Geospatial analysis of telecommunication and travel behaviour of households: Lessons from a developing city in Nigeria

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Abstract: The advent of telecommunications and other advanced technologies rapidly increases activity accessibility. Consequently, this study examined the impact of telecommunication on the mobility pattern of households in Nigeria. The multi-stage procedure was adopted for the study, and a systematic sampling technique was employed to select 10% of the registered building for questionnaire administration. Thus, 512 respondents were sampled. The stepwise regression analysis revealed that age, income of respondents, call duration, and subscription cost were significant factors influencing telecommunication usage. We found that telecommunication replaces in-store shopping, with 40% of the respondents substituting their shopping trips with telecommunication. We, therefore, proposed that people should be enlightened on the culture of the use of telecommunication and that its usage extends beyond call linkages, as other benefits should be explored.

Keywords: telecommunication, travel behaviour, mobility, sustainable planning, geographical information system

1. Introduction

Recently, the relationship between telecommunication and household travel behaviour has been an issue of discourse among transport planners and researchers. The need for this arose because of the incessant transport problems encountered by people when making trips, thus necessitating an alternative means of movement without necessarily embarking on physical travel. According to Blanchard and Wanddel (2017), Improving equitable access to transport, housing, jobs, services, and amenities often requires that cities embark on policy amendments and people embark on alternatives to physical movement in space in order to reduce some of the inherent environmental problems such as urban sprawls, traffic congestion and pollution experienced in the society. The possible relationships between telecommunication and physical travel, as identified by (Mokhtarian & Salomon, 2002; Nobis & Lenz, 2009), include substitution, complementarity or modification, induction and neutrality. It is now generally recognized that Information and Communication Technologies (ICT), in its several forms, may impact activity patterns and travel behaviour along the lines of the four components of accessibility.

Telecommunication systems highly influence travel patterns and dependence on physical movements. Through mobile phones, people can connect with their families, friends, and colleagues almost everywhere and at any time. Household members can call requesting a favour that obliges the traveller to make another trip or cancel a trip. This implies that telecommunication can result in a sudden trip change or cancellation (Padayhag et al., 2011; Olawole, 2013). This study advances other discussions on telecommunication and travel by investigating individuals' accessibility, awareness and usage of telecommunication beyond the conventional belief of call linkages, instead other uses of telecommunication concerning virtual activities such as telework, e-banking, e-shopping, e-business to mention just a few and smartphone applications (Facebook, WhatsApp, Instagram) on travel were examined. Also, the study adopted the use of the Geographical Information System (GIS) to assess the point location of telecommunication stations in the study area to know the extent of coverage in Akure metropolis, Nigeria. It aims to provide an empirical basis for explaining the possible variations within the levels of telecommunications and between different categories of trips. Based on these premises, this study seeks to examine how the proliferation of telecommunication has impacted the mobility pattern of people in Akure, Nigeria.

2. Literature review

Studies on telecommunication and urban development have been conducted such that its role in enhancing city development can not be over-emphasized. According to Song (2013), telecommunications have greatly expanded over the past few decades from primarily landline telephone service to fibre optic, cable, and wireless connections, offering a wide range of voice, image, video, and data services. The study by Gossling (2017) further revealed that Information and Communication Technologies (ICT) are the base of intelligent systems by fostering and supporting sustainable transport choices. It can, therefore, be said that ICT fosters the present economic growth and development and promotes future development.

Information and Communication Technologies (ICT) go beyond mobile phones, which are commonly used and highly recognized by people. It ranges from mobile phones to internet services such as e-shopping, e-banking, e-business, and emails. Given this, its impact on people's travel behaviour cannot be overlooked, especially in developing cities.

Nobis and Lenz (2003) conducted a descriptive analysis of two extreme groups. The 'heavy ICT users', i.e. people who use cell phones and computers with internet access in their homes multiple times per week, were compared with the non-ICT users. The latter group includes everyone whose households own neither a cell phone nor a computer with internet access and, therefore, cannot use any of these devices at home. From the study, heavy users and non-users showed apparent differences in socio-demographic features and mobility. Furthermore, car availability in households with heavy ICT use correlates with their higher driving frequency, and heavy ICT users are more likely to live in families with two or more cars, while non-users live most often in households with one car or none.

