TRANSPORT & *LOGISTICS:*
the International Journal

Article history:
Received 17 May 2017
Accepted 04 September 2017
Available online 13 September 2017

ISSN 2406-1069

Article citation info: Somuyiwa, A. - Adepoju, O. O., Investigation to city logistics problems and effect on business performance in Lagos metropolis. Transport & Logistics: the International Journal, 2017; Volume 17, Issue 43, September 2017, ISSN 2406-1069

INVESTIGATION TO CITY LOGISTICS PROBLEMS AND EFFECT ON BUSINESS PERFORMANCE IN LAGOS METROPOLIS

Adebambo Somuyiwa [1], Olusegun Onifade Adepoju [2]

[1] Department of Transport Management, Faculty Management Sciences, Ladoke Akintola University of Technology, P.M.B. 4000, Ogbomoso, Oyo State
tel.: +2348033570837, e-mail: iseoluwa89@yahoo.com

[2]Department of Transport Management, Faculty Management Sciences, Ladoke Akintola University of Technology, P.M.B. 4000, Ogbomoso, Oyo State
tel.: +2348036884169, e-mail: adeseg001@yahoo.com

Abstract:
Most businesses in the city suffer setbacks as a result of logistics problems arising from fuel wastage in traffic congestion, untimely delivery of goods and services and demand for taxes by government from transport user's charge. Fuel wastage and delay can be attributed to re-routing, the condition of logistics vehicle, number of vehicles on the road, the route space, condition of the road, conflicts of right of way and condition of other vehicles on the road. Primary data collection method was used with descriptive analysis and multiple regression analysis to analyze the collected data from the selected third party logistics companies. The results revealed that, fuel consumption rates of even same make of vehicle differ and maintenance, tax imposed by government and fuel costs were the major costs draining logistics business in the city. Conclusively, the problems can be solved by 1) study the time of movement for less traffic (2) usage of information/ e-business transaction method (3) finding alternative to fuel via electric/ battery powered vehicles.

Key words:
City logistics, Problems, Effects, Business, Lagos.

INTRODUCTION

[1] defined city logistics as ''the process for totally optimizing the logistics and transport activities by private companies in urban areas while considering the traffic environment, the traffic congestion and energy consumption within the framework of a market economy''. In this sense, urban logistics can defined as the pluri-disciplinary field that aims to understand, study and analyze the different organizations, logistics schemes, stakeholders and planning

actions related to the improvement of the different goods, transport systems in an urban zone and link them in a synergic way to decrease the main nuisances related to it.

Every day in cities across the world, multiple trucks and other commercial vehicles enter crowded towns to deliver their goods to businesses, predominately retail outlets and offices, making a number of drop-offs before driving out again. One of the major problems is that, when the traffic is at its peak; vehicles will stand still and reverse logistics may not be sure. The objective of business logistics is to deliver goods/products at reasonable time and satisfy consumer's requirements. Suffice to stress that; companies incur costs in business logistics and worst still, government tax logistics operators and there are delays as a result of congestion and costs of fuel wasted in traffic. Regrettably however, roads cannot be reconstructed, buildings cannot be relocated and aspiration to own vehicles cannot be absolutely curtailed.

1 CITY LOGISTICS AND ITS PROBLEMS

Almost all "Lagosians" do think of movement as it becomes important in their daily movement decisions. Traffic congestion was said to be one of the worldwide urban problems, which can lengthen journey time, increase energy consumption, aggravate environmental pollution and result in traffic accident. Differently put, in spite of all the technical ability to solve such problems well in place, the modern cities are confronted by a transportation problem more complex than ever before and despite all the methods of movement, the problem in cities is how to move. In fact, when one experiences the situation in Lagos metropolis, like Osodi-Apapa, Third main land bridge, e.t.c; life will become meaningless as it will seem to move by foot is far better than staying inside a bus or vehicle that is not moving. Most of these problems are aggravated by the condition of the road. For instance, there used to be incessant accident as a result of big potholes along major highways. By swerving for the potholes even by some truck drivers and long vehicles; they cause serious problems that can result to other problems. [2,3] noted that traffic congestion problem becomes so manifest when measure in terms of delays, which can be defined as the time lost by vehicle due to traffic friction that are likely to be caused by other vehicle's inefficiencies or ineffectiveness as in the case of breakdowns, accidents, parking and maneuvering problems. According to [4]; Nigerian transportation problems can be traced to factors like faulty designs, lack of drainage and very thin coatings that were easily washed away, excessive use of the road network given the under-developed nature of waterways and railways among others. In most cases, this traffic used to happen as a result of collision between two or more vehicle whose perhaps their vehicles have been hit and scratched. They barricade the road and start man-no-man power tussle. Viewed from another perspective, Nigeria's major cities experience chronic traffic congestion arising from inadequate road network and misuse and abuse of those provided.

