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Analysis of the Cost of Traffic Congestion on Worker's Productivity in a Mega City of a Developing Economy

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Abstract

This study examined the cost of traffic congestion on workers' productivity in Lagos, Nigeria. The study adopted multi-stage sampling technique. Transport corridors prone to congestion were purposively selected. Quoted companies along the selected corridors were stratified and workers in the selected companies were randomly selected. A total of 510 respondents were randomly sampled from the 5100 workers of six (6) selected companies to elicit information on time spent in congestion, costs of traffic congestion and effect of traffic congestion on their performance. Multivariate Regression was used to analyse the effect of cost, time and commuting distance (independent variables) on the performance of workers (dependent variable). Result of MANOVA revealed that 15.6 per cent of variation in workers' productivity is accounted for by traffic congestion. Based on the Multivariate Regression, it was found that average distance covered (km) ($F = 3.39, p = 0.0015$), time (min) $F = 12.51$ $p = 0.0000$) and costs (N) ($F = 31.79$, $p = 0.0000$) are significantly related to traffic congestion. Estimates of costs of traffic congestion on workers' productivity showed that lateness in the time bracket of 90 minutes is significant ($p< 0.05$) but negatively related to workers' productivity. The study concluded that there is inverse relationship between traffic congestion and workers' productivity, implying that increase in the rate of traffic congestion will lead to low productivity. Therefore, the study recommended that government should endeavour to effect policies that are capable of reducing traffic congestion on the roads in order to improve free flow of traffic that would significantly improve the productivity of workers in both the public and private sectors of the national economy.

Key Words: *Congestion, Productivity, Cost, Traffic, workers*.

Introduction

Transportation system is an integral part of a modern day society, designed to provide efficient and economical movement between the component parts of a country and offer maximum possible mobility to all citizens (Leshem and Ritov, 2007). According to (Leshem et al, 2007), road transportation is a critical link between all the other modes of transportation and their proper functioning. It is the lifeblood of industrialised economies. Unfortunately, the existing road network, including the motorway system, is becoming explosively congested due to increase in the number of vehicles and inability to build new and larger motorways (David and Gregory, 2010).

Congestion is relatively easy to recognize when roads are noticeably filled with cars, trucks, and buses. Sidewalks filled with pedestrians. Congestion, both in perception and reality, impacts the movement of people and freight in most urban areas and is deeply tied to our history of high level of accessibility and mobility (Downs, 2004). Congestion, according to Ogunsanya (1984), can be described as a situation, which arises as a result of many vehicles struggling to use the same road at the same time along spatial and temporal dimensions. Some say that traffic congestion has been around since ancient Rome (Downs, 2004), '*the Caesars noted that 'the passage of goods carts on narrow city streets so congested them that they became impassable and unsafe for pedestrians'.*

Everyone detests traffic congestion, but it keeps getting worse, in spite of attempted remedies. This violates theoretical axiom that all problems have solutions in the long run. Rising traffic congestion is an inescapable condition in large and growing metropolitan areas across the world. Peak-hour congestion is an inherent result of the way modern societies operate, and the strong desires of their residents to pursue goals that inevitably overload existing roads and transit systems every day (David and Gregory, 2010). The problem of traffic congestion is that too many people want to move at the same time each day. This is predicated on efficient operation of both the economy and the school system which requires that people work, go to school, and run errands during the same hours so they can interact with one another. The situation becomes more crippling and unalterable due to the delicate space it occupies in the national economy and its pivotal role in society. It must be emphasized that the scourge is not peculiar to Nigeria. Indeed, it has become like cancer spreading its fangs in every major urban region in the world.

In the economic context, productivity is viewed as the ratio (total business output)/(weighted average cost of business inputs), and business output is defined in terms of dollars of business sales and business inputs are defined to include costs of obtaining labour, equipment, supplies, transportation, and other services. In general, congestion delays can affect productivity in three major ways: by increasing business costs of current delivery operations, by limiting or reducing business sales through a reduction in effective market size, and by increasing unit costs through loss of opportunities for scale economies in production and delivery processes. (Evers, 1988; McCann 1993; Ciccone and Hall 1996; Weisbrod, Vary and Treyz, 2001).

Hensher and Puckett (2005) observed that business costs and productivity clearly indicate that businesses incur costs associated with transporting goods and people that are beyond the direct personal value of driver time and direct operating cost. In their own view Kim, Hewings and Hong (2004) emphasised that these can be examined in terms of overall productivity measures, which in theory encompass the net effect of all such costs. Alternatively, they can be examined in terms of their primary components:

- Market access costs,
- Logistics costs,
- Production scheduling (JIT processing) costs, and
- Overall productivity.

