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ASSESMENT OF VEHICLE TRACKING SYSTEM IN DANGOTE CEMENT TRANSPORT, OBAJANA- NIGERIA

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Abstract

Dangote Cement Transport (DCT), Obajana has over 5,000 trucks used for cement products distribution from Obajana to all its retail outlets Nigeria. Due to incessant cases of traffic rules violation, theft and losses of goods, illegal use and slow turnaround of vehicles. DCT engaged NOVA Track Technological services for real-time tracking of her trucks in 2014. Five years after, there are controversies as to whether or not the tracking system has achieved its objectives. This study assesses the effectiveness of vehicle tracking system in DCT. Data were collected on the number of accidents and diversions between 2010- 2019 (pre and post VTS adoption) from documentary records of the company. The data were analyzed using descriptive and inferential statistics, while the hypothesis was tested at 0.05 significance level. Findings show that the relationship between recorded number of accident before and after the introduction of the tracking was negative and linearly weak with correlation coefficient of -0.24. Furthermore, deviation from assigned routes before and after VTS introduction also has weak correlation in all the northern routes. The study concluded that the adoption of the tracking system has not come with the expected reduction in accidents and route diversions. It was recommended that DCT drivers should be re-oriented about the benefits of the tracking system after which strict rules with severe punishment should be instituted.

***Key Words:** Devices, GPS, Satellites, Tracking, Trucks, Vehicles,*

1.0 Introduction

Goods movement by road-based vehicles is increasingly becoming a challenge in Nigeria. These challenges include; high rate of accident, diversion of payload, vehicle hijacking, high turnaround time of vehicles, just to mention a few. Optimization of vehicles for distribution of goods and services can be achieved through adequate monitoring of the fleet movement. With a dependable vehicle tracking system which creates regular alerts about the vehicle movement, company can have real-time information on their vehicle assets. This system can also help in reducing insurance premiums, as the vehicle's loss-risk would decrease significantly. Vehicle tracking system is a systematic approach that involves real-time monitoring of the vehicle irrespective of locations for better management. Vehicle tracking system which has been in use for about two decades provides viable security architecture for any haulage company that wishes to have values for money(Ishola, 2014). According to Ogunniyi, Akerele, & Afolabi, (2011), Vehicle tracking system includes installing an electronic device with purpose-designed computer software on at least one operating base in the vehicle, so that the owner or a third party can check the location of the vehicle, collect field data during the process and forward it to the operating base.

2.0 The Need for the Research

According to Ikeguna, (2016) Dangote Cement Transport, Obajana has over 5,000 vehicles which requires constant monitoring, hence the adoption of NOVA Track services for its fleet management and monitoring in November 2014. Nova Track Technological Services is a Nigeria's leading provider of vehicle monitoring services. It uses the GPS/GPRS vehicle tracking device in a 12-channel GPS monitoring satellite receiver that delivers precise, second-by-second base location, speed and direction information to the terminal. Using the aforementioned information, the device continuously tracks vehicle operation day and night. However, five years after the adoption of this technology, there are controversies as to whether or not the system had been able to reduce the rate of accident and unauthorized diversion of vehicle. Preliminary investigation into DCT operations shows that, the company still grabbles with issues of accident, poor management of their assets, traffic rules violation, incidences of theft and losses of company vehicles and goods and fuel mismanagement all of which is placing huge operational and financial burden on the company. It is against this backdrop that this study assesses the effectiveness of vehicle tracking system in DCT Obajana. A null hypothesis: The tracking system employed by Dangote Cement Transport is not significantly effective was tested using the pre and post VTS accident and deviation records of the Company.The significance of the study lies in helping the company determining whether there is value for money based on the human, financial and technological resources invested in the tracking system with a view to making recommendation that will ensure better future performance of the company fleet management system.

3.0 Empirical Review on Vehicle Tracking System

Sathe (2013), in his study of GPS applications to urban freight modeling and planning, pointed out that GPS data could provide a valuable tool for transport DOT planning and programming. Vankatakrishnan and Seethalakshmi (2012), develop an automated trip-end recognition algorithm by averaging maximum and minimum dwelling times, heading changes and searching distances between GPS points, their approach has proved very useful in improving the quality of details about transit time estimation. Abid and Ravi (2012) used GPS-based test vehicles to calculate travel times on urban arterial roads by developing an algorithm that calculated travel time between the intersections of a GPS system installed on a vehicle, the major finding of the study is that the mobile objects are not limited by an underlying road network. Saranya and Selvakumar (2013) demonstrated the procedure and efficacy of how GPS can be used to check travel diaries in London, Houston, Quebec City and the Netherlands, while Pankaj & Bhatia, (2013) used GPS to collect travel data in personal vehicles and used the data to plan journey itinerary.

