MODAL CHOICE FOR JOURNEY TO WORK IN ILORIN, NIGERIA

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Abstract

The study examined the modal choice for the journey to work in Ilorin, Kwara State, Nigeria with a view to discern the pattern. Journey to work when unidirectional leads to a high congestion problem. This creates a great concern for urban transport planners. Most of the movements made in cities are dominated by journey to and from work leading to congestion problems in the two peak periods of morning and evening. Thus a study of modal choice of the people for journeys to work places is necessary in order to proffer workable solution to urban transport problems. The study used data collected from the traditional wards in the city through the administration of 640 questionnaires in a home interview survey using systematic sampling procedure. The study found that the journey to work in Ilorin were distributed between taxi cabs (37.5%); private cars (30.2%); motorcycles (13.6%) while trekking, public bus services and staff buses provided 18.7%.. Multiple regression method was then used to determine the pattern of journey to work in Ilorin. The results showed that the form of transport and the time taken for journey to work are significant variables in the explanation of journey to work pattern in Ilorin. The study recommended that in order to ease the transportation problem of the inhabitants of Ilorin, intra-urban mass transit services should be provided.

Key words: Transport Modes, Mass Transit, Modal Choice, Private Transport, Public Transport

Introduction

The mode-choice decision implies which type of transport to use to make a trip. The choice of a particular mode of travel in urban areas is neither a static nor a random process. It is influenced either singly or collectively by many factors such as speed, journey length, comfort, convenience, cost, and reliability of alternative mode, the availability of specific travel modes, town size, age, composition and the socio-economic status of the persons making the journey (Hanson, 1980).

Journey to work constitutes one of the most common movement patterns in cities. It involves large number of people, it requires very expensive transport facilities (roads, public transport, car parks) and it poses some difficult problems to the urban transport planners (See Tolley and Turton, 1995). Most of all the movements made in cities are dominated by journey to and from work leading to congestion problems in the two peak periods of morning and evening. An important issue that is often raised in the study of journey to work is what mode is preferably used by most employees. Mode choices available in cities exert a very strong influence upon journey to work. Choice has to be made by employees in terms of transport modes, either private or public to be used before undertaking the journey to work. Different choices made by workers regarding transport modes are greatly influenced by some non-transport factors such as income status, occupational status, sex, age, car ownership, accessibility to public transport and distance among others.

The contribution of modal choice to the economic development of any urbanized area cannot be underestimated. Transport provision is seen as a major factor in economic development. Areas with limited modal choices tend to be among the least developed. Indeed, the developed world possesses a wide range of modes that can provide services to meet the needs of society and the economy.

A major problem in developing countries is the concentration of employment in the city centres. In cases where employment is spatially spread, the road network is poorly designed and planned in such a way that nearly all movements pass through the city centre to reach work locations. Thus, journeys to work are often unidirectional or centripetal leading to traffic congestion. Another related issue is the inefficiency and inadequacy of transport modes which results in overdependence on roads for all intra-urban movements dominated by journey to work. Also, the urban poor, who form the greatest number of employees, depend on the same mode of transport for their journey to work. In cases where jobs are located in the peripheral areas of the city, which are far distant from the inner core where the majority of the urban poor are forced to live due to their low income status, they are often faced with mobility and accessibility problem.

The technological advancement in the twenty-first century has brought drastic changes to transport. In the process of searching for appropriate urban transport planning procedure, details of modal choice for the journeys made to workplaces, form a significant component in transportation studies. In addition, consideration has to be given to transport modes in tackling environmental externalities linked to transportation. Thus a study on modal choice of the people for their journeys to workplaces is necessary in order to determine any inadequacy or dearth in terms of modes available and to proffer workable solution that will promote rapid economic development.

Mode-Choice in Urban Transportation

Mode in transport can be defined as the physical way a movement is performed. Transport modes posses key operational and commercial advantages and properties. They can also complement each other in terms of costs, speed, reliability, frequency, safety, and comfort with cost standing out as the most important consideration in the choice of mode (Rodrigue *et al*, 2006). The selection of a specific transport mode for a particular trip purpose depends upon a range of factors including the range of modes available, their relative cost, safety factors and convenience (Hoyle and Knowles, 1998). The journey to work is one of the most commonly experienced forms of everyday travel, encompassing almost all transport modes, and making a substantial contribution to urban traffic congestion (Cervero *et al.*, 2003; Kingham *et al.*, 2001). Also, Salter (1974) opined that trips may be by differing methods or mode of travels and that the determination of the choice of travel mode is known as modal split.

