Scientific Research Publishing

Analysis of Gender Differences in Modal Choice among Residents of Coastal Communities of Yenagoa Metropolis in Bayelsa State, Nigeria

Ezekiel Ovuokerie Gunn[1], Clement Ebizimor Deinne[2]

[1]Department of Urban and Regional Planning, Niger Delta University, Wilberforce Island, Nigeria
[2]Department of Geography and Environmental Management, Niger Delta University, Wilberforce Island, Nigeria
Email: ovuokerie2001@gmail.com

Abstract

This study examined gender differences in modal choice among residents of coastal communities of Yenagoa metropolis in Bayelsa State, Nigeria. The Four-Step model of transportation planning and modal choice provided the theoretical basis for this study. A survey research design involving a stratified sampling technique was adopted. The descriptives on transport modes, amount and time spent revealed that 10 (76.9%) males and 3 (23.1%) females preferred bicycle as means of transportation, 7 (58.3%) males and 5 (41.7%) females preferred motorcycle, while a significant proportion 90 (53.9%) males and 77 (46.1%) females preferred tricycle, 80 (63.0%) males and 47 (37.0%) females preferred cars/taxis, and 12 (46.2%) males and 14 (53.8%) females preferred mass transit bus. However, 14 (46.7%) males and 16 (53.3%) females in marshy terrain and coastal locations preferred canoes and boats. The result of the logistic regression model revealed that gender modal preference is more likely to be influenced by mode of transportation with a beta weight of 1.140, safety considerations 1.139, ownership of transport 1.135 and distance to place of work 1.073. Hence, this study recommends that a combination of these factors should be incorporated into transport planning to achieve effective transport planning and sustainable development in the Yenagoa metropolis.

Keywords

Gender Modal Choice, Four-Step Transport Planning Model, Stratified Sampling, Binary Logistic Model, Yenagoa Metropolis, Bayelsa State

1. Introduction

According to [1], modal choice refers to the mode chosen by travelers. It is a

decision-making process involving choice between different transport alternatives, which is a result of a combination of several factors among which are individual socio-demographic factors, spatial characteristics and socio-psychological factors. [2] stated that Modal choice is a function of several things including traveler's characteristics such as age, income, gender, literacy, household size and travel mode characteristics such as travel cost, travel time, convenience, safety and security, as well as the built environment characteristics among others.

Mobility, according to [3], is essential for accessing basic services, such as education, healthcare, and social networks. This ability is particularly important for developing countries where mobility remains limited and the majority of their population depends on walking or using public transport in their daily lives.

[4] stated that in recent decades, much effort toward understanding gender differences in mobility patterns has been demonstrated both in theory and practice. Investigating relationships between changes in need due to demographic and socio-economic changes and spatio-temporal constraints proposed by [5], was one of the most interesting aspects of identifying women's mode choice behavior that has been researched in the last decade. [6] stated that transportation is one of the vital sectors supporting people's activities because without any movement, it is impossible for humans to fulfill their needs. Commonly many activities are done with a variety of purposes, which are working activities, education activity, recreation activities, and social activities. People choose and determine which travel mode is most suitable for them to fulfill these needs.

Understanding gender differences in modal choice for sustainable transportation planning is vital and relevant for efficient transport management. [7] noted that commuting mode choices play a significant role in sufficient transportation and have a long-term impact on traffic, emissions, and delays. According to [8], gender studies on modal choices are particularly important in understanding modal choices of family members. Women tend to have specific commute reasons related to household responsibilities. [9] presented an extensive overview of the research on gender and mobility that has been conducted since the early 70s and that spans several disciplines, ranging from social sciences to geography, to environmental studies. [10] posited that generally, factors influencing mode choice may be classified into two groups: internal and external factors. Internal factors include socio-economic and demographic factors, habits and perceived level of control, while external factors consist of travelling time and the cost of the journey.

Authors such as [11]-[13] noted that transport attributes, such as travel cost and trip distance, external factors such as urban form and land use, and socio-demographic characteristics are all critical determinants of transport mode choice. [14] stated that travel and transportation options have been continually evolving, and with every technological evolution, different modes of transport have been introduced with different consequences. Despite the benefits of transportation to accessing work, education or other community and social activities, there are also negative consequences, including crash-related deaths and serious injuries, traffic congestion, air pollution, and noise.