[5] further enumerated the effects of logistics on environment. They opined that, distribution of goods impairs local air quality, generates noise and vibration, causes accidents and makes a significant contribution to global warming.

However, the gap identified by this paper is that; while there are and must always be needs to move in the cities, the logistics is being hampered by congestion and its attendants. Hence; there is need to investigate these activities with a view to finding lasting solutions to them. In an attempt to solve this, several advance techniques, such as Geographic Information System (GIS), Traffic Radio, Global Positioning System (GPS), logistics knowledge, Intelligent Transport System (ITS) and modeling, to optimize the city environment has been developed. City/urban logistics is a concept trying to integrate the existing resources to solve the difficulties caused by the impacts of increasing population and vehicle ownerships in the urban area. To this end, this paper attempted to complement other methods currently in use by identifying ways of improving business logistics system in Lagos metropolis.

2. REVIEW OF LITERATURE

The urban logistics as [6] argued is indispensable to the economy as it moves goods and passenger but also its concomitant effects of pollution; traffic congestion and noise are major issues of concern. Even though urban areas and freight movement activities are different around the world, they all have in common that they are complex and difficult to understand [7]. Each city is also different with regard to its characteristics (for instance size, important economic sectors, transport infrastructure and traditions). [6] argued that, many cities, such as Bangkok, London, Tokyo and Lagos have suffered from these problems due to traffic congestions, environment impact, low transport efficiency, and consequently the competitiveness of business decreased. For the characterization of the city area it is necessary to identify the features that can represent any possible constraints, but also give a picture of the actual state of the art in terms of logistic conditions, such as commercial density and homogeneity, logistic accessibility, or if there are any restrictions applied.

The difficulties experienced daily in moving through and operating businesses in Lagos led to the inefficient use of trucks, where smaller loads are being transported and trucks often have to wait near the location of customers when they arrive earlier than the designated time. People who live, work and shop in the city do not welcome large trucks coming into local streets, and of course, it is these vehicles that carry commodities that are necessary for them. The dispersal of freight in small consignments by poorly loaded vehicles to a multitude of locations was found to impose high economic and environmental costs. Numerous studies were then done to find ways of consolidating loads and, thereby, cut traffic levels, energy use, emissions and costs [8]. In most studies, one major contributor to the issue of congestion is parking. Another one is that, people do sell their markets along major roads and encroach on the road despite all the effort of government with the usage of environmental policies and laws.

The reliability of delivering goods has become more important for Just-In-Time transport systems. There are two types of reliability; (a) delivery without any damage to the goods, (b) delivery without any delay with respect to designated time at customers. Freight carriers typically attempt to minimize the costs associated with collecting and delivering goods to customers to maximize their profits. There is much pressure to provide higher levels of service to customers at a lower total cost. This is especially important when carriers are requested to arrive at customers within a designated time period. However, freight carriers often face difficulty in operating their vehicles on urban roads due to traffic congestion.

According to [9]; reverse logistics is also a major aspect to be considered in the business of city logistics. It refers to the logistics process that concerns the integration of used and obsolete products back into the supply chain as valuable resources. [10] defined reverse logistics as 'the process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal'. When vehicle for business operations carried goods at a normal charge for to-journey and come back empty, usually it reduces the income of the company. Hence, charges are often made for go and return journey.

2.1 Environmental Impacts of City Logistics

2.1.1Congestion

[11] Identifies exposure to congestion as one of the key freight variables that the UK government needs to manage in order to reduce CO_2 emissions. As speed decreases below the optimal level, considerably more fuel is used. To make matters worse, congestion forces driving

in a stop–start manner, which results in increased fuel consumption and emissions as the vehicle accelerates and brakes instead of travelling at a steady speed. This means that estimates of fuel consumption based on vehicle test cycle data may not accurately represent the fuel used in typical driving conditions, as discussed in [12]. A significant aspect of traffic congestion lies in the cost to the average user, particularly the motorists and inhabitants of this area. [3] explained how costs incurred per day for roughly working days per month and subsequently per annum can accumulate to close to a million naira as a result of traffic.

