”*. Findings on speed limits and the vulnerability of tricycle occupants disconfirm Mbara (2016) and Mani and Pant (2012) because they believe that the tricycle is light and cannot over speed to the point where toppling over could be fatal.

It was further noted by KI 2 that *“the main concern is the high accident rate associated with their usage”*. Although by themselves, accidents may not be fatal, using the highway with other bigger vehicles could make them so. As hinted at earlier, the traffic mix can be dangerous to riders in the city. Corroborating Jack et al. (2021), Obiri-Yeboah et al. (2021) and Tuffour and Appiagyei (2014) tricycle transport needs proper regulation if their utmost benefits are to be harnessed.

6.3.1 The dilemma: Legality versus leaving no one behind

Sustainable transport is a necessity for urban growth as it ensures people have access to affordable, accessible transport that is energy efficient. Not making a choice is a choice in itself. As this study has highlighted, regardless of LI 2180, there is a persistent usage of tricycles in GAMA. Therefore, in purview of RCT, this state of dilemma offers decision-makers, riders as well as users, the opportunity to make a rational choice of legalization while embracing all its pros and cons or the option of creating more transport poverty or exclusion with its pros and cons as well. Similarly, there is also the decision to prioritize the transport needs of the unserved or underserved communities over the operationalization of LI 2180. This sub-section encapsulates key informants' perspectives on sustainable transportation, as well as their perceptions of tricycle sustainability and the dilemma of its legalization in Ghana.

Based on their experiences, key informants explained sustainable transport in various ways emphasizing the need for continuity, mindfulness of scarce resources, safety and the need to encompass all key stakeholders (Barceló, 2019). In the view of TO 1, *“sustainable transportation requires adequate budget and collaboration because the bigger picture involves the GPS-MTTD, municipal guards, zonal councils, health sector and the fire service. Thus, institutional buy-in is a crucial factor in the sustainability of tricycles”*. TO 2 likewise described sustainable transport as *“a safe transport that does not hamper the environment with*

considerations for emissions and energy usage... we do not have the capacity to measure emission levels but what I can say is that in Ghana, we use a lot of old cars and that can affect the environment". The key informant from EPA further described sustainable transport as *"a means of transport that does not inhibit future generations of having same [the kind of transportation technology existing currently]. Or any transportation that does not adversely affect the environment like the use of fossil fuels. It should have long-term positive implications and should minimize the usage of individual vehicles"* (KI 1).

Considering the importance of safety in the sustainable transport discourse, another key informant indicated that *"safety is critical to sustainable transportation and with scarce resources, there is a need for investments in safety and maintenance, of roads and vehicles... this will lead to sustainable transport which is mobility without risk or harm"* (KI 4). Apart from investing in safety infrastructure for sustainable transport, investment in safety also includes training to ensure that vehicle operators are well-equipped. Thus, KI 2 mentioned that *"all drivers should be trained, tested and given further training through refresher courses to keep them at pace with current trends... enforcement is key... when licenses are issued, we need to ensure that the rules are enforced"*.

Ghana ensures sustainable transportation through the implementation of several policies and strategies. According to the EPA, these include the state of the environment report, the bus rapid transport, banning of overaged vehicles through the Customs Excise and Preventive Services (CEPS) management (PNDC Law 330 (1993)), and the Ghana standard for the environment and health protection known as Act 1219 (2018), which are requirements for motor vehicle emissions. Aside from these, the NRSA also safeguards sustainable transport through the national transport policy (includes other modes of transport), road safety policy (specifically for roads) and the national road safety strategy.

Regarding the road safety strategies, KI 4 reported that *“the first phase of the strategy was implemented in the year 2000 and since then, three strategies have been implemented. The fourth is currently in progress and it is in line with the second decade of action which is to reduce by 50%, the level of fatalities and injuries between 2021 to 2030”*. He further explained that these safety strategies serve as the blueprint for road safety management in Ghana. Thus, he added that *“the strategies come with plans in which all the stakeholders have outlined the steps they will be taking or what they will be doing in the action period... others [strategies, policies and commitments] include the enactment of the road law which talks about safer use of vehicles, safer roads, and roadworthiness in the Decade of Action. There are also rules of engagement by the State to ensure safety through education, sensitization and awareness creation. The State’s commitments to funding interventions like the national road safety strategies 1, 2 and 3”* (KI 4).

However, the challenge with district assemblies, as indicated by the transport officers, is that assemblies have little control regarding standards. Nevertheless, according to TO 2, they engaged public transport operators as a way of creating awareness of sustainable transport. He said *“...when it comes to emissions EPA takes the lead and with vehicle standards, DVLA takes the lead. We only look at the DVLA documents that they [DVLA] have certified and provide permits... we [the transport department] however talk to the leaders of lorry stations to admit vehicles that are not very old and are roadworthy to ensure safe trips and less emission”*.

Further, from these perspectives of sustainable transportation, key informants were asked to express their opinion on tricycle transportation. The study revealed that key informants were aware of the effect of tricycle transportation on Ghanaian road safety in the study sites. For example, a key informant expressed that *“even what it [tricycle operation] is doing to the environment is obvious. So as an institution, we have acknowledged, and we have come to terms with it. They used not to be so many about ten years ago and they were used for carting*

bags of sachet water, tomatoes, and other goods from the market. As it is now, it is being used as passenger transport. The road traffic regulations, LI2180, regulation 128, is against that. It can be used for private purposes in the same way as people use their private cars but not commercially for hire and reward". Recognizing that tricycles may be a necessity for some cross-sections of urban commuters, some key informants have advocated for education to curtail the negative effects such as reckless riding which leads to road accidents.

The results suggest that key informants were mindful of the particular reasons that compelled people to use trikes. They emphasized the need for affordable fares, unserved routes, unemployment as well as the multiplier and spillover effects as some of the reasons. A key informant admitted for instance that *"some people use it out of convenience. Though very risky, it is faster than other options. They also emit less because petrol engines usually emit less. They also come in [imported] new and create a livelihood for a lot of community folks"* (KI 2). Similar views were shared by the other key informants (KI 1, KI 3, KI 4 and the two transport officers). As shown in the previous chapter, the low energy consumption capacity of the tricycle can help to attain environmental sustainability in the short term. The ability of the tricycle to provide jobs can help with the achievement of SDG 8.2, which promotes youth employment, education, and training to significantly reduce the percentage of youth not in employment, education, or training (United Nations, 2022b). With respect to employment, a cross-section of riders in the IDIs indicated that as family men, they use their income to take care of their families while others indicated that they have used their profits to set up other businesses.

Furthermore, from fieldwork observations and jottings, it is evident that tricycle transportation has created spillover jobs. For example, businesses like spare parts shops, washing bays, mechanic shops and welding shops have sprung up in proximity to tricycle stations as spillover economic opportunities. In effect, the tricycle transport business is not creating employment

for riders only but a long chain of beneficiaries, directly or indirectly related to tricycle transport. These findings are in line with Recio et al. (2019) who have explained that transport hubs act as economic spaces where a lot of young informal workers thrive. The findings validate Owusu-Ansah et al. (2022) who revealed some economic activities including repairs of tricycles in which young people are involved.

Additionally, a key informant noted that *“due to limited employment avenues; the quick and easy job entry for young males in the transport sector; the fact that the tricycle is cheaper to obtain and easier to drive as compared to a car; accessible and can be used on the blind side of authorities, it attracts unemployed young males. Even minors can ride even though it is prohibited. The vehicle is also portable and provides quick employment. There is a great demand for their services because they work as feeders and fill a transportation gap”* (TO 2).

KI 3 also mentioned that people used the tricycle for lack of a safer alternative. She stated that *“there is also a lack of safer alternatives in peri-urban areas especially. Hence, there is a strong interaction between demand and supply, that is, what people need, and what is available”*.

Nonetheless, legalization is key to sustaining tricycle transportation and making it better. As indicated earlier in this report, riders overspeed when police officers are in sight obviously because their operation is chiefly illegal and they are most likely to be riding with inadequate documentation. This was confirmed by the KIIs with key informants. Moreover, before the 2020 elections, there was a debate about whether to legalize their operation. A key informant's opinion, however, is that *“tricycles should not be a means of public transport if we still hope to reduce road accident fatalities”* (KI 4). All these are valid concerns that must be thought through to provide a clear path for the public to follow.

6.4 Addressing the excesses and embracing ambivalence in tricycle transportation

Previous discussions have indicated both positive and negative aspects of tricycle transportation. However, irrespective of LI 2180 and the negative aspects, key informants tended to lean towards the positive aspects of tricycles, showing ambivalence in various ways. This sub-section, therefore, focuses on the unequivocally negative aspects identified by key informants and their tendency to overlook although not downplaying the issues based on reasons related to the necessity of tricycles in the transport space.

The qualitative analysis indicated that participants had observed the lack of training and licenses among riders but do not criticize their operation completely. According to TO 1, *“most riders do not have **licenses** and that makes their operation unsafe. They are supposed to go through training to acquire license A for motorbikes and the rule must be applied the same way as acquiring a license for cars”*. This was iterated by another participant who mentioned that *“there are recalcitrant people who feel they can drive without a worthy driver’s license. Some do not even register the vehicle and the riders do not have a license. These are the result of weak enforcement regimens... all these are offences punishable by law. Somebody must arrest and prosecute for discipline to prevail.so, we need a collaboration with the police or tax force operations to arrest the situation”* (KI 2). Moreover, KI 2 in contrast indicated that *“it is the cost [fare] that makes people use trikes. They [riders] charge GHC1.00 whereas a car taxi takes GHC5.00. As a rational human being, you will choose the lower fare without considering whether it is legal or illegal. The primary purpose of moving from one destination to the other is paramount”*.

Key informants further recognized the chaos tricycles create on highways but recommended areas of strengthening to make it safer. In this respect, KI 2 stated that *“we are all witnesses to the misuse in the public transport space and the high rate of accidents. Most accidents and fatalities are caused by motorbikes and tricycles. It is the misuse that we are worried about.*

They are registered for private use, but they end up picking up passengers with them. The problem is that we are not responsible for the enforcement of traffic rules. It is the police GPS-MTTD". This statement questions enforcement in that a vehicle cannot be registered for one purpose and be used for another. KI 2 further explained that "the compliance and enforcement task force carry out enforcement operations periodically with the police. Albeit the police are the primary enforcers so if a trike is registered privately and it is used for commercial purposes, it is the duty of the police to stop that practice. Sometimes they are unable to do so for political reasons". Additionally, according to KI 2, "there have been many occasions people have been arrested and they were ordered to release them. So, if you listen to the police, they also lament about the interference in their work. It is really a national problem".

