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INFLUENCE OF MOBILE PHONE USAGE ON TRAVEL BEHAVIOUR OF INTER-URBAN PUBLIC TRANSPORT PASSENGERS IN LAGOS, NIGERIA

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ABSTRACT

Sustainable transportation cannot be overemphasized in recent times because of its relevance in economical, social and ecological impacts of transportation system. As a result, this study investigated the extent to which mobile phone usage (phone calls) influence travel behaviour of inter-urban public transport passengers with a view to achieving a sustainable transport development in Lagos metropolis. A set of structured questionnaire were administered on 1,483 early morning (6am-8am) inter-urban public transport passengers of the selected 76 inter-urban motor parks of Lagos metropolis. Using multi-stage sampling technique, zones of survey, inter-urban motor parks, vehicle types and occupancy ratio were identified and an average of 7, 14 and 43 passengers were interviewed at each of low, medium and high inter-urban motor parks based on passengers' flow on a Wednesday, Friday and Saturday mornings. Data were analysed using frequency tables, chi square, spearman's rank correlation, optimal scaling multiple regression analytical tools for the interpretations and discussions of results. The average trip frequency of inter-urban passengers was 1 trip per week while the average last travel time spent was 5 hours. Also, the average inter-urban travel distance was 380 km and the average inter-urban travel cost was N3, 000 per trip. Besides, the major travel purposes of respondents were business and school (52.4%). The average respondents' inter-urban call frequency was 8 times per week while call distance was 375 km. Furthermore, the average respondents' inter-urban call duration was 4 minutes. There were significant positive relationship between the respondents' travel distances and inter-urban passengers' call distances ($n=1483$, $r_s=0.483$, $p>0.01$), which revealed that as the call distances increases, the travel distances increases; inter-urban call durations ($n=1483$, $r_s=0.119$, $p>0.01$) which revealed that as the call durations increases, the travel distances increases; passengers' received inter-urban calls frequencies ($n=1483$, $r_s=0.075$, $p>0.01$), which revealed that as the calls frequencies increases, the travel distances increases; and received calls distances of inter-urban passengers ($n=1483$, $r_s=0.429$, $p>0.01$) which revealed that as the received calls distances increases, the travel distances increases respectively. The overall variance of explanation showed that travel distances of passengers were influenced by mobile phones usage ($R^2=0.474$), which explained the contributions of mobile phones usage to travel distances. Also, mobile phone calls were greatly influenced by travel demands and socio-economic variables ($R^2=0.728$), which revealed their contributions. The study concluded that mobile phone calls have positive relationship on travel behaviour of inter-urban public transport passengers in Lagos metropolis.

Keywords: Mobile Phone Usage, Travel Behaviour, Inter-Urban, Public Transport Passengers, Sustainable Development

INTRODUCTION

The aftermath of various challenges in the study group of Europe of 1982 and of Nigerian Communication Commission (NCC) in 1985 evolved from the concerns of environmental, ecological and economic transportation sustainability. This empirically brought about the studies on mobile phones' usage and travels, especially as telecommunications rapidly become a feature of general culture. Its effects on inter-urban travels, especially with respect to the interaction and co-evolution of technology and human activity were not thoroughly understood. Based on this direction, there had been a lot of researches to support the influence of mobile phones' usage on inter-urban travels. Although, such studies evolved from the intra-urban forms of travels and these include Mokhtarian (1989) who investigated telecomunications and travel behaviour of passengers in Texas and found that, trip length increases as a result of the use of telecoms; Fadare (1989) studied socio-economic attributes and telecoms and found that, household size, employed members of household and monthly income are contributors to trip rates and telecoms usage, thereby producing longer trip length in Ibadan; Oyesiku (1990) studied the inter-urban travel patterns of Ogun state Urban centers and found that, there were statistical variations between the commercial, transition and residential zones of the study area in relations to telecommunications usages.

Zumkeller (2000) used empirical platform and modelling to study the impact of telecommunications and transport on spatial behaviour and found a combined platform of physical and virtual off-home activities. Handy (2001) studied travel choices in Berkeley and found that, the road mode of transportation was mostly used because of its travel frequency; Fadare and Salami (2004) empirically analyzed the impact of pre GSM fixed land line telephone uses and travel behaviour of residents in Oshogbo and found that, there were statistical positive significant relationships between trip purpose, distance of calls and travel outcomes; Fujiwara (2005) examined the Urban travel behaviour characteristics of 13 cities based on household interview survey in East Asia and found statistical significant variations between and within the cities' phone calls usage and call distances, number of received calls, travel time, travel frequency, number of inter-urban calls, distance of received calls and callers' durations as telecommunications attributes; Obalowo (2007) investigated the impacts of telecommunication usages on households' travel demands in Yaba, Lagos and found that, there were lesser demands for households travels due to mobile phones usages.

Ogunkoya (2008) studied the Cybernetics of travels and telecommunications relationships in metropolitan areas of Nigeria and found that there had been a drastic increase in mobile telephone ownership and the respondents agreed that accessibility to mobile telephone reduces the number of intended trips by them; Olaseni (2010) studied the locational analysis of inter-urban motor parks in Lagos and found positive statistically significant variations between the commercial, transition and residential zones of the study area; Fadare (2010) revealed that the use of telecommunications is a natural substitute for transportation, It is as a matter of resultant outcome rather than initial intent that telecommunications frequently substitute for transportation.

Boansi, Okyere and Adarkwa (2012) investigated sustainability of the urban transport system of Kumasi, Ghana using a survey research with relevant variables of socio-economic and travel demands. The study emanated from transport and sustainable development and established that sustainable transport has social, environmental and economic components, which is key to this study.

