

JOURNAL OF HUMAN SETTLEMENTS RESEARCH & DEVELOPMENT

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

VOL. 10, NO. 1

APRIL, 2024

ISSN NO: 2141 - 7601

PUBLISHED BY: CENTRE FOR HUMAN SETTLEMENTS AND URBAN DEVELOPMENT JOURNAL FEDERAL UNIVERSITY OF TECHNOLOGY, P.M.B. 65, MINNA, NIGER STATE, NIGERIA email: chsud.journal@futminna.edu.ng

©Copyright2024

Foreword

This edition of Journal of Human Settlements Research & Development (JHSR&D) is dedicated to works and case studies on "Living and livelihood in the urban settlements of today" as a follow up to the previous edition on "Managing Human Settlements in the Urban Century". This edition highlights various activities undertaken, particularly in sub-Saharan Africa, to address the obvious challenges of rapid urbanization amidst failing infrastructure and facilities. Hence, the opening chapters – "Ownership structure and operational safety efficiency of commercial motorcycle and tricycle operations in Minna" and "Factors influencing urban sprawl development along Abuja – Keffi highway corridor in north central Nigeria", are closely related to transportation and the movement of people in and between fast growing cities. Besides the opening chapters, other subsequent chapters also examined the nature, usage and safety issues in the emerging and main mode of commercial transport in many cities in Nigerian today – The Tricycle.

The continuous fight against the menace of natural and man-induced disasters are featured especially in the submissions "Spatial assessment of flood vulnerability in resettlement sites in Niger state, Nigeria" and "Analysis of air quality health index of artisanal gold mining Sites for sustainable development". In many ways, these works examined the ever-increasing demand for stakeholders to redouble effort in addressing human settlements' challenges through all-engaging and particularly beneficiaries' driven solutions globally agreed to be participatory and sustainable for man and for curtailing his varying influence on earth.

Contemporary livelihood opportunities and challenges were first highlighted in the works of Okon *et al.* and Lohoh *et al.* in "*Exploratory study of indigenous security approaches in the Cultural landscape of Yakurr people in southern Nigeria*" and "Understanding urban fragility through definitions, conceptual Frameworks, and contemporary issues in the 21st century Africa" respectively. These were followed by Idris *et al.* that showed the use of floral and other vegetal components of the human habitat in enhancing security for man, his households, and livelihood activities. While Edem-Nse and Bala dwelled on the use of traditional knowledge, institutions and architecture in addressing flooding and similar disasters in the unfolding realities of global weather and climate extremes, Akinbami *et al.* and Akinbami *et al.* both demonstrated the growing concerns about insecurity in areas of human activities particularly transit-oriented spaces and institutions of higher learning.

These works have brought to the outside world the increasing intricacies of living and working in many cities of the global south. The levels of individuals and communities' efforts in creating mechanisms to address the numerous and ever-increasing predicaments of a population burdened by dysfunctional infrastructure amidst public response that are too little and infrequent. However, the resolve by many residents of this part of the world to rekindle traditional knowledge and institutions when formal and appointed agencies failed, is a considerable sign that the present state of things will soon be over. All over, sooner than expected.

Dr Aliyu M Kawu MNITP, RTP, MeRSA

Editor-in-Chief Journal of Human Settlements Research & Development (JHSR&D) (formerly CHSUD Journal)

Journal of Human Settlements Research & Development

Editorial Committee

Editor-in-Chief

Dr. Aliyu M. Kawu

Editorial Assistant

TPL. (Ms.) F.J. Odegbenro

EDITORIAL BOARD

Prof M B Nuhu – Dept. of Estate Mang & Valuation, FUT, Minna, Nigeria
Prof M Zubairu – Coordinator, Niger State Urban Support Programme, Minna, Niger State
Prof (Mrs) S N Zubairu – Dept of Architecture, FUT, Minna, Nigeria
Prof O O Morenikeji – Dept of URP, FUT, Minna, Nigeria
Prof P Ayuba – Dept of Architecture, FUT, Minna, Nigeria
Prof A E Abalaka – Dept of Building, FUT, Minna, Nigeria
Prof I C Onuigbo – Dept of Land Survey & Geo-informatic, FUT, Minna, Nigeria
Dr (Mrs) N. I. Popoola – Dept of Estate Mang & Valuation, FUT, Minna, Nigeria
Prof A O Sulyman – Dept of URP, FUT, Minna, Nigeria
Prof M Dalil – Dept of URP, FUT, Minna, Nigeria

EDITORIAL ADVISERS

Dr Shuan Sadre Ghazi – Innovation for SDGs, United Nations University, (UNU-MERIT), The Netherlands Prof Abimbola Windapo – Dept. of Construction Economics and Magnt, Univ. of Cape Town, South Africa Prof Tunde O Agbola – Dept of URP, Univ. of Ibadan, Nigeria Prof T. Gbenga Nubi - Dept. of Estate Magnt, Univ. of Lagos, Nigeria Prof Taibat Lawanson - Dept. of URP, Univ. of Lagos, Nigeria Dr Kibe Muigai - Snr. Adviser, UN-HABITAT, Nairobi, Kenya TPL K M Yari - UN-Habitat, Abuja, Nigeria Dr Abdul Husaini – Niger State Ministry of Lands & Housing, Minna, Nigeria Dr (Mrs) Habiba M Mohammed – Dept of Plant Biology, IBBU, Lapai, Nigeria Dr Ashiru Bello – Dept of URP, ABU, Zaria, Nigeria Dr U Y Ado – Dept of URP, ADUSTECH, Wudil, Kano, Nigeria

Papers for Journal

The journal accepts well researched papers, including case studies, from all disciplines in Environmental Sciences and other disciplines or subject areas related to the built environment. However, papers to be considered for a specific volume of the journal should fall within the theme and sub-themes specified. The theme for each volume of the journal will be specified.

Submission of Papers

All manuscripts should be submitted to the editor, JHSR&D. Three hard copies of papers should be forwarded to the editor with a letter of undertaking that the work is not under consideration elsewhere and it will not be sent to another journal until final decision has been made on it.