2.1.2Air pollution

However, the main fuel used by goods vehicles continues to be diesel, with relatively small amounts of freight moved in petrol-engine vans. Trucks and vans emit pollution mainly because the combustion process in their engines is incomplete. Diesel and petrol contain both hydrogen and carbon. If it were possible to achieve perfect combustion, 100 percent of the hydrogen would be converted into water and all the carbon into CO_2.

However, because combustion is not complete, tailpipe emissions of pollutants such as hydrocarbons, carbon monoxide and nitrogen oxides result [13]. It is difficult to measure emissions of particulates precisely, because of their ultra-fine nature. (Particulate Matter PM measured based on size) PM10 particles, for instance, have a radius of 10 microns or less (a micron is a hundredth of a millimetre). Measuring these particles when the vehicle is stationary is difficult enough; measuring them under different driving conditions and speeds introduces additional complexities. Calculating the impact of these tiny soot particles on human health presents further problems, although there is growing evidence of their effects on respiratory problems as well as on general morbidity [14]. Particulates come in various sizes and from a variety of sources. In the case of vehicles, the majority take the form of soot emitted by diesel engines, particularly those that are badly tuned. There are concerns over the likely carcinogenic effects, particularly of the smaller PM10 particles [15]. These particles are also linked to respiratory and cardiovascular problems and to asthma. The high sulphur content of the bunker fuels used in shipping presents a much more serious environmental problem, particularly around ports, although the International Maritime Organization (IMO) has implemented new regulations under Annex 6 of its MARPOL (Maritime Pollution) convention to radically reduce SOx like SO_2, SO_4,emissions [16].

2.1.3Noise pollution

Road traffic is the main cause of environmental noise at the local level. The immediate adverse effects of noise disturbance include annoyance, communication difficulties, loss of sleep and impaired cognitive functioning resulting in loss of work productivity; longer-term, physiological and psychological health issues may also arise [17].
Noise standards have been tightened several times since then [18]. Significant reductions in noise levels have been achieved by technical advances in engine design, tyres and the aerodynamic profiling of vehicles. Nevertheless, overall noise levels have not improved, as the growth and spread of traffic in space and time has largely offset both technological improvements and other abatement measures [19].

3. METHODOLOGY

This study was carried out in Lagos and the extension of Lagos which cuts across Ogun State Nigeria. Specifically, Sango- Ota axis which has been subsumed to be an extension of Lagos based on the locations of the manufacturing companies whose distribution and head

offices are in Lagos metropolis. It is the second largest city in Nigeria based on. According to [20] and [21], Lagos State lies in the south Western part of Nigeria on the west Coast of Africa. It lies approximately on longitude 2º 42' E and 3º22'E and Latitude 6º22'N.

Ten third party logistic service provider firms were purposively and randomly selected to determine the impacts of city logistics problems on business performance in Lagos metropolis. The direction and number of outlets by logistics firms across Lagos metropolis from their indicated locations were used to understand the configurations of route networks. In order to fathom the problems encountered along the various routes, samples of drivers of selected logistics firms were interviewed and the receiving officers at various outlets were given questionnaires so as to elicit information on timely deliveries and logistics problems as well.

Tab. 1 *Sampled size*

Companies	**Population of Drivers**	**Total drivers sampled ≥ 50%**	**Outlet officials**	**Sampled officials**
1	10	6	3	2
2	6	5	5	5
3	8	5	4	3
4	8	4	6	3
5	13	7	3	3
6	7	6	6	4
7	8	4	5	3
8	11	6	3	3
9	5	4	4	2
10	4	3	4	3
		50		31

Source: Authors' computation (2017)

The total sampled size =50 +31 = 81.

4. RESULTS AND DISCUSSION

The respondents were asked at the various companies the respective impacts of traffic congestion on their business performance. They were asked to rate the majorly the cost incurred as a result of three major areas by which they must attend to in city and other logistics operations: Maintenance cost, fuel consumption and tax imposed by government. The figure 1 below provided the responses gathered from the selected logistics companies.