James (2012) investigated problematic use of mobile phones: measuring the behaviour, its motivational mechanism and negative consequences using self-report questionnaire to administer the item pool to a developmental sample and found a distinction between actual behaviour, its outcome and motivations while Agunloye (2013) examined the influence of mobile phone calls on travel pattern of airline transport passengers in Murtala Mohammed Airport Two (MMA2) Lagos, Nigeria using survey research method and found that there was a positive significant relationship between mobile phone calls and travel frequency in the study area.

From the fore-going, it was established that there were substitutions, modifications and complementarities for intra-urban travels. However, there is no empirical study on the extent to which mobile phone usage influences the inter-urban travels of public transport passengers in Lagos metropolis. Hence, it becomes a research problem that this study explored. Therefore, the statement of problem is the ''investigation of the extent to which mobile phone usage influence inter-urban travels of public transport passengers with a view to achieving a sustainable development in the study area.

METHODOLOGY

Data on mobile phone usage and travel behaviour of inter-urban public transport passengers in Lagos, Nigeria were majorly sourced through questionnaire administration. The sample frame of the study was 8,021 early morning (6am-8am) inter-urban public transport passengers of the selected 76 inter-urban motor parks of Lagos metropolis while the sample size translated to 20.5% based on Cochran's sample size formula. However, the successfully completed and returned questionnaire that was used for the analysis was 18.5% (1,483 questionnaire). The content and construct validity of measurement were used. The multi-stage sampling technique was used for the study because of the nature of waiting passengers' at the inter-urban motor parks. The sampling procedure for this study firstly encompassed the identification of the zones of survey, secondly, identification of the entire inter-urban motor parks in each of the zones. Thirdly, identification of average number of vehicles in each carrying capacity (low 76 vehicles; medium 99 vehicles and high 121 vehicles) generating the afore-mentioned average number of early morning inter-urban passengers**.** Finally, an average of 7, 14 and 43 passengers were interviewed at each of low, medium and high inter-urban motor parks on Wednesday, Friday and Saturday mornings. The choice of these days was in accordance with the works of Olaseni (2010) and Author's pilot survey (2011). The reliability of instrument used was confirmed by Cronbach's Alpha reliability statistical tool, using the Split Half Method. Frequency tables, chi square, spearman's rank correlation co-efficient, ANOVA and optimal scaling multiple regression statistical tools were used for data analysis through the SPSS data analyses software programme.

RESULTS AND DISCUSSION

Results in Table 1 shows that passengers' group destinations were southwest (20.1%), southeast (36.5%), southsouth (13.1%), northeast (10.2%), northwest (7.2%) and north central (12.9%) respectively in the study area. Using the chi-square statistics, the study found that there is statistical significant differences in respondents' inter-urban trip destinations in inter- urban motor parks of Lagos metropolis (X^2 =203.163, $p<0.05$).

Table 1: Passengers' Inter-Urban Trip Destination

Group destinations	High Capacity Motor Parks		Medium Capacity Motor Parks		Low Capacity Motor Parks		Totals	
	Freq.	percent	Freq.	percent	Freq.	percent	Freq.	%
southwest	127	14.0	118	33.4	53	24.0	298	20.1
southeast	389	42.8	97	27.5	54	24.0	540	36.5
south south	105	11.6	50	14.2	39	17.6	194	13.1
northeast	105	11.6	34	9.6	13	5.9	152	10.2
northwest	75	8.3	14	4.0	18	8.1	107	7.2
north central	108	11.9	40	11.3	44	19.9	192	12.9
Totals	909	100	353	100	221	100	1,483	100

Inter-Urban Passengers' Travel Modes

As shown in Table 2, the study showed that respondents' travel modes in the different motor parks were mini bus (56.4%), large bus (37.6%), saloon/taxi (3.2%) and others were (2.8%). Using the chi-square statistics, the study found that there is statistical significant differences in respondents' travel modes in inter- urban motor parks of Lagos metropolis (X^2 =1248.374, p<0.05).

Table 2: Inter-Urban Passengers' Travel Modes

Travels' modes	High Capacity Motor Parks		Medium Capacity Motor Parks		Low Capacity Motor Parks		Totals	
	Freq.	percent	Freq.	percent	Freq.	percent	Freq.	%
mini bus	446	49.1	250	70.8	139	62.9	835	56.4
large bus (conventional)	430	47.3	74	21.0	54	24.4	558	37.6
saloon/taxi	17	1.9	17	4.8	14	6.3	48	3.2
others	16	1.8	12	3.4	14	6.3	42	2.8
Totals	909	100	353	100	221	100	1,483	100

Passengers' Inter-Urban Trip Frequency in the Past 1 Month

As shown in Table 3, the study revealed that respondents' inter-urban trip frequency were none (22.5%), < 1.5 times (61.8%), 2-3 times (8.8%), 3-4 times (2.2%), 5-6 times (0.3%), 6-7 times (0.7%), >8 times (3.7%) in the past 1 week from different motor parks of Lagos metropolis. The study revealed that the average trip frequency in the past 1 month from different motor parks is 3 times. Using the one way ANOVA, there are statistical significant variations in the duration of stay of respondents in inter-urban motor parks of Lagos metropolis (F=21.925, p<0.05) (see table 5).