Electronic Version: In addition to three hard copies, an electronic version of the article should be forwarded to JHSRD e-mail.

Address for Correspondence

The Editor, JHSR&D, Centre for Human Settlements and Urban Development, Federal University of Technology, P.M.B. 65, Minna, Niger State, Nigeria.

For detailed information on our programmes,

Please contact: Centre for Human Settlements and Urban Development, Federal University of Technology P.M.B. 65, Minna, Niger State, Nigeria Email: chsud.journal@futminna.edu.ng 08028597919; 08053131254

TABLE OF CONTENTS

Content	Page
Forword	i
Editorial Committee	ii
Paper Submission Guidelines	iii
Table of Contents	iv
Ownership Structure and Operational Safety Efficiency of Commercial Motorcycle and Tricycle Operations in Minna, Nigeria Morenikeji Wole, Sanni, L. M., Adeleye, B. M. & Musa, H. D. A	1 - 13
Factors Influencing Urban Sprawl Development Along Abuja – Keffi Highway Corridor in North Central Nigeria Jibrin, Sabo, Junaid, Asimiyu M & Sulyman, Aremu O.	14 - 21
A Historical Perspective on Sanitation and Domestic Sewage Management in Cities Sunday Kazahshii Habila	22 - 31
Comparative Analysis of Infrastructural Facility Availability at Resettlement Schemes in Parts of Niger State, Nigeria <i>Yisa M. K., Sadiq Abubarkar, Usman A.A. and Jiya S. B.</i>	32 - 44
Challenges of Self-Build Housing in Peri-Urban Settlements of Minna: A Pilot Survey Fabunmi, F.O., Sule, A.I., Bala, I., Adegbenga, A. & Iroaganachi, N. V.	45 - 53
UAV Orthomosaic Accuracies: GNSS-Derived Ground Control Points Analysis of Federal Polytechnic Ado-Ekiti Site, Nigeria Israel Oluwaseun Taiwo, Sunday Olukayode Oladejo & Matthew Olomolatan Ibitoye	54 - 66
Evaluation of the Level of Adherence to Usage of Safety Helmets Among Motorcyclists in Semi-Urban Areas of Abuja, Nigeria Araoye Olarinkoye Ajiboye; Gbolahan Ismail, Dere; Chukwunenye Augustus Amamilo; Michael Undiukeye Amoh & Chinonye Cletus Onah	67 - 77
Users' Assessment of the Sustainability of Tricycle as Public Transportation in Ilorin, Nigeria Oladotun E. Morakinyo, Araoye O. Ajiboye, Richard O. Taiwo, Khadijat Abdulquadri, Adewale A. AJIBADE, Imran A. Abdulganiyu	78 - 90
Spatial Assessment of Flood Vulnerability in Resettlement Sites in Niger State, Nigeria Yisa Moses Kodan, Hadiza Muhammad Liman, Jiya, S. N. and Charles Onuora Okwuwa	91 - 98
Analysis of Air Quality Health Index of Artisanal Gold Mining Sites for Sustainable Development Idris Aliyu Auna, Jiya Solomon Ndace, Sheikh Danjuma Abubakar and Ishaq Yusuf	t 99 - 110
Understanding Urban Fragility Through Definitions, Conceptual Frameworks, and Contemporary Issues in the 21 st Century Africa Edward A. Lohor, Y. A. Sanusi, and Aliyu. M. Kawu	111 - 122
Exploratory Study of Indigenous Security Approaches in the Cultural Landscape of Yakurr People in Southern Nigeria Ebri A. Okon, Muhammad I. Bala, Abubakar D. Isah, Chukwudum J. Eze	123 - 133

Multifunctional Biomimetic Adaptive Facade Design for Hot Climatic Regions: an Inspiration from Barrel Cactus Plant	
Abdulrahman Baba Idris, Abubakar Danladi Isah, Isa Bala Muhammad	134 - 145
Flood Resilience and the Preservation of Traditional Architecture in Niger Delta Communities, Nigeria	
Edem-Nse, Yakno Gift and Muhammad Isa Bala	146 - 156
Surface Modification and Fibre Contents Effect of Coir Bio Fibre on the Mechanical Properties of RHA-Based High-Performance Concrete	
Kure, M.A, Olawuyi B.J, Ogunbode E.B, Apeh J. A	157 - 170
Assessment of Crime Prevention Strategies in the University of Ilorin Students Hostels Babatunde S. Akinbami, Abdulhakeem A. Yusuf, Deborah, B. Adeleke, Ajibola O. Hazeez	171 - 180
Travellers' Perception of Safety and Security in Ilorin Motor Parks	
Babatunde S. Akinbami, Christianah O. Oladokun, Folashade O. Adigun, Emmanuel S. Adekanyec, Ajibola O. Hazeez	181 - 190
Impacts of Demographics on Residential Mobility in Mokwa, Nigeria Samuel, J., Olawale, A. A., Ogunbode, E. B.	191 - 201
Impact of Community-Based Revitalization of Dilapidated Housing in Minna, Nigeria Aniya, U. J., Zubairu, S. N., Olagunju, R. E. and Akande, O. K.	202 - 209

USERS' ASSESSMENT OF THE SUSTAINABILITY OF TRICYCLES AS PUBLIC TRANSPORTATION IN ILORIN, NIGERIA

¹Oladotun E. MORAKINYO, ²Araoye O. AJIBOYE, ³Richard O. TAIWO, ⁴Khadijat ABDULQUADRI, ⁵Adewale A. AJIBADE ⁶Imran A. ABDULGANIYU

 ¹Department of Urban and Regional Planning, Federal Polytechnic, Ayede, Corresponding Email: morakinyooe@federalpolyayede.edu.ng
 ²Department of Logistics and Transport Technology, Federal University of Technology, Minna, araoyeajiboye@futminna.edu.ng
 ³Department of Urban and Regional Planning, Federal Polytechnic, Ayede, taiworo@federalpolyayede.edu.ng
 ⁴Department of Urban and Regional Planning, Aliko Dangote University of Science and Technology, Wudi, khadijatabdul@kustwudil.edu.ng
 ⁵Department of Urban and Regional Planning, PAN African College of Education, Offa ayobamiajibade27@gmail.com
 ⁶Kano State Urban Planning and Development Authority, Bompai, Kano. murainaganiyu2015@gmail.com

