Public transportation in metropolitan Lagos, Nigeria: analysis of public transport users’ socioeconomic characteristics

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1. Introduction

Public transport refers to the means by which larger proportions of urban dwellers gain physical access to the goods, services, and activities they need for their livelihoods and well-being (Fitzgerald, 2012). Public transportation therefore plays a very important role in both the developed and developing world cities. It serves to reduce reliance on private car-ownership by providing an affordable alternative for urban commuters. Demand for public transport service is a direct consequence of the quality of urban living environment, and household, community, and social networks. It is therefore important to understand the characteristics of the public transport demand of the constituting households. Without a good understanding of the nature of the public transport users, it would be difficult to make usable demand forecasts, which is fundamental for public transport service planning and operation as well as policy formulation (Polat, 2007; Taylor & Fink, 2012). Demand for

ABSTRACT
This paper presents the findings of the study of socioeconomic characteristics of the users in metropolitan Lagos. Specifically, it provides detailed analysis of the public transport users, disaggregated by gender, marital status, age, education level, employment, income, auto-ownership and household size, with a view to engender the identification of groups of passengers who exhibit similar behaviours. The identification of these groups can help establish regular patterns in the way passengers use public transit and characterize the demand accordingly. The average user was male (60.3%), aged 32.9 ± 0.289 years, with an average income of N57,140.55 ± 1,446.86 and household size of 4.92 ± 0.052 persons, having acquired 12.84 ± 0.119 years of formal education, traveling 25.479 ± 0.4307 kilometres daily in 110.29 ± 3.318 minutes on public transport on an average cost of N712.83 ± 29.749. The paper concludes that without a clear understanding of these patterns, it would be difficult to make accurate demand forecast, necessary for service planning and policy formulation.

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travel is basically a reflection of the commuters. These characteristics include the gender, age, marital status, level of education, employment status and types, income and household size among others. These factors affect demand (Tsai, Mulley, & Clifton, 2012).

Understanding the passengers’ characteristics can be useful in a variety of applications. It can be used to calibrate the performance of the public transport network, and forecast more accurately the levels of demand, make adjustment in the level of service delivery and accommodate variations in ridership across weekdays and seasons (El Mahrsi, Come, Baro, & Oukhellou, 2014). At city-wide level understanding, the socioeconomic characteristics of commuters can prove very valuable in evaluating public transport accessibility level and in detecting whether particular groups are underserved (El Mahrsi et al., 2014). Passengers’ travel habits relate directly to their socioeconomic characteristics.

Modeling public transport patronage requires an understanding of the socioeconomic characteristics of the users and their travel demand requirements. Many past studies have established the critical importance of socioeconomic characteristics of the users in the construction of public transport models (Adedayo, Amure, Adeaga, & Omenai, 2014; Atasoy, Glerum, Hurtubia, & Bierlaire, 2010; Aworemi, Salami, Adewoye, & Ilori, 2008; Ortuzar & Willumsen, 2011; Taylor & Fink, 2012).

2. Characteristics of the study area

Metropolitan Lagos, located within latitudes 6°23′N and 6°41′N and longitude 3°9′E and 3°28′E, in Lagos State, southwestern Nigeria is made up of the 16 urban local government areas. Metropolitan Lagos has much higher population density than any other city in Nigeria with an average density of 2400 persons/km² and an annual population growth rate of over 5% (Odeleye, 2011). The population of the Lagos urban agglomeration grew from 10.3 million in 1995 to about 10.9 million in 1996 and to 9 million by the 2006 census figure. The city of Lagos was expected to hit the 24.5 million population mark and thus be among the ten most populous cities in the world by the year 2015 (Lagos State Government, 2002).

Estimates of transport demand in metropolitan Lagos in 1990 ranged from 7 million to 10 million passenger trips daily, of which over 95% were undertaken by road, primarily by private cars, buses and taxis, and commercial motorcycles. Of these, between 80% and 85% were made by public transport (Opeifa, 2012). Lagos has one of the most extensive road networks in the West Africa subregion, supported by suburban train and ferry services. A modern rail system spanning the length of the Badagry Expressway is currently under construction. The Lagos–Ibadan Expressway and the Lagos–Abeokuta Expressway are major corridor highways in the north of the city serving as the interstate highways to Oyo and Ogun States, respectively, while the Lagos–Badagry Expressway serves outlying towns to the west of Lagos.

3. Literature Review

The literature is on the socioeconomics characteristics of public transport users and the need to understand them as major determinants of public transport demand (Adedayo et al., 2014; Aworemi et al., 2008; Ortuzar & Willumsen, 2011; Pucher & Renne, 2003; Taylor & Fink, 2012). These authors identified the existence of high correlations between trip generation
and such variables as auto-ownership, residential density, household income, household size and structure, employment status, and type and gender among others.