It is imperative to observe that all these cost impacts can differ by industry, by location, and by specific economic market served. Similarly, since activities within organizations are performed by employees, it could be logically inferred that employee productivity translates to overall organizational productivity. Workers' productivity therefore can be affected by various factors one of which is commuting to and from workplace. On the other hand, congestion is seen as having significant impact on a number of sectors including the environment and economy as a whole and therefore occupies a prominent place on the political agenda (Grant-Muller and Laird, 2007).

In so many countries in the developed world, options such as charging peak-hour toll, expansion of road capacity, expansion of public transit capacity, introduction of specialized lanes and buses, ramp-metering, building more roads to create alternative routes, use of intelligent transportation devices to speed traffic flows, responding more rapidly to traffic-blocking accidents and incidents, adopting "parking cash-out" programmes, restricting the outward movement of new development, requiring higher densities in both new-growth and established settlements, clustering high-density housing around transit stops, yet, we still experience congestion on major roads during peak hours. What is less clear is whether or not living with congestion is another strategy that can be employed, considering the average labour hour loss accruable to too long waiting congestion line.

Demand for highway travel by Nigerians continues to grow as the population increases, particularly in metropolitan areas. The effects of congestion are captured in a number of measures and perceptions, including visible and consistent roadway congestion, the loss of personal and professional time, environmental degradation, and general traveler frustration – in essence, a reduction in overall mobility and accessibility (Louis, Neudorff, Jeffrey, Randall, Robert Reiss, Robert Gordon, 2006). In 2013, $78 billion resulted from time and fuel wasted in traffic (direct costs) and $45 billion was the sum of indirect costs businesses passed onto American consumers.

With millions of commuters wanting to move at the same time of day, our basic problem is that the road system in Nigeria might not have enough capacity to handle the resulting peak-hour loads without forcing many people to wait in line for that limited road space. Such "waiting in line" is the definition of congestion. The same condition is found, often even worse, in growing major metropolitan regions everywhere.

There had been series of attempts by governments to propagate solutions via public transit (the use of specialized lanes and buses); however, in situations where public transit does not serve efficiently, commuters are left with no alternative than to resort into using private vehicles, which are seen to be more comfortable, faster, more private, more convenient in trip timing, and more flexible for doing multiple tasks on one trip than almost any form of public transit when the congestion is bearable. Therefore, around the world, as income rise, more and more people shift from less costly modes of travel to privately-owned vehicles which in effect bring the volume of traffic too close to the maximum capacity of a road or network.

The externalization of congestion costs has been a greater challenge of transportation planning in Lagos, as it is in most developing countries (Odeleye, 2008). According to him the relocation of the urban poor to the urban fringe led to the unprecedented rapid sprawl of Lagos metropolis, due to the geometrical growth in the population of the city which complicates the pattern of road traffic congestion in the state.

For instance, the North-South uni-directional nature of traffic at peak periods often choked-up traffic towards the city centres, where commercial and other social activities are largely located, in Lagos. Hence intra-urban travelers in Lagos, particularly, commuters often spend relatively long time travelling from one part of the city to the other. This is as a result of the severity of road traffic congestion at peak periods.

For everyday travelers, the frustration of traffic is obvious. Understanding the impact on cities and the economy, however, is not as straight forward as many would like (David and Gregory, 2009). From an economic perspective, according to them, congestion's main impact is the lost productivity from more time spent traveling to work rather than working; delaying (or missing) meetings; foregoing interactions among individuals or personal activities due to long travel time; and spending more time to accomplish tasks than would otherwise be necessary if we could reliably plan for accomplishing the same things at free-flow speeds. Somuyiwa and Dosunmu (2008) concluded that almost $8000 (about ₦950, 400) is the cost of delay per individual in one year in Nigerian cities.

In short, a region's economy does better when people spend more time working and doing things they find valuable and less time traveling to do them. Individuals depend on the available transportation system to provide access to people and places they want to go. Peak-hour traffic congestion in almost all large and growing metropolitan regions around the world is almost certain to get worse during the next few decades because of rising population and wealth, no matter what policies are adopted to combat congestion. This outcome should not be regarded as a mark of social failure or wrong policies. In fact, traffic congestion often results from economic prosperity and other types of success. People congregate in large numbers in those places where they most want to be. This conclusion does not mean nothing can be done to slow down the rate at which congestion intensifies.

Therefore, it is important to unravel the possible implication of traffic congestion on workers' productivity as it involves the possible incidence of cost of traffic congestion on workers' productivity and man hour loss. Relating these to business practices in Nigeria would to a greater extent justify the need for congestion control in major cities of Nigeria.