ABSTRACT

In recent years, public transit in cities has drawn more interest as means of enhancing sustainability and urban quality of life. Informal public transit system is a common method of transportation that offers vital options for intra-urban and inter-urban travel in many developing nations including Nigeria. This study focused on tricycle as a public transport mode in Ilorin, Nigeria. The use of tricycle has gained prominence in most of the Nigerian cities today including Ilorin, hence the need to further comprehend its wider effects on sustainable urban transportation. The study analysed the environmental, economic and social sustainability of tricycle in the city. Using a quantitative research method and a deductive research approach, the study collected data using questionnaire from 385 participants which included tricycle operators and passengers in the study area. The data were analysed on IBM SPSS 24 using descriptive statistics. The findings of this study showed that tricycle operations in Ilorin have significant environmental, social and economic benefits as majority of respondents (91.2%) agreed that tricycle industry brings about employment opportunities with mean value of 4.26, 89.7% respondents agreed it has positive impact on local business and economy with a mean value of 4.11. Social sustainability findings show that tricycle is accessible for different demographics with 90.4% and 4.26 mean value ranking the highest in social impact. Environmental sustainability of tricycle usage shows that tricycles have lower emission when compared with other modes of transportation and are more fuel efficient with mean values of 3.98 and 3.97 respectively. The study however recommends other sustainable means of transportation such as walking, cycling and provision of mass transportation which can provide all the benefits tricycle can render with less environmental impact. Keywords: Ilorin, Public Transport, Sustainable, Transportation, Tricycle

INTRODUCTION

The sustainability of transport, as a fundamental element facilitating the connections and evolution of socioeconomic systems, has received considerable attention (Rodrigue, 2024). In recent years, public transit in cities has drawn more interest as means of enhancing sustainability and urban quality of life (Saif *et al.*, 2018). Public

transit has always been entirely provided by the government making it inadequate particularly in developing nations because governments lack the capacity to plan, manage, and finance it (Basirka et al., 2019). This has resulted in the proliferation of informal transport modes in many developing countries. Informal public transport in the context of governance and economics, is passenger transport provided outside of the transitory public transport regulation framework according to the World Bank (Afolabi & Akibo, 2020). Kassa (2014) identified informal public transit system as a common method of transportation that offers vital options for intra-urban and inter-urban travel in many developing nations in which Nigeria is one of them. The high cost of cars formal and the inadequate public transportation system made the formation and broad acceptance of the informal transit system in Nigeria (Obakemi, 2021). As such, in Nigeria, the private sector has taken over public transit, operating in an unregulated environment and offering inconsistent, unreliable services. Tricycles, motorbikes and minibuses are examples of privately run informal public transport modes that are now the only dependable options for meeting the people of Nigeria's mobility demands (Kumar et al., 2016). This study focused on tricycle as an informal public transport mode popularly known as 'KEKE NAPEP' in Nigeria.

The idea of sustainability, which has become popular since the World Commission on Environment and Development (WCED, 1980), is built on three major pillars: environmental sustainability, economic sustainability, and social sustainability (Goodland & Daly, 1996). These three pillars are separate yet closely connected. Applying sustainable development to transport systems necessitates fostering connections between social growth, economic efficiency, and environmental preservation. As such, to achieve sustainable transportation which is the capacity to satisfy a community's demand for mobility without having a detrimental effect on the environment nor the demands of next generations (Rodrigue, 2024); the three concepts of sustainability must be balanced. To comprehend the wider effects of tricycles on sustainable urban transportation, the study opted for a holistic perspective by analysing the environmental sustainability, economic sustainability, and social sustainability of tricycle in the study area.

Studies have identified that tricycles are not part of Nigeria's officially recognised public transportation system, thus, they are frequently seen as an informal means of transportation (Nwaogbe et al., 2012; Cervero, 2000). Despite been an informal means of transport, more than 3 million individuals commute on tricycles every day, and in the years to come, this number is expected to increase (Ishak et al., 2022; Barau, 2013). The use of tricycle has gained prominence in most Nigerian cities today because of inadequate public transport and road infrastructure (Ishak et al., 2022; Jibrilla & Fashola, 2017; Ipingbemi & Adebayo, 2016); population growth in cities as a result of urbanisation (Boyi et al., 2022; Dike, 2012) and its safety, security, price, dependability, comfort, and efficiency which commuters used as a basis of selecting their transport mode (Litman, 2020). More so, the reported mixed results literature has concerning the deployment of tricycles for public transportation in Nigeria. Key among the advantages reported in the literature are job creation and affordable costs of transportation (Jing et al., 2019; Obiora, 2019; Agustin, et al., 2018; Mukhtar et al., 2015; Nwaogbe et al., 2012; Saleh, 2011). In contrast, safety concerns and disregard for traffic rules are some of the disadvantages highlighted in the literature with tricycle operation in Nigeria (Basirka et al., 2019; Agustin, et al., 2018; Onyekakeyah, 2016; Bishop & Amos, 2015; Barau, 2013; Nwaogbe et al., 2012).

Ilorin's population was 777,667 in 2006, as reported by the National Population Census (NPC, 2006). This figure is projected to 1,370,970 by 2024, using a growth rate of 3.2%. This illustrates that the city is undergoing accelerated population growth, which affect the city's infrastructure and socioeconomic development. Yakubu *et al.*, (2019) observed that, presently, the use of tricycles has gained prominence in Ilorin to the extent that, shared taxis are gradually fading out on major roads in the city given way to bright yellow colour of tricycles competing with motorcycles, private cars and pedestrians. Ahmed (2013) identified that the increased bumper-to-bumper congestion seen at Ilorin's main intersections in recent times is evidence that tricycles and motorcycles are making it more difficult to alleviate traffic congestion problems in the city. Therefore, there is a need to assess the sustainability implication of tricycle use in Ilorin to provide valuable insights for urban planners, transport managers, policymakers, and relevant stakeholders and a foundation for making recommendations on sustainable transportation development for Ilorin city.