[15]-[17] stated that daily mobility in a population is highly gendered. In the same vein, [15] [18] [19] posited that the average travel behavior of women differs from men in locations visited, trip purpose, trip distance, and mode of transport. According to [20] [21], there are gender norms, cultural barriers, and fear of sexual harassment and assault by men that deter women from using certain modes of transport or travel at certain times of the day. [4] observed that in recent decades, much effort has been put into understanding gender differences in mobility patterns, both in theory and practice.

[22] posited that the notion of "travel choice" is central to the modeling processes in mainstream transport planning. These models are based on: "…the paradigm of rational man", underpinned by "neoclassical economic concepts, focusing upon the representation of people as individual rational choice makers, interacting together to form a state of equilibrium" and acting "…to maximize her utilities …applied to traveler behavior to stimulate choices of destination, mode, route and time." [23]

[24] posited that gender research on transport has made a particularly interesting contribution to such an understanding of urban development:

"Gender differences in transport contributed to a larger theoretical project in feminist geography: the critique of urban land use structure in contemporary capitalism, of the spatial separation of production and reproduction, and of the cultural dichotomy of public and private space".

According to [25], gender based differences in travel behavior have been extensively investigated in developed countries, particularly the West. Authors such as: [3] [26] [27] stated that in case of developed countries, gender difference in travel behavior is a well-known fact. However, for developing countries, this issue has received much less attention, where there is a possibility that the difference might be wider and even unique in some aspects. According to [28]-[30], researchers have paid much attention to gender-based travel patterns and found that women are more likely to adopt complex commute and non-work chains than men. The authors studied the gender differences in commute trips. In terms of travel mode, previous researchers such as [31] have discovered a number of differences between men and women. For example, distinct gender differences exist in the purpose of bicycle trips, desired amenities, and safety perceptions. Studies by [32]-[35] posited that besides the different reasons for traveling, studies consulted have found a different modal choice by gender, where going on foot and by public transport is more usual for women.

[30] expressed that gender differences become more complex and need special attention. Women's contribution to travel demand is anticipated to grow because of the increase in their labor participation rate caused by their increased social status. Besides, women's specific physical and psychological characteristics make women's behavior differ from men's to some extent. These studies revealed that there is a dearth of research on gender differences and modal choice in Nigeria, and the need to understand gender differences in modal choice among commuters

in coastal communities of Southern Nigeria for effective transportation planning and sustainable development initiatives. The following hypotheses were postulated for this study:

(1) The hypothesis that gender modal preference is not influenced by the socio-demographic characteristics of the respondents in Yenagoa metropolis.

(2) The hypothesis that there is no significant difference in the gender modal preference of respondents in Yenagoa metropolis.

Aside from this introductory section, the theoretical framework is presented in Section 2. The research methodology is presented in Section 3. The findings and results of tested hypotheses are presented in Section 4, while Section 5 concludes.

2. Theoretical Framework

The theoretical background of this study is the Four Step Model of Transport Planning and Modal Choice. A ubiquitous framework for determining transportation forecasts, highway planning and multimodal trips (see **Figure 1**).
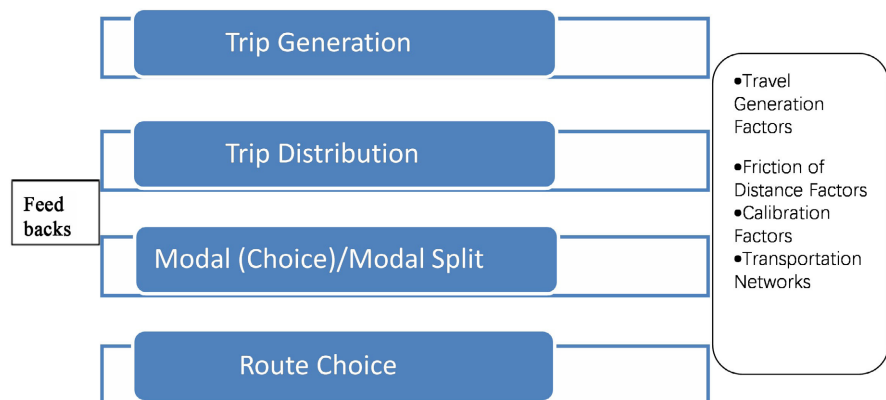
Source: Adapted from [36].

Figure 1. Model of transportation planning and modal choice.

Traditionally transportation planning divides travel behavior into four parts which represent basic elements in transportation planning based on the Four-Step Model as follows:

(1) Trip Generation is the first part of the model which deals with the number of trips undertaken by people using public or private transport within a given period of time.

(2) Trip Distribution which is the second in the model is concerned with the destination of the travelers for every trip undertaken. According to [37], there are a variety of reasons why one location is preferred over another. In general, traffic distribution is a function of population, socioeconomic characteristics, transportation facility type and extent, and land use pattern.