Albert and Ezhilarasie (2011), study focuses on the benefits and challenges of vehicle tracking technologies, they affirmed that the biggest advantage of using the GPS is that it provides real-time spatial and temporal awareness of the whole journey. Mohammad & Al-Khedher, (2011) used GPS tracking to identify the car, bus, or walk mode of the user and to predict the most likely route a person would take, while Moein, Ehasan and Ali, (2011) in their contribution used GPS data to study the outdoor movements of individuals to predict the important positions and movements of individuals.

Asaad, Hindawi and Ibraheem (2012) exclaimed that making smart transportation system applications and location-based

services requires not only greater GPS accuracy but also greater device information reliability and integrity. On that note, Monica (2013), Proposed three map matching algorithms to improve accuracy using the graph trajectory architecture. Data tracking by GPS has become a reliable source for continuous travel data collection over a given time period. Although high data quality cannot be guaranteed, techniques such as map matching have been commonly used to correct inaccuracy of the data.

Asaad, Hindawi and Ibraheem (2012), defines an anti-theft car system as a system using GSM and GPS modules the device can be built using the single-chip high-speed mixed type of the C8051F120, and the vibration sensor can be used to detect stolen vehicles. The unit remains in touch with the vehicle owner through the GSM module for the protection and reliability of vehicles. This system can help intercity carriers track their vehicles in all-time and provides protection against armed robberies and accidents.

4.0 The Study Area and Methodology

Dangote Cement Transport Obajana is an integrated logistics Company that meets the Group's full haulage needs from raw material transport to final product production. The company has about 5000 in-house haulage fleet ensuring efficient delivery of goods within and outside Nigeria. The fleets are strategically positioned in regional transport hubs across the country to ensure the reach of Dangote Cement to every locality of the country. Such regional transport hubs are assisted by full-fledged workshops to handle preventive maintainance and repair of breakdown vehicles. DCT is located about 400 km north-east of Lagos, in Obajana, Kogi State, along Kabba-Lokoja-Abuja road Figure 1). The company has an ambitious vision of becoming excellent standard haulage unit that will provide effective, efficient and reliable logistics support to the cement division. This vision is backed-up with eight smart objectives one of which includes: To align the cement transport division towards actualizing the group objective of effective and efficient haulage operations. This is to be carried out under a world class customer service, customer orientation, entrepreneurship, excellence and market Leadership philosophies.