Transport policymakers have often hoped that ICT would provide a substitute for travel. A study by De Graaff and Rietveld (2007) focused on substituting working out of the home by working at home. The study concluded that working at home and out of the home act as (slightly imperfect) substitutes, mainly depending on the characteristics of the individual. Working at and out of the home seems more determined by individual characteristics than commuting time and ICT availability. It should be noted here that communication technology cannot fully compensate for the richness of face-to-face contact, for example, the conveyance of complex, non-structured, or potentially ambiguous information (Boden & Molotch, 1994; Larsen et al., 2007; Aguilera, 2008).

In addition, it has been documented that ICT could also trigger the generation of travel. Its impact on generating additional travel might be even more critical than its substitution effect. For instance, Mokhtarian and Meenakshisundaram (1999) asserted that ICT will unlikely significantly reduce travel. However, it has been realized that telecommunication's substitution aspect could help resolve some travel-related problems by providing alternative means of movement for people. An example of the nowadays generally accepted concept of the complementarity of ICT and travel can be found in Farag et al. (2007), who studied online and/or in-store shopping. They found that searching online positively affects the frequency of physical shopping trips, influencing buying online. In addition, it was found that e-shopping could be task-oriented for some people and leisure-oriented for others. Nowadays, it is

generally recognized that ICT potentially impacts all kinds of activities, including jobs, shopping, recreation, and others (Muhammed et al., 2008). Lenz and Nobis (2007) argue that ICT leads to a reorganization of activities in time and space, with a consequent impact on travel behaviour. The concept of "fragmentation", as introduced by Couclelis (2000), concludes that transport demand increases with the fragmentation of activities. They make a distinction between spatial fragmentation (fragmentation of activities over different locations), temporal fragmentation (fragmentation of activities over time) and fragmentation in the way activities are performed (activities themselves can be carried out in different ways, for example, shopping physically versus e-shopping). Based on these empirical findings, it is unclear whether ICT leads to increased travel demand for people who have already made many journeys before the diffusion of ICT or whether ICT has a small reducing effect on these people's very high mobility level.

2.1. Factors influencing the use of information and communication technology

Generally, individuals access telecommunication services for different reasons. Usually, before any form of telecommunication service can be used, an individual must subscribe to a mobile telephone or an Internet network. According to Verkasalo (2008), subscription to a mobile telecom network requires decision-making on the part of the individual who decides whether to use a mobile telecom service. The subscription decision is usually based on a subscription's perceived benefits and costs. It is assumed that when the perceived benefits associated with a subscription are more significant than the costs of a subscription, individuals will subscribe and use mobile telecom services. However, if a subscription costs more than the perceived benefits, individuals will not subscribe and use mobile telecom services.

Kyeremeh and Fiagborlo (2016) examined telephone service subscriptions and discovered a relationship between telephone service subscriptions and socio-economic and demographic variables. As posited, the probability of subscribing to telephone services was related to several socio-economic and demographic factors. Similar studies by Duffy-Deno (2001) and Sung and Cho (2001) further confirmed that income and education positively influenced a household's telephone service subscription. Households with higher incomes were more likely to subscribe to telephone services than those with relatively lower incomes. The study proposed that lower-income earners should be given subsidies for universal telephone service. Olatokun and Bodunwa (2005) analyzed mobile telecommunication demand in Nigeria by examining the Global System for Mobile Communication (GSM) usage. The study found that social activities (e.g. contacting friends and relations) hugely accounted for the use of mobile telecommunication services. Mobile telecom services were less used in research and academic activities, and limited network coverage and poor quality of service (i.e. unstable network and difficulty in making and receiving calls) inhibited the effective use of mobile telecom services. The study concluded that mobile telecom networks that provided quality customer service were better positioned to acquire more subscribers.

The literature has shown that the cost of mobile telephone services, quality of service, individual socio-demographic characteristics, and trip types influence the demand for access to telecommunication networks.

3. Methodology

This study relied on a subset of primary data collected as part of research on the telecommunication and trip-making behaviour of households in Akure Metropolis. The study adopted a multi-stage sampling procedure, and a combination of qualitative and quantitative data was gathered for the analysis. The primary data were obtained through a reconnaissance survey and the administration of a questionnaire.

The first stage involved the stratification of residential areas in Akure South Local Government Area, identification, and selection of political wards in the study area. Information from the stratification of the area revealed 11 political wards in the study area. 50% of the wards were randomly selected. Using this method, six political wards were selected for sampling.

Streets and buildings in the selected political wards were identified in the second stage, and information from the Akure South Local Government headquarters and Town planning office revealed

that there is a total of 189 registered streets in the selected areas. Simple random sampling was adopted to select 38 registered streets, representing 20% of the total. Further information from the Akure South Local Government Area revealed 5,123 registered buildings and 10% were randomly selected. Thus, a total of 512 buildings representing households were surveyed.