Although KI 2 admitted that the tricycle issue is a national problem, and even though the law prohibits its commercial usage, he also admitted that it is the only means in certain deprived parts of the country, where without trikes, it is almost impossible to be mobile. He shared that *"I strongly believe that we have come to that point where we need to relook at the law. Currently the law says it is for private purposes, but it is about time we meet stakeholders and discuss it further to see what we can do. Because if you look at the magnitude of the commercial use currently, it is huge. And when it is like that enforcement is difficult if you do not revise your laws. Otherwise, we can pretend that it is illegal, yet it is happening"*.

These arguments were further iterated by another key informant who said that *"it [tricycle] has become a necessary evil, but the negligence of safety protocols and its application is the challenge ... riders need to be trained and given license A. The appropriate dress code, which includes a crash helmet, hand gloves, boots, and knee covers as prescribed in the road safety regulation, LI 2180 must also be worn by riders. ... and they should be restricted to peri-urban and farming communities, not in highspeed corridors"* (KI 4). These are in congruence with

Jack et al. (2021) who have advocated for the legalization of tricycles for commercial use in Ghana.

Other key informants shared this view of tricycles meeting peculiar needs in certain communities. KI 3, for instance, stated, *“as spelt out in sub-regulation 17 of the LI2180, tricycles are prohibited from operating commercially but they are helping. In a stakeholder committee meeting which included the police, I told the committee that they can help in the peripheral areas like outside Accra, but some measures must be put in place before giving them a permit”*.

Further still, another key informant confirmed that tricycles cannot be eliminated from the system immediately. In his view, *“tricycles have come to stay and they provide part of transportation services within our system. Rather, measures should be put in place, legally to regulate their activities and infrastructurally, separate lanes can be dedicated to two and three-wheelers... Above all, there is the need to build capacity and collaborate with other key institutions to put a framework around the activities of tricycle transport operators”*. As observed by Onyango (2018), tricycles have a great potential for providing accessible, secure, and flexible public transport in poor locations of urban areas. In furtherance of the above, another key stakeholder in his recommendations remarked that *“if riders don’t have training, they will not know the regulations. Consequently, they may flout traffic rules unknowingly”* (KI 3).

6.4.1 Addressing the excesses besides LI 2180

Ambivalence was not only recognized in the submissions of the participants as they debated the use and prohibition of tricycles, most of the institutions likewise displayed ambivalence in their actions or strategies. Some of these strategies carried out by the government transport

agencies were essentially general guidelines that could be applied to tricycle transportation to have it regulated.

The results have demonstrated that regulatory institutions do not have adequate data on the operation of riders because the law on traffic regulation does not recognize them. Meanwhile, transport officers indicated that they create, keep and update records of commercial vehicle operators at the assembly. For instance, TO1 mentioned that they organize commercial transport operators and put them into their database, which gets updated and reviewed. According to him, *“the database has the operator’s name, which is usually a Union, for example, GPRTU, PROTOA, etc. We also have cooperatives, but with the cooperatives, we have them at the assembly level some of whom register with the Registrar General”* (TO 1). Thus, registration is done based on unions, which have executives. Key items of information required were the name, position, telephone number, and the location of the business, as well as all the vehicles that are used within the union. Confirming the process of registration mentioned above, KI 3 stated that *“with legalized modes, they often belong to a union like GPRTU, they have a structure, and you can engage them”*.

Furthermore, stakeholders often stated that riders who overspeed and disregard traffic regulations should be arrested because, according to KI 2, all these traffic offences riders commit are punishable by law. Enforcement regiments were noted to be weak, and this was confirmed by all key informants. In recognition of the chaos and accidents, stakeholders recommended training for riders. A key informant cautioned that *“training is good, but it must be accompanied with strict enforcement to achieve a holistic impact”* (KI 3). Another key informant also cautioned, *“as I have already mentioned, training, retraining and continuous training...We are at that point where we want to offer continuous training for these people [riders]. Last year, we [DVLA] advertised in the papers for driving schools and people who wanted to establish training schools for motorbikes to apply and get registered for profit. DVLA*

cannot train but it offers guidance by providing training materials and a syllabus. We also certify the instructors for the training and people are responding” (KI 2).

Generally, tricycles were considered unsafe, and this was confirmed by the quantitative analysis. As a result, KI 3 expressed that *“though for safety reasons I do not want tricycles to be used as means of public transport, as human, I must come to terms with reality that in some parts of the country, trotros are unavailable and unreliable. These people also have the right to move because they are sick or in labour or must access essential services from district capitals but trotro moves once a day or every other day... Aside all these, we need to consider the economic aspect. People have to eat. I know families that rely on the income from Pragiya operation for survival... I believe they should be feeders, they should not cross traffic lights, they should remain in one community”.*

The data suggest that the absence of a legal framework to regulate tricycle operation limits the extent regulation institutions can go but mediation could be useful in some cases. For instance, TO 2 cited that *“little has been done. Because of the position of the national law, we don’t even try to engage them. The only time I engaged them was when car taxi drivers complained about how Pragiya riders were bringing down their business. I organized the leadership of the riders and asked them to move farther away from the car taxi station so that both groups could make a living in peace”.* However, many district assemblies wish to engage operators because tricycle operators want to be engaged and are willing to pay for their permits. TO 2 further noted that *“once it is legalized even without DVLA, we can go out and scout for them”.*

Emission level was another area of concern, although with some contradictions as well. TO 2 noted that *“it is normal for people in the north to have motorbikes irrespective of their fleet of cars but in a city like Accra, it is likely to create congestion and regulating them will not be that easy”.* Regarding emissions, TO 2 observed that *“car taxis may emit more than trikes but*

when trikes are many, the smaller emissions will add up to form the same. The unfortunate aspect of trikes is that fatality is relatively higher compared to other vehicles. Thus, in an urban set up like Accra, the Central Business District (CBD) specifically, I don't think it is the way to go because they are likely to cause a lot of fatalities [due to the large volumes of vehicles and traffic]. It is sustainable because their emissions are low, so I voted for its usage in the urban villages". This was further echoed by KI 1 who mentioned that *"most tricycles use fossil fuels just like cars so they all emit into the atmosphere... like rickety vehicles, once they use fossil fuels, they will affect the environment at all cost... but they are more sustainable in terms of lower emissions"*.

Additionally, although EPA and DVLA, for example, have partnered to provide emission standards for vehicles in Ghana, the problem of tricycles has not been raised as a significant environmental issue. Thus, KI 2 reaffirmed that *"work is in progress regarding the standardization of emission levels between EPA, DVLA and GSA. It has been gazetted and will serve as a standard for any agency that has to do any emission testing will fall on this new structure"*. All these developments serve as rudimentary work that can become part of the framework to completely regulate tricycle operators should the law change. Even though discussions have gone on over the years between regulatory institutions, it has not translated into any change. KI 2 emphasized that *"the discussions are between the ministry of transport and government in collaboration with its agencies. Thus, the sector minister led those discussions around the electioneering period in 2020. The NRSA and DVLA among other stakeholders were consulted but no firm decisions were taken. The law remains the same"*.

Consequently, stakeholders should not wait for the obvious as laws do not make themselves. There are three obvious outcomes if nothing is done. First, the lawlessness in tricycle operation will continue; second, it will become more chaotic; and third, government will lose money that could come from permits and registration. On the other hand, two deliberate steps can be taken.

First, the LI 2180 can be enforced, ignoring the gaps tricycles fill in the transportation space; and second, considering the benefits they offer, LI 2180 can be reviewed such that state transport agencies can legitimately regulate the activities of tricycle operators.

To have a deliberate outcome, there must be a deliberate decision; hence, the Ministry of Transport has done regional consultations and the next phase is to do with national consultations to obtain the views of stakeholders in public transport (Ministry of Finance, 2020). This was confirmed by the various regulatory institutions indicating broad stakeholder engagements to review the Traffic Regulatory Act and various strategies to reduce the risks involved with using motorbikes. To this effect, a stakeholder explained that *“if we decide to continue with the private use then the enforcement side has to be strengthened. But if we decide to allow it to be used for commercial purposes, then we may have to prescribe some guidelines as to what will make it safe for them to use. Then the accidents will minimize. But it is a decision for the country to make by way of policy. It’s a national issue so we should engage at that level, [to include] all stakeholders. [It should be a] broad consultation. I know a couple of countries that have adopted it. If you go to India, they use it commercially, likewise Nigeria and a few others”* (KI 2).

6.4.2 Sustainable urban transport: Looking beyond tricycle transportation

This sub-section deals with tricycles as a form of sustainable transport in the purview of SDG 11 and the innovative strategies adopted to make their operation better and safer. These provide entry points into the future of tricycle transportation and what is being done and anticipated to be done to secure that future. The underlying question, therefore, is whether tricycles are meeting an urban transportation need. Thus, the possibility of looking beyond its limitation and focusing on strategic and systematic ways of its improvement of urban transportation forms the sinews of this sub-section.

Tricycles provide invaluable services to the urban population. As a result, participants were asked about the benefits and challenges they had with tricycle transportation and how these challenges could be addressed. In this regard, participants hinted at various challenges as discussed in the previous chapter. However, the main recommendation regarding tricycle transport challenges was the amendment of LI 2180. The results suggest that many of the users, riders as well as other key stakeholders shared this view. It is anticipated that an amendment of the law will take into consideration the versatile usage including commercial use. If tricycle operation will continue, then LI 2180 needs to be reconsidered. Another recommendation was the allocation of separate lanes to trikes and differentiating between the number plates. Consequently, the TO 1, emphasizing this strategy stated that *“people are saying they should differentiate between the number plates”*. As a result, key stakeholder engagements are ongoing to possibly review LI 2180 as indicated by K2 and TO 1 and 2.

It was found that tricycles had proliferated for reasons such as limited employment opportunities for young school leavers, and high demand for *Pragiya* because of insufficient transport supplies and affordability. These were raised by all key institutions as well as other stakeholders such as the users and riders. Confirming Obiri-Yeboah et al. (2021) and Oteng-Ababio and Agyemang (2015) the transport officers, for example, explained that the lack of economic opportunities for even university and polytechnic graduates has pushed a lot of young people into the business. They did, however, earn more money than taxi drivers (Doherty, 2020; Obiri-Yeboah et al., 2021). These have implications for the creation of more secure jobs for the teeming youth.