Literature Review

Paratransit, sometimes known as "informal" or even "illegal" transportation, functions outside of the official transportation network (Cervero, 2000). The ability to offer shared usage and personalised transportation on demand is a feature of paratransit services, which are defined by the variable route and scheduling of comparatively small vehicles (capacity of 4-12 individuals). Tricycles provide essential and valuable transportation for underprivileged individuals, especially in densely populated metropolitan areas. They establish feeder connections between residential areas and main highways and can offset the loss of moderate line-haul public transit by providing regular service and assured seating space (Nwaogbe et al., 2012). Cletus, (2019) also expressed that: children, the elderly, and adults prefer tricycles for their health and fitness benefits. Ajiboye et al., (2020) using comfort, reliability, safety, security and scheduling, found out that the relationship between passenger's satisfaction and the services provided by tricycle operators is significant. Tricycle as a public transport mode has dominated other public transport means because of affordability (Nwaogbe et al., 2012) and employment provision to youths through NAPEP scheme. Some commuters prefer tricycle than taxi because of its availability, readiness, accessibility and ability to drop off commuters at any point (Agustin et al., 2018). Aikin & Akude (2015)

argued that commuters save more money using tricycle for their mobility needs while findings from Jing et al., (2019) showed that commuters agreed that service cost is relatively moderate, and it is convenient to use the tricycle. Therefore, commuters now choose tricycle transport since it is safer and less expensive than other forms of motorised road travel (Ogunsanya and Galtima, 2006). Mukhtar et al., (2015) argued that riding a tricycle is a source of livelihood for many young people in Northern Nigeria, which helps to reduce poverty among them in the area. Similarly, Ajiboye et al., (2020) found out that the overall socioeconomic conditions of Niger State citizens have improved with the usage of tricycles which is helping to eliminate poverty. Ismail et al., (2018) in their study on tricycle operation as a substitute for urban transport in Lokoja revealed that the monetary benefit accrued to the operators ranges from \$4.26-\$8.51 monthly. This situation in Nigeria is similar to what is obtainable in Ethiopia where Chinniah & Kalimuthu (2014) found out that tricycle operation is an engine room of employment in Haussawa town in Ethiopia.

The tricycle industry in developing nations, particularly impoverished towns, employs 15%-30% of the labour force through vehicle maintenance, production, spare part sales, petrol filling stations, vulcanisers, washing bays, restaurants, and ancillary services. More so, importing tricycles from China and creates markets for indigenous India distributors, generates revenue for the government, and boosts bilateral trade relationships with Nigeria (Saleh, 2011). Isaac *et al.*, (2020) expressed that tricycles transportation have made easier in underdeveloped nations while also cutting down on wasted time and resources. For instance, Jing et al., (2019) noted that tricycles have improved economic activity lowering post-harvest losses by by transporting farm products to markets. Ajiboye et al., (2023) observed that the transition from taxis to tricycle in Nigeria resulted in the use of tricycles as a means of freight and cargo transportation in the country. Aikins & Akude (2015) also revealed that in Ghana, tricycles have significantly contributed to a decrease in all instances of wastage associated with agriculture as products are promptly delivered to residences with the help of tricycles; minimising the losses brought on by thefts among others. Likewise, tricycle offers a highly possible substitute for traditional transit, particularly in isolated, rural locations with low population densities that cannot support a system of scheduled transportation (Ipingbemi & Adebayo, 2016).

Contrary to the positive impacts, there are numerous negative impacts of tricycle operation. Safety and security of tricycle operation have become a significant concern ofor commuters. As a means of public transportation, the tricycle has been criticised for been unsafe, and noted to be a significant cause of accidents on major roads (Onyekakeyah, 2016). The manners in which the tricycle is manufactured, and the reckless nature of the riders undermine safety which often predisposes it to road accidents (Nwaogbe et al., 2012, Agustin, et al., 2018). Jibrilla & Fashola (2017) stated that even while tricvcle transportation is becoming more and more popular in Nigeria, there is a significant amount of risk as tricycles accounted for 21,876 (21%) of all accidents in the nation between 2008 and 2013. This is because the low speed nature of tricycles is more likely to cause accidents that result in fatalities or serious injuries when they operate in mixed traffic (Jibrilla & Fashola, 2017). Although, Dike (2012) found out that tricycle operation is neither safe nor affordable, however it is comfortable and readily available. In comparison to taxis, tricycles are smaller, slower and offer less comfortable services; but they are less expensive than cars (Cletus, 2019). When compared to motorcycles, the use of tricycles has decreased the accident rate (Jibrilla & Fashola, 2017).

Ipingbemi & Adebayo (2016) expressed that ownership, diverse smaller vehicles. overloading in some areas of the city, and competitive rivalry among drivers are the characteristics of tricycle operation. Moreover, tricycle use is linked to negative social and environmental effects, including noise pollution, fine particle emissions, a lack of paved roads, a dearth of parks, and a dearth of terminals on roads meant for passengers to travel without stops. This is particularly evident at the peak hours of the day especially at the Central Business District (CBD), marketplaces, schools and similar places. More so, on many occasions, operators do not have the required licenses or registration; they do not fulfil the standards for commercial vehicle certification on age restrictions, minimum car size requirements, or fitness requirements and often do not have liability insurance (Cervero, 2000). Furthermore, Ezeuwulu (2002), claimed that despite the tricycle business' introduction of an improved transportation infrastructure for products and services, as well as the abundance of complementary opportunities that have been granted to it; their riders are responsible for a lot of crashes by riding on the wrong sides of moving vehicles and appearing to have little awareness of traffic laws. Nwaogbe et al., (2012) expressed that not only can night travels and overloading of tricycles harm the old and young, but they also make pickpocketing and other forms of theft easier to carry out. In addition, tricycle operation in big cities has caused significant problems, particularly in crime and social vices, leading to state governments viewing it as a threat. As a result, some states, including Enugu, Delta, Rivers, and Lagos, are prohibiting tricycles in state capitals and large towns (Basirka et al., 2019).