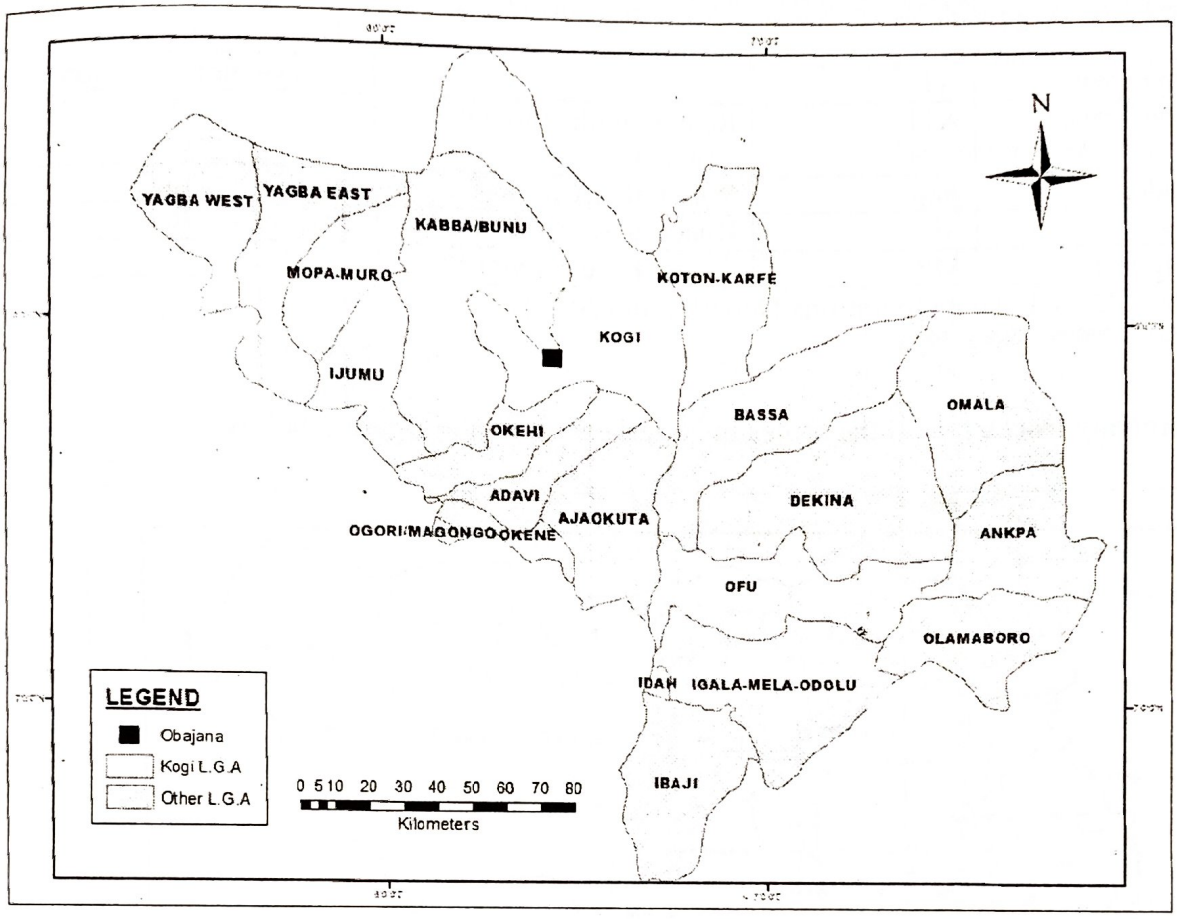

Figure 1. Obajana in the context of Kogi state

Production and evacuation of Dangote cement product is a 24 hour all day operational process in all plants, its transportation is guided by world class operational and non-operational standards as depicted in table 1 below.

Table 1 Operational Standards of DCT- Obajana

Operational	Abbreviation	Understanding	Tolerance Days
Empty	E	In Obajana, Taking ATC	1
Loading	L	Awaiting entry/loading	
AGO Queue	Q		
Dispatched in Obajana	DO	Vehicle in Obajana & should move	0.5
Transiting Going	TG		1 upto 500kms, 2 > 500 kms
Awaiting offloading	AO	Within 1 or 2 days after arrival	1
Offloading delay	OD	Starts a day after arrival	3
Transit Coming	TC		1 upto 500kms, 2 > 500 kms
Transloading	TL	Transloading goods of a HBD/Accd truck	1 upto 500kms, 2 > 500 kms
Special Ops	SO	Detailed for one time/specific task	
Non Operational	**Abbreviation**	**Understanding**	**Tolerance Days**
Transit to Workshop	TTW	Yet to enter workshop	1
Workshop	W		Workshop to indicate
Highway breakdown	HBD		2
Accidented Fatal	AF	Involved in a fatal accident	5

Accident	A	Does not involved any fatality	3
Awaiting Tyre	AT		Tyre unit to indicate
Awaiting Trailer	ATL	Require trailer through swapping	2
Impounded	Imp	With Police/Customs	15
Missing	M	Hijacked/Stolen & missing	30
Minor Repair	MR	No need to enter workshop	2

Source: DCT-Obajana Operations Department (2019)

The company trucks ply all the routes in Nigeria as shown in figure 2 below.