Conceptual Framework and Literature Review

Business Cost of Traffic Congestion

There is evidence that traffic congestion causes a significant cost imposition. For example a survey from the United Kingdom found that traffic congestion was perceived as the most important factor likely to affect costs and service. (Fernie, and Marchant, 2000). A large number of transport economics studies focus on the time component of commuting costs (Small and Verhoef, 2007). Estimates of the time component of commuting costs vary by a large margin, but studies tend to find that the value of travel time is 20% to 100% of the hourly (gross) wage (Small, 1992). De Borger and Fosgerau (2008) find strong reference- point effects in stated preference data and suggest a way to correct for this effect. Revealed preference studies tend to find substantially higher values than stated preference studies. Although the time component is an important part of the commuting costs, the other components are not negligible, and may therefore not be ignored (Cogan, 1981). For commuters, the monetary costs are thought to be about 30% to 40% of the time costs (e.g., Fujita, 1989;Small, 1992). Furthermore, workers may vary the speed of their commute through their choice of travel mode, so the share of the time costs as part of the total commuting costs is endogenously determined. As a consequence, information on the costs of the time component is not necessarily informative about the total commuting costs.

For all travel modes except car use, the marginal monetary costs are easy to determine. For non-motorized transport (bicycling, walking), the marginal monetary costs are (close to) zero; for public transport (train, bus, metro), the marginal monetary costs can be derived from the price paid for the ticket. For car users, however, who are the majority of commuters, the marginal monetary costs associated with commuting are not so straight forward to determine. These costs of car use comprise not only the variable costs of car use (fuel, depreciation of the car due to its use), but also costs that are related to the ownership of the car (interest, insurance, etc). The latter cost component is frequently treated as *fixed,* and it is therefore assumed not to affect workers' marginal costs of travel. This may be argued to be a relevant assumption in the United States, where car availability is high and almost all workers commute by car. Outside the United States, the proportion of workers who commute by car is much smaller. For example in the Netherlands, approximately 50% of workers commute by car. Car ownership decisions will frequently depend on the length of the commuting distance, which constitutes about one third of a car's mileage (DeJong, 1990). Consequently, even though treating car ownership costs as fixed may make sense with respect to some travel decisions, these costs are clearly not fixed with respect to commuting.

Workers' marginal commuting costs can be derived in various ways. One method, familiar to labour economists, is to use the tradeoff between wages and the length of the commute, using hedonic wage models, as developed by Rosen (1986). But such a method has a number of disadvantages, as it relies on the (implicit) assumption that workers have full information about availability of jobs and do not have to search for jobs (Hwang *et al.*, 1998; Gronberg and Reed, 1994). A number of studies have shown that estimates of valuation of job attributes, such as commuting time, are likely seriously downward-biased if hedonic wage models are used (Van Ommeren *et al*., 2000; Villanueva, 2007).

Types of Congestion

The three types of congestion are outlined by Brownfield et al (2003) as recurrent congestion, non-recurrent congestion and the pre-congestion state, as shown in Table1. These types are based upon the frequency and predictability of the congestion the factors which are capable to impact on driver behaviour. The costs associated with each type of congestion are likely to be different. Non-recurrent congestion costs may be more difficult to quantify due to the inherent sparseness of adequate amounts of data needed – it may be argued that the costs could be higher as drivers have not been able to take the possibility of congestion into account in planning their journey or alternatively the costs may be less dramatic as drivers pre-developed strategies for coping with congestion will not have come into play. Some routes are increasingly subject to non-recurrent congestion however, for example with accident black spots. In these cases drivers may 'learn' an expected cost in terms of likely delay and successful contingency routes. The Pre-congestion state will carry some costs similar to those of congestion, including loss of control over drivers' environment, deterioration in the environment and other impacts.

Table I: Type of Congestion

Congestion Type	Definition
Recurrent congestion	Occurs at regular times at a site. It can be anticipated by road users that normally use the route during those times. Examples of recurrent congestion are morning or evening peak hour congestion, or congestion due to a regular events such as a street market on a particular day each week.
Non-recurrent congestion	Occurs at non-regular times at a site. It is unexpected and unpredictable by the driver and is normally due to incidents such as accidents, vehicle breakdowns or other unforeseen loss of carriageway capacity.
Pre-congestion (Borderline congestion)	Occurs where free-flow conditions breakdown but full congestion has not yet occurred. This may occur either side of the time period when congestion occurs or upstream or downstream of congestion that is already occurring.