RESEARCH METHODOLOGY

This study made use of questionnaire to collect primary data for this study. To calculate the sample size for this study, the population of Ilorin which was 777,667 in 2006 according to the National Population Commission was projected to 1,370,970 in

July 2024 using a growth rate of 3.2%. The sample size was calculated to be 385 using 0.0281% of the projected population. This study adopted a quantitative research method, a deductive research approach and random sampling of both tricycle operators and passengers across the 20 wards of the 3 local governments in Ilorin with a minimum of 19 surveys conducted in each ward. Responses were collected on environmental, economic and social sustainability of tricycles in the study area. Also, the efficiency of policy and regulations guiding tricycle usage were examined. A likert scale rating was adopted for the responses. The

likert scale was given as: Strongly Agree -5 ,
Agree – 4, Undecided – 3, Disagree – 2,
Strongly Disagree – 1. Descriptive statistics
were used for analysing the data with the aid
of IBM SPSS 24 computer software. The
results are presented in tables and charts
showing frequency and percentage counts as
well as the mean distribution of the factors.

RESULTS

The field results on the environmental, economic and social sustainability of tricycles in Ilorin are presented in Tables 1, 2 and 3, including the examinations of the policy and regulation of tricycle operations.

Environmental Factors	Strongly Agree	Agree F/%	Undecided F/%	Disagree F/%	Strongly Disagree	Mean
	F/%				F/%	
Tricycles have lower emission levels compared to other forms of public transportation	104/27.0	210/54.5	37/9.6	26/6.8	8/2.1	3.98
There are effective regulations in place to control or reduce emissions from tricycles	41/10.6	123/31.9	114/29.6	79/20.5	28/7.3	3.18
Tricycles are more fuel- efficient compared to other transportation modes	114/29.6	182/47.3	60/15.6	23/6.0	6/1.6	3.97
Most tricycles in my area use petrol as fuel	256/66.5	111/28.8	17/4.4	1/0.3	-	4.62
The use of tricycles helps reduce traffic congestion	78/20.3	153/39.7	75/19.5	74/19.2	5/1.3	3.58
Old or discarded tricycles are properly recycled or managed	44/11.4	80/20.8	142/36.9	79/20.5	40/10.4	3.02
Waste generated from tricycle operations is properly managed	32/8.3	83/21.6	149/38.7	91/23.6	30/7.8	2.99
Tricycle operation does not generate noise and air pollution	43/11.2	102/26.5	65/16.9	139/36.1	36/9.4	2.94

Table 1: Environmental Sustainability

Source: Author's work, 2024

Table 1 showed the environmental sustainability of tricycle in Ilorin. Most of the respondents agreed that most tricycles in their area use petrol as fuel (SA+A = 95.3%; Mean = 4.62), have lower emission levels compared to other forms of public transportation (SA+A = 81.5%; Mean = 3.98) and are more fuel-efficient compared to other transportation modes (SA+A = 76.9%; Mean

=3.97). Majority also agreed that the use of tricycles helps reduce traffic congestion (SA+A = 60%; Mean =3.58). Just under half agreed that there are effective regulations in place to control or reduce emissions from tricycles (SA+A = 42.5%; Mean =3.18). However, majority disagreed that tricycle operation does not generate noise and air pollution (SD+D = 45.5%; Mean =2.94).

Others were mostly undecided if waste generated from tricycle operations is properly managed and if old or discarded





Figure 1: Economic Sustainability Source: Author's fieldwork, 2024.

Figure 1 showed the economic sustainability of tricycle in the study area. As shown in the analysis, with majority of the respondents indicating that the tricycle industry helps in creating employment for the people (SA+A = 91.2%; Mean = 4.26), tricycle usage has a positive impact on local businesses and the economy (SA+A = 89.7%; Mean = 4.11), tricycles are more affordable for the average

 Table 2: Social Sustainability

commuter compared to other modes of transport (SA+A = 74.6%; Mean = 3.86), cost of maintenance is usually much cheaper than other transport modes (SA+A = 61.6%; Mean = 3.69) and working conditions and income from operating commercial tricycle are satisfactory (SA+A = 57.9%; Mean = 3.54).

Social Factors	Strongly Agree F/%	Agree F/%	Undecided F/%	Disagree F/%	Strongly Disagree F/%	Mean
Tricycles are accessible	152/39.5	196/50.9	22/5.7	14/3.6	1/0.3	4.26
for different						
demographics,						
including the elderly						
and disabled						
Tricycles offer a reliable	107/27.8	200/51.9	42/10.9	28/7.3	8/2.1	3.96
transport service for all						
class of people						

Tricycles provide better	104/27.0	215/55.8	43/11.2	20/5.2	3/0.8	4.03
connectivity to						
underserved or remote						
areas						
Tricycles have a good	62/16.1	129/33.5	81/21.0	90/23.4	23/6.0	3.30
safety record compared						
to other modes of						
transportation						
There are adequate	44/11.4	126/32.7	110/28.6	89/23.1	16/4.2	3.24
safety regulations and						
enforcement measures						
for tricycle operations						
The presence of	80/20.8	226/58.7	54/14.0	17/4.4	8/2.1	3.92
tricycles positively						
affects community life						
and social interactions						
Tricycle services are	43/11.2	104/27.0	85/22.1	125/32.5	28/7.3	3.02
usually of higher quality						
when compared to cars						
and buses						
Tricycle operators often	60/15.6	152/39.5	101/26.2	63/16.4	9/2.3	3.50
possess the required						
permit to operate						
Tricycle operators do	36/9.4	67/17.4	92/23.9	127/33.0	63/16.4	2.70
not disobey traffic						
rules/regulations						

Source: Author's fieldwork, 2024.