Table 3: Passengers' Inter-Urban Trip Frequency in the Past 1 Month

Travel frequencies	High Capacity Motor Parks		Medium Capacity Motor Parks		Low Capacity Motor Parks		Totals	
	Freq.	percent	Freq.	percent	Freq.	percent	Freq.	%
none	154	16.9	98	27.8	82	37.1	334	22.5
< 6 times	638	70.2	178	50.4	100	45.2	916	61.8
6-10 times	68	7.5	47	13.3	16	-	131	8.8
11-15 times	22	2.4	11	3.1	-	-	33	2.2
15 -20 times	5	0.6	-	-	-	-	5	0.3
21-25 times	4	0.4	4	1.1	1	0.5	9	0.7
above 25 times	18	2.0	15	4.2	22	10	55	3.7
Totals	909	100	353	100	221	100	1,483	100

Table 5: ANOVA, Testing the Variation in Respondents' Inter-Urban Travel Frequency in the Past 1 Month

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	147.645	5	29.529	21.925	.000
Within Groups	1989.268	1477	1.347		
Total	2136.913	1482			

Passengers' last travel times

As shown in Table 6, respondents' last travel times were none (7.5%), <3 hrs (13.2%), 3-6 hrs (34.5%), 7-10 hrs (26.8%), 11-14 hrs (13.3%) and > 14 hrs (4.7%) respectively. The study revealed that the average last travel time spent across the three carrying capacities was 4.5 hours. Using the one way ANOVA, there are statistical significant variations in the respondents' last travel times in different motor parks in the three carrying capacities of Lagos metropolis ($F=14.533$, $p>0.05$) (see table 7).

Table 6: passengers' last travel times

Travel times	High Capacity Motor Parks		Medium Capacity Motor Parks		Low Capacity Motor Parks		Totals	
	Freq.	percent	Freq.	percent	Freq.	percent	Freq.	%
none	47	5.2	31	8.8	33	14.9	111	7.5
<3 hrs	105	11.6	52	14.7	38	17.2	195	13.2
3-6 hrs	311	34.2	148	41.9	53	24.0	512	34.5
7-10 hrs	274	30.1	68	19.3	56	25.3	398	26.8
11-14 hrs	133	14.6	32	9.1	32	14.5	197	13.3
above 14 hrs	39	4.3	22	6.2	9	4.1	70	4.7
Totals	909	100	353	100	221	100	1,483	100

Table 7: ANOVA, Testing the Variation in Respondents' last travel times

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	124.070	6	20.678	14.533	.000
Within Groups	2100.164	1476	1.423		
Total	2224.235	1482			

Inter-urban Travel Distance

Results as shown in Table 8, revealed that respondents' inter-urban travel distances were none (7.5%), <250km (13.9%), 250km-500km (42.3%), 500km-750km (21%%) and >750km (15.3%) respectively. The study revealed that the average inter-urban travel distances in different motor parks of Lagos metropolis was 380 km. Also, there are statistical significant variations in the respondents' inter-urban travel distances in different motor parks in the three carrying capacities of Lagos metropolis using the one way ANOVA (F=9.056, p>0.05) (see table 9).

Table 8: Inter-Urban Travel Distance

Travel distances	High Capacity Motor Parks		Medium Capacity Motor Parks		Low Capacity Motor Parks		Totals	
	Freq.	percent	Freq.	percent	Freq.	percent	Freq.	%
none	47	5.2	31	8.8	33	14.9	111	7.5
<250 km	95	10.5	78	22.1	33	14.9	206	13.9
250km-500km	449	49.4	127	36.0	52	23.5	628	42.3
500km-750km	186	20.5	56	15.9	70	31.7	312	21.0
> 750km	132	14.5	61	17.3	33	14.9	226	15.3
Totals	909	100	353	100	221	100	1,483	100

Table 9: ANOVA, Testing the Variation in Respondents' Inter-Urban Travel Distance

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	63.551	6	10.592	9.056	.000
Within Groups	1726.322	1476	1.170		
Total	1789.873	1482			

Passengers' Travel Cost

Results in Table 10 showed that, respondents' inter-urban travel costs (fare) were none 111 (7.5%), <N2, 000 (15%), N2000-N4000 (42.3%), 4001-6000 (22.9%), 6001-8000 (7.2%), 8001-10,000 (3.3%), 10,001-12,001 (0.3%), 12,001-14,000 (0.3%), above 14,000 (1.2%) respectively in the last 1 week. The study revealed that the average inter-urban travel cost in different motor parks of Lagos metropolis is N3, 000. Also, there are statistical significant variations in the respondents' travels costs (fare) in different motor parks in the three carrying capacities of Lagos metropolis using the one way ANOVA (F=17.057, p>0.05) (see table 11).

Table 10: Passengers' Travel Cost

Travel costs	High Capacity Motor Parks		Medium Capacity Motor Parks		Low Capacity Motor Parks		Totals	
	Freq.	percent	Freq.	percent	Freq.	percent	Freq.	%
none	47	5.2	31	8.8	33	14.9	111	7.5
<N2,000	87	9.6	97	27.5	39	17.6	223	15.0
N2000-N4000	420	46.2	125	35.4	81	36.7	626	42.3
4001-6000	237	26.1	64	18.1	38	17.2	339	22.9
6001-8000	65	7.2	22	6.2	20	9.0	107	7.2
8001-10,000	41	4.5	8	2.3	-	-	49	3.3
10,001-12,001	3	0.3	1	0.3	1	0.5	5	0.3
12,001-14,000	4	0.4	1	0.3	-	-	5	0.3
above 14,000	5	0.6	4	1.1	9	4.1	18	1.2
Totals	909	100	353	100	221	100	1,483	100

Table 11: ANOVA, Testing the Variation in Respondents' Travel Cost

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	169.607	6	28.268	17.057	.000
Within Groups	2446.145	1476	1.657		
Total	2615.752	1482			

Passengers' Inter Urban Trip Purpose

As shown in Table 12, the study revealed that respondents' inter-urban travel purposes were none (7.5%), business (37.3%), school (15.1%), work (11.9%), leisure and recreation (11.2%) while others are (17%) in the study area. Using the chi-square inferential statistics, the study found that there is statistical significant differences in respondents' travel purposes in inter- urban motor parks of Lagos metropolis (X^2 =502.280, p<0.05).