(3) Modal Choice (Modal Split), the third component of the model deals with the choice of transportation mode or alternative during a given trip. The third component of the model "modal choice" is the crux of this study.

(4) Route Choice, the fourth component of the model is concerned with the route that is utilized to arrive at the traveler's destination [38]. At least four factors influence people's decision to take one path over another. The factors are: the duration of travel, travel expenses, convenience and service level and travel time and prices which are the most commonly used considerations.

3. Research Methodology

A survey research design involving a multi-stage sampling technique of three stages was adopted in this study. In the first stage, Yenagoa metropolis was purposively selected due to gender preference for certain modes of transportation. In the second stage, all the 21 communities that make up Yenagoa metropolis were involved in this study. In the third stage, using convenient sampling, four hundred copies of structured questionnaires were randomly administered to users of public transport in parks within each selected community that make up the metropolis of Yenagoa.

3.1. Sample Size

The sample size for this study was statistically determined using the formula from [39]

$$n = N/(1 + N (e)^2)$$

where,

   N = Target Population

   n = Sample Size

   e = Margin of error (5%)

   Applying the Taro Yamane Formula

   $n = 175,076.85/1 + 175,076.85 (0.05)^2$

   $n = 175,976.85/(1 + 437.692125)$

   $n = 399.088199$

   $n = 400$

A sample size of 400 was determined statistically using Taro Yamane's formula, while 376 copies of the 400 structured questionnaires administered were retrieved (94.25%).

3.2. Measurement of Variables

In this study, travel modal choice is determined by measurable indicators/variables such as travel time, travel cost, travel distance, travel mode, trip purpose, age, gender, and income of commuters (Table 1).

Table 1. Description of variables utilized in this study.

| Variable	Description	Coding Scale
Age	The age of respondents	1 = <20 years, 2 = 21 - 30 years, 3 = 31 - 40 years, 4 = 41 - 50 years, 5 = 51 - 60 years, 6 = 61 - 70 years, 7 = >70 years

Continued

Gender (dummy)	The gender of respondents	1 = Female, 0 = otherwise
Income	The average monthly income of commuter's household	1 = <₦50,000, 2 = ₦50,001 - ₦100,000, 3 = ₦100,001 - ₦150,000, 4 = ₦150,001 - ₦200,000, 5 = >₦200,000
Ownership of Transport (dummy)	Respondents ownership of means of transportation	1 = Owned transport mode, 0 = otherwise
Travel Time	The time spent in travelling and commuting from places of origin to destination	1 = < 30 minutes 2 = 30 minutes - 1 hour 3 = >1 hour
Distance Travelled	Average distance travelled by the respondents to work, market, school, church etc.	1 = <1000meters (neighbourhood) 2 = 1 km - 2 km 3 = 2 km - 3 km 4 = >3 km away
Travel Cost	The amount spent/cost implications of traveling	1 = <₦5,000, 2 = ₦5,001 - ₦10,000, 3 = ₦10,001 - ₦15,000, 4 = ₦15,001 - ₦20,000, 5 = >₦20,000
Choice of Travel Mode	The preferred mode of transportation	1 = Bicycle, 2 = Motorcycle, 3 = Tricycle, 4 = Car, 5 = Bus, 6 = Canoe, 7 = Foot
Reasons for modal choice	Respondents' reasons for modal choice/preference	1 = Security and safety reasons 2 = Monetary and cost implications 3 = Quality and comfort reasons

Source: Authors' classification (2024).