Further, several of the feeder roads were dusty and potholed; hence, most car taxis avoided those routes, which had turned into niches for tricycles and motorbikes. Without tricycle transportation, it is obvious that people living along such routes will experience serious transportation deprivation largely because of their location. This could explain why

government transport agencies are not strictly enforcing the prohibition imposed on tricycles by LI 2180.

Cost of travel or transport fare as well as convenience of travel were mentioned as motivating factors. Unlike car taxis, which typically dropped off clients at taxi ranks unless it was *dropping*, tricycle users were picked up and dropped off near their homes.

Besides, the cost for a similar service with a car taxi will cost more. Thus, *Pragiya* appears to have operated closer to the users for more convenience by reducing the amount of walking users did as well as the hassles of carrying a payload/luggage for a long distance. And last, moving through traffic was quicker for tricycles, enabling users to quickly go about their business and run errands within a limited time. All these support the quantitative findings that showed a high preponderance of some of these factors.

Furthermore, as the quantitative findings on the perceptions of the sustainability of tricycles suggest, safety is the bane of this miniature vehicle. Hence, tricycle riders through their internal checks and controls as well as some government transport institutions in charge of tricycle transportation in Ghana have made attempts to address the tricycle's major challenge of safety. As indicated in the previous chapter, riders at Dome, for example, do not wear slippers to work and new riders are not permitted to carry excessive payload. Above all, riders attended meetings regularly to remind themselves of appropriate conduct on the road. Rider 3 recounted that *"we [senior or more experienced riders] often advise the younger ones to be very careful. We are all very careful because when you [rider] cause problems on the road, it costs you [rider] money... The fact that we don't hear of frequent accidents means that the boys [younger or new riders] listen to our advice and ride carefully"*. Government transport agencies like the DVLA, GPS-MTTD and the district assembly taskforce also ensure that riders obey traffic rules regardless of their legal documentation status. These efforts come across as attempts to

improve the sustainability of tricycles so they can continue to render safe services as their mandates require of them. However, the crux of this issue lies with the MoT and the amendment of LI 2180. A key informant said that *“if we want it to be legalized regardless, then the government has to amend the laws. The situation makes sense on both sides, it is very dicey, and we need to think it through very well”* (KI 3).

Concerning safety, the DVLA's initiative to permit private individuals to operate 'riding schools' is a significant step towards improving road safety, particularly for motorbike and tricycle riders. This is intended to standardize training, improve road safety, increase access to licences and encourage riders to be responsible on the road. However, the challenge is public awareness about the availability and benefits of these training programs which is important for widespread participation.

This realization also rests on how tricycle operation fits into the future of transportation. Generally, in most future urban transportation visions, technology solutions whose efficacy has not always been established are emphasized. They include the transportation of goods or people utilizing miniature aircraft like drones, flying cars, or taxis; driverless cars and connected cars on shared mobility platforms; and advanced traffic management systems that enable vehicle-to-infrastructure link to ease intermodal travel (Golinska-Dawson & Sethanan, 2023; UN-Habitat, 2022). The qualitative results, therefore, showed that the riders have networked within cities and regions. They have also systemized their operations; they connect directly to customers and themselves on phone in the course of their work. No tricycle-sharing apps were discovered as there are in Kampala (Doherty, 2020) but there were indications of connectedness between riders and customers. Rider 1 mentioned that *“sometimes, we overspeed and ride recklessly when a client has called us to pick them up...we have to rush so that we don't keep the client waiting for too long”*.

Further still, the GPS-MTTD through Operation PAARI (Police Action Against Rider Indiscipline), which aims to curb rider indiscipline, has successfully reduced motorbike-related accidents. The key informant at the GPS-MTTD stated that *“based on existing data, cameras have been fixed in certain places. The Police also arrest riders who cross the red light. Also, police motorbikes have been distributed to pursue people who violate traffic rules. Eventually, some are taken to court while others are given warning letters. The Police have been asked to apply stringent measures because it is only the evidence of stringent measures that can curtail traffic rule violations”* (KI 4). The work of Boateng (2021) supports the findings on the activities of the NRSA.

These are indications that tricycle transportation is more likely to persist because the conditions that fuel its persistence continue while efforts are made to cope with and improve their safety. Thus, if no one must be left behind, then the transportation needs of the poor and vulnerable in society cannot be overemphasized. This implies that efficient and affordable public transport should be available to the poor and vulnerable in urban areas. However, its realization requires deliberate efforts. For instance, from the qualitative data, according to KI 4, *“There has to be a complete policy shift, that is we need to change the law if we can do anything about these tricycles legally. We can dedicate lanes to enable them to safely provide the essential services they provide to continue. We also require regulations because we are torn between banning and regulations and there must be police action against recalcitrant riders”*. The implication, however, is that the vision of sustainable and equitable urban futures will therefore not be realized unless cities and subnational governments take decisive action to solve both ongoing and emerging urban difficulties (UN-Habitat, 2022).

6.5 A future with or without tricycle transportation: Implications for policy and practice

A future with or without tricycles largely depends on government policy as already discussed, with the opportunities and challenges that cities encounter being considered from various contexts in the future of cities. Inextricably linked to the future of cities is the diversity of these urban contexts, which differ in terms of the scale and type of urbanization, population size, socio-spatial organization of settlements, economic composition and connections to the global economy, level of informality, culture, local challenges, and local political and institutional systems (UN-Habitat, 2022). The operation of tricycles has become both a challenge and an opportunity for cross-sections of urbanites due to the diversities of urban populations and landscapes. This sub-section, therefore, focuses on the implication of a future with or without tricycles and the deliberate choices that may be required for whichever future is chosen.

In this respect, such a future without commercial tricycle operation should have an effective public transport system that will serve urbanites who use the tricycle for other purposes. It should have public transport access improved since access is a major determinant of tricycle usage. For instance, key informants explained that the provision of bus rapid transits and effective train systems as well as other in-city means of transport, which may include car sharing and boats for areas with waterfronts to reduce traffic. As can be recalled, traffic is a major reason for the use of tricycles. Hence, road and water transport infrastructure can be developed to enhance the private investment of roadworthy vehicles into the public transport business.

Additionally, regarding a reduction in the use of fossil fuels, key informants generally recommended efficient car taxis, electric vehicles or less fuel-consuming vehicles and mass transit systems as the optimum choice.

On the other hand, if they are going to be part of the public transport system, then deliberate efforts should be made to properly incorporate them in the transport sector without posing a risk in terms of increasing accident rates. For example, KI 2, KI 3 and KI 4 as well as TO 2 indicated the creation of separate lanes, restricting their operations to certain locations, using them mainly as feeders and ensuring a strict protocol on enforcement of road traffic regulations as suggested by Boateng, 2021 and Jack et al. (2021). Above all, riders must acquire training and appropriate licenses before they start riding. According to TO2, if these measures are not put in place, *“what will happen is more accidents because they [riders] have no training. They do not know how to observe road safety regulations. Also, once we do not know the people driving, they can rob people knowing that they cannot be traced easily. These are the possible dangers we are likely to face”*.

However, KI 3 had a different opinion regarding training and reckless riding. She stated that *“road traffic safety regulations are almost universal. Red is stop everywhere so the riders know they are supposed to stop at the red light, but they don’t because they are recalcitrant riders. Education and enforcement must go together ...People must know what they are supposed to do and what not to do, so they can comply. It will make it easier to enforce. Research has also shown that without enforcement, education is ineffective”*. According to Mbara (2016), in Johannesburg, South Africa, riders are trained and given licenses before they start riding; hence, adequate training and appropriate licensing can precede riding in the future of tricycle ridership in Ghana.

Furthermore, the trajectory of tricycle transportation has not been the same for many countries. While some have banned it (Hasan, 2013), others (Agheyisi, 2021) have incorporated it into their transport system. KI 2 mentioned that *“countries like India, Nigeria and a few others have adopted it for commercial purposes”* and this has been confirmed by several writers (Agheyisi, 2021; Ehebrecht et al., 2018; Obakemi, 2021). Consequently, it can be considered

in Ghana as well. Nonetheless, the critical issue at stake is policy. The focus is to take a decision to include or not to include them by answering the question of whether to legalize or otherwise. The decision should be able to address the question of where they can operate if they are legalized.

Transportation issues transcend political jurisdictions and are inter-ministerial in nature. Consequently, key informants noted that the issues regarding tricycle transportation cannot be addressed from a narrow perspective or with few institutions. They argued for comprehensive stakeholder participation, which has already concluded in the regional phase where the review process elicited opinions on the commercial use of motorbikes and tricycles. The goal is to have nationwide consultations on proposed legislative changes (Ministry of Finance, 2020). This will include the Ministry of Local Governance because of the crucial role of the district assemblies in the regulation of public transport. These were further validated by the KIIs with government transport agencies.

Apart from tackling it from the viewpoint of an effective public transport system, issues regarding unemployment should be addressed. Furthermore, services must be expanded to reach more routes, especially in the cut-off areas; and the cost of transportation and accessibility should be a major concern. As the quantitative data suggests, cost and accessibility are major determinants of the use of tricycles. This is because some institutional frameworks are required to address the numerous, intricate, and interconnected urban challenges (UN-Habitat, 2022). Coordination of efforts and transformative action are also required to achieve SDG targets and the New Urban Agenda. Coordinated and concerted efforts further echo Barceló (2018), who advocates for a holistic approach to addressing issues on sustainable transport.

6.6 Summary and conclusion

This chapter used mostly insights from key informants in government transport agencies and occasionally quantitative data from respondents. It has looked at the roles of key government transport agencies and some of the legal frameworks within which they operate; and demonstrated how the key institutions in tricycle transportation interact to ensure road safety, which is key to sustainable urban transport. Furthermore, the chapter discussed the policy implications of a future with or without tricycles. In conclusion, the DVLA, NRSA, GPS-MTTD, EPA and the District Assembly transport office have distinct but related mandates to ensure that the roads are safe for all users. They represent a strong inherent evaluative system on paper but are a bit porous in practice because each institution works independently of the other and the links for coordination are not very clear.



CHAPTER SEVEN

SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS

7.1 Introduction

The chapter summarizes the study's major findings and provides conclusions and policy recommendations. Theoretically and conceptually, the study was grounded in the debates on transportation need and the processes that have led to the selection of certain modes of transport in an unequal terrain of transport service delivery, sustainable transportation, rapid urbanization, and institutional restriction. Consequently, the study employed Alfonzo's (2005) social-ecological model of walking based on Maslow's (1943) theory of human motivation and the RCT to situate the study. More importantly, the proliferation of tricycles in some parts of Accra was used as an entry point to appreciate the dynamics of urban transportation motivated by various transportation needs.