Table 12: passengers' Inter Urban Trip Purpose

Travel purposes	High Capacity Motor Parks		Medium Capacity Motor Parks		Low Capacity Motor Parks		Totals	
	Freq.	percent	Freq.	percent	Freq.	percent	Freq.	%
none	47	5.2	31	8.8	33	14.9	111	7.5
business	388	42.7	117	33.1	48	21.7	553	37.3
school	117	12.9	75	21.2	32	14.5	224	15.1
work	99	10.9	54	15.3	24	10.9	177	11.9
leisure and recreation	107	11.9	27	7.6	32	14.5	166	11.2
others	151	16.6	49	13.9	52	23.5	252	17.0
Totals	909	100	353	100	221	100	1,483	100

Major Reason for Travelling Instead of Using Phone(s)

As shown in Table 13, the study revealed that respondents' major reasons for travelling instead of using phones in the study area were bad network (2.9%), personal interaction (84.8%), loss of phone calls (3.6%) while cost of calls was

(8.7%) respectively. Using the chi-square statistics, the study found that there is statistical significant differences in respondents' major reason for travelling instead of using phones in inter- urban motor parks of Lagos metropolis (X^2 =2836.501, p<0.05).

Table 13: Major Reason for Travelling Instead Of Using Phone(s)

Major reasons	High Capacity Motor Parks		Medium Capacity Motor Parks		Low Capacity Motor Parks		Totals	
	Freq.	percent	Freq.	percent	Freq.	percent	Freq.	%
bad network	16	1.8	22	6.2	5	2.3	43	2.9
personal interaction	746	82.1	301	85.3	210	95.0	1,257	84.8
loss of phone calls	31	3.4	22	6.2	1	0.5	54	3.6
cost of calls	116	12.8	8	2.3	5	2.3	129	8.7
Totals	909	100	353	100	221	100	1,483	100

Respondents' Number of Phones Owned

Results showed in Table 14 that respondents' number of phones owned were none (5.5%), 1 phone (49.2%) 2 phones (34.5%), 3 phones (8.3%), 4 phones (2.5%)in the study area. The study further shows that the average respondents' number of phone in different inter-urban motor parks is 1 phone. Using one way ANOVA, the study also revealed that there is a statistical significant variation in respondents' number of phones in different inter-urban motor parks in Lagos metropolis (F=4.388, p>0.05) (see table 15).

Table 14: Respondents' Number of Phones owned

Number of phone calls	High Capacity Motor Parks		Medium Capacity Motor Parks		Low Capacity Motor Parks		Totals	
	Freq.	percent	Freq.	percent	Freq.	percent	Freq.	%
none	47	5.2	27	7.6	7	3.2	81	5.5
1	444	48.8	188	53.3	97	43.9	729	49.2
2	331	36.4	94	26.6	87	39.4	512	34.5
3	70	7.7	32	9.1	21	9.5	123	8.3
4	17	1.9	12	3.4	9	4.1	38	2.5
Totals	909	100	353	100	221	100	1,483	100

Table 15: ANOVA, Testing Variance in Respondents' Number of Phones in Lagos Metropolis

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	17.613	6	2.936	4.388	.000
Within Groups	987.485	1476	.669		
Total	1005.098	1482			

Passengers' Major Mobile Phones

Table 16 revealed that, respondents' major mobile phones from different inter-urban motor parks in Lagos metropolis were Airtel (26%), MTN (52.3%), Globacom (13.7%), Visafone (1.4%), Starcoms (0.9%), Etisalat (5.3%) Multilinks (0.3%) while others were (0.1%) respectively. This study found a statistical significant difference in inter-urban call purpose of inter-urban passengers in Lagos metropolis (X^2 = 2828.407, p<0.05).

Table 16: Passengers' Major Mobile Phones

Major Mobile Phones	High Capacity Motor Parks		Medium Capacity Motor Parks		Low Capacity Motor Parks		Totals	
	Freq.	percent	Freq.	percent	Freq.	percent	Freq.	%
airtel	245	27.0	99	28.0	42	19.0	386	26.0
mtn	444	48.8	194	55.0	138	62.4	776	52.3
globacom	139	15.3	33	9.3	31	14.0	203	13.7
visafone	16	1.8	3	0.8	2	0.9	21	1.4
starcoms	5	0.6	2	0.6	5	2.3	12	0.9
etisalat	56	6.2	20	5.7	3	1.4	79	5.3
multilinks	3	0.3	1	0.3	-	-	4	0.3
others	1	0.1	1	0.3	-	-	2	0.1
Totals	909	100	353	100	221	100	1,483	100

Passengers' Inter Urban Calls' Frequency in the Last One Month

As shown in table 17, respondents' inter-urban call frequency were none (5.1%), <5 times (40.2%), 5-10 times (23.4%), 11-15 times (7.9%), 16-20 times (5.1%), 21-25 times (3.1%) and > 25 times in the study area. The study further shows that the average respondents' inter-urban call frequency in different inter-urban motor parks in Lagos metropolis is 7.5 times. Using one way ANOVA, the study also revealed that there is a statistical significant variation in respondents' inter-urban call frequency in different inter-urban motor parks in Lagos metropolis ($F=11.444$, $p>0.05$) (see table 18).