The third stage involved the selection of respondents for questionnaire administration. In selecting the respondents, a systematic random sampling technique was adopted, and the questionnaire was administered to an adult not below the age of 18 years on each floor of the selected buildings. One out of every 10th building was systematically selected, representing 10% of the total building. Using this procedure, a total of 512 respondents were surveyed.
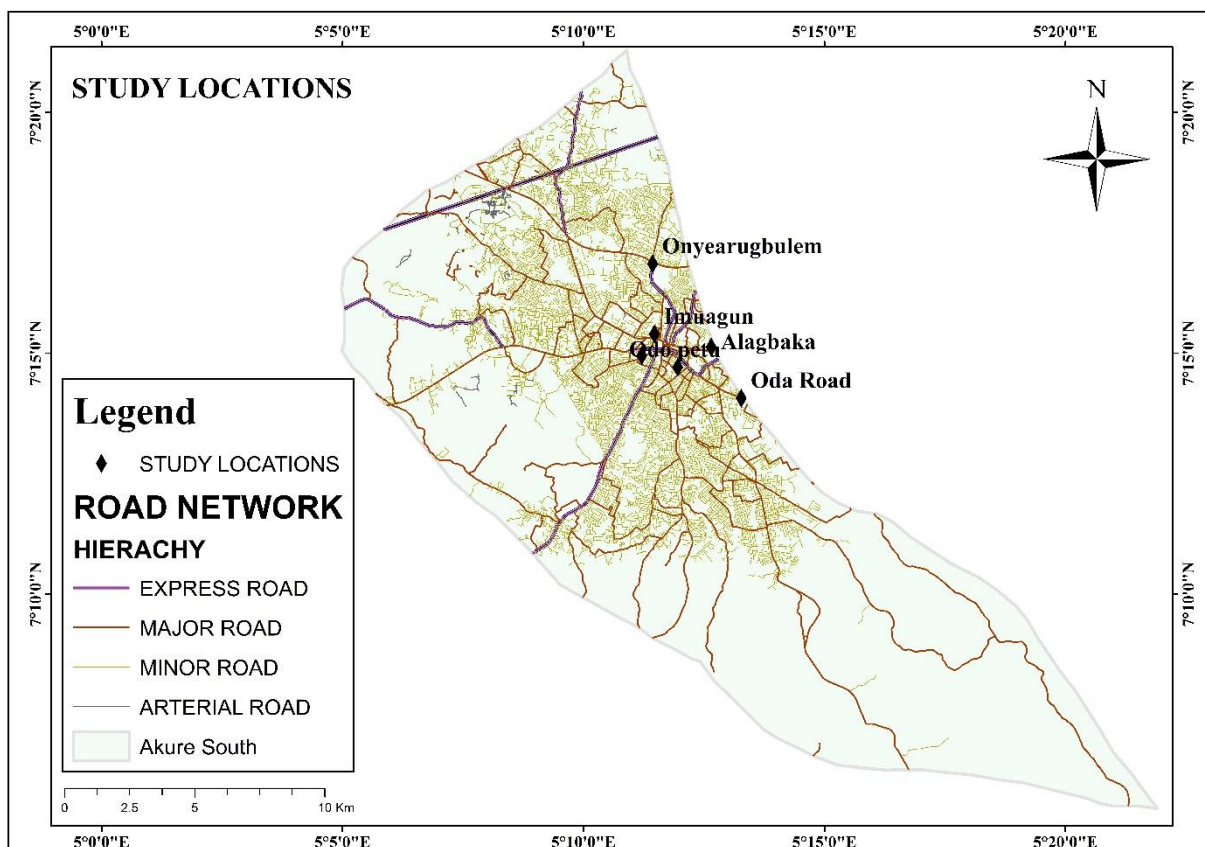
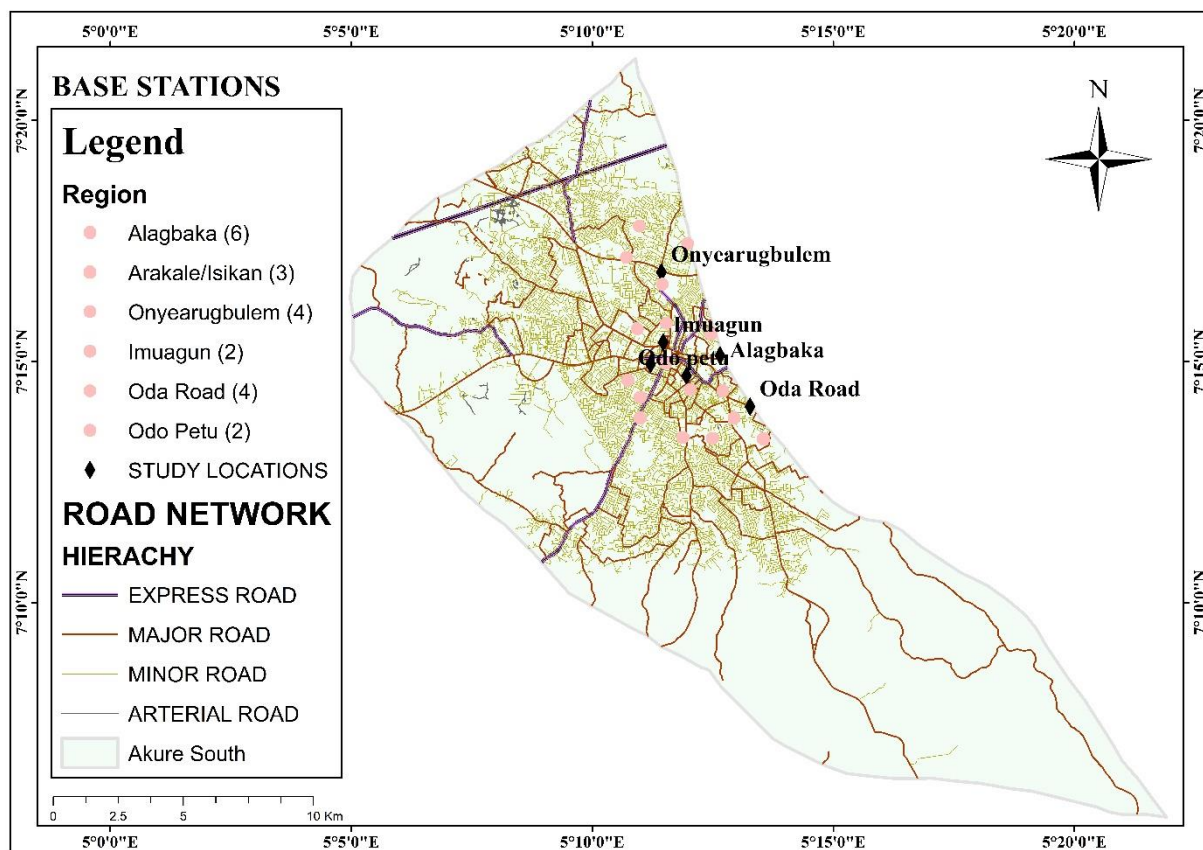$$K = N/n$$