7.2 Conceptualization and theoretical grounding of the study

The study was grounded in the social-ecological framework model for walking and the RCT as mentioned earlier. The former was used to explain how transportation needs are ordered and most importantly, how people make mode choices based on their transportation needs. It was also useful in showing how the transport needs of participants drove them to use the tricycle in the study locations. However, it did not account for the cost-benefit analysis that commuters make when deciding to select a transport mode. Consequently, the RCT was used to frame the cost-related decisions regarding transport mode selection. This theory emphasized how commuters considered the cost of using a tricycle over other modes. It helped in providing an understanding of commuters' mode choice and the proliferation of tricycles in the study locations.

The convergence of these theories is that urban commuters have different transport needs depending on their location, purpose of trip, trip origin and destination as well as cost and available resources when choosing a mode. Thus, the reason to adopt a trike varies for people in different contexts.

The conceptual framework begins with the drivers of the proliferation of tricycle transportation, it moves on to the decision-making belt and then to the outcome. There were three main drivers of tricycle transportation, namely authorities, which regulate commercial transport activities; operators, who own or rent trikes and provide tricycle transport services; and passengers or users who patronize the services of the operators. However, the adoption of tricycles is acted on by passengers' location and socio-economic characteristics like age and income. In the decision-making belt, passengers make a cost-benefit analysis and psychographic considerations based on their transport need and how they perceive the mode suitable to meet that transportation need they have. In the outcome section, it is expected that the choice of a tricycle could foster sustainable urban transportation in terms of universal accessibility, affordability, and efficiency.

The study was conducted using a mixed-method approach where quantitative data preceded the collection of qualitative data. Both primary and secondary data were used. Quantitative data were collected from 610 respondents, of which 205 were riders and 405 were users of tricycles using CAPI. Using IDs, KIIs and observation, qualitative data were collected from station masters, users, riders, and owners as well as KIs from DVLA, NRSA, EPA, GPS-MTTD and transport officers of district assemblies. The study was carried out in three communities in Accra, namely Pokuase-Amasaman, Oyibi and Dome in the Greater Accra Region of Ghana. Analyses of results were done using SPSS and Stata and results were presented in tables and graphs.

7.3 Findings and conclusions

7.3.1 Evolution of tricycle transportation in the GAMA

The tricycle, also called the *Pragiya* or Yellow Yellow, is a compact vehicle used for short-distance travel and other informal forms of transportation in the study sites. Users had accustomed to tricycle transportation due to rising transport fares and share convenience. On the other hand, riders were into the business because they wanted to make ends meet.

Using mostly qualitative data, this study identified two main types of passenger tricycles. They are type A being Apsonic and Huahai trikes and type B being TVS and Bajaj trikes. All the trikes had blue number plates signifying that they have been registered with the DVLA for private purposes. Trikes were often decorated with stickers some of which were faith-based.

The role of station masters and tricycle stations in the evolution of tricycle transportation cannot be overemphasized because they form an integral part of the process. Generally, the stations were founded and headed by station masters who were males, owned trikes and in some cases, were riders themselves. They determined how the stations were managed sometimes with other older members who formed the executive body. Station masters maintained that there was a gap in the transportation space that needed to be filled. Thus, having heard and or seen how tricycles were transforming livelihoods in the northern and middle belts of Ghana, the opportunity was seized to replicate the same.

Tricycle stations are located where there is a commercial presence or at places where people converge to make their final trip to their destinations. Their formation was often met with resistance from the police and other commercial transport operators for different reasons. While the former resisted because of the Road Traffic Regulation Act, (LI2180), the latter opposed their formation because of competition over customers. These challenges notwithstanding, station masters have attempted to put a structure around tricycle transportation in the setting of a tricycle station, first, through the rider associations and second through the admission rules

and processes for social support and discipline. Tricycles have therefore survived these oppositions and competitions because though it is illegal and chiefly perceived as unsafe, users found them to be convenient when they had to move from one point to the other in the community where certain transport services were unavailable.

Riders are males, many of whom were previously unemployed while others engaged in enterprises that could not pay their bills. They were largely organized and belonged to the riders' association at the station and were disciplined though not all of the riders belonged to the riders' association. Some riders obtained their trikes through *work and pay* while others obtained theirs through their savings and loans. Still, a few others acquired theirs as gifts from family or from family soft loans. However, the majority made daily sales of between GHC50.00 to GHC70.00 to the owners they rented from. This amount was sometimes paid weekly depending on the arrangement between the owner and rider who could make as low as not meeting minimum daily sales and about GHC300.00 daily.

Users were mostly females, and the trikes were used for work-related trips more than any other purpose. *Passenger loading* (shared public transport) and *dropping* (individual public transport) were the main trip types. Generally, the evolution and proliferation of tricycles are attributable to widespread urbanization which has led to less dense areas and unserved routes. Inadequate transportation options, restrictive regulations, and heavy traffic are further factors. Furthermore, it is evident that operators entered the industry mainly to make money, even though customers adopted trikes for sheer convenience. Overall, trikes have improved transport access in the study areas.

In view of all the above, tricycles can be allowed to operate as a form of intermediary transport in less busy areas to improve commuters' access to other transport networks. For instance, separate lanes can be assigned to tricycle transportation and they can be restricted on where

and when to operate. To obtain data on riders, tricycle stations, which are informally organized through the station masters and rider associations, could be a starting point. Thus, station masters can be targeted for information on riders, for rider training exercises and be used as channels of instilling discipline on the road. Again, the reasons for the evolution of tricycles reflect the transportation challenges faced by cross-sections of commuters in the Greater Accra Metropolitan Area (GAMA). In reviewing the LI2180, considerations can be made for women and other casual workers to increase their mobility.

7.3.2 Determinants of tricycle adoption, perceptions of sustainability and challenges

Different factors influenced the adoption of tricycles in all the study sites including transport need, tricycle transport fare, psychographic factors, and other trip contexts. Regarding transport need, generally, accessibility or availability followed by feasibility which includes suitability and affordability were the major reasons for the adoption of tricycles in all the sites. Although safety was found to be the least transport need that influenced the use of trikes, it was found to be a major reason for the use of tricycles especially at dawn and at night by market women. As a result, though safety was not a major reason considered before the selection of tricycles and was not a major transportation need, safety was the reason for tricycle adoption at certain times of the day.

The study also found that the adoption of tricycles did not follow the human need theory where feasibility is the first and fundamental need; and it was established that accessibility presented itself differently to users based on their primary mode. For example, it was noted that respondents whose primary mode was a personal car were more likely to use the *Pragiya* for safety reasons than any other users with different primary modes. Largely, the transport need that precipitated the use of *Pragiya* was mainly influenced by the respondents' primary mode, location, and average monthly income.

Considering the transportation fare increases, it is only rational that commuters make a cost-benefit analysis when selecting a mode of transport. As a result, the cost of the *Pragiya* fare was a determining factor because users made rational decisions regarding cost when selecting *Pragiya*. The study has shown that while others chose *Pragiya* for its low fares though they would have preferred other modes if they were equally low, others for special reasons or needs would still choose *Pragiya* even if other modes offered the same low fares. Thus, *Pragiya* fills a gap in the transportation space but is not adopted merely for its low fares.

The nature of the trike captured in the psychographic factors was also considered before tricycle adoption. The main ones that influenced adoption include service availability, suitable for short trips, the ability to drive through rough roads, the ability to drive through alleys and the ability to take people to their destinations. On the other hand, the least psychographic considerations made in the selection of tricycles include the ability to minimize noise, privacy and whether the body of the vehicle looked strong enough.

Additionally, the adoption of tricycles was influenced by other trip contexts which include trip type, whether there was somebody accompanying, the destination and whether the passenger had a load. The type of trip showed that the majority of the respondents used *passenger loading*. It further showed that *trotro* primary mode users used the *Pragiya* in similar ways they used the *trotro* and hence were more likely to use *passenger loading* than users with other primary modes. Again, car taxi primary mode users were more likely to have a load than any other users. Users possibly made a consideration on how much they would have to pay for an alternative mode when selecting a tricycle even though the low fares were not a key consideration. It is clear that the margins were wide making commuters seemingly settle for the least affordable fares even though they could pay for a moderately affordable fare. Thus, for the cost of the alternative mode, *trotro* primary mode users paid GHC4.00 which is twice the *Pragiya* fare while car taxi primary mode users paid GhC10.00 for their alternative.

Regarding destination, most of the destinations were non-market-roadside and most of these trips were made by car taxi primary users.

7.3.2.1 Perceptions of the sustainability of tricycles

Sustainable transportation was defined in this study as a means of transport that uses fewer resources and it generally supports shared usage; it is cost-effective for all, environmentally safe, physically safe, and accessible. Generally, users perceived the tricycle to be sustainable. In terms of social sustainability, it is able to provide universal accessibility in that it is able to connect vulnerable people like women and children to their destinations. Tricycles were perceived to have economic sustainability, which was assessed by reliability and affordability. These showed that trikes were efficient in terms of reliable waiting time, low fares, and low fuel consumption. Aside from these, the study also found that tricycles have economic benefits which attract many unemployed males and the fact that informal workers especially could move from one point to the other quickly and affordably. Environmental sustainability was seen from the point of view that the tricycle does not emit as much pollutants as car taxis for example; and noise pollution was minimal, especially when the trikes are new, hence were perceived to be environmentally safe.

Unfortunately, the safety component of social sustainability was not all that strong because users perceived the tricycle to be unstable and therefore unsafe. Rightfully so, being a major cause of accidents and accident fatalities was not enough reason to deter users who did not prioritize safety while choosing a tricycle. Users rather demonstrated that feasibility, accessibility, and affordability were very important considerations to make when selecting tricycles which reflect the other components of sustainability.

7.3.2.2 Operational challenges of tricycle transportation

Operators of tricycles did not report many aggressive behaviours, although it was not completely absent among them. Their major challenges from outside were rivalry from other mode operators, collection of bribes by the police and from within, poor licensing and reckless riding. Both users and riders as already intimated did not see safety as a challenge and there were variations in how they perceived challenges. Riders were more inclined in mentioning rivalry, poor licensing and collection of bribes as challenges than users were.

Other challenges that emerged from this study include the othering of tricycles, badmouthing, legalization, and health issues related to the complications of the occupation.