Table 17: Passengers' Inter Urban Calls' Frequency in the Last One Month

Calls' Frequencies	High Capacity Motor Parks		Medium Capacity Motor Parks		Low Capacity Motor Parks		Totals	
	Freq.	percent	Freq.	percent	Freq.	percent	Freq.	%
none	38	4.2	20	5.7	18	8.1	76	5.1
<5	439	48.3	102	28.9	55	24.9	596	40.2
5-10	195	21.5	107	30.3	45	20.4	347	23.4
11-15	70	7.7	31	8.8	16	7.2	117	7.9
16-20	41	4.5	18	5.1	16	7.2	75	5.1
21-25	29	3.2	10	2.8	7	3.2	46	3.1
above 25	97	10.7	65	18.4	64	29.0	226	15.2
Totals	909	100	353	100	221	100	1,483	100

Table 18: ANOVA, Testing Variance in Respondents' Inter Urban Calls' Frequency in Lagos Metropolis

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	228.250	6	38.042	11.444	.000
Within Groups	4906.531	1476	3.324		
Total	5134.781	1482			

Inter-Urban Passengers' Call Distance per Day

As shown in Table 19, respondents' inter-urban call distances were none (5.1%), <250km 250 (16.9%), 250km-500km (47.5%), 500km-750km (18.2%) and >750km (12.3%) in the study area. The study further shows that the average respondents' inter-urban call distances in different inter-urban motor parks in Lagos metropolis is 375 km. Using one

way ANOVA, the study also revealed that there is a statistical significant variation in respondents' inter-urban call distances in different inter-urban motor parks of Lagos metropolis (F=3.438, p>0.05) (see table 20).

Table 19: Inter-Urban Passengers' Calls Distances per Day

Passengers' Call distances	High Capacity Motor Parks		Medium Capacity Motor Parks		Low Capacity Motor Parks		Totals	
	Freq.	percent	Freq.	percent	Freq.	percent	Freq.	%
none	38	4.2	20	5.7	18	8.1	76	5.1
<250km	127	14.0	78	22.1	45	20.4	250	16.9
250km-500km	505	55.6	126	35.7	73	33.0	704	47.5
500km-750km	140	15.4	73	20.7	57	25.8	270	18.2
above 750km	99	10.9	56	15.9	28	12.7	183	12.3
Totals	909	100	353	100	221	100	1,483	100

Table 20: ANOVA, Testing Variance in Respondents' Inter Urban Calls Distances per Day in Lagos Metropolis

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	20.939	6	3.490	3.438	.002
Within Groups	1498.138	1476	1.015		
Total	1519.078	1482			

Inter-Urban Call Duration per Day

As shown in table 21, respondents' inter-urban call durations were none (5.1%), < 6 minutes (51.5%), 6-10 minutes (27.5%), 11-15 minutes (8.0%) 16-20 minutes (2.9%), 21-25 minutes (2.1%) and >25 minutes (2.9%) respectively. The study further shows that the average respondents' inter-urban call duration in different inter-urban motor parks in Lagos metropolis is 3.5 minutes. Using one way ANOVA, the study also revealed that, there is a statistical significant variation in respondents' inter-urban call duration in different inter-urban motor parks in Lagos metropolis (F=12.982, p>0.05) (see table 22).

Table 21: Inter-Urban Call Duration per Day

Call duration	High Capacity Motor Parks		Medium Capacity Motor Parks		Low Capacity Motor Parks		Totals	
	Freq.	percent	Freq.	percent	Freq.	percent	Freq.	%
none	38	4.2	20	5.7	18	8.1	76	5.1
< 6 minutes	491	54.0	149	42.2	124	56.1	764	51.5
6-10 minutes	256	28.2	105	29.7	48	21.7	409	27.5
11-15 minutes	68	7.5	38	10.8	14	6.3	120	8.0
16-20 minutes	25	2.8	13	3.7	2	0.9	40	2.9
21-25 minutes	17	1.9	9	2.5	5	2.3	31	2.1
> 25 minutes	14	1.5	19	5.4	10	4.5	43	2.9
Totals	909	100	353	100	221	100	1,483	100

Table 22: ANOVA, Testing Variance in Respondents' Inter Urban Calls Duration per Day in Lagos Metropolis

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	109.167	6	18.194	12.982	.000
Within Groups	2068.678	1476	1.402		
Total	2177.845	1482			

Passengers' Calls Destinations

Results revealed in table 23 that respondents' inter-urban call destinations were none, (5.1%); north, (19.2%); south, (21.1%); east, (34.7%) and west, (19.9%) respectively This study found a statistical significant difference in inter-urban call destinations of inter-urban passengers in different inter-urban motor parks of Lagos metropolis (X^2 = 324.866, p<0.05).

Table 23: Passengers' Calls Destinations

Calls Destinations	High Capacity Motor Parks		Medium Capacity Motor Parks		Low Capacity Motor Parks		Totals	
	Freq.	percent	Freq.	percent	Freq.	percent	Freq.	%
none	38	4.2	20	5.7	18	8.1	76	5.1
north	185	20.4	62	17.6	37	16.7	284	19.2
south	165	18.2	91	25.8	57	25.8	313	21.1
east	365	40.2	89	25.2	60	27.1	514	34.7
west	156	17.2	91	25.8	49	22.2	296	19.9
Totals	909	100	353	100	221	100	1,483	100

Respondents' Received Inter-Urban Calls in the Last One Month

As shown in table 24, respondents' inter-urban received calls were none (5.4%), <5 times (38.6%), 5-10 times (25.9%), 11-15 times (11.9%), 16-20 times (5.1%), 21-25 times (3.1%) and > 25 times (10%) in the study area. The study further shows that the average respondents' received inter-urban calls in Lagos metropolis is 7.5 calls. Using one way ANOVA, the study also revealed that, there is a statistical significant variation in respondents' inter-urban call duration in Lagos metropolis (F=5.523, p>0.05) (see table 25).