There is a strong relationship between the purpose of a trip, its frequency, timing, length, characteristics of participants and the choice of mode to use. Also, access to particular modes is frequently limited by income (Tolley and Turton, 1995) and the most suitable mode for one trip may not necessarily be the best for the other. In particular, journey to work is one of the most common personal movement patterns and has been studied in detail (See Atubi *et al.,* 2004; Atubi, 2008; De Palma *et al.,* 2000; Blumenberg *et al,* 2003; Suthanaya, 2011; McKibbin, 2011). It involves large number of people, requires substantial investment in transport facilities and

presents some of the most intractable problems to the urban transport planner. In many urban centres, up to 20 percent of all trips are to and from work and these are primarily responsible for the congestion in the two daily peak travel periods (Tolley and Turton, 1995).

Schaeffer and Sclar (1975) have devised a three-fold trip classification based upon journey purpose and to a lesser extent, their frequency. These are extrinsic trips, intrinsic trips and transport generated trips. Extrinsic trips are those made to fulfill a definite objective such as journeys from home or another origin to the workplace, retail centres or a restaurant or club. Walking, cycling or motoring trips carried out in connection with recreational or leisure activities where no real purpose can be identified are described as intrinsic trips. Transport generated trips comprise of such trips as car journeys to filling stations and repair garages and train and bus trips to depots during off-peak periods in conurbations.

Hurst (1974) also proposed a three-fold division of trips which he defined as 'movement space' based upon the type and length of trip. Most trips made within a 'core area' such as a major conurbation where travel to work accounts for a large proportion of all journeys fall into this category. For example in the UK, 45 percent of all journeys are less than 4km in length and 80% of all trips of less than 1.6km are made on foot in highly urbanized states. The second category called 'median area' encompasses less frequently performed journeys including business and social trips and the third category called 'extensive area' is defined as the total spatial extent within which people travel and interact.

Comparison has also been made between private transportation and public transportation in urban transport studies. Private transportation is using one's own vehicle like car, motorcycle or bicycle and even walking. Public transportation on the other hand is passenger transportation services usually local in scope available to any person who pays a prescribed fare. It operates on established schedules along designated routes or lines with specific stops and is designed to move relatively large number of people at one time. Public transport includes modes such as tramways, buses, trains, subways and ferryboats and its efficiency is based upon transporting large numbers of people and achievement of economies of scale. Public transport has a major role to play in most motorized societies as it serves the purpose of collective transportation and accessible mobility over specific areas.

Many scholars from both developed and developing countries have worked on the modal choice for journeys to work. Atubi (2008) used gravity model to determine the relationship or interaction between residential areas in Warri, Nigeria. He found that as transport cost increases the number of trips with respect to residential areas decreased. De Palma and Rochat (2000) investigated the mode choice for trips in the city of Geneva using nested logic approach. They focused on the joint nature of the decision of how many cars to own in the household and the precision to use the car for the trip to work. Their findings suggest that travel time and travel cost play a key role in mode split choice between car and transit. McKibbin (2011) used regression method to determine the influence of the built environment on mode choice in Sydney. The study revealed that the built environment variables that influenced mode-share to the greatest extent were destination, accessibility, density, land use diversity and distance to transit.
In the work of Abane (1993), carried out in Accra Ghana, it has been found that formal sector employees on slightly higher incomes are more demanding of public transport services but that,

overall, modal choice was determined more by personal factors such as age, sex and income than by characteristics of the transport. Studies in the Philippines and Indonesia demonstrate a positive relationship between expenditure on transport and household income (Ocamps, 1982). Studies in Indian cities by Maunder *et al* (1981) also revealed a similar income-related modal split with variations dependent largely on the extent to which public transport was available.

Materials and Methods

The data used for this study comprised of the number of people using the different modes to work in the study area, the number of sampled households owning cars and the number who are non-car owning, determination of the factors affecting modal choice; socio-economic characteristics of the sampled households; characteristics of the transportation system used in the study area. These were obtained through both primary and secondary sources in the 20 wards of Ilorin City.