Some commuters utilized tricycles as their primary mode of transportation, while others used them regardless of the low fares. As a result, prohibiting tricycles will have an impact on the mobility of some sectors of the urban community unless safer and more efficient alternatives are made available. As a result, legalization is recommended in the context of strict enforcement of road traffic regulations and adequate licensing. Additionally, road safety awareness development, training, and licensing by the DVLA in collaboration with tricycle stations and station masters could enhance safety. Stricter enforcement of traffic laws will also aid in the reduction of accidents.

Because feasibility and accessibility were the major transportation needs that influenced adoption and safety was the least of the concerns, any intervention to improve urban transportation should focus on efficiency (feasibility and accessibility) such that commuters are concerned about the safety of the means they choose rather than just getting a means.

7.3.3 Policies and the role of government transport agencies in sustainable tricycle transportation

Remarkable contributions have been made by government transportation agencies to sustainable transportation in Ghana. All the agencies have mandates supported by Acts of Parliament to, among other things, make sure that both riders and vehicles adhere to the proper standards and get the necessary operating licenses. Their goal is to sustainably establish transportation regulations that apply to the use of tricycles as well as other vehicles.

However, LI2180 continued to prohibit the commercial use of tricycles for public transport because it embodies the abused framework within which tricycle operation is done. Until this law is successfully reviewed, all the government transport agencies like the DVLA, NRSA and the GPS-MTTD will continue to enforce their mandates. This will invariably limit the operation of tricycles for public transport because of the imminent fear of getting arrested for engaging in an illegal transport business. The fear of getting arrested will neither stop the usage of tricycles because there is a strong demand and ready supply of tricycles.

The dilemma, however, is that there is a subtle institutional lack of coordination because of the illegal status of tricycle operation. Thus, while DVLA is unable to register the trikes for commercial purposes, they register them for private use even though it is evident that the majority of trikes end up being used for commercial purposes. Again, while it offered economic opportunities in terms of jobs to the unemployed in the communities they operated, their respective district assemblies were losing out on internal revenues mostly used for road repairs. The reason is that whereas legitimate transport operators who paid tolls and taxes lost out on income because of the loss of passengers to trike riders, district assemblies did not have the legal authority to tax riders either. Another effect of the illegality of tricycles on the district assembly is that it cannot have a structure to regulate the activities of trikes as it does for other transport operators.

Additionally, tracking reckless riders may have been challenging in the past due to identification issues. However, there are equipment and procedures in place to check overspeeding and reduce the incidence of motorbike/tricycle accidents. In spite of this, the safety aspect of sustainable transport remains crucial as most riders remain untrained and unlicensed.

Although key informants plainly recognized the benefits that users have for using the trike, they were also concerned about its safety. Because sustainable transport embodies continuity, inclusivity and adequate management of resources, a high fatality rate is therefore detrimental to the sustainability of tricycle transportation. Thus, improving the safe use of tricycles is imperative.

The illegality of tricycle operation affects regulatory attempts. It is therefore recommended that tricycle operation should be legalized so that government agencies can conveniently and legally engage and regulate them. A system can be put in place to ensure that riders are trained and licensed before they start to operate. Above all, transport agencies can ensure strict enforcement of traffic rules in the interim.

7.4 Conclusions

The study sought to identify the factors that influenced the evolution and proliferation of tricycles as well as their adoption in some parts of Accra. Regarding evolution and nature of tricycle transport, the study has shown that the tricycle is a small compact vehicle, that can convey people and goods on short trips for more convenience and efficiency in an urban area saddled with diverse transport need contexts. Having carved a niche for themselves, without tricycle transport, some commuters may find it difficult to be mobile while others may pay high fares and or spend so much time to reach their destinations.

The tricycle transport industry is a transactional interface where several actors including users, riders, queen mothers, Station Masters, authorities and tricycle owners interact to provide transport services to commuters. In effect, this activity has become a means of survival for a good number of riders, owners and station masters as well as generating income for other minor actors like vendors and dealers of tricycle spareparts. Furthermore, tricycles are a suitable means by which many informal workers become mobile at affordable rates. Even though it is considered unsafe and prone to overturning, it was largely perceived to be a sustainable means of transport among users. Linking these to the hierarchy of walking needs, it can be surmised that several transport needs are being systematically met by users and riders through the tricycle. As a result, the order of transport need in this study according to the hierarchy of walking needs begins with accessibility, feasibility, comfort, pleasurable to safety.

The study identified some of the reasons why users adopted the tricycle, and it was apparent that the adoption process was significantly influenced by the same variables that influenced the proliferation. This is because the causes of tricycle evolution served as the key drivers behind their inception and subsequent adoption. Once private individuals became aware of the feasibility and accessibility issues in the transportation sector, they took the opportunity to address these flaws in the transportation space using tricycles. The adoption of tricycles was driven by peculiar transport needs, primarily, accessibility. Moreover, RCT applied in the study showed that though users as well as riders may have taken rational decisions regarding the use of tricycles, users who utilized trikes regardless of fares often had peculiar transport needs for which tricycles were needed to address.

Regardless of the several tricycle transport challenges, leaders of tricycle stations showed certain skills that suggest that despite these challenges, riders were organised and handled their own affairs using group-based agreements that fundamentally worked for them. These skills

could be leveraged by authorities to sanitize tricycle transport operations in GAMA while LI 2180 is given another look.

Tricycle transport could be said to be sustainable according to the findings of this study on the account of being universally accessible by connecting people to their destinations; efficient in terms of its availability and affordability and ability to promote green environment by reducing noise and air pollution. However, the bane of tricycle transport is its safety. Though riders are in denial of the high rate of accidents involving trikes, statistics from GPS-MTTD showed that tricycles are highly unsafe. Riders claimed that they were hardly ever involved in accidents because of their speed limits and blamed high fatalities on motorbike riders. This can be addressed with strict enforcement of road traffic regulations. Moreover, from the supply side, tricycles did not emerge to solve transport safety problems but to increase the access to transport services of the unserved routes in less dense sprawling communities and areas with rough dusty roads unserved by mainstream transport services. On the demand side, since the quest was not for safer alternatives, safety was not a concern to most users. Additionally, the frame over the tricycle with its leather cover was an advantage because it protected occupants from the elements of the weather, unlike the motorbike that has no cover.

The sustainability of tricycle transport is also associated with government transport agencies like the DVLA and NRSA whose responsibility it is to implement transport policies to regulate the operation of riders. Presently, most riders are aware of the illegality of their operation, but many do not have alternative jobs that can sustain them if they are banned. Even though tricycles offer invaluable services to the public, there is an ongoing agitation to rid them of the streets due to operational inappropriateness like reckless riding, lack of license and road congestion. These realities are valid, in that the evidence of the benefits users and operators derive from tricycles as well as the damages are clear. The ambivalence of government transport agencies manifesting in inconsistent policies, lack of clear direction, and inadequate

support for transportation initiatives significantly impact the effectiveness and development of transportation systems. Therefore, policy and institutional clarity on tricycle transport are crucial for any future progress.

7.5 Recommendations and implication for policy

Currently, tricycles continue to operate without adequate structures to regulate their activities. Thus, the future of tricycles in the less dense communities of Accra, for example, largely depends on how well tricycle operation is legally structured, and how well other transportation facilities are extended to these areas to avoid reliance on perceived unsafe modes. This can be done in the short to medium term through the MoT and subsidiary agencies like the NRSA and DVLA as well as the District Assemblies. In doing this, the place of technology, political will and available resources cannot be discounted. For example, in the pursuit of environmental sustainability, electric tricycles can be a better alternative and pave the way for the use of electric cars in future. The government can therefore support this course by reducing the importation cost of electric tricycles more than conventional trikes. Again, electric trikes could be maintained as the only type that should operate after a certain grace period when the system will be rid of the conventional type.

Safety was also a contentious issue in this study, and it could be addressed in the short term by the concerted efforts of the DVLA, NRSA and the operators of tricycles. Due to the complexity and uncertainty surrounding the licensing process, the DVLA could arrange training for groups of riders in accredited tricycle stations and provide licences for riders. Afterwards, individuals wishing to join the station later must first provide a valid license to be admitted and station Emasters could be useful in this regard. Safety could further be improved with stricter adherence to road safety regulations by the GP-MTTD as well as a disaggregation of the data on road accidents by the GP-MTTD. The data currently does not distinguish between the

different types of tricycles and the motorbike. Subsequently, the information could be disseminated among riders during training and at their meetings to caution them when riding.

In the long term, changing the narrative is crucial and it could be done through legalization, adequate training and licensing as intimated earlier. Thus, in pursuit of Agenda 2030, United Nations-Department of Economic and Social Affairs (UN-DESA) (2021) and United Nations Human Settlements Programme (UN-Habitat) (2019) articulate the inclusion and reduction of inequality in city building as part of addressing spatial and income inequality. However, this may not be entirely easy to achieve and may be uncomfortable to pursue because other people may not be accepting of this aspiration. Echoing UN-DESA (2016), which projects an integrated approach, capacity building, monitoring and evaluation as well as stakeholder engagements and public awareness, Oteng-Ababio and Agyemang (2015) have advocated for stakeholder engagements on the Ghanaian tricycle-motorcycle issue. Such approaches could help unpack the issue and establish the connections it may have with other aspects of the city, like traffic management and job provision. Nonetheless, in doing so, stakeholders which include the MoT through the DVLA, NRSA as well as civil society must be strategic and mindful of the local and national implications of their decisions because transportation is connected to everything else.

In this regard, a review of the Road Traffic Act is unequivocally recommended in the long term because it requires consultation, research and analysis of best practices to provide a framework within which tricycles can legally operate. A review of the legislative instrument has the potential of embracing tricycles as an intermediary means of transport in the outskirts or low dense areas of the city when incorporated systematically into urban transportation. For example, lanes could be designated for trikes and riders could be restrained from using major roads and highways. Furthermore, tricycle operation could be regulated by the district assemblies as well as the NRSA in similar ways as other modes.

Tricycles are serving their purpose in terms of increasing accessibility and reducing trip time. In effect, they do not seem to be disappearing any time soon. Therefore, integrating tricycles as an alternative means of short-distance travel in GAMA, where there are diverse transport challenges, offers a practical solution with multiple benefits. Authorities like the MoT, the DVLA, and the NRSA can play pivotal roles in this integration.