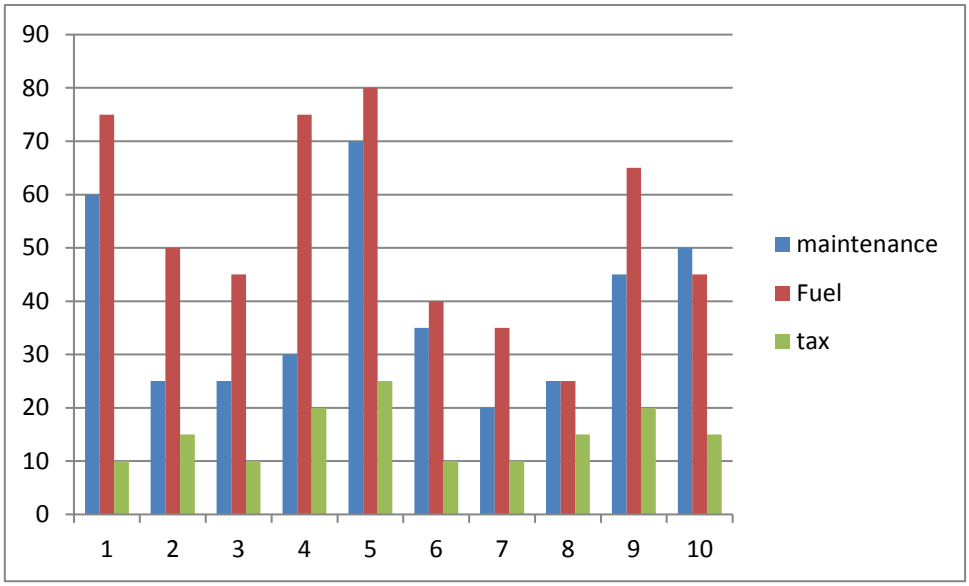

Fig. 1 *Responses from selected companies on cost incurred in city logistics*
Source: Authors' computation (2017)

Based on the findings, the cost for all the logistics companies with respect to fuel consumption is the largest cost incurred in city logistics. Secondly, maintenance cost is the next cost that drains the companies cost as indicated in the fig 1 except for the 10th company where their maintenance cost is higher compared to the cost incurred on fuel consumption. This can be attributed to the past experiences of the 10th company where the company had to purchase another vehicle for a vehicle owner as a result of collision between the company's vehicle and other vehicle without proper insurance. Moreover, attached to this is also the cost of compensating the family of deceased, repairs of the vehicle, and loss of productivity in case of accidents involved by the company. Lastly, tax imposed by government has less impact among the three identified variables because across the companies, it is not more than 25%.

Among the 50 sampled drivers; 19 of them drive on daily basis at the most congested areas like Oshodi –Apapa and Mile 2 in the metropolis. Hence, the sick records indicated that, 17 of them had visited hospitals more than four times per year. However, when the routes for some of the drivers changed in the year 2016; it was on record that, those changed visited hospitals at most two times in that year. This provided us the information that, congested routes contributed to the level of stress experienced by the drivers.

Multiple regression analysis was also used to investigate the contributions of the following identified variables as they affect the city logistics in Lagos metropolis.

1. fuel
2. damage to vehicle
3. engine wear
4. cost on tax

The investigation conducted for fuel cost analysis: The logistics companies' drivers were asked to move at around 12pm and observe the fuel consumption level as against the previous fuel consumption. It was believed that, at this time; some of the routes ply by the drivers should be less busy. The fleet management records of the company showcased the number of time the company repaired the vehicles plying the city. Also; the parts of vehicle replaced; cost of parking and taxes paid by the companies. Delay was measured by the differences in expected time of delivery and actual delivery time for the various vehicles used by observing time logs at origins and destinations.