3.3. The Study Area

Bayelsa State is located in south-southern Nigeria. It is bordered to the east by River State, to the north by Delta State and flanked by the Atlantic Ocean to the southern parts. The capital city, Yenagoa is located between latitudes 4˚55' and 5˚02' and longitude 6˚15' and 6˚25'. Yenagoa lies on a coastal plain with an average height of 15 metres above sea level [40] [41]. According to [42], the rapid increase in population over time has impacted the movement of persons and goods across the city of Yenagoa because the flow generated outweighs the road capacity, resulting in traffic congestion. The hostile ecological conditions limited the inhabitants to fishing which inhibited human settlement growth, and limited commercial agricultural practices and other economic activities (see Figure 2).
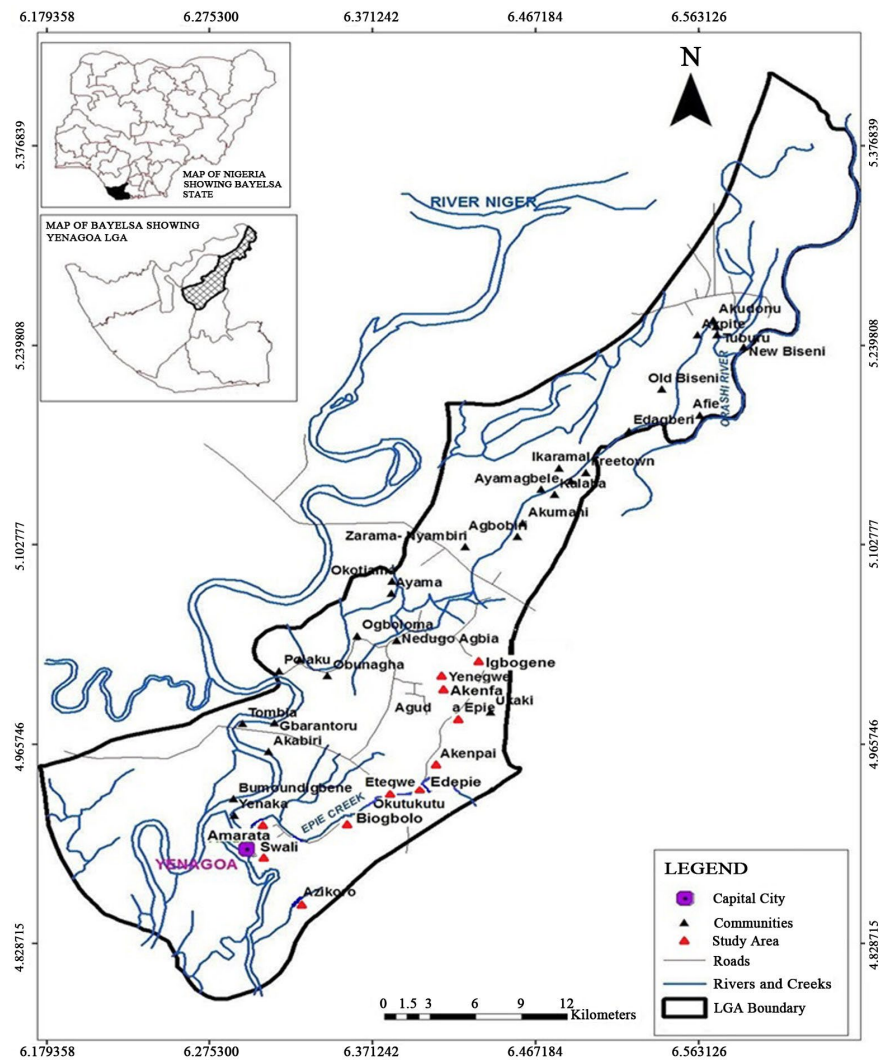
Source: Surveyor-General Office, Bayelsa State.

Figure 2. The study area.

4. Discussion of Results and Findings

4.1. Demographic Characteristics of Respondents

The age distribution of the respondents presented in Table 2 shows that males 10 (55.6%) and females 8 (44.4%) are less than 20 years, 44 (47.3%) males and 49(52.7%) females are between 21 - 30 years, 59 (52.7%) males and 53 (47.3%) females are between 31 - 40 years. Information on the average monthly income of the respondents reveals that 37 (54.5%) males and 31 (45.6%) females earned less than fifty thousand naira, while 40 (46.0%) males and 47 (54.0%) females earned between fifty-one thousand and one hundred thousand naira, 89 (58.9%) males and 62 (41.1%) females earned between one hundred thousand and one hundred and fifty thousand naira, followed by 30 (61.2%) males and 19 (38.8%) females earned between one hundred and fifty thousand and two hundred thousand naira.

Table 2. Demographic profile of respondents.

Age	Male	Female	Total
Less than 20 years	10	8	18
	55.60%	44.40%	100%
21 - 30 years	44	49	93
	47.30%	52.70%	100%
31 - 40 years	59	53	112
	52.70%	47.30%	100%
41 - 50 years	75	32	107
	70.10%	29.90%	100%
51 - 60 years	20	13	33
	60.60%	39.40%	100%
61 - 70 years	5	6	11
	45.50%	54.50%	100%
More than 70 years	1	1	2
	50.00%	50.00%	100%
Total	214	162	376
	56.90%	43.10%	100%
Estimated Income	Male	Female	Total
Below ₦50,000	37	31	68
	54.40%	45.60%	100%
₦50,001 - ₦100,000	40	47	87
	46.00%	54.00%	100%
₦ 100,001 - ₦150,000	89	62	151
	58.90%	41.10%	100%
₦ 150,001 - ₦200,000	30	19	49
	61.20%	38.80%	100%
More than ₦200,000	18	3	21
	85.70%	14.30%	100%
Total	214	162	376
	56.90%	43.10%	100%

Source: Authors' analysis (2024).

