European Journal of Business and Management
ISSN 2222-1905 (Paper) ISSN 2222-2839 (Online)
Vol.7, No.17, 2015

Correlates of Road Traffic Congestion and Workers' Performance in Lagos Metropolis

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Abstract
This study examined the impact of road traffic congestion on workers' performance in Lagos Metropolis, Nigeria.The population for this study emanated from the staff of eight (8) purposely sampled quoted companies within Lagos metropolis one each from each of the following sectors: Telecommunication, Tourism & Hospitality, Financial Institution, Oil and Gas, Food, Production/Manufacturing, Shipping and Trading that comprises of 5340 staff where 534 respondents were randomly sampled. The data was collected through a structured questionnaire from 534 sampled staff of the eight selected companies. Information was solicited on how traffic congestion affect their effectiveness, efficiency, development, satisfaction, innovation, quality of work and how it affect the set target at work. Workers performance measures the bottom-line results on which traffic congestion variables has an impact. The performance construct was indicated by items such as effectiveness, efficiency, career progression of worker, satisfaction, innovation, and quality of work. These data were subsequently analyzed through descriptive statistics and multiple regression. The result shows that time loss due to congestion has no significant effect on quality and efficiency of work carried out by workers. While time loss due to congestion is positive and significantly related to effectiveness of workers ($t = 2.851$, $p < 0.05$). In the same vain time loss due to congestion has a negative and significant effect on career progression of worker ($t= -0.310$, $p<0.05$) and satisfaction ($t = -4.392$, $p<0.05$) of workers. The study recommended that 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.
Keyword: Traffic, Congestion, Workers, Performance, Satisfaction

1. Introduction

Traffic congestion refers to the incremental costs resulting from interference among road users (Transport Demand Management Encyclopedia 2008). In a similar vein, Weisbrod, (2010) defines Traffic Congestion as a condition of traffic delay (that is; when traffic flow is abysmally below reasonable speed) because the number of vehicles trying to use a road exceeds the design capacity of the traffic network. It is widely viewed as a growing phenomenon in many urban areas because the overall volume of vehicular traffic in many areas continues to grow faster than the overall capacity of the transportation system. The resulting traffic slow-downs can have a wide range of negative impacts on people and on the business economy, including impacts on air quality (due to additional vehicle emissions), quality of life (due to personal time delays), and business activity (due to the additional costs and reduced service areas for workforce, supplier and customer markets). (Weisbrod el at 2002)

Congestion arises out of the conjunction of two factors. The first is that every process has a finite capacity. The second is that every process has a stochastic character. That is, there is some degree of randomness in both the demands placed on a process to service those demands (Marvin, 1979). Whenever the total input rate is greater than the output link capacity, congestion occurs. When the network becomes congested, the queue lengths may become very large in a short time, resulting in buffer overflows and cell loss. Congestion control is therefore necessary to ensure that users get the negotiated Quality of Service (QoS) (Active Traffic Management, 2005). The congestion arising from the relationship between the demand placed on a road by vehicles and the available road capacity impacts directly or indirectly on productivity of workers entrapped in the traffic congestion.

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).

Those who argue that this congestion is actually a sign of a productive region are correct in some sense, but they do not account for the fact that users of the system do not pay the full costs of their travel. For example, because one more person in traffic makes everyone else's travel slower and contributes to emission level of the surrounding neighbor hoods and urban air sheds. Besides many trips impose costs on others exceeding the value of their own trips costs (Waliszewski, 2005). These costs on others are called external costs, or externalities.

In many metropolitan areas, there are increasing concerns about how the growth of traffic congestion may adversely affect the economy (business sales and income) as well as concerns about the relative benefit-cost ratio or returns on investment associated with alternative projects or policies to address those problems. Unfortunately, the severity and pattern of congestion, as well as the effectiveness of alternative projects or policies to address it, can vary widely from area to area, depending on the size and layout of the metropolitan area, its available transportation options, and the nature of its traffic generators. Similarly, there is no single rule of thumb for the economic cost of worsening congestion or the economic benefit of congestion reduction, for that can also differ depending on an area's specific economic profile as well as its unique pattern of congestion (Huisken, 2006).