Table 24: Passengers' Received Inter-Urban Calls in the Last One Month

Received calls	High Capacity Motor Parks		Medium Capacity Motor Parks		Low Capacity Motor Parks		Totals	
	Freq.	percent	Freq.	percent	Freq.	percent	Freq.	%
none	38	4.2	20	5.7	22	10.0	80	5.4
<5	416	45.8	97	27.5	60	27.1	573	38.6
5-10	214	23.5	120	34.0	50	22.6	384	25.9
11-15	106	11.7	45	12.7	26	11.8	177	11.9
16-20	48	5.3	19	5.4	9	4.1	76	5.1
21-25	26	2.9	16	4.5	3	1.4	45	3.1
above 25	61	6.7	36	10.2	51	23.1	148	10
Totals	909	100	353	100	221	100	1,483	100

Table 25: ANOVA, Testing Variance in Respondents' Received Inter-Urban Calls in Lagos Metropolis

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	89.521	6	14.920	5.523	.000
Within Groups	3987.129	1476	2.701		
Total	4076.650	1482			

Received Calls' Distance of Inter-Urban Passengers in the Last One Month

As revealed in table 26, respondents' inter-urban received call distances were none (5.4%), <250km (16.6%), 250km-500km (50.2%), 500km-750km (17.3%) and >750km (10.5%) in Lagos metropolis. The study further shows that the average respondents' received call distances in inter-urban motor parks of Lagos metropolis is 380 km. Using one way ANOVA, the study also revealed that there is a statistical significant variation in respondents' inter-urban call distances in Lagos metropolis ($F=4.124$, $p>0.05$) (see table 27).

Table 26: Received Calls' Distance of Inter-Urban Passengers in the Last One Month

Received Call Distances	High Capacity Motor Parks		Medium Capacity Motor Parks		Low Capacity Motor Parks		Totals	
	Freq.	percent	Freq.	percent	Freq.	percent	Freq.	%
none	38	4.2	20	5.7	22	10.0	80	5.4
<250km	107	11.8	94	26.6	45	20.4	246	16.6
250km-500km	543	59.7	145	41.1	56	25.3	744	50.2
500km-750km	137	15.1	55	15.6	64	29.0	256	17.3
> 750km	84	9.2	39	11.0	34	15.4	157	10.5
Totals	909	100	353	100	221	100	1,483	100

Table 27: ANOVA, Testing Variance in Respondents' Calls' Distance in Lagos Metropolis

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	23.608	6	3.935	4.124	.000
Within Groups	1408.255	1476	.954		
Total	1431.864	1482			

Received Inter-Urban Callers' Duration in the Last One Month

As shown in table 26, inter-urban callers' duration were none (5.4%), < 6 minutes (49.9%), 6-10 minutes (27.4%), 11-15 minutes (8.08%) 16-20 minutes (4.1%), 21-25 minutes (1.9%) and >25 minutes (2.5%) respectively. The study further shows that the average respondents' inter-urban callers' duration in different inter-urban motor parks in Lagos metropolis is 8 minutes. Using one way ANOVA, the study also revealed that, there is a statistical significant variation in

respondents' inter-urban call duration in different inter-urban motor parks in Lagos metropolis (F=14.495, p>0.05) (see table 27).

Table 26: Received Inter-Urban Callers' Duration in the Last One Month

Callers' Duration	High Capacity Motor Parks		Medium Capacity Motor Parks		Low Capacity Motor Parks		Totals	
	Freq.	percent	Freq.	percent	Freq.	percent	Freq.	%
none	38	4.2	20	5.7	22	10.0	80	5.4
< 6 minutes	469	51.6	154	43.6	117	52.9	740	49.9
6-10 minutes	265	29.2	101	28.6	41	18.6	407	27.4
11-15 minutes	83	9.1	32	9.1	15	6.8	130	8.8
16-20 minutes	33	3.6	22	6.2	6	2.7	61	4.1
21-25 minutes	9	1.0	11	3.1	8	3.6	28	1.9
> 25 minutes	12	1.3	13	3.7	12	5.4	37	2.5
Totals	909	100	353	100	221	100	1,483	100

Table 27: ANOVA, Testing Variance in Respondents' Callers' Duration in Lagos Metropolis

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	120.267	6	20.044	14.495	.000
Within Groups	2041.040	1476	1.383		
Total	2161.307	1482			

Respondents' Inter-Urban Call Purposes in the Last One Month

Results in table 28 revealed that respondents' call purposes were none (5.4%), business (40.9%), school (13.5%), work (12.3%), leisure and recreation (18.7%), others (17.8%) in the study area. This study found a statistical significant difference in inter-urban call purposes of inter-urban passengers in different inter-urban motor parks of Lagos metropolis (X^2 = 1034.437, p>0.05).