Source: Adapted from Brownfield, (2003)

The increase in traffic congestion is more than a time-wasting nuisance to freight movers. High levels of traffic congestion have been found to reduce the number of trip a truck driver can make in a day and therefore increase shipment costs, which impacts the competitiveness of metropolitan manufacturers and other businesses. Theoretically, it goes without saying that there is a link between per capita income of an economy and such economy's marginal labour productivity. One justification for the special emphasis on labour productivity is perhaps because labour is a universal key resource. The term labour productivity implies the ratio of physical amount of output achieved in a given period to the corresponding amount of labour expended. By implication, productivity here means the physical volume of output attained per worker or per man-hour. (Oyeranti 2000)

However, apprehension exists on the definition of labour that is suggestive of the fact that labour productivity is an expression of the intrinsic efficiency of labour alone. Indeed, productivity is more of the end result of a complex social process involving science, research, analysis, training, technology, management, production plant, trade union, and labour among other inter-related influences. To this end, it must be appreciated that the definition of productivity partially is purely to satisfy the demand of theoretical curiosity. Practically, the interdependence nature of the demands for factors implies that it is impossible to say precisely and clearly how much output has been created by any one of the different inputs taken by itself. Some common misunderstandings exist about productivity. First, productivity is not only labour efficiency or labour productivity even though; labour productivity statistics are essentially useful policy-making data. Productivity is much more than just labour productivity and needs to take into account other inputs involved in the production process. Two, productivity is not the same as increase in output or performance. (Scott 1983). Sumanth (l984) described this misconception as the confusion between productivity and production. Output may be increasing without an increase in productivity if, for example, input costs have risen disproportionately. One useful way to combat this misconception is to be conscious of the trend of input costs particularly by relating output increases to price increases and inflation. This approach is often the result of being process oriented at the expense of paying attention to final results. Bureaucratic settings are more prone to this misconception of productivity.

Leeuw and Wright (2006) in their study of workers' productivity employ variables such as average number of employees (production and non-production combined), annual payroll, average number of production workers, production worker hours, production worker wages, value added, total cost of materials, total value of shipments and total capital expenditures and relate such to workers' productivity.

In an attempt to draw the line between productivity and output increase, the term 'productivity growth' is sometimes introduced whereby it denotes the rate of growth of the level of productivity. In this study however, productivity denotes the level of output by workers which is measured by the number of hours worked per day particularly as affected by congestion problem.

Materials and Methods

The study is carried out in Lagos State (figure 1), the second largest populated city in Nigeria. The population of Lagos State was estimated to be 17.5 million (National population census, 2006). The state represents one of the most urbanized zones in Nigeria where traffic congestion is mostly being noticed. Lagos is generally the hub of economic activities in Nigeria and specifically the country's financial, commercial and industrial nerve center with over 2,000 manufacturing firms and over 200 financial institutions (Adeoti and Osotimehin, 2011). Further, the state is notable for the presence of major transhipment sources such as Seaports, Airport and Railway Terminus (Iddo), which road transportation serve as a hub to their efficacy.

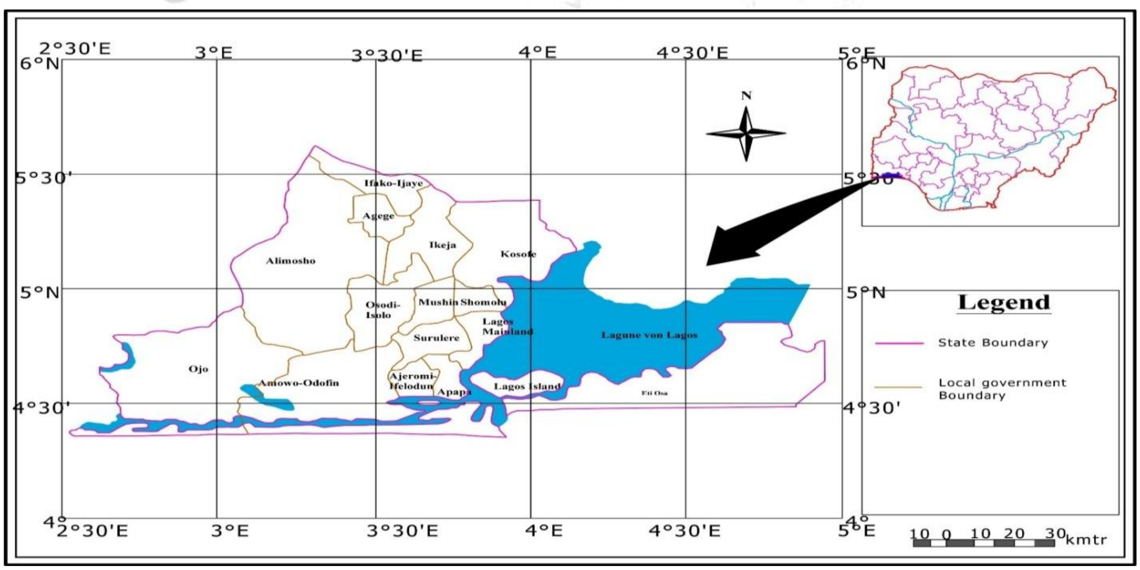

Figure 1: Map of Lagos Metropolis
Source: Bohr (2006)

