

## **Cybernetics of Travels and Telecommunications Relationships: A Case of Urban Metropolitan City of Nigeria**

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**Abstract:** Travel and telecommunication especially with use of conventional telephone system have for long have an order of relationships that follows that of substitution-that is accessibility to telephone substitute for trip making. This hypothesized relationships already established in the developed countries was replicated in the developing countries having the same pattern. This study examines the pattern of relationship with an advanced telecommunication which is still nascent in Nigeria-Mobile telephone has on trip making in Nigeria largest metropolitan area. Self completion survey was used for this study and regression analyses were applied for data analysis. The result of the new relationship hypothesized follows that already established in literature and new addition as that of substitution, complementarity and enhancement, neutrality, modification and perfection of trips across various activity zones within the urban centre.

**Key words:** Cybernetics, telecommunication, relationship, urban, Nigeria

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### **INTRODUCTION**

The increasing emphasis on globalization as a major panacea to upturn development from the advanced nations to the developing nations has evoked increasing growth of urbanization in many developing countries urban centre.

An increasing activity of manufacturing, commercialization and industrialization pose a major challenge to the functionality of cities in many developing world to move its people adequately, efficiently and effectively.

Mobility is central to effective functioning of cities, therefore, policy makers, transport planners and etc, pay a great deal to the development of transport infrastructure in cities. Mobility has become an integral part of education, access to sports and the amount of international trade, travel and investment (Owen, 1987).

Movement patterns within the cities can be categorized as being of either short-term or long-term duration. Short term or daily movement consists of trips involving such activities as work, shopping and recreation, whereas long-term, or more permanent movement, involves changing residence (Brotchie, 1984).

Conceptually, urban transport is intricately linked with urban form and spatial structure. Transportation in urban areas is highly complex because of the mode involved, the multitude of origins and destinations and the amount and variety of traffic. Implicit in this nation, among others is the intense flow of traffic within major

urban agglomeration of the world. Traditionally, alternative to reduction of trips within cities had been sought in development of telecommunication infrastructure to reduce the intense of intra-city trips. With believe that some trips are mostly likely to be substituted through telecommunication means. While some few studies have been advanced in literature on the relationship that exist between transport and telecommunications in the developed countries (Lee and Meyburg, 1981). However, fewer studies or researches have been conducted in the developing countries. Among recent research in this area in Nigeria are the studies on the relationship between inter-city travels and telecommunications in Nigeria (Oyesiku, 1996). Infact, most of the studies stated above only focused on establishing or otherwise known hypothesized relationship between travel and telecommunication such as in the following: substitution; complementarily and enhancement. And it was carried out with telephone and telex as means of telecommunication to study relationships with travel.

However, the objective of this study is to discuss some results of a study on the possible effect of access to mobile telephone (GSM) on trip patterns of Lagos metropolis. The effects of telecommunication such as telephone, telex and telefax and etc on trip pattern in an urban areas have either served as substitution, complementarily and enhancement (Lee and Meyburg, 1981; Meyburg, 1983; Clark and Unwin, 1981; Miller, 1982, cited in Oyesiku, 1996).

Another objective of this study is to contribute to the literature on the effects of mobile phone on trip-generation of Lagos metropolis.

However, with the introduction of mobile telephone (GSM), which can be carried about while talking, a high resolution phones that can even transmit text message combined with other features of its equals. The justification for this study is that this is a new innovation in telecommunication technologies whose relationships to travel in developing countries of which Lagos metropolis would be an interesting case studies.