Table 28: Inter-Urban Call Purposes in the Last One Month

Call Purposes	High Capacity Motor Parks		Medium Capacity Motor Parks		Low Capacity Motor Parks		Totals	
	Freq.	percent	Freq.	percent	Freq.	percent	Freq.	%
none	38	4.2	20	5.7	22	10.0	80	5.4
business	408	49.9	130	36.8	69	31.2	607	40.9
school	105	11.6	67	19.0	28	12.7	200	13.5
work	107	11.8	53	15.0	22	10.0	182	12.3
leisure	74	8.1	26	7.4	22	10.0	122	8.2
recreation	9	1.0	10	2.8	9	4.1	28	1.9
others	168	18.5	47	13.3	49	22.2	264	17.8
Totals	909	100	353	100	211	100	1,483	100

Correlations between Inter-Urban Travel Distances and Mobile Phone Usage of Respondents in Lagos Metropolis

This analysis explains the nature of bivariate relationship between inter-urban mobility (travel distance) and mobile phones usage in Lagos Metropolis. The variables of mobile phones usages were correlated with variables of inter-urban

mobility (travel distance). The results of the travel distance of inter-urban passengers with the variables of mobile phone usage in Lagos metropolis is as shown in Table 29.

As demonstrated in table 30, only five variables out of the ten mobile phones usages' variables had significant relationships with travel distances of respondents in inter-urban motor parks of Lagos Metropolis. The study revealed that, there are positive statistical significant relationships between the respondents' travel distances and inter-urban passengers' call distances (n=1483, r_s=.483, p>0.01); inter-urban call durations (n=1483, r_s=.119, p>0.01); passengers' received inter-urban calls frequencies (n=1483, r_s=.075, p>0.01); Received calls distances of inter-urban passengers (n=1483, r_s=.429, p>0.01) and Received inter urban callers' durations (n=1483, r_s =0.115, p>0.01). This results support one of the findings of Mokhtarian (1989) who investigated telecommunications and travel behaviour of passengers in Texas and found that, trip length increases as a result of the use of telecommunications.

The correlation result of the respondents' travel distances and inter-urban passengers' calls distances (n=1483, r_s =.483, p>0.01) revealed that, there is positive statistical significant relationship between the travel distances and inter-urban passengers' calls. This suggests that the higher the number of inter-urban passengers calls, the longer the travel distance. This is supported by the average travel distance of inter-urban passengers, which is 375km in Nigeria. Besides, this also opposes the theory of tele-substitution as the use of mobile phones increases travel length.

The result of correlation of respondents' travel distances and inter-urban call durations revealed that, there is a positive statistical significant relationship between the travel distances and inter-urban call durations. This suggests that, the higher the number of times used for calls, the longer the travel distances of inter-urban passengers' calls durations. This is supported by the average travel duration of inter-urban passengers, which is 3.5 times in Nigeria.

The correlation result of the respondents' travel distances and passengers' received inter-urban calls frequencies revealed that, there is a positive statistical significant relationship between the travel distances and passengers' received inter-urban calls frequencies. This suggests that the higher the number of inter-urban passengers calls received, the longer the travel distances. This is supported by the average inter-urban passengers calls received, which is 7.5 calls in Nigeria. Besides, this also opposes the theory of tele-substitution as the use of mobile phones increases by the callers of the respondents increases the travel length.

The correlation result of the respondents' travel distances and Received calls distances of inter-urban passengers revealed that, there is a positive statistical significant relationship between the travel distances and Received calls distances of inter-urban passengers. This suggests that, the higher the number of Received calls distances of inter-urban passengers, the longer the travel distances from Lagos metropolis. This is supported by the average inter-urban passengers calls received, which is 380km in Nigeria. Besides, this also opposes the theory of tele-substitution as the use of mobile phones increases by the callers' distances, the respondents' travel lengths increases.

The correlation result of the respondents' travel distances and Received inter urban callers' durations revealed that, there is a positive statistical significant relationship between the travel distances and received inter urban callers' durations by inter-urban passengers. This suggests that, the higher the number of Received inter urban callers' durations, the longer the

travel distances from Lagos metropolis. This is supported by the average Received inter urban callers' durations, which is 8 minutes in Nigeria.

Table 29: Relationships between Inter-Urban Travel Distances and Mobile Phone Usages of Respondents in Lagos metropolis

		inter-urban travel distance	passengers' number of phone calls	passengers' inter urban calls	inter-urban passengers' call distance	inter-urban call duration	passenger' received inter-urban calls	call distance of inter-urban passengers	inter urban callers' duration
Spearman's rho	inter-urban travel distance	1.000							
	passengers' number of phones	.019	1.000						
	passengers' inter urban calls	.047	.304(**)	1.000					
	inter-urban passengers' call distance	.483(**)	.131(**)	.265(**)	1.000				
	inter-urban call duration	.119(**)	.224(**)	.399(**)	.263(**)	1.000			
	passenger' received inter-urban calls	.075(**)	.224(**)	.682(**)	.198(**)	.417(**)	1.000		
	call distance of inter-urban passengers	.429(**)	.137(**)	.210(**)	.561(**)	.210(**)	.219(**)	1.000	
	inter urban callers' duration	.115(**)	.203(**)	.379(**)	.183(**)	.532(**)	.471(**)	.236(**)	1.000

** Correlation is significant at the 0.01 level (2-tailed).

Multivariate Analysis of Factors Influencing Travel Distance of Inter-Urban Passengers in Lagos Metropolis

The Optimal Scaling Categorical Multiple Regression Analysis of this study is of the form $Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_3x_3 + \ldots\ldots\ldots b_{10}x_{10} + e$ (since ten variables were used). These explanatory variables are:

x_1= passengers' number of phones

x_2= passengers' major mobile phones

x_3= passengers' inter urban calls

x_4= inter-urban passengers' call distance

x_5= inter-urban call duration

x_6= passengers' calls destinations

x_7= passenger' received inter-urban calls

x_8= received call distance of inter-urban passengers

x_9= received inter urban callers' duration

x_{10}= inter-urban call purpose

As shown in table 4.51, the optimal scaling categorical multiple regression performed on the combined data of Lagos metropolis revealed that, the R^2 = 0.474 and Adjusted R^2 =0.461 was 47.4% and 46.1% respectively. This means that 53.9% of the variance of travels distances of respondents in Lagos metropolis could not be explained by the eight significant factors selected. This study shows that the total strength of relationship between mobile phones usage and inter-urban mobility of respondents in the entire inter-urban motor parks of Lagos metropolis is 0.70, which is a strong positive relationship.