Information contained in Table 3 on the transport modes, amount spent in commuting from places of origin to destination reveal that 10 (76.9%) males and 03 (23.1%) females of the total respondents utilize bicycle as means of transportation, followed by 7 (58.3%) males and 5 (41.7%) females utilizes motorcycle, while a significant proportion 90 (53.9%) males and 77 (46.1%) females utilizes tricycle due to its flexibility characteristics, while 80 (63.0%) males and 47 (37.0%) females

utilize car/taxi, and 12 (46.2%) males and 14 (53.8%) females prefer to use mass transit buses. However, 14 (46.7%) males and 16 (53.3%) females in marshy and coastal locations utilize canoes and boats.

Table 3. Transport modes, amount and time spent.

Modes of transport	Male	Female	Total
Bicycle	10	3	13
	76.90%	23.10%	100%
Motorcycle	7	5	12
	58.30%	41.70%	100%
Tricycle	90	77	167
	53.90%	46.10%	100%
Car	80	47	127
	63.00%	37.00%	100%
Bus	12	14	26
	46.20%	53.80%	100%
Canoe	14	16	30
	46.70%	53.30%	100%
Foot	1	0	1
	100%	0.00%	100%
Total	214	162	376
	56.90%	43.10%	100%
Amount Spent (Cost ₦)	**Male**	**Female**	**Total**
No Response	57	46	103
	55.30%	44.70%	100%
Less than ₦5,000	90	75	165
	54.50%	45.50%	100%
₦5,001 - ₦10,000	36	21	57
	63.20%	36.80%	100%
₦10,001 - ₦15,000	13	6	19
	68.40%	31.60%	100%
More than ₦20,000	18	14	32
	56.20%	43.80%	100%
Total	214	162	376
	56.90%	43.10%	100%
Time Spent	**Male**	**Female**	**Total**
Less than 30 minutes	100	93	193
	51.80%	48.20%	100%
30 minutes to 1 hour	96	52	148
	64.90%	35.10%	100%
More than 1 hour	18	17	35
	51.40%	48.6	100%
Total	214	162	376
	56.90%	43.10%	100%

Source: Authors' analysis (2024).

The information on distance traveled and modal preference presented in Table 4 show that 40 (57.1%) males and 30 (42.5%) females travel less than one kilometer (<1000 m) within the neighbourhood, followed by 48 (56.1%) males and 36 (43.9%) females who travel between one kilometer to two kilometers (1 km - 2 km), while 50 (52.1%) males and 46 (47.9%) females travel between two kilometers and three kilometers (2 km - 3 km) and 79 (60.9%) males and 50 (39.1%) females travels more than three kilometers (>3 km). The reasons for the modal preferences among the respondents ranged from security and safety, transport cost to quality of service and comfort respectively.

Table 4. Distance traveled and reasons for modal preference.

Distance traveled	Male	Female	Total
<1,000 m	40	30	70
	57.10%	42.50%	100.00%
1 km - 2 km	48	36	82
	56.10%	43.90%	100.00%
2 km - 3 km	50	46	96
	52.10%	47.90%	100.00%
>3 km	79	50	128
	60.90%	39.10%	100.00%
Total	214	182	376
	56.90%	43.10%	100.00%
Reasons	Male	Female	Total
Security and Safety	118	80	198
	59.60%	40.40%	100.00%
Monetary and cost	24	16	40
	60.00%	40.00%	100.00%
Quality and comfort	72	66	138
	52.20%	47.80%	100.00%
Total	214	162	376
	58.90%	43.10%	100.00%

Source: Authors' analysis (2024).

4.2. Test of Hypotheses

Hypothesis One:

Ho$_1$: The hypothesis that gender modal preference is not influenced by the socio-demographic characteristics of the respondents in Yenagoa metropolis was tested using binary logistic regression analysis. According to [43], the logit model is a regularly adopted model for mode split.

Binary logistic regression analysis:

The dependent variable was encoded as 1 = Female and 0 = male.

The socio-demographic characteristics considered include: (x_1) = age of respondents, (x_2) = level of education, (x_3) = income, (x_4) = location of businesses, (x_5) = ownership of transport, (x_6) = means of transport, (x_7) = time spent, (x_8) =

amount spent, (x_9) = place of work and (x_{10}) = safety considerations.