Oni (1992) sees traffic problems as multi-dimensional and bewildering citing the example of Lagos. The countless man-hours lost in traffic congestion and the wastefulness of human energy and motor fuel are factors that have a most serious impact on the economic efficiency, productivity and social performance of the area.

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.

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. We depend on our transportation system to provide access to people and places we 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 populations 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. The aim of this paper is to examine the impact of road traffic congestion on workers' performance in Lagos Metropolis, Nigeria.

2. Literature Review

2.1 Employee Work Performance Theory

A major concern of organizations centers on the performance of employees (Agarwala, 2001). Competition has become a way of life for most organizations. Organizations are in constant war of competition striving to attain the so called sustainable competitive advantage (that is performing better than the rivals within the same respective industry). To survive and be successful; it is important for organizations to remain competitive. Since human resources are a unique and valuable source of competitive advantage, organizations must ensure the most effective and efficient utilization of these resources; simply because the ultimate source of value is people. It is human resource that creates value in any competitive organizations. Thus the achievement of any organization centers on the performance of employees (Agarwala, 2011).

Performance refers to job related activities expected of a worker and how well those activities were executed i.e. what an employee does or does not do on the job. The performance construct is usually indicated by items such

as *effectiveness*, i.e. if the workers meets his/her daily job objectives, *efficiency*, i.e. if the workers uses the fewest possible resources to meet his/her objectives, *development*, i.e. if the worker is developing in his/her capacity to meet future opportunities and challenges, *satisfaction*, of all participants – owners and investors, customers, society, other co-workers, and organization members, *innovation*, for products and processes, and *quality* of work. Performance related variables and construct has been designed by Allen and Meyer (1990). When employees do not perform according to expectations, or when they underperform; it is difficult for a firm to achieve its strategic goals and objectives. Under such conditions, the firm will not be able to achieve a competitive advantage.

2.2 Business Cost of Traffic Congestion

There is evidence that business views traffic congestion as causing a serious problem. The belief is that it causes a significant cost imposition. A survey from the United Kingdom found that traffic congestion was perceived as the most important factor likely to affect costs and service in the next three years (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).

2.3 History of Urban Economy of Lagos Metropolis

For the whole of Lagos State, primary activities (fishing, mining and quarrying, agriculture, and forestry) accounted for less than 2 per cent of total workers in the enumerated sector in 1978, and the main formal sector employment-generating activity during the 1970s was manufacturing (Lagos State Government, 1981). Metropolitan Lagos accounted for 38 per cent of total manufacturing employment in Nigerian cities in 1976, and over 60 per cent of the total value added in manufacturing in the six major industrial centres (Enterprise Consulting Group Ltd., 1988). Commercial activities have always been very strong in the city and are carried out at both the formal and informal levels. Agriculture and fishing and distributive trade are the largest employers of people without formal education. According to Lagos State Social Security Exercise and Population Figure (2006) the role of agriculture within metropolitan Lagos is less than 2 per cent of the workforce, although the precise figure of employment in this sector is not available. It finds expression in market gardening and other

forms of agriculture, mostly on the outskirts of the metropolis. About one-quarter of all workers are in distributive trade. Public administration accounts for another one-quarter and other services have about one-fifth of the employment in the formal sector. During the oil boom years, the multinational companies were very strong in both manufacturing and trade. However, with the downturn in the economy, the trend has been for many of them to divest their operations. Relevant figures are, however, not available. With the federal political decision-making organs and key federal ministries having moved to Abuja, industry and commerce continue to be the live wires of the economy of the metropolis.

3.0 Methodology

Lagos State lies in the south Western part of Nigeria on the west Coast of Africa. It lies approximately on longitude 2^{o} 42^{1} E and $3^{o}22^{1}$E and Latitude $6^{o}22^{1}$N (Merem and Twumasi, 2008). The more built up Mainland and Lagos Island, according to Merem and Twumasi (2008), make up the areas referred to as Metropolitan Lagos (figure 1), which accounted for about 80% of the population of the state. 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.