Table 30: Model Summary

Multiple R	R Square	Adjusted R Square
.689	.474	.461

Dependent Variable: inter-urban travel distance

This relationship also helps to reject the null hypothesis that ‘‘there are no significant relationships between passengers’ inter-urban travel distances and passengers’ number of phones, inter-urban calls’ frequency, inter-urban call distance, inter-urban calls durations, received inter-urban calls frequency, received inter-urban callers’ duration, received inter-urban calls distance amongst others in the study area’’ and accepts the alternative hypothesis. The regression model was significant at explaining the variance in travels distances of respondents in Lagos metropolis (see table 4.52).

Table 31: ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	703.483	36	19.541	36.249	.000
Residual	779.517	1446	.539		
Total	1483.000	1482			

Dependent Variable: inter-urban travel distance

From table 31, an Optimal Scaling Categorical Multiple Regression equation of the variable Y (travel distance) in relation to the ten independent variables could be written as:

$$Y = 1.583 + -.028_{x1} + .054_{x2} + -.101_{x3} + .397_{x4} + .022_{x5} + -.095_{x6} + .070_{x7} + .326_{x8} + -.041_{x9} + .123_{x10+e}$$

This equation shows that inter-urban calls distance has the highest contribution of 0.397 to the variation in travel distance of inter-urban passengers in Lagos metropolis. Passengers' major mobile phones, passengers' inter urban calls, inter-urban passengers' call distance, passengers' calls destinations, passenger' received inter-urban calls, Received call distance of inter-urban passengers, Received inter urban callers' duration and inter-urban call purpose were statistically significant. Only passengers' number of phones and inter-urban call duration were not statistically significant (see table 32).

Table 32: Coefficients

	Standardized Coefficients		df	F	Sig.
	Beta	Std. Error	Beta	Std. Error	Beta
passengers' number of phones	-.028	.020	1	1.997	.158
passengers' major mobile phones	.054	.019	7	7.921	.000
passengers' inter urban calls	-.101	.025	4	15.789	.000
inter-urban passengers' call distance	.397	.026	2	227.892	.000
inter-urban call duration	.022	.021	1	1.105	.293
passengers' calls destinations	-.095	.020	4	22.872	.000
passenger' received inter-urban calls	.070	.025	3	8.025	.000
Received call distance of inter-urban passengers	.326	.026	3	157.466	.000
Received inter urban callers' duration	-.041	.021	5	3.807	.002
inter-urban call purpose	.123	.019	6	40.880	.000

Dependent Variable: inter-urban travel distance

RECOMMENDATIONS AND CONCLUSION

Recommendations

There is a need to establish an e-commerce centre that will help to reduce the observed travel distances that increased as a result of the increase in calls distances. It is also important to introduce e-schools in Nigeria in order to reduce the passengers' travels as revealed in the study to be one of the major travel purposes which consequently result into longer travel distances of inter-urban passengers with a view to achieving sustainable development in the study area. The centrifugal elements of travels should also be discouraged through the introduction of research institute that will specialize on telecommunication usage and travel behaviour that will be saddled with the responsibilities of investigating the received call

purpose with a view to providing alternatives to the inter-urban passengers/callers demands. This becomes necessary because of the revelation of the higher the number of inter-urban passengers calls received, the longer the travel distances.

In addition to the afore-mentioned, there is a need to respond to the sprawling land use pattern of the country such that business, school and work areas will be equitably available in each state of the country. This could also be achieved by the recent introduction of compact city and smart growth concepts being concepts that encourage the development of mixed landuse inter-urban trip length and time hence, productivity can be enhanced even as travel costs are reduced. This landuse and transport integration from the compact city concept has been adopted in Curitiba in Brazil and was later replicated in New-York City with outstanding success (Alade, 2009) and it is expected that its replica in the spatial structure of Nigeria will help to produce the desire results that have been established in other parts of the world. Besides, there is also a need for a 5 year interval periodic inter-urban travels survey as this will help to solve urgent problems emanating from inter-urban passengers' travels and help the policy direction in the Nigeria National Transport Policy as this is usually done in the United States between 5-7 years periodic intervals.

CONCLUSION

This study has investigated the influence of mobile phones usage (phone calls) on travel demands of inter-urban public transport passengers with a view to attaining a sustainable development in Lagos metropolis and found positive relationships between mobile phones' usage and travel demands of inter-urban public transport passengers in Lagos metropolis. It has also validated the theory of tele-substitution and proved to have potentials for solving challenges of road traffic accidents, congestion and most importantly evolving a sustainable transport planning. This study has implications on wealth creations, travels demands modelling and forecasting, climate change adaptability, low carbon city generation, smart growth creation among others. Telecommunications are just beginning to accommodate almost every aspect of lives; as populations increase, particularly population within Lagos metropolis, there is a need to also increasingly rely on general phone usages (other than phone calls alone) to avoid congestion on transportation networks and at activity sites.

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