However, the two corridors that are of concern in this paper are Ketu/Ojota through Western Avenue, (figure 2) and Alapere through third Mainland Bridge (figure 3). These corridors were chosen because of their peculiarities to traffic congestion in Lagos metropolis, particularly during the peak hours. The Ketu/Ojota through Funso Williams (formerly Western Avenue) was chosen considering its linkage to Lagos Island, while Third Mainland Bridge leads to Ikoyi/Victoria Island (these two corridors lead to where majority of financial institutions and oil companies have their managerial headquarters). Generalising the result from here seems appropriate since the Nigeria environment is structured in such a way that almost all major cities of the federation are arranged in a similar pattern of settlement and the general nature of the Nigerian roads does not vary significantly from one another.

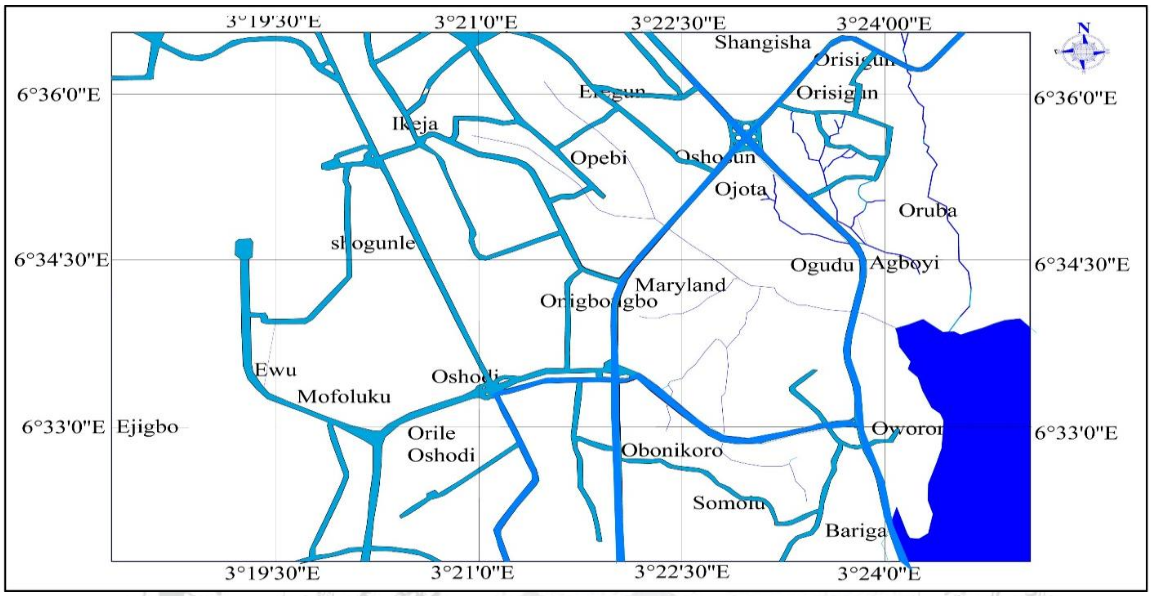

Figure 2: Map of Lagos State Showing Ketu/Ojota Through Funso Williams

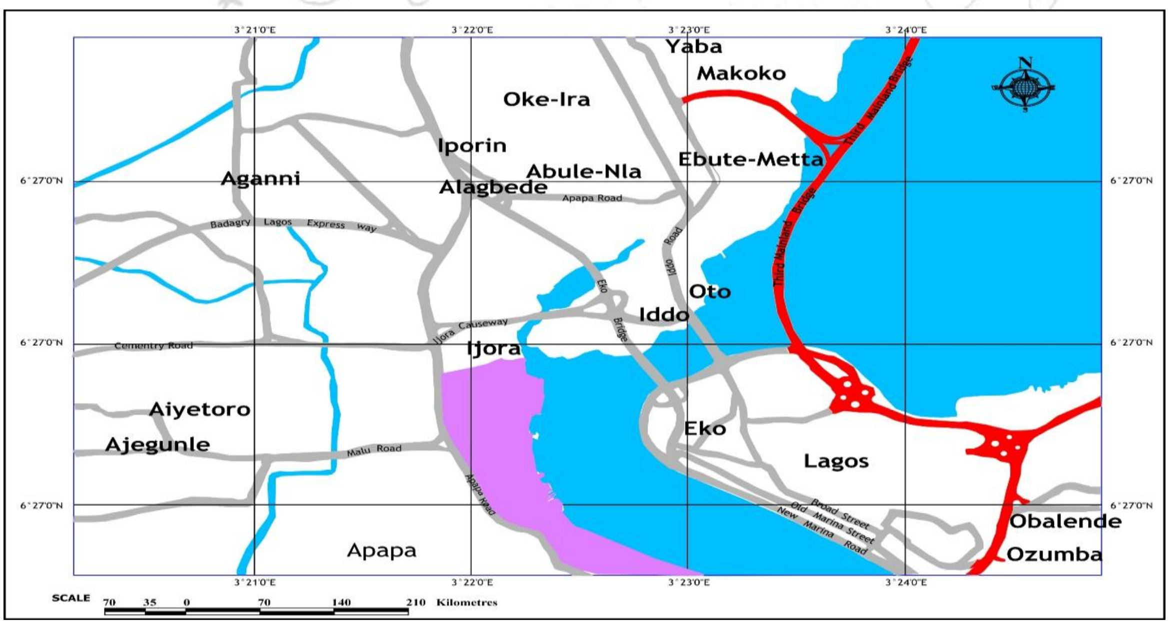

Figure 3: Map of Lagos showing Third Mainland Bridge

The population of 5100 for this study emanated from the six (6) sampled quoted companies that falls within the two principal corridors (Victoria Island and Lagos Island) within Lagos metropolis. A multistage sampling technique was used for this study. At stage one (1), two commercial locations namely, Lagos Island and Ikoyi/Victoria Island were purposively sampled because of their link to the principal traffic congestion corridors of Ketu/Ojota through Funso Williams (formerly Western Avenue), and Alapere through third mainland bridge. The daily traffic volume counts on the selected corridors were collected from LAMATA. At the second stage, the listed quoted companies in Nigeria were stratified into two strata based on their presence in the two identified corridors At the third stage, three (3) quoted companies were randomly selected from each strata based on their presence in the two identified corridors thus a total of six (6) companies were selected. At the fourth stage, total of 10 percent (10%) of available staff strength in each of the sampled firms were randomly selected. Specifically, 304 respondents were sampled from Victoria Islands/Ikoyi, 206 were sampled from Lagos Island, This results in a total of 510 respondents that questionnaire were distributed to and a total of 500 questionnaires were returned and fit for analysis.