Tab 2 *Model Summary*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.603[a]	.403	.421	.86034

a. Predictors: (Constant), fuel, damage, wear, tax
b. Dependent variable: City logistics
Source: Author's computation, (2017)

Tab 3 *Coefficients of regression analysis*

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.886	.568		10.353	.000
	fuel	.057	.080	.066	.714	.017
	damage	-.414	.060	-.549	-6.929	.000
	wear	.103	.089	.103	1.164	.047
	tax	-.260	.087	-.246	-2.987	.204

a. Dependent Variable: City logistics
Source: Author's computation, (2017)

Tab 4 *: ANOVA*

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	59.252	4	14.813	20.486	.000[a]
	Residual	71.584	99	.723		
	Total	130.837	103			

a. Predictors: (Constant), fuel, damage, wear, tax
b. Dependent variable: City logistics
Source: Author's computation, (2017)

[22] provided the explanations to some the terminologies used. The sum of square is differences between observed values, and the value predicted by the mean which is known as the total sum of squares (denoted SST) because it is the total amount of differences present when the most basic model is applied to the data. SSR is the value that represents the degree of inaccuracy when the best model is fitted to the data. The improvement in prediction resulting

from using the regression model rather than the mean is calculated by calculating the difference between SST and SSR. This difference shows us the reduction in the inaccuracy of the model resulting from fitting the regression model to the data. This improvement is the model sum of squares (SSM). According to [22], the value of SSM is large then the regression model is very different from using the mean to predict the outcome variable. This implies that the regression model has made a big improvement to how well the outcome variable can be predicted. A useful measure arising from these sums of squares is the proportion of improvement due to the model. This is easily calculated by dividing the sum of squares for the model by the total sum of squares. The resulting value is called R^2 and to express this value as a percentage you should multiply it by 100. R^2 represents the amount of variance in the outcome explained by the model (SSM) relative to how much variation there was to explain in the first place (SST). Therefore, as a percentage, it represents the percentage of the variation in the outcome that can be explained by the model. *F* is based upon the ratio of the improvement due to the model (SSM) and the difference between the model and the observed data (SSR). The value of *b* represents the change in the outcome resulting from a unit change in the predictor. Outcome = model + error

One statistic is the adjusted predicted value for a case when that case is excluded from the analysis. Standardized is the difference between the predicted value for a case when the model is calculated including that case and when the model is calculated excluding that case *R* is a measure of the multiple correlation between the predictors and the outcome and that R^2 indicates the variance in the outcome for which the predictors account.

Table 2 revealed the summary of the model for the regression analysis of the data. R value of 0.603 approximately 60.3% represented the combined relationship value between all the predictors (independent variables)' impact on City logistics (dependent variables). R^2 is 0.403 and this implies that 40.3 percent of the variation on performance is explained by the variables fuel, damage and wear at ($p<0.05$). However, from the analysis, tax is not statistically significant. This may be due to inability of some of the companies to present their tax payment clearances for this research work. From Table 3, which represents the coefficients of the analysis; a unit increase in fuel consumption causes and increase of about 0.057 in city logistics at $p<0.05$. However, a unit decrease in damage will reduce logistics problem by 0.414 as it was indicated with minus sign at $p <0.05$. Also, a unit increase in wear and tear of vehicle increases the city logistics problem by .103 for selected companies at $p<0.05$. Table 4 presented the F – value which indicated how significantly well the regression has predicted the changes of City logistics in relation to the identified variables with F= 20.5 approximately with $p<0.05$.

5. CONCLUSIONS

Different countries especially developed economy had used various approaches to solve city/urban logistics problems. There are successful logistics model that cut-crosses these restrictions, because it is based on door-to-door food delivery services that uses public transport and non-pollutant vehicles (bicycles) for their daily deliveries. Moreover, the solution presented in the case of Belo Horizonte (Brazil) includes innovations on Business-to-Consumer approaches, namely the distribution directly from the producer to the final consumer. The Monoprix rail train was designed to supply all Monoprix's supermarkets within Paris. The Abertis Logistics Park (Chile) is a modern logistics park located in the Metropolitan Region and has good access to the main highways of the city and routes to two major ports in the country, with no restrictions applied. There is no one policy that can meet all the demands and requirements of urban freight transport, since each policy has different effects on freight operations. Furthermore, the area of city logistics is ever growing and there could never be a perfect ontology to describe it-the tools and frameworks need to be continuously developed and improved. There may be need to however work on stringent measures to reduce congestion in

Lagos metropolis as it will reduce not only the stress but also costs of business operation will invariably may be used to improve business performance in the city. Conclusively, the problems can be solved by 1) study the time of movement for less traffic (2) usage of information/ e-business transaction method (3) finding alternative to fuel via electric/ battery powered vehicles. Very soon, we hope to see development of cable transport, more chopper (helicopter) and ferry services that will reduce congestion in Lagos metropolis.