Transport demand is derived from the need by urban dwellers to reach activities and access opportunities that are not available at their trip origin (Scottish Executive, 2000). According to Rodrigue, Comtois, and Slack (2008), the demand is generated by the economy, which is composed of persons, institutions, and industries and which stimulates movements of people and freight. When these movements are expressed in space, they create a pattern, which reflects mobility and accessibility. Naess, Anderson, Nicolaisen, and Strand (2014) observed that forecasting the demand for public transport plays a major role in transport policy formulation, planning and engineering.

Specifically, Badoe and Miller (2000) noted the existence of a more direct relationship “between employment density and transit service supply.”

Using these variables to predict travel demand requires a considerable level of disaggregation and separately evaluating accessibility for different trip purposes, modes of transport, income levels, gender, age, occupational groups, and types of activity (Ben-Akiva & Lerman, 1979; Handy & Niemeier, 1997; Kwan, 1998; Wachs & Kumagai, 1973). This approach enhances the possibility of determining the differences in accessibility between income levels and access to opportunities, evaluating the conditions of access to systems for disabled people, and generating analysis of accessibility to certain transport system.

The factors influencing the choice of mode include among others the characteristics of the trip maker which include car availability and/or ownership, possession of a driving license, household structure, income, and residential density (Ortuzar & Willumsen, 2011). Spillar and Rutherford (1988) found that public transport use per person grows with increasing density up to a ceiling of somewhere between 20 and 30 people per acre and 0.1 to 0.2 daily per capita public transport trips. They concluded that the finding do not suggest that as density increases, total public transport ridership reaches a maximum. Rather, total public transport usage will increase as density increases because greater numbers of people have access to public transport. These findings indicate that individual personal public transport usage characteristics increase to a maximum point.

The purpose of transport planning and management is to match transportation supply with travel demand. Venigalla, Miller, & Chatterjee, 1995 found that a good understanding of existing travel pattern is, therefore, a basic requirement for the analysis of existing transport-related problems. The Institution of Highways and Transportation and Department of Transport (1987) emphasized that estimating the demand for the various travel modes remains a critically vital part of the transport planning process as both the existing and future travel demands will have a major influence on transport policies and the provision of transport facilities.

4. Methods

The survey research design method was adopted for this study. Using the multistage sampling technique, the 16 local government areas constituting the metropolitan Lagos were classified as low-, medium-, and high-density wards, and 25% of the wards were selected using the stratified random sampling technique. Residential buildings in the selected wards were listed using a base map, and buildings were randomly selected also using stratified sampling technique. One thousand four hundred and seventy-five households were randomly
surveyed in the selected buildings through a questionnaire survey, designed to collect data on the respondents’ socioeconomic characteristics which include gender, marital status, age, level of literacy, employment status and type, income level, work place, household size, and access to telecommunication facilities. 91.6% (1351) of the sampled households were found to use public transport.

5. Findings

5.1. Socioeconomic characteristics of public transport users

The socioeconomic characteristics of the public transport users in metropolitan Lagos were presented under two headings, i.e., the socioeconomic characteristics and the household characteristics of the commuters.

5.2. Analysis of socioeconomic characteristics

The socioeconomic characteristics include the age, gender, marital status, level of education, employment status and types, location of place of work, and household monthly income, while the household characteristics include residential density, household size, access to telecommunications facilities, and auto-ownership.

Table 1 shows the summary and the descriptive statistics of the numeric data on the socioeconomic variables, while Table 2 presents the socioeconomic characteristics of the respondents. The table shows that over 70% of the respondents are within the working age group of between 25 and 65 years. This shows that a larger proportion of public transport users fall with the working class. The male respondents are dominant (60.3%) because they are the gender that is more mobile in urban areas; hence they use the public transport more. Married respondents are about 54%. The table also revealed that over 81% of respondents have secondary school education or higher, presently a highly literate population. Almost 73.3% of respondents are employed either in the formal or the informal sectors, 28.7% of them in the trading and commerce employment sector, while 18.3% are in civil service. This observation meant that traders and civil servants constituted the larger proportion of the users of the public transport system representing an average of 47% in the entire metropolitan Lagos employment force.

5.3. Analysis of household characteristics

Table 3 presents the structure of household characteristics of the respondents. Average monthly household income data shows that more than 11% earn below the minimum wage
of $90. On the whole, more than 40% earn less than $300 per month. Household size is a critical index in urban economic analysis. This is also an important variable in the determination of population and neighborhood planning requirements. Data on household size within the study area showed that majority of the households had between 4 and 6 persons. About 62% of the entire households fell into this range. Generally, the households with average household size of 5 constituted the largest patrons of public transport in the study area.

Households’ access to the various telecommunications facilities showed that households’ access to radio sets, mobile phones, and television sets was very high. The most popular possession of the households was the mobile phone as 96.8% of the households had access to the facility in the study areas. Access to internet was at 46.7%. The survey showed greater proportions of the patrons of public transport in metropolitan Lagos had access to radio sets, mobile phones, and television sets. Auto-ownership data shows that 51.5% of the households have no cars, while 26.4% have only one car.