The social sustainability of tricycle operation is shown in table 2. The table revealed that most of the respondents agreed that: tricycles are accessible for different demographics, including the elderly and disabled (SA+A = 90.4%; Mean = 4.26), tricycles provide better connectivity to underserved or remote areas (SA+A = 82.5%; Mean = 4.03), tricycles offer a reliable transport service for all class of people (SA+A = 79.7%; Mean = 3.96), the presence of tricycles positively affects community life and social interactions (SA+A = 79.5%; Mean = 3.92) and tricycle operators often possess the required permit to operate (SA+A = 55.1%; Mean = 3.50). Not up to half of the respondents agreed that tricycles have a good safety record compared to other modes of transportation (SA+A = 49.6%; Mean = 3.30) and there are adequate safety regulations and enforcement measures for tricycle operations (SA+A = 44.1%; Mean = 3.24). On the contrary, majority of the respondents disagreed that Tricycle services are usually of higher quality when compared to cars and buses (SD+D = 39.8%; Mean = 3.02) and Tricycle operators do not disobey traffic rules/regulations (SD+D = 49.4%; Mean = 2.70).

USERS' ASSESSMENT OF THE SUSTAINABILITY OF TRICYCLES AS PUBLIC TRANSPORTATION IN ILORIN, NIGERIA



Table 4: Policy and RegulationSource: Author's fieldwork, 2024

The effectiveness of the policy and regulation guiding the use of tricycle in the study area was examined in the figure 2. From the findings, majority of the respondents agreed that: there are clear and effective regulations governing tricycle usage in my area (SA+A = 61.6%; Mean =3.64), these regulations ensure sustainable operations of tricycles (SA+A = 59.5%; Mean = 3.57) and There are policies in place to promote sustainable practices in the tricycle industry (SA+A = 54.1%; Mean = 3.53) and Government and local authorities play a supportive role in managing the tricycle sector (SA+A = 52.7%; Mean = 3.41).

DISCUSSIONS

Assessing the environmental sustainability of tricycles in the study area revealed that most of the tricycles use petrol as fuel and have lower emission levels compared to other forms of public transportation and are more fuel-efficient compared to other transportation modes. Dike (2012) talking about the suitability of tricycle regarding commercial public transport and within-city transportation, identified that tricycles have low fuel consumption of 38km per litre. Also, the use of tricycles helps reduce traffic congestion. This finding contradicts the observation of Ahmed (2013) who identified increased bumper-to-bumper that the congestion seen at Ilorin's main intersections in recent times is evidence that tricycles and motorcycles are making it more difficult to alleviate traffic congestion in the city. Similarly, Obiora (2019) identified that many Nigerians generally hold the opinion that tricycle leads to problems of traffic congestion alongside crime. Despite the increasing use of tricycle in Ilorin and other cities in Nigeria (Ishak et al., 2022; Barau, 2013), there are not effective regulations in place to control or reduce emissions from them. More so, waste generated from tricycle operations are not properly managed including old or discarded tricycles.

For the economic sustainability of tricycle operation, the responses show that tricycles considerably boost the city's economy. The tricycle industry helps in creating employment for the people and tricycle usage has a positive impact on local businesses and the economy. Studies have identified that the adoption of tricycle as a mode of transportation in Nigeria was to alleviate poverty and bring economic opportunity to the masses (Mgbemena, 2013; Saleh, 2011; Ajiboye & Dosunmu, 2007; Ogunsanya & Galtima, 2006). For example, Saleh (2011) estimates that the tricycle industry in developing nations employs 15%-30% of the labor force, covering the entire supply chain from supply to operation and maintenance. Indeed, over the years, tricycle usage has contributed immensely to job creation and means of livelihood of the urban populace (Ajiboye et al., 2020; Obiora, 2019; Ismail et al., 2018; Mukhtar et al., 2015). Government also benefits from levies that tricycle operators pay daily (Saleh, 2011). More so, tricycles are more affordable for the average commuter compared to other modes of transport, cost of maintenance is usually much cheaper than other transport modes and working conditions and income from operating commercial tricycle are satisfactory. These findings have also been confirmed in several other studies (Jing et al., 2019; Ismail et al., 2018; Aikin & Akude, 2015; Nwaogbe et al., 2012). From these findings, tricycles have contributed significantly to economic sustainability of Ilorin.

Highlighting the social sustainability of tricycle operation in the study area: tricycles are accessible for different demographic groups including the elderly and disabled and offer a reliable transport service for all. Cletus (2019) in a study identified that the children, elderly and adults all prefers the use of tricycles for their transport needs due to the health benefits it offers. In addition, tricycles provide better connectivity to underserved or remote areas. This agrees with Ipingbemi & Adebayo, 2016) that identified that tricycle offers a highly possible alluring substitute for traditional particularly in transit. isolated. rural locations with low population densities. The

presence of tricycles also positively affects community life and social interactions.

While tricycle operators do often possess the required permit to operate, their safety records compared to other modes of transportation is only just fair with these safety regulations and enforcement measures are not adequate. When compared to cars, tricycle services are usually of inferior qualities and tricycle operators often disobey traffic rules/regulations. Although, the study by Ogunsanya & Galtima, (2006) alluded that safety is one of the reasons why people make use of tricycles; however, safety concerns and disregard for traffic rules are some of the disadvantages highlighted in the literature with tricycle operation in Nigeria (Basirka, 2019; Agustin, et al., 2018; Onyekakeyah, 2016; Bishop & Amos, 2015; Barau, 2013; Nwaogbe et al., 2012). The manners in which the tricycle is manufactured, and the reckless natures of the riders undermine safety which often expose them to accidents (Nwaogbe et al., 2012, Agustin, et al., 2018). To describe the recklessness of tricycle drivers, Ezeuwulu (2002) observed that tricycle drivers often ride the sides of passing automobiles and appear to have little awareness of traffic laws. From the findings presented, mixed results are revealed as regard the social sustainability of tricycle operation in Ilorin. While, it offers a unique social opportunity, the safety concern is of primary importance.

The study further examined the effectiveness of the policy and regulation guiding the use of tricycles in the study area and discovered that there are clear and effective regulations governing tricycle usage in which these regulations ensure sustainable operations of tricycles. Also, there are policies in place to promote sustainable practices in the tricycle industry with the government and local authorities playing supportive roles in managing the tricycle sector. However, as a reflection of the disregard for traffic rules; tricycle operation is also plagued by several infractions like underage driving, over speeding, violation of traffic laws,

overloading, and as a front for illegal activities (Barau, 2013).