Acknowledgement

We sincerely acknowledge the reviewers and the editorial teams of this reputable journal for painstakingly reading the manuscripts and made constructive suggestions that produced this paper. The supports from our superiors who are constantly guiding us and forcing us to be the best we need and should be. We appreciate you all.

References

[1] Taniguchi, E., Thompson, R.G., Yamada, T. Van, Duin R., 2001, "City Logistics. Network modeling and intelligent transport systems".

[2] Adenle, J. A., 1981, "Factors Militating Against Free Flow of Traffic in Metropolitan Lagos. Transportation in Nigerian National Development," In: S.D. Onakomaiya (Ed.) NISER, Ibadan.

[3] Somuyiwa, A.O and Dosunmu, A., 2008, "Logistics Infrastructure and Port Development at Apapa Port," Nigeria. Pakistan Journal of Social Sciences 5(9), pp. 953-959.

[4] Obafemi, A. A., 2011, "Road network assessment in Trans-Amadi, Portharcourt," Nigeria using GIS -international journal for traffic and transport engineering, 1(4), pp. 257 – 264.

[5] Rao, P. and Holt, D., 2005, "Do green supply chains lead to competitiveness and economic performance?" International Journal of Operations & Production Management, 25 (2), pp. 898–916.

[6] Ogden, K.W., 1992, "Urban Goods Movement: A guide to policy and planning".

[7] Dablanc, L., 2011, "City distribution, a key element of the urban economy: guidelines for practioners," In: Macharis C, Melo S (eds) City distribution and urban freight transport: Multiple perspectives, pp. 13-36.

[8] Rushton, A., 1979, "Improving Goods Delivery," National Materials Handling Centre, Cranfield.

[9] Lambert, S. and Riopel, D., 2003, "Logistique inverse: revue de literature," Les Cahiers du CERAG, n_G-2003-61.

[10] Rogers, D., Tibber-Lembke, R., 2001, "An examination of Reverse logistics practices," J Bus logist 22(2) pp. 129-147.

[11] McKinnon, A.C., 2007, "CO2 Emissions from Freight Transport in the UK," UK Commission for Integrated Transport.

[12] McKinnon, A.C. and Piecyk, M., 2008, "Measurement of CO2 emissions from road freight transport: a review of UK experience," Energy Policy, 37, pp. 3733–42.

[13] Holmen, B.A. and Niemeier, D.A., 2003, "Air quality," Handbook of Transport and the Environment.

[14] Pope, C.A., Burnett, R.T., Thun, M.J., Calle, E.E., Krewsi, D., Ito, K. and Thurston, G.D., 2002, "Lung cancer, cardio-pulmonary mortality and long term exposure to fine particulate air pollution," Journal of the American Medical Association, 287, pp. 1132–41.

[15] EPA, 2009, "Particulate matter," Available at: www. epa.gov/air/particlepollution/

[16] International Maritime Organization (IMO), 2008, "International Convention for the Prevention of Pollution from Ships, 1973, as Modified by the Protocol of 1978 Relating thereto (MARPOL)," Annex VI, Prevention of Air Pollutionfrom Ships, Amendments – revised, IMO.

[17] Den Boer, L.C. and Schroten A., 2007, "Traffic Noise Reduction in Europe: Health effects, social costs and technical and policy options to reduce road and rail traffic noise".

[18] Affenzeller, J. and Rust, A., 2005, "Road traffic noise: a topic for today and the future," VDA Technical Congress.

[19] INFRAS, 2004, "External Costs of Transport: Update study," Final Report, INFRAS.

[20] Merem, E. and Twumasi, Y. A., 2008, "Using Geospatial Information Technology in Natural Resources Management: The Case of Urban Land Management in West Africa," Sensor, 8, pp. 607-619. Available at: www.mdpi.org/sensors

[21] Fadare, S.O. and Ayantoyinbo, B.B., 2010, "A Study of the Effects of Road Traffic Congestion on Freight Movement in Lagos Metropolis," European Journal of Social Sciences, 16(3).

[22] Field, A., 2009, "Discovering Statistics Using SPSS".