The wards in the study area as shown on fig. 1.0 are Adewole, Baboko, Balogun Ajikobi, Balogun Alanamu, Balogun Fulani, Balogun Gambari, Magaji Ogidi, Magaji Oloje, Magaji Are, Magaji Badari, Magaji Geri, Magaji Ibogun, Magaji Ojuekun, Magaji Okaka, Magaji Zarumi, Oke-Ogun, Sabon-gari 1, Sabon-gari 2, Uban Dawaki, Zango.

The data used were sourced from the conventional home interview survey. The residential land use were used as the basis of questionnaire administration. A sample of 1 in 30 dwellings were selected using the systematic sampling procedure. The sampling was done on dwellings along main streets. A total of 640 respondents from all the 20 wards of the city were interviewed during the socio-economic survey.

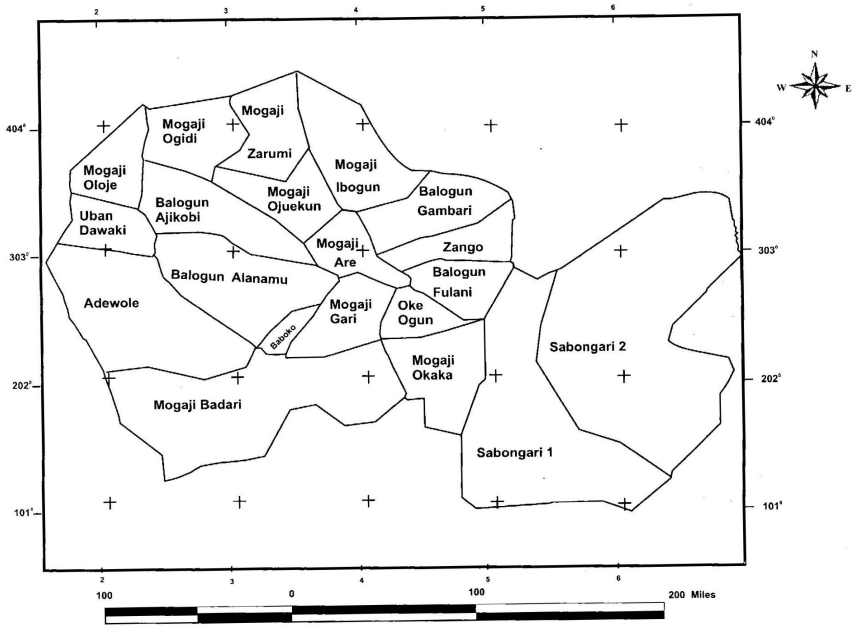


Fig. 1.0: Ilorin Traditional Wards

***Source**: Kwara State Ministry of Lands and Housing, Ilorin, 2009*

The data collected were analysed and presented using bar charts, pie-charts, tables and cross tabulation. The multiple regression method was also used to analyse factors used for determining tripmaking patterns. The variables used are INCOME, CAR OWNERSHIP, TRANSPORT FORM, TIME TAKEN FOR JOURNEY TO WORK, SEX, EDUCATIONAL QUALIFICATION, MODE OF TRAVEL. The study employed the use of the SPSS (Statistical Package for the Social Sciences) with the Microsoft Excel 2007.

Results and Discussion

Socio-economic Characteristics of Urban Commuters

The pattern of socio-economic characteristics of commuters in Ilorin is as shown on Table 1.0. This covers the monthly income, educational status and occupational status of commuters.

Table 1.0: Socio-Economic Characteristics of Urban Commuters in Ilorin

	Number of Respondents	Percentages of Total
Monthly Income		
Less than ₦10,000	91	14.2
₦10,000 - ₦30,000	331	51.9
₦31,000 - ₦50,000	102	16.0
₦51,000 - ₦70,000	45	7.0
Above ₦70,000	70	10.9
Total	**640**	**100.00**
Educational Status		
No Formal Education	17	2.7
Primary Education	35	5.5
Secondary Education	239	37.3
Tertiary Education	349	54.5
Total	**640**	**100.00**
Occupational Status		
Civil Servants	198	39.9
Trading	223	34.8
Transport and Communication	30	4.7
Army Force/Security Officer	20	3.1
Agriculture	08	1.3
Self-Employed/Private	119	18.6
Establishment	42	6.6
Artisan		
Total	**640**	**100.00**

***Source**: Authors' Field survey.*

With respect to monthly income, 91 respondents representing 14.2% of the total earn less than ₦10, 000.00 while 331 respondents representing 51.9% earn between ₦10, 000.00 and ₦30, 000.00. The analysis shows that 102 respondents representing 16.0% earn between ₦31, 000.00 – 50,000.00 while 45 respondents representing 7.0% earn between ₦51, 000.00 – ₦70, 000.00. The number of respondents earning above N70, 000.00 stands at 70 represent 10.9% of total respondents.