7.6 Contribution to knowledge and areas for further research

This study has explored the use of tricycles in Accra and has answered a number of questions to this effect. It has added to the broader conversation on tricycle transport by evaluating users' perception of the sustainability of tricycles and identifying the main reasons for their utility in GAMA where it is gaining more popularity. It has also shown how urbanites are using the tricycle as an alternative means of public transport. The study has provided an entry point into streamlining the operations of tricycles and helps to appreciate any decision on a future with or without tricycle public transport in Ghana.

Nonetheless, some questions still remain unanswered, and these can be taken up in further research. First, the perspectives of non-tricycle users are missing from the study. Being a major stakeholder of road and transport networks, their assessments of how tricycles are used, concerns about safety and whether they are safe for use as an alternative transport mode could have ignited nuances that could improve the debates on their sustainability and legalization. Second, there is the question of how users and non-users of the tricycle perceive its usage as a means of public transport. Thus, another study can compare perceptions to further strengthen the debates on legalization. Third, it will be interesting to know whether the use of tricycles is a pre-emptive or reactionary measure to urbanization issues and how its operation has impacted on peripheral expansion in Accra.

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APPENDICES

APPENDIX I: QUESTIONNAIRE

Questionnaire for USERS & RIDERS

Questionnaire Number: _ _ _

Please write or tick where appropriate

SECTION 1: Socio-economic Data

1. I am a ...

1. Passenger

2. Rider

2. Gender

1. Male

2. Female

3. Age

1. 15-19
2. 20-24
3. 25-29
4. 30-34
5. 35-39
6. 40-44
7. 45-49
8. 50-54
9. 55-59
10. 60-64
11. 65+

4. What is your highest level of education?

1. No education
2. Primary
3. JHS
4. SHS/Technical/Vocational
5. Tertiary

5. What is your employment status?

1. Unemployed
2. Employed
3. Student

Skip 6 if unemployed/student

6. What is your status in this job?

1. Paid employee
2. Casual worker
3. Paid apprentice
4. Unpaid apprentice

5. Non-agric self-employed with employees.
6. Non-agric self-employed without employees
7. Non-agric contributing family worker
8. Agric-self-employed with employees
9. Agric self-employed without employees
10. Agric contributing family worker
11. Domestic workers
12. Other (Specify)

7. Do you have any other work that brings you extra income?

1. Yes
2. No

8. What is the range of your total income?

1. less than or equal to GHC984 per annum
2. GHC984-1760 per annum
3. Above GHC1760 per annum

9. What range of your income do you spend on transportation?

- 1.
- 2.
- 3.

10. Do you have a physical disability?

1. Yes
2. No

11. Do you own a tricycle for commercial passenger transportation?

1. Yes
2. No

12. Which municipality do you reside?

1. Pokuase-Amasaman
2. Oyibi
3. Dome

13. Where in the municipality do you stay?

13.a Any landmark?.....

14. How long have you lived there?

1. More than 5years
2. One to 5years
3. Less than 1 year

15. Which region do you hail from?

1. Northern Belt
2. Middle Belt

3. Southern Belt

16. How many registered vehicles including cars, pickups, motor bikes, etc do you have access to in your house?

1. Zero
2. One
3. Two
4. Three and above

17. Do you have a driving license?

1. Yes
2. No

18. Do you use the tricycle (Pragiya) in combination with other modes?

1. Yes
2. No

Section 2: Nature and evolution of tricycles in Ghana

Section 2.1: Proof/ evidence of proliferation

S/N	Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
19.	Would you agree that motor tricycles are the new system of transportation in this area?					
20.	Would you agree that there is an increase in the usage of motor tricycles?					

21. Are you aware of LI 2180 which prohibits the usage of tricycles as a form of public transport?

1. Yes
2. No

Section 2.2: Factors influencing proliferation

S/N	Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The increase in use of motor tricycles can be attributed to						
22.	Excessive traffic/need to dodge traffic					
23.	Poor transportation regulations					
24.	Unemployment					
25.	Need for extra income					
26.	Ineffective transportation network					

27.	High transportation fares of other modes					
28.	Need to keep environment safe					
29.	Easy operation of tricycle					
30.	Low cost of operation as compared to car taxi					
31.	High Loading capacity					
32.	Lower fuel consumption					
33.	Lower fares					
34.	Ability to drive through alleys					
35.	Low incomes (high poverty levels)					
36.	Unserved routes					

Section 2.3: Major drivers in transportation dynamics

S/N	Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
37.	Some state institutions like the Assemblies and DVLA have facilitated increased usage of tricycles as Regulators					
38.	Some private individuals like the retailers and owners have facilitated increased usage of tricycles as Suppliers					
39.	Patronage for the service by some urbanites has facilitated increased usage of tricycles as Passengers					

Section 2.4: Benefits of the tricycle as public transport

S/N	Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
40.	Creates jobs					
41.	Reduced travel time					
42.	Affordable					
43.	Connects people to other transport networks					
44.	Late night / early morning travels					
45.	Good for load					
46.	Short distance travel					
47.	Extra income/saves income					
48.	Convenient for my rounds					
49.	Commuting to work / school					
50.	Reduces crime rate					

51. Which modes do you combine tricycle with?

1. Walking
2. Car taxi
3. Bus
4. Personal vehicle

Section 2.5: Tricycle operation

52. Do you own the tricycle, or you rent?

1. Own
2. Rent
3. NA

53. What is your average daily sales (minus fuel)?

1. GHC below 50.00
2. GHC 51- 100.00
3. GHC 101- 150
4. GHC above 150.00
5. NA

54. What time of day do you start your first trip?

1. Early morning (before 5am)
2. Morning (After 5am)
3. Afternoon (After 12pm)
4. Late Afternoon (After 4pm)
5. Night (After 7pm)
6. Anytime

55. What time of day do you take your last trip?

1. Early morning (before 5am)
2. Morning (After 5am)
3. Afternoon (After 12pm)
4. Late Afternoon (After 4pm)
5. Night (After 7pm)
6. Anytime

56. How many trips do you do in a day?

1. Less than 5
2. 6 to 10
3. 11 to 15
4. Above 15

57. How many hours do you work a day?

1. Less than 5 hours
2. 5- 8 hours
3. 9-12 hours
4. Above 12 hours
5. NA

58. Do you pay regular tax or fees to any authority for operating the tricycle?

1. Yes
2. No
3. NA

59. Do you belong to a group (tricycle riders association)?

1. Yes

2. No
3. NA

60. What is the average trip length for a passenger?

1. 2 to 5 minutes
2. 6 to 10 minutes
3. 11 to 15 minutes
4. Above 15 minutes

Section 2.6: Travel log for most recent trip with tricycle to map usage.

BOX A Institution of origin and destination 1. Residence 2. Office / Bank 3. Public administrative office 4. Factory / Warehouse 5. School / University 6. Medical / Welfare 7. Religious / Social 8. Wholesale / Retail shop 9. Restaurant / Entertainment 10. Park / Green space 11. Roadside 12. Others...	BOX B Type of origin and destination 1. Home 2. Workplace / School 3. Town/ Service Provider 4. Others	BOX C Trip Purpose 1. To home 2. To work 3. To school / Education 4. Business 5. To send / To pick up other family members or friends 6. To go shopping / Market 7. To eat (not at home) 8. To have an exercise 9. Joy riding 10. Social / Recreation / Religious 11. Others...
BOX D Trip type 1. Passenger loading 2. Dropping		

61. When was your most recent trip?

1. Today
2. Yesterday
3. Sometime this week
4. Last week
5. Some weeks ago
6. Last month and beyond

S/N	Question	Answer
Use Boxes A, B, C and D to answer the following questions		
62.	Where did you start the journey? (Origin/start location)	
63.	Origin type	

64.	Departure time at origin (write)	
65.	Arrival time at destination (write)	
66.	Travel time (to determine the length of trips...short, medium or long) Calculate from 3 and 4	
67.	Destination	
68.	Destination type	
69.	Trip purpose	
70.	Trip type	

Section 2.7: Other trip contexts aside location and socio-economic factors

71. Was there company?

1. Yes, with a child/children
2. Yes, with an adult
3. No

72. Was there load?

1. Yes
2. No

73. How much did the trip (per person) cost?

1. GHC1.00
2. GHC1.50
3. GHC 2.00
4. GHC3-5.00
5. GHC6.00 and above

74. What is the next best alternative?

1. Troto
2. Car Taxi (passenger)
3. Car taxi (dropping)
4. Walking (no other alternative)

75. How much could it have been for the next best alternative?

1. GHC2.00
2. GHC 3.00
3. GHC 4.00
4. GHC 5.00
5. GHC6 and above

For users who park their private cars to use Pragiya

76. Where do you park?

1. Parking lot
2. On shoulder of road

3. Inside building or house

4. NA

77. Reason for mode choice

1. Feasibility (suitable)
2. Accessibility (always available)
3. Safety (physically strong, avoid injury)
4. Comfort (ease of entering and getting out)
5. Pleasurable (enjoyable)

1. What is your overall trip assessment?

1. Very bad
2. Bad
3. Neutral
4. Good
5. Very good

Section 3: Psychographic features or attributes that influence tricycle adoption decision

S/N	Feature/Attribute	Very Important (5)	Important (4)	Moderately Important (3)	Of Little Importance (2)	Not Important (1)
Feasibility (suitable for trip)						
2.	Ease of Payment					
3.	Tricycle takes me to my destination					
81.	Carries load					
82.	Dodges traffic					
83.	Travels rough road					
84.	Drives through the alleys					
85.	Low cost of travel					
86.	Distance					
Accessibility (Available)						
87.	Journey Time					
88.	Waiting Time					
89.	Network Coverage (Number of Routes)					

90.	Availability of Service					
Safety (physical condition)						
91.	Protection from elements of the weather					
92.	Tricycle looks strong/safe					
93.	Safety in the Vehicle					
94.	Personal Security					
Comfort (ease)						
95.	Cleanliness of Vehicle					
96.	Privacy					
97.	Seat Comfort					
98.	Noise					
99.	Crowding					
100.	Ease of Entering/Exiting the vehicle					
101.	Less contact					
Pleasurability (enjoyment)						
102.	Driver's Appearance and Behavior					
103.	Enjoyment of trip					
104.	Enjoy fresh breeze					

Section 4: Perceptions of tricycle sustainability

Indicate the extent to which you accept these statements regarding tricycle use and sustainability						
S/N	Sustainability indicator	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
105.	Connects poor to their destinations					
106.	Connects other vulnerable people like children, women, aged and disabled					
107.	Tricycles are reliable, available and timely					
108.	Tricycle fares are lower than car taxis and therefore affordable					
109.	Tricycles have what it takes to avoid fatalities					