**Travel and telecommunications relationships:** Basically, two levels of interaction between physical travel and telecommunication sub-systems have been advanced in literature: substitution and complementarily. However, lately, some modifications to the established relationship have been added. This is as a result of increasing knowledge advanced in the manufacture of telecommunication technologies. Otherwise known as information communication technologies and possible effects on travels, the substitution relationship, which is more popular among the earlier research in the under study is defined as a trip that is totally eliminated rather than somehow altered by the use of telecommunication (Lee and Meyburg, 1981, cited in Oyesiku, 1996). Implicit in this definition is the fact that total amount of interactions (travel and telecommunications) will not be affected by the assignment of either mode. The substitution hypothesis assumes that the use of telecommunication would shift traffic from physical movement to information communication technologies e.g. Telephone, Telex, etc. Accordingly, Clark and Unwin (1982) defines substitution as a replacement of face to face contacts. In other words, physical interaction is replaced by telephone. Conclusively, the need for travel by physical movement would diminish as telecommunication would substitute for intending trips. Relevant cases of substitution are telecommunicating, telex, telefax, teletext, teleshopping, telebanking, telemedicine and tele entertainment. In Nigeria, as in many developing countries telephoning and telex was identified (Oyesiku, 1996), though, other additions such Mobile telephone, fixed wireless and internet are recent additions. The focus of this study is to ascertain the line of direction of one of these additions to travels. This will help evaluation and direction either for or against or modification of already established hypothesized relationship between telecommunication and travels.

Another form of established relationship, is complementarily, defined as one, in which the telecommunications sub-system complements the physical transport modes. The complementarily as enunciated Oyesiku (1996), can be viewed in broad two ways: the first

is that one sub-system increases the efficiency of the other, that is the use of telecommunications makes the transportation subsystem more efficient in terms of safety and minimizes capital, energy, operation cost and so on. Further, Campell and Thomas (1981), in their contribution remark that through complementary interaction some unnecessary trips could be eliminated and better coordination achieved.

The second type of complementary interaction is more in line with economic usage. This is in a sense similar to complementarily of products. In other words, access to telecommunications would possibly lead to generation of more trips.

Other forms of hypothesized relationships as exist in literature according to Mokhtarian (1990), citing the work of Salomon (1986) and ECMT (1983) identifies Operational Excellency (i.e. telecommunications improves travel by making the transportation system more efficient). Similarly, Mohhataria (1990) emphasized the synergistic relationship between transportation and telecommunication infrastructural inherent benefits to the two systems. Lastly, the indirect, long term impacts of telecommunication on travel (e.g., telecommunication may ultimately affect land use, which will affect travel).

Having considered the possibilities of hypothesized relationships between telecommunications and travels, however, the reliability of such relationships having the same pattern in developing country like Nigeria urban cities is yet clarified. Though, similar studies on the inter-city travel and telecommunication with emphasis on telephone (landline) access in Nigeria existed in literature with defined possibilities (Oyesiku, 1996). The distinguishing aspect of this study is unraveling possible the outcome of such relationship with the use of a mobile telephone (GSM) which can be carried about and has some compatible uses. Such as, texts, mms, GPRS etc. which the convectional telephony system lacks have on travels.

## **MATERIALS AND METHODS**

**The study area:** The study, which took place in between 2001 and 2003, covers 150. Sample mobile phone users of Lagos metropolitan resident, metropolitan Lagos is located in the South Western part of Nigeria. It is the largest metropolitan area in Nigeria. This status is maintained till date. Lagos metropolis lies generally on low lands, with about 17,500 ha of built up area. The approximate population of Lagos is more than 9 million people. The projected average population by the year 2000 is 10 million (source: Lagos State in Maps 1999). The projected average population density of the built-up area of Lagos metropolis is about 20,000 people per square kilometer. It is an emerging African mega city.

Lagos State is the most urbanized state in the country (Odumosu and Adedokun, 1987). The domineering presence of Lagos metropolis as the former Federal Capital Territory (FCT), the commercial nerve centre of the country, as well as the capital of Lagos State, which no urban centre in Nigeria can boast of, shows the importance of urbanization to the land and people of Lagos State (Ogunkoya, 2003).

Up-to-date information on the socio-economic and demographic characteristics and the pattern of intra-city travel pattern of the households was collected. Some important characteristics of the respondents on which information was collected include age, sex, marital status, occupation, educational background and so on.