The educational status of respondents showed that 17 respondents constituting 2.7% have no formal education while 35 respondents representing 5.5% have primary education. Also, 239 respondents representing 37.3% have secondary education while 349 respondents constituting

54.5% have tertiary education. The distributional pattern of occupational status of respondents shows that 198 respondents representing 30.9% are civil servants while 223 respondents constituting 34.8% are traders. The pattern shows that 30 respondents representing 4.7% engage in transport and communication while 20 respondents constituting 3.1% are members of the Armed forces and security personnel. Only 8 respondents representing 1.3% are into agriculture and 119 respondents representing 18.6% are self employed and in private business. The number of artisans in the occupational pattern stands at 42 respondents representing 6.6 %.

Modal Choice for Journey to Work

The modes considered for journey to work in Ilorin are taxis, private cars, buses, motorcycles, trekking, and car sharing and staff bus. Table 2.0 shows the pattern of distribution of modal choice for journey to work in the city. The pattern shows that taxi-cabs dominate modal choice of journey to work in Ilorin constituting 37.5%. Respondents who take taxi-cabs as modal choice pointed to safety as the main reason for their decision. Private cars occupy second position as modal choice to work amounting to 30.2%. High income earners and some of the middle income residents take private cars to work. Convenience and comfortability are the reasons suggested for their choice.

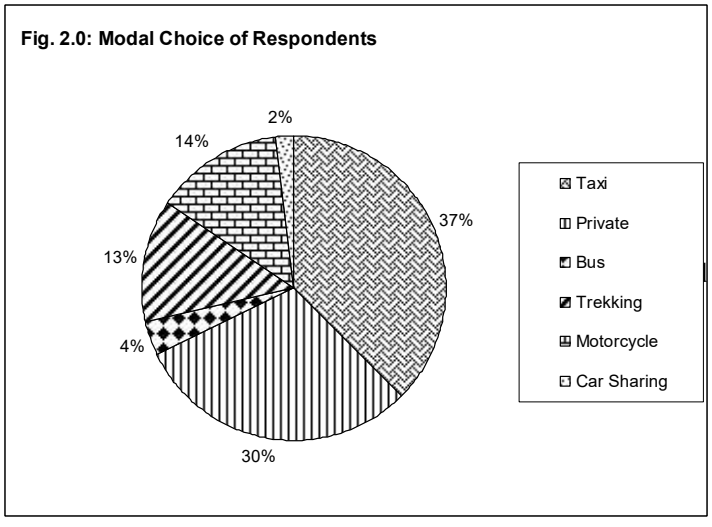
The next to private cars is the usage of commercial motorcycle as a means of modal choice to work trips accounting for 13.6% of the total trips. Facts collected depict that some respondents used motorcycles for the reason of fastness mostly in areas of high traffic and where competition for road space is high. In addition, most of the respondents who take motorcycles as their modal choice do so due to flexibility in the fares charged by commercial motorcycles, unlike commercial taxi or buses whose routes are fixed and uniform fares are charged.

Another common modal choice to work is trekking or walking which constitutes 12.8%. Poor-income residents take walking as the mode for journeys to work. Proximity to their residences, low income level is the reasons put forward by various respondents for making this choice. Bus commuters constitute 3.6% of the modal choice. This percentage is quite small in contrast to other cities. This is so because buses are not many in the city and at the same time they are not geographically distributed.