110.	Tricycles have what it takes to avoid injuries					
111.	Tricycles minimize traffic noise exposure					
112.	Tricycles minimize air pollution					

Section 5: Challenges with tricycles as means of public transport

S/N	Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
113.	Reckless riding					
114.	Poor licensing					
115.	Collection of bribes by authorities					
116.	Air and noise pollution					
117.	Unsafe					
118.	Increases crime rate					
119.	Rivalry from other networks					



Appendix II: Key Informant Interview Guide

Key informant interview guide for Authorities

Key Informant interview guide (DVLA, Assembly, NRSC, EPA, MTDD)

1. How long have you been on this job? And what has your experience been like?
2. So, what is your current position.
3. What is the typical nature of your work?
 - a. Probe for roles they play and those they work closely with in other departments or institutions?
 - b. Probe for departments and institutions they are mandated by law to work with and those that they work with but not spelt out by law.
 - c. Probe for the legal backing of their mandate
4. What is sustainable transportation and what policies has Ghana adopted to ensure sustainable transportation?
 - a. Probe for policies and frameworks and the specific reasons for their adoption.
5. What are the standards in terms of emissions for vehicles?
 - a. Based on these policies and emission standards, what would you say about the sustainability of tricycle as a form of taxi?
 - b. How do you ensure that environmental standards are followed in the operation of vehicles?
6. What are the roles of the Assembly, DVLA, EPA and NRSC in ensuring sustainable urban transportation?
7. What is your impression on the upsurge of tricycles as a means of public transport in some parts of Accra?
 - a. Probe for the position of the law on this occurrence.
 - b. What laws or policy frameworks directly deal with tricycle transportation?
 - c. Where in your district can they be found?
 - d. What is driving their operation?
 - e. What direct or indirect financial benefits accrue to the district from tricycle operators?
 - f. What benefits could there be for users?
 - g. What has been the role of your institution in facilitating the proliferation of tricycles in this municipality?
8. What are your major challenges with the upsurge of tricycles as means of public transport?
 - a. Probe for concerns of safety, reckless driving, unlicensed drivers, unregistered vehicles, environmental safety, fuel consumption, emissions, observation of road safety rules and speed limits and underage riders.
9. What has been the response of your institution about these challenges?
 - a. Probe about data (records), logistics, infrastructure and political interference as sources of challenges

10. What have you done about these challenges as an officer here?
 - a. Probe for definite measures if any.
11. What will you say is the most appropriate thing to do?
 - a. Probe for definite measures
 - b. Probe for collaboration with other departments, coherence, coordination and cooperation.
12. What standards should tricycles meet before registration?
 - a. What activities can registered tricycles undertake by law?
 - b. Licensing is categorized, which type must tricycle riders have?
 - c. Licensing is categorized in terms of which vehicle one can operate, is the purpose of the vehicle to be registered disclosed so as to aid in the registration process? Such that after registration, if the vehicle is applied in a different way, then the operator could be sanctioned.
13. What are the fundamental laws that shape speed limits in Ghana?
14. What is the appropriate speed and weight limits of tricycles?
 - a. Why so? Probe for principles underpinning these limits (rationale).
 - b. Whose duty is it to ensure that these limits are adhered to?
15. Training (could state resources be used to train people in an illegal business)
 - a. What could the implication be if training is not adequately provided?
16. Kindly take me through the process of registering a motor tricycle and the acquisition of driving license?
 - a. Minimum requirements. Probe for minimum qualification for acquiring a driving license in relation to the underage riders in the business.
 - b. After licensing, is there an avenue for further training?
 - c. Fundamental laws that shape driving licenses in Ghana?
 - d. What kind of license is given to tricycle drivers?

Key informant interview guide for Station Masters

1. How long have you been running this station as Station Master?
 - a. Ask who started the station if it is not mentioned.
 - b. Who helped to establish the station?
 - c. What were you doing before you started this business?
2. What was the motivation to start the station?
3. How do people join?
 - a. Fees
 - b. Code of conduct
 - c. Leadership
4. Where do you load to?

5. What are your main challenges?
6. How do you handle conflicts?
 - a. Theft
 - b. Rivalry with other networks

Key informant Interview guide for OWNERS

- 1) How long have owned a tricycle?
- 2) How many tricycles do you own?
- 3) How much on average does a tricycle cost?
 - a. Probe for different types and price range
- 4) How did you acquire yours?
 - a. Probe whether it was through a loan, savings, investment or otherwise
- 5) How do you manage it? Do you ride yourself or use riders?
 - a. How do you find riders for your tricycle? Qualification, Characteristics?
 - b. Any initial arrangements with riders? Start and Close time, parking, payments etc.
 - c. What happens if the initial arrangements are broken?
- 6) How beneficial has the tricycle business been to you?
 - a. Probe for personal private movements
 - b. Financial gains in terms of profits and business expansion.
- 7) How much on average do you make in terms of *sales* on a tricycle?
- 8) What are some of the costs you incur aside fuel cost and the cost of the tricycle itself?
 - a. Probe for cost of spare parts.
 - b. Probe for cost of obtaining license and how much it costs.
 - c. Probe for monthly allowances and how much is paid.
 - d. Insurance for the vehicle and the rider?
 - e. Provision of helmet?
- 9) What inspired you to go into this business?
 - a. Probe about unemployment, underemployment, low income, extra income, business opportunity, transportation related problem.
- 10) Apart from tricycle business, what other business or job do you do?
- 11) Why do you think there are a lot of tricycles used as means of public transport these days in some parts of Accra?
- 12) How does it benefit users?
- 13) What are some of the challenges with its usage?
 - a. Users
 - b. Riders (careless riding, *spare*, drugs, license,)
 - c. Other road users
 - d. Authorities (License acquisition, bribes, intimidation?)
- 14) How does its usage affect the environment?

- 15) How does its usage affect people's pocket?
- 16) Which people often use the tricycle?
- a. Is it good for school children, market women, disabled, short distance travelers etc.
- 17) As we round up, I'd like you to tell me something about your educational background and anything else you would like to add.



Appendix III: In-depth Interview guide for users and riders

In-depth interview guide for users

1. Where do you live?
2. How long have you lived there?
3. What is the nature of the area where you live?
 - a. Is it a new settlement?
 - b. What is the nature of your road network?
 - c. Do you have traffic issues?
 - d. Are other forms of public transport readily available in the area?
4. What kind of work do you do? Does it entail making a lot of short trips in and around town?
5. At what point did you see the tricycles operating here as public transport?
6. Why do you think they are operating here?
7. How long have you used the tricycle?
8. What do you use the tricycle for?
 - a. Probe for purpose of journey. (trip type, origin and destination)
9. Do you always have company when using the tricycle?
10. Why is the tricycle your choice of making short trips?
 - a. Reasons that have to do with the make of the vehicle (compact), space for load, spacious/comfortable, ease of boarding and alighting, airy (open sides), fewer passengers etc.
 - b. Convenient on the pocket, waiting time, trip time, safety
11. Can you share some of the problems you encounter when using the tricycle?
12. There are a number of them here, why do you think their number keeps increasing?
13. What is the one thing that makes you want to use the tricycle regardless of all the problems you have with it?
14. Are you aware that it is a crime to use the tricycle as a passenger vehicle or for public transport?
15. Over all, what is your perception of the tricycle for public transport

In-depth interview guide for riders

- 1) As a rider, what do you think is the reason for the increased usage of tricycles?
- 2) Which category of people do you offer your services to? Who are your clients?
- 3) Apart from you (operators) and passengers, which other people or institutions are closely involved in your work? Could be positive or negative.
- 4) What are the charges for different services e.g. Dropping, with load etc. (charging modalities)

- 5) What values do you draw from the business (anything you have been able to achieve or can do since you started this business)
- 6) Passengers raise a lot of safety concerns. What do you have to say?
 - a. Safety clothing
 - b. Respect for traffic rules
 - c. Theft
 - d. Reckless driving
- 7) License, servicing and maintenance
 - a. Routine maintenance
 - b. Washing etc.
- 8) What are some of the arrangements you have with your owners?
 - a. Daily sales
 - b. Working hours and days
 - c. License
 - d. *Work and pay*
- 9) What are some of the concerns owners raise about you?
 - a. *Spare riding*
 - b. Working outside approved hours
 - c. Theft
- 10) Do you also feel unsafe with the job you do?
 - a. Accidents
 - b. Arrests
 - c. Intimidation and illegal fee collection
 - d. Thefts
 - e. Brawls
 - f. Authorities can stop you at any time
- 11) Do you think you are helping your communities by offering these services?
 - a. Why so? Probe other businesses they invest in, maintaining a family/ supporting other family members, making financial contributions in various social groups.
- 12) What about all the negative things they say about you? Help me to name a few.
- 13) How does the public perceive you generally?
- 14) What kind of perception do you have of yourselves that is different and positive from what the public has of you? What positive outlook do you want the public to have about you?
- 15) What is your biggest challenge with the business?
- 16) What do you think is the way to address this challenge?
- 17) If you had alternative jobs, what kind of job would you like to do?
- 18) What are your skills in the alternative jobs you desire?
- 19) What has kept you from those jobs?
- 20) What are your plans for the future?

Appendix IV: Observation

(To be made at the areas where riders solicit for passengers and on my trips in the study areas)

1. How riders solicit for passengers
2. How they ride and their conduct on the road
3. Attitude towards passengers
4. The kind of load they pick
5. Personal appearance of riders (presence of safety clothes, clean or shabby clothes)
6. Use of the blinds to prevent the elements of the weather (dust, sun, rain)
7. The appearance of the vehicle
8. Decorations in and on the vehicle
9. Presence of music or music devices
10. Resolution of disagreements among riders, riders with passengers or riders with authorities.