Table 2. Descriptive statistics of socioeconomic characteristics.

| Characteristics | Description of category | Distribution (%) |
|-----------------|-------------------------|-----------------|
| Age group       | 15–24 years             | 22.7            |
|                 | 25–34 years             | 38.5            |
|                 | 35–44 years             | 24.3            |
|                 | 45–54 years             | 10.2            |
|                 | 55–64 years             | 3.2             |
|                 | >65 years               | 0.4             |
| Gender          | Male                    | 60.3            |
|                 | Female                  | 39.7            |
| Marital status  | Never married           | 38.4            |
|                 | Married                 | 53.8            |
|                 | Divorced                | 1.7             |
|                 | Separated               | 1.8             |
|                 | Widowed                 | 2.5             |
| Educational level | None                   | 3.3             |
|                 | Primary education       | 5.6             |
|                 | Junior sec/modern school| 5.6             |
|                 | Senior sec/secondary/TTC | 32.6          |
|                 | National diploma/NCE    | 21.2            |
|                 | University degree/HND    | 27.5            |
|                 | Others                  | 3.3             |
| Employment status | Formal employment       | 36.9            |
|                 | Informal employment     | 36.4            |
|                 | Retired                 | 2.9             |
|                 | Schooling/apprenticeship| 16.5            |
|                 | Unemployed              | 5.8             |
| Employment type | Trading and commerce    | 28.7            |
|                 | Civil service           | 18.3            |
|                 | Farming                 | 0.9             |
|                 | Artisans                | 7.9             |
|                 | Schooling               | 15.4            |
|                 | Retired                 | 2.4             |
|                 | Unemployed              | 6.3             |
|                 | Industrial work         | 8.3             |
|                 | Others                  | 7.0             |

Source: Field Survey (2012).
6. Discussion

Public transport plays a critical role in assuring the mobility of a larger proportion of households in the largest, densest cities of the world. In a metropolitan area as Lagos, with a population of over 20 million people, about 80% of its total daily passenger trips were made by public transport. Commuters in Lagos have been relying increasingly on the car for all their travel purposes, not just for the journey-to-work. More than 75% of the public transport users were found to be within the active working age bracket of between 25 and 65 years, majority (60%) of which are males. Corresponding to that increased reliance on the public transport, auto-ownership is low with 52% of the households owning no vehicle, and 26% of households just one car vehicles. While these aggregate statistics confirm the extreme low auto dependence of metropolitan Lagos, they mask important variations by density areas of the city and among socioeconomic groups. There are important differences in travel behavior by income, age, and gender among others. Auto-ownership, mobility rates, means of transport, trip distance, trip purpose and time of day of travel vary from one group to another. Such differences can be crucial in designing equitable transport policies at all government levels.

### Table 3. Household characteristics.

| Household income/month | Frequency | Percentage |
|------------------------|-----------|------------|
| <$100                  | 157       | 11.6       |
| $100–$200              | 209       | 15.5       |
| $200–$300              | 181       | 13.4       |
| $300–$400              | 126       | 9.3        |
| $400–$500              | 82        | 6.1        |
| >$500                  | 106       | 7.8        |
| Don’t know             | 155       | 11.5       |

- **Household size**
  - 1–2 persons: 275 (20.4%)
  - 4–6 persons: 837 (62.0%)
  - 7–9 persons: 208 (15.4%)
  - More than 9 persons: 13 (1.0%)

- **Access to telecommunications facilities**
  - Access to radio set: 1150 (85.1%)
  - Access to mobile phone: 1308 (96.8%)
  - Access to land phone: 284 (21.0%)
  - Access to computer: 631 (46.7%)
  - Access to television: 1280 (94.7%)
  - Access to cable television: 630 (46.6%)
  - Access to facsimile (fax): 35 (2.6%)

- **Number of vehicles in household**
  - 0: 696 (51.5%)
  - 1: 356 (26.4%)
  - 2: 143 (10.6%)
  - 3–4: 92 (6.8%)
  - More than 4: 29 (2.2%)

Source: Field Survey (2012).
7. Conclusion

The main purpose of this research was to provide information on the socioeconomic characteristics of the urban commuters in metropolitan Lagos. Examining current and projected socioeconomic data in a city is an important step in determining present and future transportation requirements. Socioeconomic characteristics, such as population, size, number of households, and employment, are key variables that aid in understanding the traveling habits of the city’s population. The aim here was to discover groups of passengers who exhibit similar behaviors from a purely temporal standpoint (i.e., passengers taking public transportation at the same times without accounting for the boarding locations). Intuitively, the discovery of these groups can help identify frequent patterns in the way passengers use public transit and characterize the public transport demand accordingly. Also it is hoped that the clear understanding of commuters’ socioeconomic may be used to construct temporal passengers’ profiles with a view to applying a generative model-based clustering approach to public transport management to discover groups or clusters of passengers who behave similarly. This may go a long way in public transport policy formulation and planning and scheduling of service.

Disclosure statement

No potential conflict of interest was reported by the author.

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