CONCLUSION AND RECOMMENDATION

The findings of this study have shown that tricycle operations in Ilorin have significant environmental, economic and social benefits. Since reaching a balance between the three sustainability goals is necessary to achieve sustainable transportation; in which tricycle operation in Ilorin is striving to achieve, it's use as a mode of public transport in the study area is sustainable. One of the core objectives of sustainable cities is to provide accessible, reasonably priced, and ecologically friendly transportation choices that the entire city can utilise (UNDP, 2023) which the study proved tricycle is achieving in Ilorin further buttressed it sustainability as a mode of transportation in the study area. Also, sustainable transportation is the capacity to satisfy a community's demand for mobility without having a detrimental effect on the environment nor the demands of next generations. Therefore, tricycle as a public transportation option in Ilorin is sustainable. This study however recommends the following to further enhance sustainable transportation in Ilorin:

- There is a need to enlighten all transport stakeholders including the general public on the need for sustainable transportation.
 Particularly, public engagement, enlightenment campaigns and sensitization programmes can be adopted.
- 2. The use of train and buses should be promoted as the acceptable public transport modes in Ilorin. Both would provide comforts and affordability that tricycle users mentioned while contributing less to environmental pollution. This means that government must invest massively in the transportation sector to be formalized and its operations effectively monitored.
- 3. As suggested, the infrastructure for public transportation must be easily

accessible, inclusive, convenient, and well-integrated with the infrastructure for bicyclists and pedestrians (Montgomery, 2020). This means that walking and cycling infrastructure which are nonmotorised form of transport must be developed in Ilorin.

REFERENCES

- Afolabi, O. & Akibo, K. (2020). Urban challenges and informal public transport services in Nigeria. *Review* of International Comparative Management, 21(3), 319-331. https://ideas.repec.org/a/rom/rmcimn /v21y2020i3p319-331.html#download
- Agustin, C. P, Costales, N. C., Gadingan, M. M, Francisco, L. M. & Fronda, E. P. (2018). The functionality of the tricycle regulation unit of International Tuguegarao City. Journal of Advanced Research in Management and Social Sciences, 7(3). 211-236. https://garph.co.uk/IJARMSS/Mar20 18/12.pdf
- Ahmed, Y. A. (2013). Urban traffic dilemma and potential remedy: example from Ilorin City, Nigeria. African Research Review - An International Multidisciplinary Journal, 7(1), 216-270. http://dx.doi.org/10.4314/afrrev.v7i1 .17
- Aikins, K. and Akude, G. (2015). The impact of motor tricycles on transportation of agricultural produce in the Pru District of Ghana. *Global Journal of Biology, Agriculture and Health Sciences,* 4(3), 22-26. https://www.researchgate.net/publica tion/283715499
- Ajiboye A. O. & Dosunmu V. A. (2007). Analysis of the sources of finance of micro, small, and medium-scale transport enterprises in Nigeria. The

case of commercial motorcyclists. *The Interface: A Biannual Journal of Management*, 3(2): 75-85. https://www.researchgate.net/publica tion/348565675

- Ajiboye A. O., Ohida M. E., Abdullahi M. I., Komolafe B. O. (2020). Operation and management of tricycle (Keke Napep) as a mean of public transport in Minna, Nigeria. *Journal of Asia-Pacific Management and Business Application*, 9(2). http://dx.doi.org/10.21776/ub.apmba .2020.009.02.8
- Ajiboye, A., Ohida, M., Ezeh, B., Yakubu-Wokili, H. & Abubakar, I. (2023).
 Evaluation of tricycle usage as a means of freight transport in Minna. Journal of Environmental Design, 18(1), 1-13.
- Barau, L. (2013). Suitability of tricycles as a passenger transport in Kano Metropolis. An Unpublished Post Graduate Diploma in Transport Planning, Transport School, NITT Zaria.
- Basirka, I., Dickson, O. & Odeyemi, T. (2019). Two versus fourwheeler? Confusing traffic regulations and tricycle riders in Kano Metropolis. IFRA-Nigeria Working Papers Series 50, IFRA-Nigeria. https://hal.science/hal-03368454v1
- Bishop. and Amos. P. (2015). Т.. Opportunities to improve road safety through "Boda-Boda" Associations in Tanzania. An Unpublished Thesis. Postgraduate Diploma Nigerian Institute of Transport Technology, Zaria. Transaid AFCAP Training Programme Project, London: Africa Community Access Partnership (AFCAP)
- Boyi, B., Yusuf, N., Samaila, K. (2022). Feasibility studies of the behaviour of tricycle operators at a given signalized intersection in kano

metropolis: case study of Tal'udu and Gwammaja. *Iconic Research and Engineering Journals*, 6(3), pp. 83-90.

https://www.irejournals.com/formate dpaper/1703805.pdf

- Cervero, R (2000). Informal transport in the developing world. Nairobi: United Nations Centre for Human Settlements (UN-Habitat). https://www.researchgate.net/profile/ Aaron-Golub/publication/289661223
- Chinniah, A., & Kalimuthu, B. (2014). A study on problems and prospects of transport in Ethiopia-special reference with auto rickshaw's (Bajaj) in Hawassa City, SNNPRS, East Africa. *IFSMRC AIJRM*, 2(1), 1-24.
- Cletus, G. (2019). Assessment of the contribution of tricycle transportation business to the growth of the local economy of the Wa municipality A Thesis submitted to the Department of Governance and development management in partial Fulfilment of the requirement for the award of Mphil. Degree in Development Management.

http://www.udsspace.uds.edu.gh/

- Dike, D. N. (2012). An empirical study of the use of tricycle as a public transport mode in Nigerian cities. *Journal of Social Sciences and Public Affairs*, 2(2), 66-76. https://www.researchgate.net/publicati on/327282419
- Ezeuwulu, O. (2002), Tricycle operation: problems and prospects. Owerri: Imoco Printing Press & Publishing Co. Ltd. http://www.idosr.org/
- Goodland, R., & Daly, H. (1996). Environmental sustain ability: Universal and non-negotiable. *Ecological Applications*, 6(4), 1002– 1017. https://doi.org/10.2307/2269583