Appendix V: Indices (variables) computed using principal component analysis (PCA)

Variables (indices)	Index components	Measurement of components	Kaiser-Meyer-Olkin (kmo) statistics
Perceived feasibility	C1= Ease of entry	Likert scale 1 – 5 (1- not important; 5- very important)	0.87
	C2= Takes me to (conveys me at) my destination		
	C3= Carries load		
	C4= Dodges traffic		
	C5= Goes on rough roads		
	C6= Drives through the alleys		
	C7= low cost of travel		
	C8= Suitable for a relatively short distance		
Perceived accessibility	C9= Relatively short journey time	Likert scale 1 – 5 (1- not important; 5- very important)	0.83
	C10= Relatively short waiting time		
	C11= Larger network coverage (Number of routes)		
	C12= Availability of service		
Perceived safety	C13= Protection from the elements of the weather	Likert scale 1 – 5 (1- not important; 5- very important)	0.83
	C14= Tricycles look safe/strong		
	C15= there is safety in the vehicle		
	C16= Personal security		
Perceived comfort	C17= Cleanliness of vehicle	Likert scale 1 – 5 (1- not important; 5- very important)	0.93
	C18= Privacy		
	C19= Seat comfort		
	C20= Noise		
	C21= Crowding		
	C22= Ease of entering or exiting		
	C23= Less contact		
Perceived pleasure	C24= Drivers' appearance and behaviour	Likert scale 1 – 5 (1- not important; 5- very important)	0.64
	C25= Enjoyment of trip		
	C26= Enjoy fresh breeze		
Sustainable Pragma services	D2= Connect/conveys poor people to their destination	Likert scale 1 – 5 (1- strongly disagree; 5- strongly agree)	0.68
	D3= Connects/conveys other vulnerable people like children and women to their destination		
	D4= Tricycles are reliable, available and timely		
	D5= Tricycle fares are lower, therefore affordable		
	D6= Tricycles have what it takes to avoid fatalities		
	D7= Tricycles produce relatively less noise		
	D8= Tricycles relatively pollute less		

Appendix VI: Ethical Clearance



UNIVERSITY OF GHANA ETHICS COMMITTEE FOR THE HUMANITIES (ECH)

P. O. Box LG 74, Legon, Accra, Ghana

My Ref. No...ECH 285/ 21-22 ...

March 16, 2022.

Victoria Tanti Wilson
Institute of Statistical, Social and Economic Research
University of Ghana
Legon

ETHICAL CLEARANCE (ECH 285/ 21-22)

The protocol title below has been reviewed and approved by the ECH Committee.

TITLE OF PROTOCOL: DYNAMICS OF PUBLIC TRANSPORTATION IN GHANA: THE CASE OF THE USE OF TRI-CYCLES IN ACCRA

PRINCIPAL INVESTIGATOR: VICTORIA TANTI WILSON

Please note that the final review report must be submitted to the Committee at the completion of the study. Your research records may be audited at any time during or after the implementation. Any modification of this research project must be submitted to ECH for review and approval prior to implementation.

Please report all serious adverse events related to this study to ECH within seven (7) days verbally and in writing within fourteen (14) days.

This certificate is valid till March 15, 2023. You are to submit annual reports for continuing review.

Please accept my congratulations.

Yours Sincerely,

Professor C. Charles Mate-Kole
ECH Chair

Cc: Professor George Owusu, Institute of Statistical, Social and Economic Research, UG
Dr. Aba O. Crentsil, Institute of Statistical, Social and Economic Research, UG
Dr. Musiyimi Mbathi, University of Nairobi Department

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Appendix VII: Post-estimation test for M-Logit

Log-Lik Intercept Only: -484.282	Log-Lik Full Model: -371.084
D(296): 742.168	LR(63):226.397
	Prob > LR: 0.000
McFadden's R^2 : 0.234	McFadden's Adj R^2 : 0.011
Maximum Likelihood R^2 : 0.429	Cragg & Uhler's R^2 : 0.472
Count R^2 : 0.431	Adj Count R^2 : 0.087
AIC: 2.372	AIC*n: 958.168
BIC: -1034.251	BIC': 151.692



Appendix VIII: Time of respondents' first and last trip

Time of day	First Trip		Last Trip	
	Frequency	Percentage	Frequency	Percentage
Early morning (before 5am)	50	8.2	3	0.5
Morning (After 5am, before 7 am)	442	72.5	35	5.7
Afternoon (After 12pm)	36	6	54	8.9
Late afternoon (After 4pm)	4	0.7	178	29.2
Night (After 7pm)	4	0.7	199	32.6
Anytime	74	12.1	141	23.1
Total	610	100	610	100

Source: Fieldwork, April 2022



Appendix IX: Post-estimation test for OLS

Test of Multicollinearity		
Variable	VIF	1/VIF
monthly_tnt	1.19	0.843294
2.prag_oth~s	1.11	0.89736
fuel_eff	1.17	0.85333
unmot_routes	1.59	0.627004
low_income	1.61	0.621912
lower_fares	1.49	0.672249
rivalry_ne~s	1.18	0.848947
proh_LI2180	1.28	0.780055
short_dist~v	1.33	0.749221
min_crime	1.19	0.839976
2.a2	1.11	0.899803
a4		
2	3.7	0.270436
3	5.54	0.180518
4	5.98	0.167322
5	3.33	0.300086
a3		
2	3.1	0.323013
3	4.26	0.234821
4	3.87	0.258194
5	2.97	0.337158
6	1.73	0.57704
7	1.46	0.68337
8	1.21	0.82372
9	1.23	0.810669
10	1.11	0.900944
a5		
2	2.05	0.488519
3	1.91	0.523243
Mean VIF	2.22	

Model specification test						
ust_Pragy~v	Coefficient	Std. err.	t	P>t	[95% conf.	interval]
_hat	0.4790203	0.29113	1.65	0.101	-0.09331	1.051348
_hatsq	0.5132714	0.282679	1.82	0.07	-0.04244	1.068984
_cons	0.1239648	0.073685	1.68	0.093	-0.02089	0.268821

A link test was done to determine whether the regression model is appropriately defined, concentrating on the linearity assumption. In regression, the linearity assumption says that the relationship between the independent variables and the dependent variable is linear. The link test aids in determining if the model's functional form is adequate. In the link test, the null hypothesis is that the model specification is accurate, which includes the assumption of linearity. The alternative hypothesis is that the model definition is incorrect implying that linearity has been violated. At the 5% level, the p-value obtained from the link test is not significant. At a significance level of 5%, we do not reject the null hypothesis and conclude that the model is accurately defined and follows the linearity assumption.

Shapiro–Wilk W test for normality					
Variable	Obs	W	V	z	Prob>z
e	405	0.99312	1.915	1.547	0.06089

The Shapiro-Wilk test is used to determine the normality of Ordinary Least Squares (OLS) regression residuals. This test determines if a regression model's residuals (the differences between observed and predicted values) have a normal distribution. The Shapiro-Wilk test yielded a p-value of 0.06 so we failed to reject the null at a significance level of 5%. This implies that the residuals are normally distributed, however slightly higher than 0.05 significance level suggesting a relatively small departure from normality. It also implies that there is inadequate data to suggest that the residuals vary considerably from a normal distribution. This shows that the assumption of normality for the residuals in the OLS regression is sufficiently satisfied.

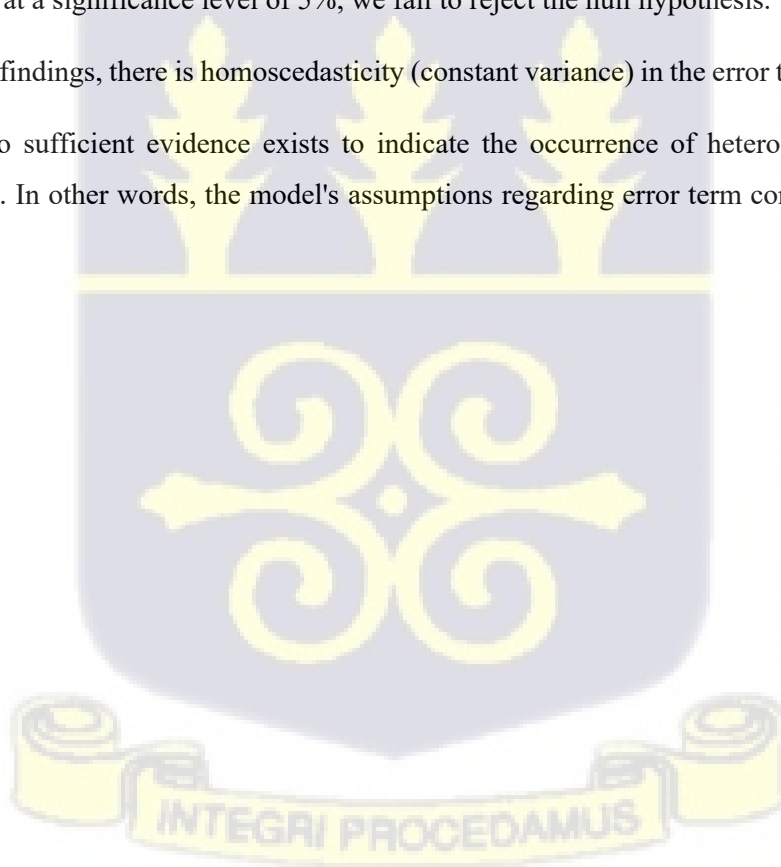
Breusch–Pagan/Cook–Weisberg test for heteroskedasticity

Assumption: Normal error terms					
Variable: Fitted values of sust_Pragya_serv					
H0: Constant variance					
	chi2(1) = 1.36				
	Prob > chi2 = 0.2433				

To assess the assumptions of the Ordinary Least Squares (OLS) regression, the Breusch-Pagan / Cook-Weisberg test was used. Heteroscedasticity occurs when the variance of a regression model's error terms (residuals) is not consistent across all levels of the independent variables. In the Breusch-Pagan / Cook-Weisberg test, the null hypothesis is that the error terms have constant variance, implying homoscedasticity. The alternative hypothesis is that the variance of the error terms is non-constant, implying heteroscedasticity. The Breusch-Pagan / Cook-Weisberg test yielded a p-value greater than 0.05. As a result, at a significance level of 5%, we fail to reject the null hypothesis.

According to the findings, there is homoscedasticity (constant variance) in the error terms of the model.

It implies that no sufficient evidence exists to indicate the occurrence of heteroscedasticity in the regression model. In other words, the model's assumptions regarding error term constant variance are reasonably met.



GALLERY





A. Image of tricycles moving in and out of the tricycle station at Dome. Green arrow shows where the riders keep the loading board under an umbrella close to the roadside. The blue arrow leads to where riders park to wait for their turn to load. Source: Fieldwork, April 2022.

B. Dome: A rider waiting for a full set of passengers before moving. Source: Fieldwork, April 2022.

C. Researcher on one of the trikes during data collection at Pokuase-Amasaman. Source: Fieldwork, April 2022.

D. A loaded tricycle with passengers and goods at Dome. Source: Fieldwork, April 2022.