Table 2.0: Modal Choice of Respondents to their Workplaces

S/N	Wards	Taxi	Private Car	Bus	Trekking	Motorcycle	Car Sharing	Staff Bus	Total
1	Adewole	10	16	-	01	03	02	-	32
2	Oke ogun	14	09	-	03	10	02	-	38
3	Sabongari 2	15	18	-	02	03	-	-	38
4	Balogun Fulani	13	06	-	14	06	-	-	39
5	Oloje	09	07	05	05	04	-	-	30
6	Gambari	12	09	03	06	03	-	-	33
7	Sarumi	12	08	-	02	03	01	-	26
8	Ajikobi	08	06	03	03	05	01	-	26
9	Oju ekun	12	06	-	02	05	-	-	25
10	Mogaji Okaka	12	09	03	03	06	-	01	34
11	Ubandawaki	10	07	-	06	07	-	-	30
12	Sabongari 1	09	14	01	05	04	-	-	33
13	Mogaji Ibagun	15	11	02	06	05	-	01	40
14	Ogidi	12	14	-	04	-	02	-	32
15	Baboko	17	03	02	02	01	01	-	26
16	Zango	15	11	-	04	05	-	-	35
17	Mogaji Ngeri	12	09	-	03	02	01	-	27
18	Badari	08	12	01	02	06	-	-	29
19	Mogaji Are	18	11	02	06	02	03	-	42
20	Alanamu	07	07	01	03	07	-	-	25
	Total	**240**	**193**	**23**	**82**	**87**	**13**	**02**	**640**
	Percentage	**37.5%**	**30.2%**	**3.6%**	**12.8%**	**13.6%**	**2.0%**	**0.3%**	**100%**

***Source**: Authors' Field survey*



Source: Authors' field survey

Car sharing and staff bus commuters account for only 2.0% and 3.0% respectively. This implies that these two modal choices are not highly prominent in Ilorin. Figure 2 shows the pattern of the modal choice of journey to work in Ilorin.

Car Ownership

The assessment of respondents with respect to car ownership was considered under three categories. Table 3.0 shows the distribution. The first group comprise of respondents with no cars. This carried the largest number of 396 respondents constituting 61.9%. Also, 177 respondents amounting to 27.6% have one car while 67 respondents constituting 10.5% have two or more cars. The pattern shows that majority of the respondents depend on public transportation or walking for their means of conveyance for journey to work.

Table 3.0: Car Ownership

S/N	Car Ownership	Number of Respondents	Percentage of Total
1	No Car/Van	396	61.9
2	One Car/Van	177	27.6
3	Two or more Cars/Vans	67	10.5
	Total	**640**	**100.00**

Source: Authors' Field survey

Total Trip making per day per household

The marginal percentage of trips made per day per household is shown on Table 4.0. This has been divided broadly into two categories. The first category who make fairly frequent trips fall within a marginal percentage of 4.10 – 5.00%. This group of trips were generated by respondents from Balogun Gambari, Sabongari 1, Sabongari 2; Balogun Fulani; Oloje; Sarumi; Ajikobi; Oju-ekun; Magaji Ibagun; Ogidi; Baboko; Zango; Mogaji Ngeri. The second group is respondents classed as making frequent trips of between 5.10 – 6.10 marginal percentage and cover Adewole, Oke-ogun; Mogaji Okaka; Ubandawaki; Badari; Mogaji Are; Alanamu. The pattern shows that on the average the marginal percentage share of trips made per household in all the wards range between 4.10–6.10.

Table 4.0: Total Trip making per Household in a day

S/N	Wards	Marginal Percentage
1	Adewole	5.60
2	Oke ogun	5.20
3	Sabongari 2	4.80
4	Balogun Fulani	4.70
5	Oloje	4.60
6	Gambari	4.10
7	Sarumi	5.00
8	Ajikobi	4.70
9	Oju ekun	4.80
10	Mogaji Okaka	6.00
11	Ubandawaki	5.30
12	Sabongari 1	4.10
13	Mogaji Ibagun	5.00
14	Ogidi	5.00
15	Baboko	4.50
16	Zango	4.90
17	Mogaji Ngeri	4.70
18	Badari	6.10
19	Mogaji Are	5.30
20	Alanamu	5.70
	Total	**100.00**

Source: Authors' Field survey

Modelling Journey to Work in Ilorin

In order to determine the pattern of journey to work in Ilorin, multiple regression method was used. The model used takes the form

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7)$

where Y represents the number of trips made in the wards and

X_1 = Income of trip makers

X_2 = car ownership

X_3 = form of transportation

X_4 = Time taken for journey to work

X_5 = Sex of trip makers

X_6 = Educational qualification of trip makers

X_7 = Mode of travel used by trip makers

The model was operationalised in the form.