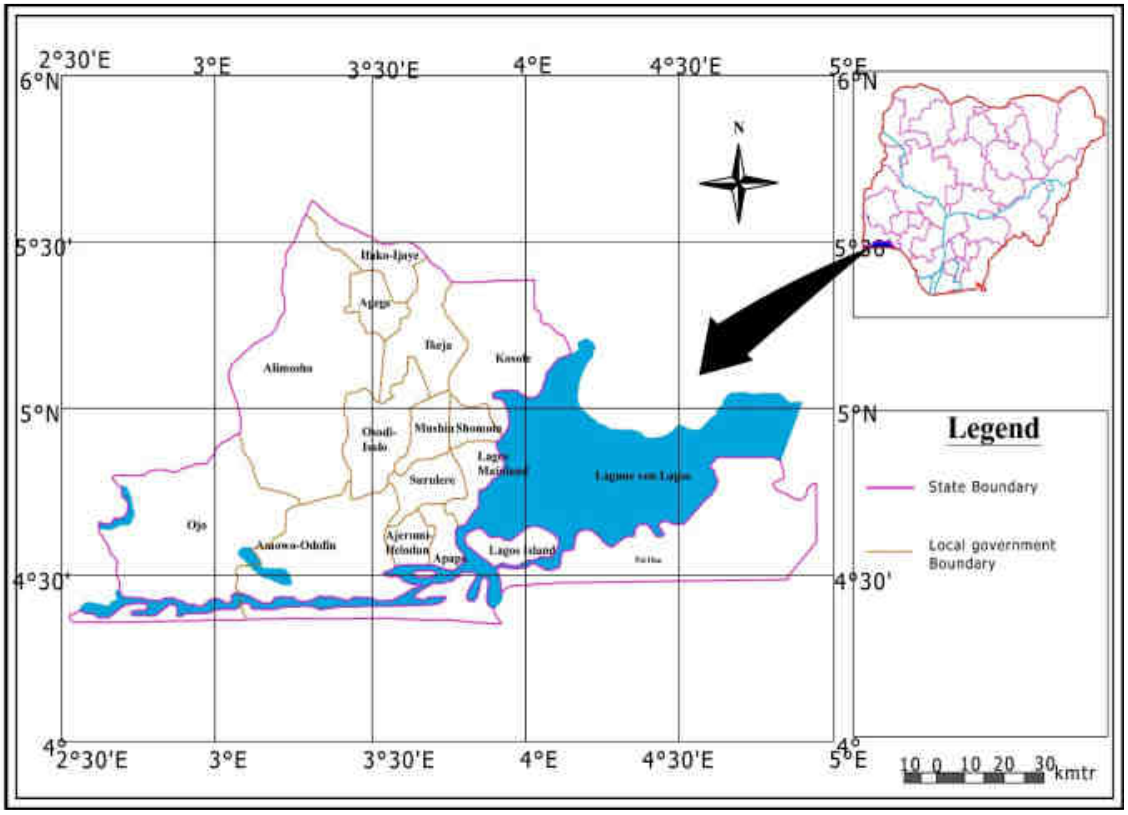

Figure 1. Map of Lagos Metropolis
Source: Bohr (2006)

Traffic congestion is measured with travel time estimate. Travel time estimate involves estimating the time it takes to travel from point A to point B on a corridor. This was achieved by participatory observations using test vehicle techniques.

The population for this study emanated from the staff of eight (8) purposely sampled quoted companies within Lagos metropolis one each from each of the following sectors: Telecommunication, Tourism & Hospitality, Financial Institution, Oil and Gas, Food, Production/Manufacturing, Shipping and Trading that comprises of 5340 staff where 534 respondents were randomly sampled. The data was collected through a structured questionnaire from 534 sampled staff of the eight selected companies. Information was solicited on how traffic congestion affect their effectiveness, efficiency, development, satisfaction, innovation, quality of work and how it affect the set target at work.