Where, K= sample size
N= Number of registered buildings/dwelling units/household
n= represents 10% of all households per settlement.

Figure 1: Road Network in the study area

Source: Arc Map/Fieldwork 2021

Figure 2: Telecommunication point map for the study areas

Source: Arc Map/Fieldwork 2021

Figure 2 explains the telecommunication nodes in the study location. Point locations of the base stations were taken from the site via GPS, which were transferred and later referenced on the ArcGIS software. From Figure 2, Alagbaka has the highest number of base stations, with six telecommunications nodes, while Oda Road has four. This is the periphery of the town with the high-income earners, thus the reason for the large numbers of base stations. In addition to this, Onyearugbulem and Isinkan had four and three, respectively. Suffice it to say that the Odopetu and Imuagun areas had just two base stations each. These two areas are the core areas of the town where most of the aged reside. Additionally, these areas have few residential buildings, and the few ones are already old and dilapidated. Based on this, it can be asserted that telecommunication providers consider the population, socio-economic characteristics of the people and activity patterns in a location when choosing base stations.

4. Results and discussion

4.1. Socio-economic characteristics of the people

The sampled respondents' socio-economic characteristics distribution shows that nearly 54.1% % were males by gender while 45.9 % were females. Ubogu (2008) asserted that the dominance of the male gender reflects the sexual composition of most urban centres in Nigeria due to the adventurous and migratory nature of males than females. The marital status of respondents showed that 72.8% were married, 24.7% were single, and the remaining were either divorced or widowed. Information on the age distribution of households revealed that a more significant percentage (33.1%) of the respondents were below 30 years of age, while 30.1% were between the ages of 30 and 39 years. This implied that a more significant percentage of those sampled were young and middle-aged. The mean age stood at 35.9 and a standard deviation of 12.29. More than half (51.5%) of the population had a small household size of less than 6 people, and 44.6% had a medium size household of 6-9 people. The mean household size for the study stood at 4.72. From the study, it was discovered that 72.1% of the respondents had tertiary