Most household heads are well educated and they fall into the work force age group (18-55 years). Majority earn their living from varying occupation, which falls into: teaching, civil servant, private sector employed, technician, managers, business persons, traders and others. Majority of the households fall into low income (Below #10,000 and #20,000) per month and middle income (Above #21,000 - #80,000 per month and high income (Above 80,000 per month) groups as at the time of study in 2002. The average household size managing between 5 and 6 (Oyesiku, 1990; Ogunkoya, 2003) including the head, spouse, children and dependant from the extended family, following the cosmopolitan nature of Lagos metropolis, which is believe of economic and activities. It becomes necessary to maintain contact either by telecommunication or physical transport requiring face to face encounter with business associates, family members, relative and kins living in different localities within the metropolis.

**Data source:** Self-completion survey method was used for this study. That is, the use of questionnaire to elicit information on intra-city trips generated. Two types of data were collected for this study: the intra-city trips generated from urban metropolitan residents in order to determine their socio-economic characteristic such as income, occupational status, age, marital status, household size, access to telecommunication (GSM). The second sets were relevant literature, journals and articles etc on trips pattern of urban resident.

It should be noted, data were only collected within the Lagos metropolitan area. Sampling frame include the list of Lagos metropolitan trip makers, who as well have access to mobile telephone. During the period of the research, the total populations for each of the mobile phone service providers were as follows: Econet, 450,000: 14 towns and cities; MTN, 505,000 in 18 towns and cities; Nitel, 118,574 subscribers of which 50,000 were in Lagos (In Guardian, August 6 and 8, 2002). All these constitute

the survey population. The sampling frame from which sample were drawn were sampling unit which double as within the Lagos metropolis. A random sampling techniques were explored to choose and cover the 20% of the total subscriber population of 200,000 who had their number of 150 questionnaires were distributed, which is about 0.0015% of the total. Though, Bruton (1975) recommended a sample size of 10% for population of areas under 50,000 and 1% for areas having 1,000,000 people and above. The cost of procuring survey materials and skilled interviews were the major factor considered in the choice of 0.001% sample size.

In the analysis later to be discussed, the degree of interaction is measured in terms of the volume of intra-city trips generated by the respondent. This is then related to the usage of mobile phone by respondent. For the purpose of this study, the sampled respondents are those who have access to mobile phone for relativity of either in contribution to trip generation of otherwise.

Earlier researches on telecommunication and travel behavior have always been on conventional telephone system (Oyesiku, 1996). However, the reason justifying this current interest is that in Nigeria, telecommunication and travel behavior with conventional telephone system has been studied (Oyesiku, 1996), but telecommunication-mobile phone (GSM) and travel relationship is yet to be explored.

## **RESULTS AND DISCUSSION**

In other to established emerging level of interaction between mobile telephone use and volume if trip. A hypothesis of possible interaction or relationship on the under study was postulated as thus: there is no relationship between mobile telephone use and the volume of trips. The number of call per day, amount spent on making call and number if call per month as shown in Table 1a are predictors of mobile telephone usage and these are use to show the significance between mobile phone use and volume of trips. Table 1a shows that the indices of mobile telephone usage are significant individually on the volume of trips. Also, this shows that correction is significant at the 0.01 and 0.05 levels two-tailed. Therefore, we reject the null hypothesis, which says mobile telephone use does not significantly relate to the volume of trips and accept the alternative hypothesis, which says mobile telephone usage does significantly relate to the volume of trips.

The most significant explanatory variables of the step wise analyses are accessibility to mobile telecommunication and income (Table 1b). This is determined by the value of 't' as shown is the excluded variables.