- Ipingbemi, O. & Adebayo, A., (2016). Tricycle as a mode of public transportation in Ibadan Metropolis. *Ife Research Publications in Geography* 14 (1), 126-135. https://www.academia.edu/3564241 3/Tricycle_as_a_Mode_of_Public_T ransportation_in_Ibadan_Metropolis _Nigeria
- Isaac, I., Habila, J., Opara, C. & Akpaka, U. (2020). Appraisal of the operation of tricycle as a means of commercial transportation in Minna, Nigeria. *International Journal of Advanced Academic Research* (Sciences, Technology and Engineering), 6(9), 119-133. http://dx.doi.org/10.46654/in.248898 49.e6919
- S., Shabadin, A., Maidin, Ishak. М., Nemmang, М., Susilawatu & Kamaluddin, N. (2022). Public perception and acceptance of tricycle as an option of transportation mode in Malaysia. IOP Conference Series: Earth and Environmental Science, 1151 012009. http://dx.doi.org/10.1088/1755-1315/1151/1/012009
- Ismail, N. A., Adeniji, T. A. & Paul, O. I. (2018). Assessment of tricycle operations as an alternative means of urban transportation in Lokoja, Kogi State, *Confluence Journal of Environmental Studies*, *12* (1), 53-62. https://www.researchgate.net/publica tion/330015767
- Jibrilla, H. & Fashola, O. (2017). Impact of commercial tricycle operation on income of youth in Mubi North Local Government Area, Adamawa State, Nigeria. *IDOSR Journal of Humanities and Social Sciences*, 2(3), 56-72. http://www.idosr.org/
- Jing, Y., Dzoagbe, N., Amouzou, E. and Ayivi, W. (2019). The impact of tricycles on transportation and

economic activities in Ghana, A case study of the Ho Municipality. International Journal of Economics, Commerce and Management, 7(12), 633-646. http://ijecm.co.uk/

- Kassa, F. (2014). Informal transport and its effects in the developing world: a case study of Addis Ababa, Ethiopia. *Journal of Transport Literature*, 8 (2), 113-133. http://dx.doi.org/10.1590/S2238-10312014000200006
- Kumar M., Singh S., Ghate T. A., Pal S. and Wilson, S. A. (2016). Informal public transport modes in India: A case study of five city regions. *IATSS Research*, 39, 102-109. http://dx.doi.org/10.1016/j.iatssr.201 6.01.001
- Kumarage, A., Bandara M., & Munasinghe, D. (2010). Analysis of the economic and social parameters of the threewheeler taxi service in Sri Lanka. *Research in Transportation Economics*, 29, 395-400. http://dx.doi.org/10.1016/j.retrec.201 0.07.050
- Litman, T. (2020). Evaluating accessibility for transportation planning: Measuring people's ability to reach desired goods and activities. Victoria Transport Policy Institute, June 5, 2020. http://www.vtpi.org/
- (2013). Mgbemena, J. Language, communication on wheels and development: national the on tricycle (keke) inscriptions example. 4(10), 529-537. https://academicjournals.org/journal/ IJEL/article-full-textpdf/20D379B41605
- Montgomery, J. (2020). The 15-minute city. Available at: https://www.thersa.org/comment/20 20/10/the-15-minute-city

- Mukhtar, A., Waziri, M., Abdulsalam, B., & Dankani, I. M. (2015). Assessment of tricycle as a tool of poverty alleviation in Maiduguri, Borno State, Northeast Nigeria. *IOSR Journal of Humanities and Social Science*, 20(8), 14-18. http://dx.doi.org/10.9790/0837-20861418
- National Population Commission (NPC) (2006). 2006 Population and housing census of the Federal Republic of Nigeria, National and state population and housing tables; priority tables (Vol. 1). Abuja: National Population Commission.
- Nwaogbe, O., Ibe, C. & Ukeagbu, S. (2012). Quality of the paratransit service (tricycle) and its operation in Aba, Nigeria: An analysis of customers" opinions. Journal of Transport and Supply Chain Management, 262-276. http://dx.doi.org/10.4102/jtscm.v6i1. 64
- Obakemi, F. (2021). Determinants of earnings among commercial tricycle operators in Ilorin Metropolis. Nigeria. *Ilorin Journal of Economics*, 8(1), 101-112. https://www.researchgate.net/publica tion/350610961
- Obiora, A. (2019). Impact of commercial tricycle business on the craftsmanship in Nigeria. African Scholar Journal of African Sustainable Development (JASD-2), 251-257. 15(2). https://www.africanscholarpublicatio ns.com/wpcontent/uploads/2020/06/ AJASD_Vol15_No2-21.pdf
- Ogunsanya, A.A. & Galtima, M. (2006). Tricycle in public passenger transport service in nigeria: case study of Yola Town. In S. G. Ikya (ed), Urban passenger transportation in Nigeria, 190-207. Ibadan: Heinemann Educational Books.

https://doi.org/10.4236/ojs.2016.65068

- Rodrigue, J. (2024). The geography of transport systems, 6th Edition. London: Routledge. https://doi.org/10.4324/9781003343 196
- Saif, M., Zefreh, M. & Torok, A. (2018). Public transport accessibility: a literature review. *Periodica Polytechnica Transportation Engineering*, 47(1), 36-43. https://doi.org/10.3311/PPtr.12072
- Saleh, M. (2011). An assessment of the effectiveness of tricycle as a mode of urban transportation in Kano Metropolis, Nigeria. Unpublished M.Sc. Dissertation submitted to the Department of Urban and Regional Planning, Ahmadu Bello University, Zaria. http://dx.doi.org/10.13140/RG.2.2.1 3257.98407
- UNDP (2023). Sustainable development goals integration. https://www.undp.org/sustainabledevelopment-goals
- Yakubu, A., Ojuolape, M. & Sanni. J. (2019). The determinants of the mode of informal transport chosen in North Central City of Ilorin, Nigeria. *Iranian Journal of Economic Studies*, 8(1), 107-118. https://doi.org/10.22099/ijes.2019.31 386.1506