education. This implied that respondents in the study area were educated. This is not surprising as the study area serves as the administrative seat of the state, where most of the literates in the society reside. The study further examined the average number of years spent in the pursuit of formal education by the household. To investigate this, years spent in the pursuit of tertiary education were categorized into 4 groups, namely, residents who acquired ordinary diplomas (OND), technical education among others (0-2 years), residents who completed higher diplomas and university degrees (3-5 years), and residents who completed or went for post-graduate studies such as post-graduate diplomas, master's degree or professional qualifications (6-9 years). Others included residents with higher degrees, such as PhD post-doctoral studies (10 years and above). Findings from the study revealed that the literacy rate is high, as a more significant percentage of the respondents (62.5%) spent an average of 3-5 years pursuing formal education, while 21.4% spent between 0-2 years within the same category.

The occupation of residents or the profession an individual engages in determines their income level (Jayamala, 2008; Sanni et al., 2010). A more significant percentage, 40.4% of respondents, were civil servants, while 29.9% were businessmen/women. Less than 1%, precisely 0.5%, were farmers. The number of government-employed respondents is not surprising because the individual highest level of education attained, to some degree, determines the kind of occupation someone can engage in as well as determining the income level (Ahn 2001, Jayamala, 2008, Badiora 2012, Stead & Marshall 2001). Income is another important variable in explaining travel behaviour and telecommunication usage (Gassner, 1998). To present this, an income group for federal tax rating was adopted to illustrate the income distribution of the respondents in the urban area. The minimum monthly income is N1000.00k, while the maximum is N400,000.00k. The average monthly income for the respondents was N51, 686.8k. 54.8% of the respondents, forming a more significant proportion of those sampled, earned between N40,000 - and N60,000. This means most earned above the federal government minimum income wage of N20,000. Further investigation into the car ownership/availability for the household revealed that 49.2% had one car, 32.5% had two cars, and less than 10% (9.7%) of the respondents had no car.

4.2. Travel characteristics of household

Analysis of trip frequency in this study is based on all-purpose trips. The number of trips for this study was represented by the average round trip made by an individual. From the study, 50.8% of the respondents make an average of four (4) trips daily. Next to this are 20.1% of the households who made just one (1) trip daily. The mean trip for the household is 2.3. The result on trip frequency corroborates the findings of Hine, Kashype and Bernergee (2012), who asserted that urban form influences one's travel behaviour. As such, households in the urban centres generate more trips than those in the rural areas. The transport mode of household is another explanation of travel characteristics, and findings showed that 87.5% of households used motorized transport (cars/public transport) as opposed to 11.1% of those who used non-motorized transport (walking & cycling).

The use of motorized transport, as the dominant mode of transport, can be a function of income level, as the majority of them earned higher income, as revealed in the study. This finding corroborates the assertions of Fadare and Alade (2009), who stipulated that the higher the income, the more the likelihood of using private cars because households in the urban areas of developing countries see car usage as a form of affluence in society. Moreover, Towner (1994) revealed that households with lower incomes were more likely to use the non-motorized means of transport.

Analysis of the trip purpose of respondents revealed that the majority made more non-discretionary trips. The trip purpose of respondents was classified into discretionary (social, shopping, medical) and non-discretionary (work and school). It was observed from the study that 82.8% of them made more non-discretionary (work) trips.

S/N	Base Station Interval	Distance (Km)	Distance (m)
Table 1: Telecommunication base station intervals		
1	1-2	2.771112	2771.113
2	2-3	3.625017	3625.017
3	3-4	2.857631	2857.631
4	4-5	3.772428	3772.427
5	5-6	3.834443	3834.443
6	6-7	1.444293	1444.293
7	7-8	2.548426	2548.426
8	8-9	2.150627	2150.627
9	9-10	0.960869	960.8693
10	10-11	0.941709	941.7092
11	11-12	3.084504	3084.504
12	12-13	1.673772	1673.772
13	13-14	3.105113	3105.113
14	14-15	1.258461	1258.461
15	15-16	1.569963	1569.963
16	16-17	3.088439	3088.439
17	17-18	4.61825	4618.25
18	18-19	3.366436	3366.437
19	19-20	3.782389	3782.389
20	20	4.140554	4140.554

Source: Author's Field Work 2022

Mean Distance=2.729722
Standard Deviation= 1.085456

The point location for each base station in the study area was selected via GPS, which was later transferred to the ArcGIS software. The vector analysis calculated the point layer/location from one base station to another. From the study, the average distance (see Table 1) between one base station to another is 2.7km. This implies an average distance of 2.7km from one telecommunication point to another. According to the mobile network guide (2014), city areas usually have more users and obstructions. There are usually more base stations to cover demand to compensate for the population, and the cell sizes will have a 2-5km radius. On the contrary, in country/rural areas with large open spaces, the base stations are further apart, and the cell radius will be around 10-32km. Based on this, the average distance from one base station to another in the study area is adequate to meet demand.