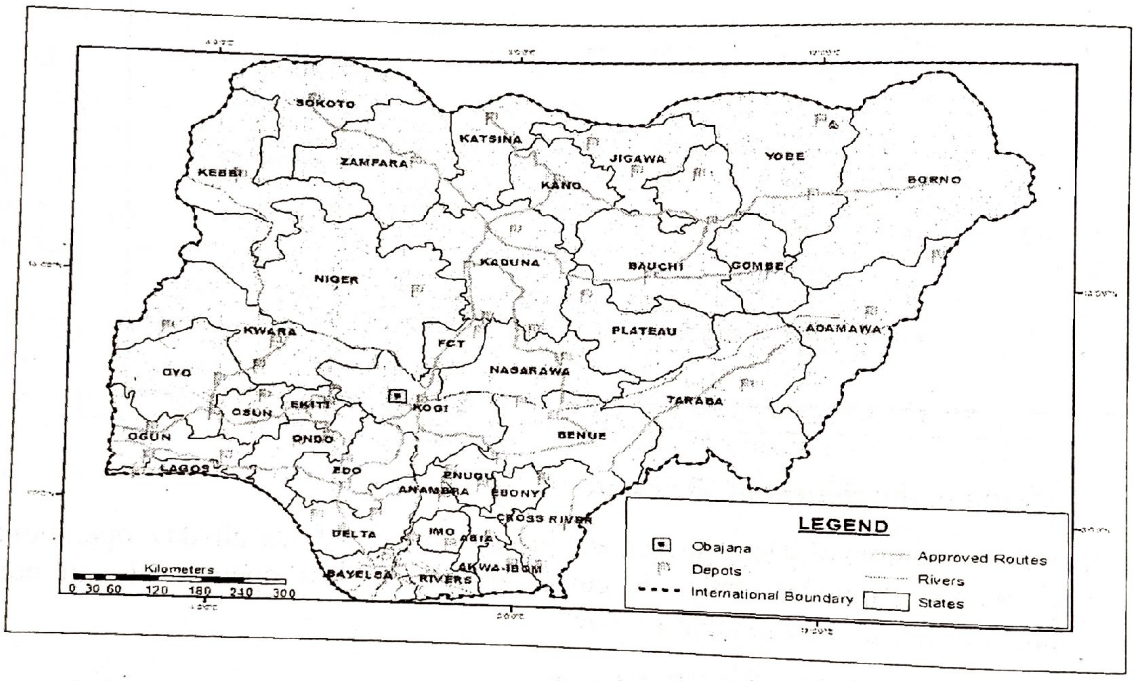

Figure 2: Dangote Cement Trucks Routes WithinNigeria

4.1 NOVATRACK Technology System

In October 2014 NOVATRACK- a leading vehicle monitoring service provider in Nigeria was launched at DCT Obajana. NOVATRACK offers Solutions to track, protect, direct and manage vital business vehicle and other mobile assets of the company. A GPRS data modem connects the web servers using the computer network GPRS to ensure coverage of the routes. The system is designed to work with either 12 or 24 V electrical vehicle systems for full flexibility and extreme accuracy. NOVATRACK equipment comes with tracking unit, antenna, speaker and microphone; it has a designed power solution installed to protect the unit from battery problems, sparks, spikes and high temperature therefore, making it ideal for use in almost any environment. This feature allows the company to control, track, and display each vehicle's status on a single screen at the base station as shown in figure 3.