Allen and Meyer (1990) designed performance related variables and construct. Workers performance measures the bottom-line results on which traffic congestion variables has an impact. The performance construct is usually indicated by items such as *effectiveness*, i.e. if the workers meets his/her daily job objectives, *efficiency*, i.e. if the workers uses the fewest possible resources to meet his/her objectives, *development*, i.e. if the worker is developing in his/her capacity to meet future opportunities and challenges, *satisfaction*, of all participants – owners and investors, customers, society, other co-workers, and organization members, *innovation*, for products and processes, and *quality* of work. These items were measured on a Likert scale ranging from 1 to 5, asking respondents to relate their traffic experience to work performance in their organization. The paper objective was later analysed through descriptive and inferential statistic- multiple regression analysis.

4.0 Analysis and Discussion

In an attempt to examine the effect of congestion on workers' performance the following variables were used as control variables: time, age, education, occupation and experience

Explicitly, the model is specified as:

$$Y_i = \beta_0 + \beta_{1i}X_{1i} + \beta_{21}X_{2i} + \beta_{31}X_{3i} + \beta_{41}X_{4i} + \beta_{51}X_{5i}\varepsilon_i$$

Where:

Y_i is the dependent variable
$\beta_{0=}$ intercept
$\beta_{1\text{-}5}=$ parameters to be estimated
$X_1 =$ Time
$X_2 =$ Age
$X_3 =$ Education
$X_4 =$ Occupation
$X_5 =$ Experience
ε is the error in the observed value for the ith case.
i= respondents

Table 1 shows the descriptive analysis of measures of performance of workers. Most (98%) of the respondents agreed that congestion affected the performance of their work in the area of effectiveness. Very low per cent (0.4%) of them disagree while 1.6 per cent of respondents are undecided. The results indicate that traffic congestion potentially has high negative effect on the level of effectiveness of workers. Similarly, traffic congestion affects the efficiency level of majority (96.7%) of respondents. The level of attribution of traffic congestion to development of workers is not clear; about 38% of respondents agreed to the link between traffic and development of workers while 31.5 per cent are undecided. This might indicate that traffic congestion effect is lower on development of workers as a measure of performance.

However, 57 per cent of sampled respondents indicated that their level of satisfaction is affected by traffic congestion; 42% are undecided while only 1.2% disagreed. Meanwhile, traffic congestion hampers innovativeness of some of the workers. Results indicate that 77% of respondents agreed that traffic congestion affect their level of innovation at work. Further, findings show that traffic congestion affects quality of work done by workers as indicated by about 90% of respondents. Very low per cent (5.5%) disagreed while 4.6 per cent of respondents are undecided.

Table 1. Descriptive Analysis of Measures of Performance

Measures	SA	A	UN	D	SD
Quality of works	327(67.7)	107(22.2)	22(4.6)	6(1.2)	21(4.3)
Effectiveness	373 (76)	108(22)	8(1.6)	2(0.4)	-
Efficiency	279(56.8)	196(39.9)	7(1.4)	9(1.8)	-
Development	94(19.5)	91(18.8)	152(31.5)	73(15.1)	73(15.1)
Satisfaction	95(19.3)	184(37.5)	206(42)	6(1.2)	0(0%)

Source: Data analysis, (2014)
SA- strongly agree; **A-**Agree; **UN;** Undecided; **D-**Disagree; **SD**-Strongly disagree
( )- %

Time loss due to congestion has no significant effect on quality of work carried out by workers. However, workers who have low level of education and are faced with traffic congestion will be more affected negatively. Similarly, workers with lower occupational status will also be negatively affected (Table 2).

In the same vein, the result show that time loss due to congestion is positive and significantly related to

effectiveness of workers. As more time is lost in congestion, effectiveness of workers is expected to reduce. Younger workers are also expected to have significant reduction in their effectiveness (β = -0.330, $p < 0.05$) when there is an increase in congestion. Workers with low level of education will also be negatively affected in their level of effectiveness due to effect of congestion. However, higher occupation status of workers can assist in maintenance of level of effectiveness inspite of congestion. High level of experience is also significantly related to maintain high level effectiveness when there is congestion.