4.3. Telecommunication usage of households

4.3.1. Access to telecommunication facilities

As established from the study, all the respondents had access to telecommunication facilities via personal mobile phones or commercial telephone service operators (telephone booths). This corroborates Olawole's (2013) assertion that Nigeria's teledensity is high. Findings from Fadare and Olojede (2009) also corroborate the result on accessibility to telecommunications in Nigeria by stipulating that mobile phones are no longer a symbol of economic status as the majority of households now have access to them. In addition, 58.6% of the respondents attested to using GSM as the most accessible and frequently used telecommunication means, while 21.8% frequently used the personal computer (PC)/desktop. The remaining 19.6% of the households asserted that they did not use any telecommunication facilities.

4.3.2. Respondents' usage of virtual platforms (e-activities)

Information and Communication Technologies go beyond call-making, commonly used and highly recognized by people. In recent times, people have adopted the use of telecommunication to conduct services, ranging from banking (e-banking), shopping (e-shopping), business (e-business), work (telework), etc. The information provided revealed that most respondents (55.2%) did not use these available platforms, such as e-banking, e-business, and emails. It, thus, stipulates that a more significant

percentage of the population still embarks on physical trips to perform these activities rather than carry out online activities/services. Overall, 16%, 14.7% and 12.2% used email, e-banking and e-business platforms, respectively, as forms of communication. Verkasalo (2008) asserted that the consideration to access telecom service is based on how the service meets the needs of individuals and that needs are inborn, which implies that the non-users of the internet facilities for virtual activities may either not see a need for it or aware of other benefits and functions associated with telecommunication. Additionally, the assertions by Oyesiku (1996) and Gbadamosi (2004) that the social and cultural background of people in Nigeria, a developing country, is such that the physical presence of friends, relatives and business associates in gatherings is often appreciated, hence, the difficulty for telecommunication to compensate for face-to-face contact fully.

4.3.3. Smartphone applications as a form of communication/alternative to movement

The presence of smartphone applications such as Facebook, Whatsapp and Instagram is gaining popularity among the young and old. It may overtake desktop and personal computers because of their expansion (Ibrahim et al., 2014); hence, there is a need to examine its ability to influence mobility. The study established Facebook and WhatsApp as the most recognized and used social media platforms, with 40.3% and 28.2% of the respondents, respectively. This may be due to the awareness and recognition gained by Facebook and WhatsApp due to their long existence as media for communication and interaction by young adults. However, 27% of the respondents attested to the non-usage of social media platforms. The study by Fondevilla-Gascon et al. (2020) also found similar results on Facebook, the most used social network.

4.3.4. Average number of trips complemented, substituted and induced by different telecommunication methods in the study area

Our study further sought to review the average number of trips either complemented, induced or substituted by telecommunication. From the study, the Global System for Mobile Communication (GSM) for phone calls was mainly used to alter physical movement in space. Based on this, 2,233 (see Table 2) trips were either complemented, substituted or induced by phone calls; out of which 932 trips were complemented, 432 trips were generated, and phone calls substituted 869 trips. This is closely followed by emails where 1,248 trips were either complemented, induced or substituted. E-shopping, social media platforms and e-banking follow this. Overall, the use of telecommunication complements most trips, thus indicating the trip-complementing effect of telecommunication on trips. The study revealed that 2,985 trips were complemented against 1,165 and 2,599 trips induced and substituted by telecommunication. From the study, it can be established that the use of telecommunication had little impact on e-banking (financial activities), as it generated the smallest number of trips (958) being impacted by using telecommunication. The reason is not far-fetched as most people in Nigeria complained of insecurity in online financial transactions due to the incessant fraud being recorded from mobile banking applications (Agu et al., 2016).