Primary data was used for this study. A structured questionnaire on traffic congestion and workers' productivity was used to obtain data on socio-economic characteristics of respondents, performance of workers, and daily commuting cost when there is traffic and when there is no traffic, rate of punctuality at work influenced by traffic congestion and associated stress factors. The questionnaire provides adequate quantitative and qualitative data for the assessment of the economic cost of road traffic congestion on workers' productivity in the study area. In this paper cost of traffic congestion was measured by distance covered, time spent and cost of transportation while workers' productivity is measured by the number of hours worked especially when affected by congestion.

Descriptive statistics and Multivariate analysis were used to analysis the data obtained. Multivariate is based on the statistical principle of multivariate statistics which involves observation and analysis of more than one observations and analysis of more than one statistical variable at a time. Due to the multivariate nature, extremeness can be defined in various ways. Four of these are:

$$Pillai'sTrace = \sum_{k=1}^{k} \frac{\lambda_k}{1+\lambda_k}$$

$$Hotelling'sTrace = \sum_{k=1}^{K} \lambda_k$$

$$Wilk's = \prod_{k=1}^{K} \frac{1}{1+\lambda_k}$$

$$Roy'sLargest\ Root = \frac{\lambda_{max}}{1+\lambda_{max}}$$

where $\lambda_1, \dots, \lambda_k$ are the eigenvalues of the $SS_{within}^{-1}\ x\ SS_{Between}$ matrix. The number of eigenvalues K is equal to the minimum of the dimension of the variables space and the number of groups minus 1,

$$K = \min(p, I-1)$$

.

Result and Discussion

Total daily commuting cost in congestion and outside it is presented in Table 1 and 2 shows that 33.2% of respondents cost of commuting is between ₦200 and ₦500; 47.8% spend above ₦500 but less than ₦1000 while 9% and 9.6% of respondents cost of commuting is less than ₦200 and above ₦1000 respectively. Outside congestion, 29.5% of respondents cost of commuting is less than ₦200; 43.2% spend between

₦200 and ₦500 as commuting cost; 26.1% and 1.2% of respondents incurred above ₦500 but less than ₦1000 and above ₦1000 respectively.