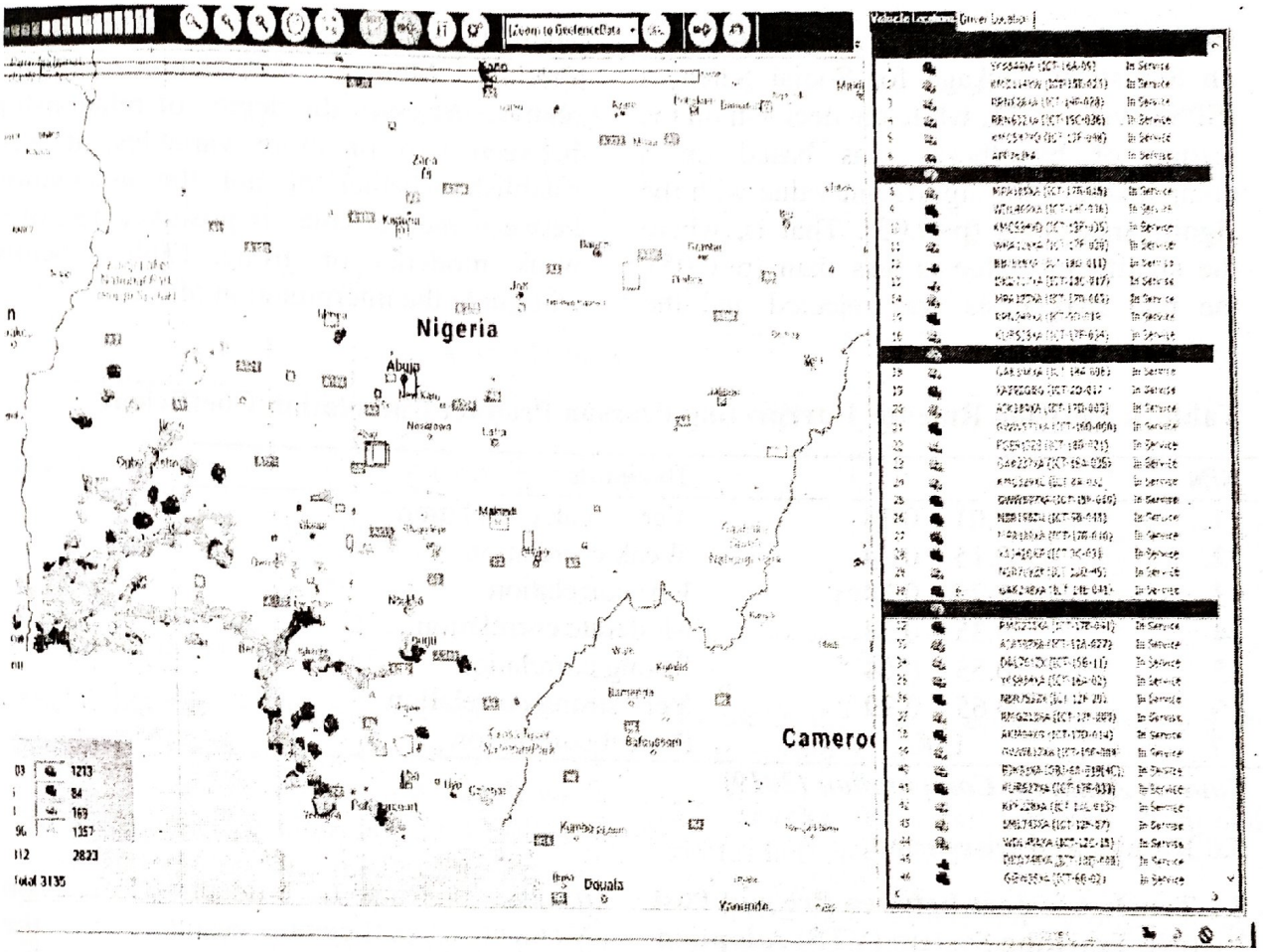

Figure 3: Control Room All Vehicle Monitoring and Status On-Screen Display

Source: Novatrack Application (2019)

The status of the vehicle is color coded to allow for a simple and fast assessment. Green colored vehicles mean that a vehicle is moving, red indicates that a vehicle is stationary, and blue indicate that the vehicle was in motion a while ago. The speed and time of the vehicle is shown by simply clicking on the vehicle icon on the screen. In addition, a list of all tracked vehicles by one user with color code status is also displayed on the right hand side of the dashboard.

4.2 Methodology

A descriptive survey research design was used for the study, in the words of Kennedy and Kepha (2015), survey research design is a systematic analysis using test samples to record, identify and explain the nature, existence and non-existence of the current status of the studied phenomena. The concept is considered acceptable as the study sought input from documentary records as a metric for assessing the effectiveness of Dangote Cement Transport vehicle tracking system. Data were obtained on reported cases of road accidents involving DCT Obajana between 2010-2014 (before the adoption of VTS) and 2015-2019 (after the adoption), as well as reported cases of deviation from assigned routes between 2009-2014 (before the adoption of VTS) and 2015-2019 (after the adoption of the VTS). Five northern routes namely: Obajana- Kano, Kaduna, Katsina, Kebbi and Adamawa were considered. The data were sourced from documented records of DCT, Obajana Central Vehicle Monitoring and Tracking Control Room.

The data were analyzed using descriptive (mean and standard deviation) and

inferential statistics of Correlation Analysis on Statistical Package for Social Sciences (SPSS) version 21, while the decision on the testing of hypotheses was based on a comparison of the significant value with the significance level ($p<0.05$). That is, where the significant value is less than ($p<0.05$), the null hypothesis was rejected and the alternate hypothesis accepted. Pearson Product Moment Correlation (PPMC) analysis assesses the degree of relationship between two or more variables, it also establish whether or not the association between the variables is positive, negative, weak, moderate or strong. Table 3 below will guide the interpretation of result.

Table 3: Decision Rule for Interpreting Pearson Product Correlation Coefficient

S/N	r	Decision
1.	0.01 – 0.14	Very weak correlation
2.	0.15 – 0.24	Weak correlation
3.	0.25 – 0.34	Fair correlation
4.	0.35 – 0.54	Moderate correlation
5.	0.55 – 0.64	Strong correlation
6.	0.65 – 0.99	Very strong correlation
7	1.00	Perfect correlation

Source: Authors; Computation (2019)

5.0 Results and Discussion

5.1 Truck Accident between Pre and Post Vehicle Tracking System (VTS) Adoption

The recorded cases of Road accident involving DCT, Obajana Trucks before the VTS adoption (2009-2014) and after the VTS adoption (2015-2019) is presented in table 4 below, whereas table 5 presents the results onPearson Product Correlation Moment Coefficient result on the relationship between accident recorded againstDangote Cement Transport, Obajana before the introduction of Novatrack VTS (2010 – 2014) as against the number of accidents recorded by the Company trucks after the adoption of VTS (2015 – 2019).