Table 2: Multiple Regression Analysis on Impact of Time Spent in Congestion on performance construct

	Quality of Work			**Effectiveness**			**Efficiency**			**Career Progression of Worker**			**Satisfaction**		
	Coeff.	t-value	p-value	Coeff.	t-value	p-value	Coeff.	t-value	p-value	Coeff.	t-value	p-value	Coeff.	t-value	p-value
Time	0.095	1.412	0.159	0.137	-2.851	0.005	0.011	0.245	0.806	-0.310	-3.387	0.001	-0.213	-4.392	0.000
Age	-0.084	-1.072	0.284	-0.330	-6.450	0.000	-0.104	-1.918	0.056	-0.399	-3.803	0.000	0.116	2.049	0.041
Education	-0.406	-5.475	0.000	-0.193	-4.004	0.000	0.160	3.138	0.002	-0.370	-3.675	0.000	0.099	1.844	0.066
Occupation	-0.167	-3.087	0.002	0.085	2.420	0.016	0.219	5.889	0.000	0.475	6.554	0.000	0.011	0.279	0.781
Experience	0.009	0.437	0.662	0.083	6.518	0.000	0.034	2.512	0.012	0.134	5.124	0.000	0.036	2.526	0.012
Constant	3.605	8.566	0.000	2.136	7.797	0.000	0.349	1.203	0.230	3.826	6.774	0.000	1.622	5.304	0.000

Source: Data analysis, 2014

Similarly, the table 2 shows the impact of time spent in congestion on efficiency of workers. The results indicate that time loss due to congestion has no significant effect on efficiency of workers. The effect of control variables however differ. Younger workers will be affected negatively as the result indicates that the efficiency level of younger workers will be reduced due to congestion. Education and occupation status have significant and positive effect on efficiency of workers, implying that workers with high level of education and high occupational status can cope better with traffic situation. Also experience has positive and significant effect on efficiency of workers. Workers with high level of experience can cope better with traffic congestion, thereby maintaining their level of efficiency at work.

As equally indicated in table 2, time loss in congestion has a negative and significant effect on development of workers. As more time is spent in congestion resulting in significant time loss, development of workers is expected to be negatively affected. The effect is expected to be more pronounced on younger workers (β = -0.370, $p < 0.005$) with low level of education (β = -0.370, $p < 0.05$). Workers with high occupational status and experience will be able to maintain their level of development inspite of congestion problem.

Furthermore, the results in Table 2 show that time loss due to congestion has negative and significant effect on satisfaction of workers. Workers who spend more time in traffic congestion could become less satisfied with job possibly due to fatigue associated with traffic congestion. However, with age maturity (β = 0.116) and high level of education (β = 0.099), workers will be able to maintain their level of satisfaction. High level of experience could also play a positive and significant role in maintaining the level of satisfaction of workers.

5.0 Conclusion and Recommendation

The analysis in this study indicates how congestion effectively impact workers' productivity. The end product demonstrate a general approach that can be applied for broad analysis of the economic costs of congestion for urbanized areas around the country. It is important to note, though, that this study focuses mainly on the implication of traffic congestion on workers' productivity. It does not cover the value of congestion delay for personal time. Nor does it examine the relative costs and benefits of alternative measures to mitigate congestion.

The study also incorporates a concept of production functions that attempt to recognize value added per production period to some degree, as it relates to productivity of workers. This effect is of particular note, for it will help to reconcile congestion impact analysis methods with more aggregate studies of the relationship between workers productivity and transportation policies.

The result from the analysis shows that time loss due to congestion is 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. The effect of traffic congestion mediated by time loss is negatively related to job satisfaction of directors, supervisors and workers at 5% level of significance. However, experience of workers plays a significant role in management of traffic congestion problem. Workers with higher level of experience are found to maintain their level of satisfaction at positive level than workers at lowest level of experience.

Similarly, time spent in congestion also found to decline efficiency of workers while its influence on development of workers may not be negative. Further, a lot of time spent in congestion potentially negates job satisfaction of workers. Therefore the study recommended that 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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