The result of the logistic regression model in Table 5 using the exponential beta weight reveals that the following variables are more likely to influence gender modal choice: mode/means of transportation with a beta weight Exp(β) of 1.140, followed by safety consideration 1.139, ownership of transport 1.135 and distance to place of work 1.073. This implies that gender modal preference is influenced by mode of transportation, safety considerations, ownership of transport and distance to the place of work in Yenagoa metropolis.

Table 5. Logistic regression model.

Variables	B	S.E	Wald	df	Sig.	Exp(β)
Age	−0.161	0.106	2.299	1	0.129	0.851
Education	−0.161	0.164	0.962	1	0.327	0.852
Income	−0.227	0.124	3.359	1	0.067	0.797
Location of Businesses	−0.018	0.013	1.973	1	0.160	0.982
Ownership of transport	0.127	0.099	1.630	1	0.202	1.135
Means of transport	0.131	0.109	1.430	1	0.232	1.140
Time spent	−0.145	0.173	0.710	1	0.400	0.865
Amount spent	−0.037	0.097	0.144	1	0.704	0.964
Place of work	0.070	0.106	0.439	1	0.508	1.073
Safety Reasons	0.130	0.116	1.246	1	0.264	1.139
Constant	0.476	0.845	0.318	1	0.573	1.610

a. Variable(s) entered on step 1: Age, Education, Income, location of business, means of transport, time spent, amount spent, place of work, safety reasons. Source: Authors' analysis (2024).

Hypothesis Two:

The hypothesis that there is no significant difference in the gender modal preference of respondents in Yenagoa metropolis was tested using Chi-square statistical test. The result reveals that the calculated Chi-square value of 7.937 is less than the table value of 12.952 at 0.05 level of significance and degree of freedom 6. Hence, the null hypothesis is accepted, which implies that there is no significant difference in gender modal choice or preference in Yenagoa metropolis at 0.05 level (see Table 6).

Table 6. Chi-square test of gender and modes of transportation.

	Value	Df	Asymp. Sig (2-sided)
Pearson Chi-Square	7.937	6	0.243
Likelihood Ratio	8.458	6	0.206
Linear by Linear	1.083	1	0.298
Number of Valid Cases	376		

Source: Authors' analysis (2024).

4.3. Reliability Statistics

The result of reliability test in Table 7 using the Cronbach's alpha index revealed a reliability index of 0.534 which implies that the questionnaire items utilized in this study are 53.4% reliable.

Table 7. Reliability statistics.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	Items
0.534	0.506	9

Source: Authors' analysis (2024).

5. Conclusion

This study examined gender differences in modal choice among residents of the Yenagoa metropolis. According to [8], gender studies on modal choices are particularly important in understanding the modal choices of family members. An understanding of gender differences in modal choice for sustainable transport planning is vital and relevant for efficient transport management. [7] observed that commuting mode choices play a significant role in efficient transportation and have a long-term impact on traffic, emissions, and delays. The results of logistic regression on gender modal preference revealed that gender modal preference is influenced by mode of transportation, safety considerations, ownership of transport and distance from places of origin to destination (work, school, market, etc.), while the differences in gender modal preference tested using Chi-square revealed that there is no significant difference in gender modal choice in Yenagoa metropolis at 0.05 level.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] De Witte, A., Hollevoet, J., Dobruszkes, F., Hubert, M. and Macharis, C. (2013) Linking Modal Choice to Motility: A Comprehensive Review. *Transportation Research Part A*: *Policy and Practice*, **49**, 329-341. https://doi.org/10.1016/j.tra.2013.01.009

[2] Munshi, T. (2016) Built Environment and Mode Choice Relationship for Commute Travel in the City of Rajkot, India. *Transportation Research Part D*: *Transport and Environment*, **44**, 239-253. https://doi.org/10.1016/j.trd.2015.12.005

[3] Babinard, J. and Scott, K. (2009) What Do Existing Household Surveys Tell Us about Gender and Transportation in Developing Countries? *Conference on Research on Women's Issues in Transportation*, Chicago, 27-30 October 2009, 213-224.