Table 1: Total Daily Commuting Cost in Congestion

₦	Frequency	Percentage
Less than 200	45	9.0
Between 200 and 500	221	33.2
Above 500 but less than 1000	184	47.8
1000 and above	48	9.6

Source: Data analysis, (2014)

Table 2: Total Daily Commuting Cost in no Congestion

₦	Frequency	Percentage
Less than 200	147	29.5
Between 200 and 500	215	43.2
Above 500 but less than 1000	130	26.1
1000 and above	6	1.2

Source: Data analysis, (2014)

Table 3 shows the effect of costs of traffic congestion on workers' productivity using multivariate model. The tests for the overall model, shown in the section labeled Model (under Source), indicate that the model is statistically significant at 1% and by implication 5% level regardless of the type of multivariate criteria that is used. Below the overall model tests, are the multivariate tests for each of the predictor variables vis distance cost and time.

Table 3: Multivariate Regression Diagnostics of Effect of Costs of Traffic Congestion on Workers' Productivity

Source	Statistics	Df	F(df1,	df2) =	F	Prob>F
Model	W 0.0255	29	203.0	3109.9	10.91	0.0000
	P 2.6450		203.0	3220.0	9.63	0.0000
	L 5.5044		203.0	3166.0	12.26	0.0000
	R 2.1575		29.0	460	34.22	0.0000
Residual		460				
Distance	0.9041	6	42.0	2132.9	1.10	0.2999
	0.0991		42.0	2754.0	1.10	0.3022
	0.1026		42.0	2714.0	1.10	0.2976
	0.0517		7.0	459.0	3.39	0.0015
Time	0.0425	21	147.0	3041.1	12.51	0.0000
	2.3046		147.0	3220.0	10.75	0.0000
	4.6976		147.0	3166.0	14.45	0.0000
	2.0828		21.0	460.0	45.62	0.0000
Cost	0.5045	2	14.0	908.0	26.45	0.0000
	0.5772		14.0	910.0	26.37	0.0000
	0.8202		14.0	906.0	26.54	0.0000
	0.4891		7.0	455.0	31.79	0.0000
Residual		460				
Total		489				

Source: Data analysis, (2014)

The predictors are all statistically significant, especially with Roy's largest root test. The statistical significance of multivariate statistics-Wilks' lamda (F (df1, df2) = 10.91), Pillai's trace (P) (F (df1, df2) = 9.63), (Lawley-Hotelling trace (L) (F (df1, df2) = 12.26) and Roy's largest root (R) (F (df1, df2) = 34.22) indicate the fit and relevance of the model in predicting the effect of costs of traffic congestion on workers' productivity. Average distance covered is found to be significantly ($F = 3.39$, $P < 0.05$) related to traffic congestion considering Roy largest root test. Similarly time ($F = 12.51$ $p < 0.05$) and costs ($F = 31.79$, $P < 0.05$) are significantly related to traffic congestion.

Table 4 shows the specific contribution of individual predictor variable such as distance, time and cost relative to measure of productivity. Specifically, average distance covered account for about 34.09% of the variation in workers' productivity and is found to be significant at 5% level. Time spent in congestion also account for about 23.16% variation in productivity and is also significant at 5%. Also cost account for about 29.1% of the variation in productivity. Commuting time is a huge fraction of total commuting costs. Research has connected costs of commuting to poor workplace productivity and is leading to people having to re-evaluate their career priorities (Kiger, 2008). The greater the distance individuals live from their worksite, the more pain people can suffer at their place of work (Rouwendal & Nukamp, 2004).

Table 4: Specific Contribution of Predictors to Productivity

Equation	Obs	Parms	RMSE	R-sq	F	P value
Distance	460	30	1.437731	0.3409	6.181346	0.000
Time	460	30	1.492273	0.2316	4.9462671	0.000
Cost	460	30	1.523562	0.2915	8.9359454	0.000

Source: Data analysis, 2014

Table 5: Multivariate Regression Estimates of Effect of Costs of Congestion on Productivity

	Coeff	**Std. err**	**T**	**P-value**
Distance (km)				
5-10	26.3827	8.9826	2.94	0.004***
10-15	-21.35032	18.7103	-1.14	0.225
15-20	-7.815503	17.97756	-0.43	0.664
20-25	-477.5124	31.45414	-15.18	0.000***
25-30	-491.5648	38.09375	-12.90	0.000***
30-35	-489.9462	21..46938	-22.82	0.000***
35-40	-462.5527	15.50649	-29.83	0.000***
>40	-480.6328	15.24708	-31.52	0.000***
Time (min)				
30-59min	216.4697	23.9282	9.05	0.000***
60-89	-12.83329	20.77092	-0.62	0.538
70-120	-44.68011	9.109738	-4.90	0.000***
120-150	-19.28897	11.26978	-1.71	0.081*
Money (₦)				
Below 500-1000	0.144667	0.5329563	0.27	0.786
1000-1500	-1.179864	0.5699448	-2.07	0.039**
>1500	-1.2020	1.101359	-1.09	0.276
Constant	3.493401	1.217092	2.87	0.004***