Table 2: Average trips complemented, substituted and induced by telecommunication in the study area			
Telecommunication Means	**Number of Complemented Trips**	**Number of Induced Trips**	**Number of Substituted Trips**	**Total**
GSM (CALLS)	932	432	869	2233
Email	664	215	369	1248
E-banking	462	198	298	958
E-shopping	402	218	568	1188
Social Media Platforms	525	102	495	1122
Total	**2985**	**1165**	**2599**	

Source: Author's Field Work, 2022

From Table 3, the impact of telecommunication on travel depends mainly on trip activities. As the table shows, the total number of trip activities complemented outweighs those induced and generated by telecommunication. Work/business trips accounted for the most significant number of complimented trips. Incidentally, such trips can be subjected to alteration or modification, especially for people in business or self-employed who may require a modification or alteration to the location and time to carry out their job function, hence corroborating the findings from Douma et al. (2004) who discovered that e-workers take advantage of ICT to modify their commutes, without impacting their workday. Incidentally, the trip generation effect of telecommunication was also significant for the trip above, contradicting the findings of Padayhag et al. (2011), which asserted that telecommuting reduces the number of work trips. Our findings on the increased number of work/business trips due to telecommunication explain that the alteration or modification in complementarity results in additional trips. Consistent with the findings of Ubogu (2008), telecommunications enable a wide variety of new last-minute information flows that sometimes generate personal travel through attractive invitations and compulsory attendance orders. The possibility of this is people being called for an unplanned job or activity which may result in travel.

Furthermore, we found that our study contradicts the findings of Farag et al. (2007) and Douma et al. (2004) on the substitution effect of telecommunication on shopping, which concluded that e-shopping is used as an additional shopping method which does not change trip making behaviour nor replaces in-store shopping but does change shopping behaviour. From our study, a more significant percentage (40%) of respondents substitute their shopping trips with telecommunication, which implies that respondents perform most of their shopping trips online without necessarily embarking on in-store shopping. Nevertheless, there seems to be a variation in the impact of telecommunication on trip activities. Notably, trips to health, religious centres, banking, and recreation have only a marginal percentage in the complementarity, substitution, and inducement effect of telecommunication on travel.

Table 3: Trip activities complemented, substituted, and induced using telecommunication			
Trip purpose	**Number of trips Complemented**	**Number of Induced Trips**	**Number of Substituted Trips**
Work/business	825 (42%)	648 (51%)	269 (19%)
Shopping	460 (24%)	221 (17%)	573 (40%)
Financial activities(banking)	170 (9%)	103 (8%)	329 (23%)
Religious	101 (5%)	98 (8%)	50 (3%)
Health	102 (5%)	78 (6%)	35 (2%)
Recreational/Social	292 (15%)	125 (10%)	192 (13%)
Total	**1950 (100%)**	**1273 (100%)**	**1448 (100%)**

Source: Author's Field Work, 2022

4.4. Factors influencing telecommunication usage of respondents

We further conducted a regression analysis to identify significant factors influencing the telecommunication usage of respondents. Ogunsanya (1986) has identified regression analysis as the widely used technique for identifying influencing factors. The formula for this is:

$$Y = a + b_1 x_1 + b_2 x_2 + \ldots\ldots + b_n x_n + e$$

Where *Y* represents the dependent variable. The dependent variables, in this case, represent
 Y= Subscription to a mobile network
$x_1, x_2, x_3\ldots\ldots x_n$ represent the independent variables
a, b are constants
e is the error term
We employed 10 predictors/independent variables listed below: Age, Income of respondents, Gender, Education, Occupation, Household size, Trip volume, Travel cost, Call duration, and Cost of

mobile subscription/data and phone calls. As the stepwise multiple regression analysis revealed, four variables significantly influenced telecommunication usage. These variables include the cost of data subscription/phone call, call duration, Age of respondents and Income. The model summary result presented in Table 4 showed that the coefficient of determination R^2 is 0.808, implying that about 80.8 percent of telecommunication usage is explained by the combined influence of the four independent variables selected by the regression model. Findings from this study corroborate earlier studies (Verkasalo, 2008; Kyeremeh & Fiagborlo, 2016; Ahn, 2001; Narayana, 2009) that found similar cost, income and age influencing telecommunication usage.

In addition, the ANOVA result with F value=127.860, 133.531, 101.513 and 89.346 at P=0.00, 0.01, 0.03 and 0.01 also concludes a significant overall regression using all the variables in the model. Furthermore, the regression coefficient presented in Table 5 provides the regression coefficient estimates, standard error of the estimates, and t-tests that a coefficient takes the zero value. The estimated coefficients are given under the heading 'Standardized (Beta) coefficients'; these explain the predicted change in the dependent variable when each explanatory variable is increased by one unit, conditional upon the fact that all other variables in the model remain constant.