Table 1a: Correlations co-efficient between mobile phone use and volume of trips

Pearson	NC day	NC day	AMOUNT	NC month	Trip vol
Correlation	Amount	1.0	.463**	.564**	.446**
	NC month		1.0	.257**	.309**
	Trip vol			1.000	.214**
					1.000
	NC day		.000	.0000	.000
	Amount			.010	.002
	NC month				0.32
	Trip vol				

\* Correlation is significant at the 0.01 level (2-tailed), \* Correlation is significant at the 0.05 level (2-tailed)

Table 1b: Stepwise regression analysis

Model/step	Unstandardised coefficient		Standardised coefficient		Sig.
	B	Std. error	Beta	t	
1 (Constant )	28.760	1.829		15.725	.000
ACCTEL	11.850	2.240	0.399	5.290	.000
2 (Constant)	28.225	1.822		15.491	.000
ACCTEL	9.071	2.548	0.305	3.560	.000
INCOMSQ	0.101	0.46	0.188	2.197	.000

a. Dependent Variable TRIPVOL

Excluded variable

Model	Beta In	t	Sig.	Partial correlation	Collinearity statistics/tolerance
Sex	0.22 <sup>a</sup>	0.296	0.768	0.024	0.988
AGESQ	0.068 <sup>a</sup>	0.903	0.368	0.074	0.992
MSTATUS	0.163 <sup>a</sup>	2.183	0.031	0.177	0.997
EDUCATE	0.089 <sup>a</sup>	0.933	0.352	0.077	0.622
HSIZEQ	0.097 <sup>a</sup>	1.288	0.200	0.106	0.995
EMPL	0.072 <sup>a</sup>	0.926	0.356	0.076	0.941
OCCUP	0.071 <sup>a</sup>	0.942	0.348	0.077	1.000
INCOMSQ	0.188 <sup>a</sup>	2.197	0.030	0.178	0.754
Sex	0.011	0.146	0.884	0.012	0.983
AGEQ	0.013	0.161	0.872	0.013	0.873
MSTATUS	0.0136	1.799	0.074	0.147	0.958
EDUCATE	0.017	0.172	0.864	0.014	0.534
HSIZEQ	0.076	1.008	0.315	0.083	0.976
EMPL	0.027	0.343	0.732	0.028	0.87
OCCUP	0.059	0.794	0.428	0.066	0.994

a. Predictors in the model: (Constant), ACCTEL, b. Predictors in the model: (Constant), ACCTEL, INCOMSQ, c. Dependent variables: TRIPVOL

Table 1c: Analysis of variance of co-efficient anova

Model	Sum of Squares	df	Mean square	F	Sig.
Regression	4680.750	1	4680.750		
Residual	24752.91	148	167.249	27.987	.000 <sup>a</sup>
Total	29433.66	149			
Regression	5467.907	2	2733.954	16.987	.000
Residual	23965.75	147	163.032		
Total	29433.66	149			

a. Predictors: (Constant), ACCTEL, b. Predictors: (Constant), ACCTEL, INCOMSQ, c. Dependent variables: TRIPVOL

The level of explanation, that is the significant or level of all the independent variables in explanation or prediction of regression co-efficient  $\beta$  is shown Table 1c which is the analysis of variance table with the F-ratio of 27.987 in first model/step and 16.987 for the second model/step. In order of importance, the variable ACCTEL was the highest predictor in the stepwise regression analysis of variance table for the first model/step. Also, for the second model/step in the stepwise regression analysis of variance table, ACCTEL and INCOMESQ are the important predictors of regression co-efficient at 0.05 and 0.01 level of significant of the volume of trips.

**Telecommunication (GSM users) versus trips generation:** A very important aspect of this paper is to examine the possible relationship between mobile telephone use and trips generation. Accordingly, the accessibility to mobile phone by respondent in Table 2a, shows that 67% of respondents have access to mobile phone, whilst, 33% do not have access to telephone. This is the pattern of mobile phone ownership during the period of study. Though, there has been a drastic increase in mobile telephone ownership since then, however, this does not invalidate the result of the study as well as the significance of the study.