Source: Data analysis, 2014

***,**,*, refers to 1%, 5% and 10% significant level

Table 5 shows the multivariate regression estimate of costs of traffic congestion on workers' productivity. An average distance of about 5-10km is significantly (β =26.3827, $t = 2.94$) related to workers' productivity at 5% level. Contrary to expectation, the result does not indicate any negative effect on productivity. A possible explanation for this finding is that the respondents have adapted their life to the congestion and lack of reliability of travel times to their commute. They have arranged their activities, so that a slightly longer or shorter commute does not have a major impact on their productivity. This explanation is consistent with Kaplan, (1997).

The result of multivariate regression analysis (Table 5) shows that productivity of workers who covered shorter distance of about 5-10km is not negatively affected, implying that shorter distance to work does not affect workers performance level. However, an inverse relationship is observed for workers who commute for a distance of about 10-15 km and 15-20km respectively. In that case, productivity of workers is found to be highly significant and negatively affected in large magnitude when workers have to commute for about 20-25km. Similarly, workers who commute for 25-30km will have their productivity significantly reduced by large magnitude. Further, longer distance of 30-35km, 35-40km and above are found to significantly and negatively affect workers' productivity. The findings corroborate Gutiérrez-i-Puigarnau, and Ommeren (2009) that workers with long commute become less productive by reducing effort levels.

The multivariate regression results further show that any time loss irrespective of number of minutes is capable of reducing the overall productivity of workers. Lateness of 30 minutes to work due to congestion is found to be positive and significantly related to workers' productivity. Observations show that lateness of about 30 minutes in most of sampled organization is usually considered 'normal'. However, lateness in the time bracket of 60 minutes exhibit inverse relationship with productivity, implying that lateness to work for that range of time reduces workers' productivity. However, the result is not significant.

Further, lateness in the time bracket of 90 minutes (one and half hours) is highly significant ($p < 0.05$) and negatively related to productivity. This implies that as workers spend more time commuting, it resulted in a declining productivity. Further analysis show that, time loss in the bracket of 120 minutes and above result in reduced productivity. Based on these findings, workers time wasting due to traffic congestion potentially cause productive sector a significant loss in productivity. It is argued that a longer commuting time may induce workers to arrive late at work or leave earlier which reduces productivity (Zenou, 2008).

Result further shows that average commuting cost of ₦1000-₦1500 has a significant and negative effect on productivity of workers. The implication is that the cost of commuting takes the chunk of the salary thereby impacting on their effort rate.

The overall implication of the results shows a significant but negative effect of longer distance to work on productivity of workers. This implies that the number of hours worked is affected by coverage of more than 20km to any place of work. The findings corroborate Tykkyläinen (2010) who asserts that long distance commuting is found to impose a significant cost on workers' productivity especially in the absence of reliable and cheap transportation technology which is essential for establishing long-distance commuting operations. Further, literature suggests that long-distance commuting has negative implications for the employees' well-being. It is often assumed that the compact working schedule due to much time spent in traffic affects negatively the overall work conditions.

Conclusion and Recommendation

Sequel to the findings, it was revealed that average distance, time and cost were found to be significantly related to traffic congestion. The result further showed that an average distance of about 5-10km is significantly (β =26.3827, t = 2.94) related to workers' productivity at 5% level. Lateness of 30 minutes to work due to congestion is found to be positive and significantly related to workers' productivity. Further, lateness in the time bracket of 90 minutes (one and half hours) is highly significant ($p < 0.05$) and negatively related to productivity. Result further shows that average commuting cost of N1000-1500 has a significant and negative effect on productivity of workers. The implication is that the cost of commuting takes the chunk of the salary thereby impacting on their effort rate. Time loss due to congestion is also found to significantly ($P < 0.05$) reduce the effectiveness of workers at a magnitude of 1.60. The result indicates that younger workers experienced reduced level of effectiveness at a magnitude of 1.98 due to traffic congestion. Time spent in congestion also shows a declining effect on efficiency significant at 5% level.

Efforts at reducing peak period traffic, expanding road intersection, providing adequate infrastructures, improving road condition in order to reduce traffic congestion and consequently reduce time loss by workers enroute their work place should be put in place. Since traffic congestion is found to negate productivity of workers, relevant stakeholders should devise other means of transportation such as rail and water where applicable, to ease congestion and enhanced performance of workers. If employers of labour can provide accommodation close to their respective place of work, the negative effect of distance could be minimized. It is equally recommended that congestion pricing policy should be introduced.

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