The summary of the regression coefficients could be used to develop a multiple linear regression model:

$$Y= 0.874+0.494(CostData)+0.343(Callduration)-0.256(Age)+0.195(Income).$$

The significant and negative standardized coefficient for age showed that a unit increase in the age of respondents would lead to a decrease in telecommunication usage or mobile network subscription of households; this implies that as age increases, there is a propensity for a reduction in access to telecommunication services or networks. In line with the findings of Subramanyam et al. (2020), Smartphone ownership among seniors varies substantially by age. Their study found a reduction in mobile phone ownership among seniors aged 70 and above. Some attributed reasons include the complexity of operations, difficulty reading from the screen due to its small invisible text, and difficulty remembering the different functions of keys on the interface. Conversely, it was asserted that most smartphones were designed for the younger, tech-savvy generation.

Nevertheless, the positive standardized coefficient for call duration and income showed that the longer/higher the call duration and income of respondents, the higher the likelihood of subscribing to a mobile network. However, it is worth noting that the positive standardized coefficient for the cost of data subscription or increased cost of recharging/data, which implies that irrespective of the cost, respondents will still subscribe to a mobile network, brings to the fore the consideration for quality of service and perceived benefits of using a service. The findings of Verkasalo (2008) and Olatokun and Bodunwa (2005) asserted that once the quality of service offered by a subscriber meets the acceptable standard, and the perceived benefits of using telecommunication or subscribing to a mobile network outweigh the cost, people consider or opt for the service.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.770[a]	.592	.588	.28164
2	.868[b]	.754	.749	.21991
3	.883[c]	.780	.772	.20939
4	.899[d]	.808	.799	.19673

Table 4: Model summary result

Source: Author's Field Survey, 2022
a. Predictors: (Constant), Amount spent on data/Phone calls
b. Predictors: (Constant), Amount spent on data/Phone calls, call duration(mins)
c. Predictors: (Constant), Amount spent on data/Phone calls, call duration(mins), age
d. Predictors: (Constant), Amount spent on data/Phone calls, call duration(mins), Age, Average monthly income of the respondent

Table 5: Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.616	.104		5.909	.000
	Amount spent on data/ Phone calls	.416	.037	.770	11.308	.000
2	(Constant)	.242	.095		2.540	.013
	Amount spent on data/ Phone calls	.304	.032	.562	9.403	.000
	Call duration(mins)	.163	.021	.453	7.572	.000
3	(Constant)	.684	.167		4.099	.000
	Amount spent on data/ Phone calls	.280	.032	.518	8.841	.000
	Call duration(mins)	.151	.021	.420	7.254	.000
	Age	-.009	.003	-.173	-3.156	.002
4	(Constant)	.874	.166		5.271	.000
	Amount spent on data/ Phone calls	.267	.030	.494	8.904	.000
	Call duration(mins)	.123	.021	.343	5.843	.000
	Age	-.013	.003	-.256	-4.525	.000
	Average monthly income of the respondent	1.714E-006	.000	.195	3.524	.001

a. Dependent Variable: Number of Mobile Networks

Source: Author's Field Survey, 2022

5. Conclusion

Using a case study of Akure, Nigeria, this study has proposed a relationship between telecommunication and household travel behaviour. It was discovered that this relationship is multidimensional as telecommunication and travel interact and benefit from each other. Also, we discovered that the impact of telecommunication on travel depends mainly on an individual's trip activity pattern. In contrast, some activities can be substituted by telecommunication, as observed in the shopping trips of respondents. The reverse is the case for work/business-related trips. It thus implies that individual travel-related activities, socio-economic attributes, and awareness of the different uses to which telecommunication can be applied go a long way in determining the impact of ICT on travel.

We, therefore, proposed that adequate efforts should be made to make telecommunication facilities go beyond call linkage as there are other purposes served by mobile telephony. For instance, households need to explore the adoption of telecommunication to carry out e-activities fully. Doing so will eliminate unnecessary trips, thus freeing the roads from congestion and other transport-related problems. Furthermore, the influence of age, income, subscription cost, and call duration on telecommunication usage showed that consideration should be given to everyone, irrespective of their status, when providing transportation infrastructure. In addition, both transport and ICT infrastructures should be provided in the world's developing countries so that they can favourably compete with their counterparts in the developed nations. To further encourage the adoption of ICT, telecommunication subscribers should provide quality services to all members of society and reduce telecommunication costs in terms of subscription fees for lower-income households.

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Conflict of Interest

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Data availability

Some or all data and models that support the findings of this study are available from the corresponding author upon reasonable request.

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