$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + e$

where Y represents the dependent variable (number of trip made)

$X_1 – X_7$ represent the independent variables specified above

$b_1 – b_7$ represent the regression coefficients while e is the error term

This approach is similar to that used by Ogunsanya (1987) to examine the factors which contribute to high cost of food stuffs in urban centres in Kwara State. The technique is capable of isolating the most important variables that contribute to the problem of investigation.

Surrogate measures were used to measure the independent variables (See Aderamo, 2003). People employed as a percentage of unemployed people was used to determine Income (INC).

People owning cars as a percentage of non-owing was used to measure car Ownership (COS). Trip makers using Private transport as a percentage of those using public transport was used to measure form of Transport (FMT); Relative travel time was used to measure Time taken for Journey to work (TJW); Percentage of male to female trip makers was used to measure Sex (SEX); percentage of literates to illiterates was used to measure Educational qualification (EDQ). Proportion of people that engage in one mode to another was used to measure Mode of Travel (MOT). The measurement procedure of the independent variables is as shown on Table 5.

Table 5.0: Independent Variables and their Measurements

Variables	**Measurement Procedure**
X_1 – Income	No of employed people as % of unemployed people in the study area.
X_2 – Car ownership	No of car owners as % of non-car owners
X_3 – Form of transportation	No of private transport as % of public transport.
X_4 – Time taken for JTW	Relative travel time.
X_5 – Sex	Males as % of females
X_6 – Educational qualification	Literates as % of illiterates.
X_7 – Mode of travel	Proportion of people that engage in one mode to another.

Source: Authors' Field survey

The regression model was run using the statistical package for the Social Sciences (SPSS) and the result obtained is as shown on Table 6.0.

Table 6.0: Regression Summary of Determinants of Modal Choice for Trip to Work Pattern in Ilorin

Dependent Variable	**Independent Variables**	**Regression Coefficients**	**Level of Significance**	**T-values**
Number of Trips (TRP)	Constant	-0.118	0.003	-3.005
	INC	0.031	0.422	0.803
	COS	0.027	0.489	0.692
	FMT	-0.114	0.584	-2.913*
	TJW	-0.117	0.117	-2.979*
	SEX	0.023	0.251	0.585
	EDQ	-0.078	0.214	-1.993
	MOT	-0.027	0.518	-0.647

Coefficient of Determination R^2 = 47.5% * Significant at 5% level ***Source****: Computer Output*

The regression summary shows that the independent variables Income (INC), car ownership (COS) and sex (SEX) of trip makers have positive relationship with number of trips made. This result agrees with observation made by the European Transport Panel in 2005 those socio-economic factors such as income, gender and other household characteristics affect trip making. Further, the Form of Transport (FMT), Time taken for Journey to Work (TJW) and Educational Qualification (EDQ) have negative relationship with modal choice of work trips in the city.
The coefficient of determination R^2 is 47.5 implying that only 47.5% of the variation in number of trips made is accounted for by the specified independent variables. The remaining 52.5% may be due to exogenous factors such as environmental and local by-laws.

The results also show that only two independent variables namely Form of Transport (FMT) and Time taken for Journey to work are significant at 5.0% level of significance. The model obtained for describing Journey to Work Patterns in Ilorin is

TRP = -0.118 + 0.031INC + 0.027COS – 0.114 FMT – 0.117 TJW + 0.023 SEX – 0.078 EDQ – 0.027 MOT

Conclusion

Journey to work dominates most of the movements made in cities. This trip type if not well planned for in cities is capable of breeding congestion problems.

Modal choice for journey to work is also important and is usually determined by some socio-economic variables such as income of trip makers, car ownership, form of transport available, sex and educational qualifications of trip makers. These variables were considered in the study of modal choice for journey to work in Ilorin and it was found that the form of transport and time taken for journey to work are significant factors in determining the pattern of journey to work in Ilorin.

The study found that journeys to work in Ilorin are shared between taxi cabs, private cars, motorcycles, trekking, public bus services and staff buses. While public transport is predominantly patronized by low and middle-income earners, the high income earners use private cars for their journey to work.

In order to alleviate the transportation problem of residents in the city of Ilorin, the study recommends that government should provide intra-urban mass transit services in the city and improve the provision of transport infrastructures.

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