Table 2a : Accessibility to mobile phone GSM

Accessibility to GSM	Frequency	%
Yes	100	67
No	50	33
Total	150	100

Source: Author's field survey (2002)

Table 2b: Monthly volume of trips of GSM users

Volume of trips by GSM users	Frequency	%
Below 20	0	0
31-40	35	35
Above 40	40	40
Total	100	100

Source: Author field survey (2002)

Table 2c: Monthly volume of trips to those without GSM

Volume of trips of those without GSM	Frequency	%
Below 20	2	4
21-30	37	74
31-40	6	12
Above 40	5	10
Total	50	100

Source: Author's field survey (2002)

Table 2d: Relationship between the GSM and trip generation

Relationship of GSM and trips	Frequency	%
Increase the number of trips	27	27
Reduce the number of trips	70	70
No response (Neutral)	3	3
Total	100	100

Table 2b shows the monthly distribution of the volume of trips of mobile telephone users. The results show that 35% of respondents (GSM users) make 20-30 volume of trips, 25% make 31- 40 volume of trip in a month and 40% of respondents (GSM users) make above 40 in trips volume in a month.

Conversely, Table 2c shows the monthly volume of trips by respondent without GSM. The results show that 4% make below 20 in trips volume in a month, 74% of respondent (without GSM) make between 21-30 in trips volume 12% of respondent make between 31-40 in trips volume in a month and lastly 10% make above 40 in trips volume in a month.

Comparatively, the analyses as shown in Table 2b and 2c showed that respondents who have access to mobile telephone make more trips in a month than those without the mobile telephone. The outcomes of this result negate the substitution hypothesis on the relationship between telecommunication and travel as (Lee and Meyburg, 1981; Clark and Unwin, 1981; Pierce, 1977).

In addition, Table 2d, also elucidating the relationship between the telecommunication and travel; shows that 70% of respondents acquire to the fact that accessibility to mobile telephone reduce the number of intended trips by them. While, 27% of respondent opined that accessibility to mobile telephone increase the number of trips made by them. And 3% of the respondent expressed neutrality on the effect of mobile telephone on

trips made by them. The study also reveals that all in all, the use of mobile phone enhances additional trips in Lagos metropolis but do not totally eliminate or substitute trips in the metropolis.

The foregoing emerged hypothesis on telecommunication and travel as established by this study support the earlier identified by Salmon (1986) cited in Mokhtarian (1991); Oyesiku (1996) and Solomon (2000) cited in Ogunkoya (2003).

The distinguishing emphasis of this study is that telecommunication (mobile telephone) has a far-reading effect on travel than the conventional telephone system.

## CONCLUSION

The continued levels of relationships between telecommunications and travels would always witness some form of modifications that may not totally go awry from already hypothesized relationship established in literature. However, the level of relationship between telecommunications and travels, with innovation in telecommunication facilities such mobile telephone would no doubts modify such relationship for improvement in the already established relationship. In the light of above, that the study on telecommunication (mobile telephone) and travel in Lagos metropolis share result outcome in convectional telephone system on travels such as the: substitution, complementary and enhancement, neutrality and modification (Mokhtarian, 1991; Oyesiku, 1996).

The study reveals a far-reaching effect of mobile telephone on travels. Hence, the intensity of trips generated in the Lagos metropolis since the introduction of mobile telephone has increased greatly. Thus, the need for massive transportation infrastructure to cope with the increasing level of trips generated is necessary.

In conclusion, the study on telecommunication (mobile telephone) on intra-city travels in metropolitan Lagos, the largest urban conglomeration in Nigeria, is that of substitution, complimentary and enhancement, neutrality, modification and perfection of trips across various activity zones within the urban centre, which is a new addition to the earlier hypothesized relationship on telecommunications and travels. The resultant hypothesis as revealed by this study is in tandem as well as an addition to earlier research on telecommunication and travels, especially the conventional telecommunication facilities. The latest contribution to literature as reveal by this study on the relationship between telecommunications and travels with the modern telecommunication facilities of which mobile telephone is one is the perfection of trips hypothesis in a developing economy of Nigeria.

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