[4] Pourhashem, G., Malichová, E., Piscová, T. and Kováčiková, T. (2022) Gender Difference in Perception of Value of Travel Time and Travel Mode Choice Behavior in Eight European Countries. *Sustainability*, **14**, Article No. 10426. https://doi.org/10.3390/su141610426

[5] Hägerstraand, T. (1970) What about People in Regional Science? *Papers in Regional*

Science, **24**, 7-21. https://doi.org/10.1111/j.1435-5597.1970.tb01464.x

[6] Ghebremeskel, F. and Mehreteab, H.T. (2022) Choice of Transport Mode by Residents of the City of Asmara-Eritrea. *Journal of Management and Economic Studies*, **4**, 146-156. https://doi.org/10.26677/tr1010.2022.1019

[7] Schwanen, T., Dijst, M. and Dieleman, F.M. (2001) Leisure Trips of Senior Citizens: Determinants of Modal Choice. *Tijdschrift voor Economische en Sociale Geografie*, **92**, 347-360. https://doi.org/10.1111/1467-9663.00161

[8] Tembe, A. and Matusse, A. (2020) Commuting Trips, Income and Gender in the Metropolitan Maputo, Mozambique. *Current Urban Studies*, **8**, 563-575. https://doi.org/10.4236/cus.2020.84031

[9] Law, R. (1999) Beyond "Women and Transport": Towards New Geographies of Gender and Daily Mobility. *Progress in Human Geography*, **23**, 567-588. https://doi.org/10.1191/030913299666161864

[10] Bergström, A. (1999) Cyklingvintertid, VTI meddelande 861, Linköping.

[11] Cervero, R. (2002) Built Environments and Mode Choice: Toward a Normative Framework. *Transportation Research Part D: Transport and Environment*, **7**, 265-284. https://doi.org/10.1016/s1361-9209(01)00024-4

[12] Giuliano, G. (2003) Travel, Location and Race/Ethnicity. *Transportation Research Part A: Policy and Practice*, **37**, 351-372. https://doi.org/10.1016/s0965-8564(02)00020-4

[13] Handy, S., Cao, X. and Mokhtarian, P. (2005) Correlation or Causality between the Built Environment and Travel Behavior? Evidence from Northern California. *Transportation Research Part D: Transport and Environment*, **10**, 427-444. https://doi.org/10.1016/j.trd.2005.05.002

[14] Dora, C., Phillips, M. and Organization, W.H. (2000) Transport, Environment and Health/Edited by Dora Carlos and Phillips Margaret. WHO Regional Office for Europe.

[15] Law, R. (2002) Gender and Daily Mobility in a New Zealand City, 1920-1960. *Social & Cultural Geography*, **3**, 425-445. https://doi.org/10.1080/1464936021000032441

[16] Peters, D. (2011) Gender and Sustainable Urban Mobility. Thematic Study Prepared for Global Report on Human Settlements 2013.

[17] Alessandretti, L., Aslak, U. and Lehmann, S. (2020) The Scales of Human Mobility. *Nature*, **587**, 402-407. https://doi.org/10.1038/s41586-020-2909-1

[18] Ravensbergen, L., Buliung, R. and Laliberté, N. (2019) Toward Feminist Geographies of Cycling. *Geography Compass*, **13**, e12461. https://doi.org/10.1111/gec3.12461

[19] Goel, R., Goodman, A., Aldred, R., Nakamura, R., Tatah, L., Garcia, L., Zapa-ta-Diomedi, B., De Sa, T., Tiwari, G., de Nazelle, A., Tainio, M., Buehler, R., Gotschi, T. and Woodcock, J. (2021) Cycling Behavior in 17 Countries across 6 Continents: Levels of Cycling, Who Cycles, for What Purpose, and How Far? *Transport Reviews*, **42**, 58-81.

[20] Phadke, S. (2013) Unfriendly Bodies, Hostile Cities: Reflections on Loitering and Gendered Public Space. *Economic and Political Weekly*, **48**, 50-59.

[21] Iqbal, S., Woodcock, A. and Osmond, J. (2020) The Effects of Gender Transport Poverty in Karachi. *Journal of Transport Geography*, **84**, Article ID: 102677. https://doi.org/10.1016/j.jtrangeo.2020.102677

[22] Gómes, L. (1997) Schedules for Lima Public Transportation. Cited in GTZ (2007), Gender and Urban Transport: Smart and Affordable. Sustainable Transport: A Sourcebook for Policy Makers in Developing Cities.

https://changing-transport.org/wp-content/uploads/2007_dalkmann_branni-gan_transportandclimatechange.pdf

[23] GTZ (2007) Gender and Urban Transport: Smart and Affordable. Sustainable Transport: A Sourcebook for Policy Makers in Developing Cities. https://changing-transport.org/wp-content/uploads/2007_dalkmann_branni-gan_transportandclimatechange.pdf

[24] Lucas, K. (2011) Making the Connections between Transport Disadvantage and the Social Exclusion of Low Income Populations in the Tshwane Region of South Africa. *Journal of Transport Geography*, **19**, 1320-1334. https://doi.org/10.1016/j.jtrangeo.2011.02.007

[25] Transportation Research Board (2004) Research on Women's Issues in Transportation. *Research on Women's Issues in Transportation: Report of a Conference*, Chicago, 18-20 November 2004, 65 p. https://doi.org/10.17226/23274

[26] Nobis, C. and Lenz, B. (2004) Changes in Transport Behavior by Fragmentation of Activities. *Transportation Research Record: Journal of the Transportation Research Board*, **1894**, 249-257. https://doi.org/10.3141/1894-26

[27] Duchesne, R. (2011) The Uniqueness of Western Civilization. Vol. 28, Brill. https://doi.org/10.1163/ej.9789004192485.i-527

[28] Matthies, E., Kuhn, S. and Klöckner, C.A. (2002) Travel Mode Choice of Women: The Result of Limitation, Ecological Norm, or Weak Habit? *Environment and Behavior*, **34**, 163-177. https://doi.org/10.1177/0013916502034002001

[29] McGuckin, N. (2004) Differences in Trip Chaining by Men and Women: Research on Woman's Issues in Transportation. *Proceedings of the Transportation Research Board of the National Academies*, Chicago, November 2004, 49-55.

[30] Yang, M., Li, D., Wang, W., Zhao, J. and Chen, X. (2013) Modeling Gender-Based Differences in Mode Choice Considering Time-Use Pattern: Analysis of Bicycle, Public Transit, and Car Use in Suzhou, China. *Advances in Mechanical Engineering*, **5**. https://doi.org/10.1155/2013/706918

[31] Krizek, K.J. and Johnson, P.J. (2004) Gender Differences in Bicycling Behavior and Facility Preferences: Research on Women's Issues in Transportation. *Proceedings of the Transportation Research Board of the National Academies*, Chicago, November 2004, 31-40.

[32] Diaz, M. (1989) Movilidadfemenina en la ciudad. Notas a partir de uncaso. Documents d'analisigeográfica, Vol. 14, 219-239.

[33] Monzón, A., Valdés, C. and Xue, G. (2008) La Movilidad en la Comunidad de Madrid. Diferenciassegún género? Congreso de ingenieríadeltransporte. Coruña (A).

[34] Vega, P. and Roman, M. (2011) Patrones Movilidad Transporte Público Andalucía. Sevilla: Consejería de Obras Públicasy Vivienda. Dirección General de Transportes.

[35] Sánchez, M.I.O. and González, E.M. (2013) Diferencias de género en la movilidad en regiones urbanas de Andalucia. *Revista Latino-Americana de Geografia e Genero*, **4**, 13-28. https://doi.org/10.5212/rlagg.v.4.i2.013028

[36] Metropolitan Washington Council of Governments (2019) The Four Step Model. https://www.mwcog.org/transportation/data-and-tools/modeling/four-step-model/

[37] Heyns, W. and Van Jaarsveld, S. (2017) Transportation Modelling in Practice: Connecting Basic Theory to Practice. In: *WIT Transactions on State-of-the-Art in Science and Engineering*, WIT Press, 3-27.

[38] Vafeiadis, E. (2012) An Interdisciplinary Study of Transport Mode Choice. Unpublished Thesis, Aalborg University.

[39] Yamane, T. (1967) Statistics: An Introductory Analysis. 2nd Edition, Harper, and Row.

[40] Ohwo, O. (2014) Housing Quality in Yenagoa, Bayelsa State, Nigeria. *Nigeria Geographical Journal*, **10**, 53-67.

[41] Gunn, E.O. and Ohwo, O. (2022) Analysis of Traffic Flow and Management Strategies in Yenagoa, Nigeria. *Wilberforce Journal of the Social Sciences*, **7**, 48-66. https://doi.org/10.36108/wjss/2202.70.0140

[42] Idhoko, K.E., Ndiwari, E.L., Ogeh, V.C. and Ikegbulam, S.C. (2016) Urban Road Network Analysis of Yenagoa, Bayelsa State Using GIS. *International Journal of Advanced Trends in Computer Science and Engineering*, **5**, 1-12.

[43] Ahmed, B. (2012) The Traditional Four Steps Transportation Modeling Using Simplified Transport Network: A Case Study of Dhaka City (Bangladesh). Volume 1, Article 3.