Table 4: Rate of DCT Obajana in Pre and Post VTS Adoption

	Pre VTS					Post VTS				
Months	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Jan	24	19	21	24	19	19	19	16	20	25
Feb	26	29	27	25	25	18	15	11	26	22
Mar	21	31	28	22	29	18	19	12	31	23
Apr	29	28	26	32	31	11	13	10	21	18
May	19	15	19	21	12	18	12	13	16	27
June	23	19	22	20	15	18	15	11	26	28
July	18	22	28	18	18	19	18	18	17	19
Aug	17	18	11	19	19	18	19	19	14	37
Sep	28	30	17	19	13	13	13	13	16	11
Oct	22	18	27	20	11	10	14	20	19	19
Nov	21	19	16	14	24	24	24	16	20	22
Dec	29	27	24	19	25	25	20	18	17	21

Source: Control unit, DCT Obajana (2019)

Table 5: Correlation Analysis Result

Descriptive Statistics

	Mean	Std. Deviation	N
Pre_VTS	109.33	19.630	12
Post_VTS	92.00	13.080	12

Correlations

		Pre_VTS	Post_VTS
Pre_VTS	Pearson Correlation	1	-.241
	Sig. (2-tailed)		.451
	N	***12***	***12***

Source: Computer Output (2019)

The mean for pre VTS years was 109.33, standard deviation is $(S.D. 19.63)$ and the mean for post VTS years was 92.00, while the standard deviation is $(S.D. 13.08)$, the implication is that the relationship between the periods before and after VTS adoption islinearly weak negative correlation and statistically not significant $(r(10) = -0.24, p = 0.45)$. This shows that the adoption of the vehicle tracking system does not bring about the expected decline in the rate of accidents recorded by the company vehicles.

5.2 Trucks Diversion off the Assigned routes before and after VTS Adoption

As mentioned earlier, five northern routes of: Obajana- Kebbi, Kaduna, Kano, Katsina and Adamawa routes was used; data collected over the ten years (2010 -2019) period is presented Table 6 below.

Table 6: Recorded Cases of Diversion Before and after the introduction of VTS

	Pre VTS Cases per State					Post VTS Cases per State				
Month	Kebbi	Kaduna	Kano	Katsina	Adamawa	Kebbi	Kaduna	Kano	Katsina	Adamawa
Jan	301	290	421	355	359	256	259	346	308	358
Feb	385	300	333	416	411	243	321	283	282	341
Mar	309	380	311	303	354	311	245	279	233	316
Apr	218	399	303	412	397	169	197	203	174	197
May	333	411	472	454	349	203	160	147	251	235
June	443	332	365	406	419	190	252	356	254	376
July	245	274	340	301	390	189	286	97	279	336
Aug	343	446	378	329	408	238	297	281	295	291
Sep	345	284	344	414	323	297	278	314	375	274
Oct	385	343	419	340	437	235	158	270	213	219
Nov	408	399	387	385	271	297	334	306	227	204
Dec	412	369	401	310	418	314	318	286	372	335

Source: Control unit, DCT Obajana, 2019.

Table 7: Correlation Analysis Result of Diversion Before and after introduction of VTS

Correlations		
Route	r	p
Kebbi State	0.393	.207
Kaduna State	-0.176	.583
Kano State	-0.004	.990
Katsina State	-0.167	.603
Adamawa State	0.341	.278

$r = Pearsons\ product\ correlation\ coefficient, p = probability\ value$

Source: Authors' Analysis (2019)

Table 7 presents the Pearson Product Correlation Moment Coefficient results of the relationship between diversion of truck drivers off the assigned route between the year 2010 and 2014 (5 years before the introduction of Nova Vehicle Tracking System) and 2015 to 2019 (5 years after the company introduced Nova VTS). On a route by route basis, the result revealed that the relationship is linearly moderate in strength and statistically not significant $(r(10) = 0.39, p = 0.21)$ along Obajana – Keb. It is linearly negatively very weak and not significant $(r(10) = -0.18, p = 0.58)$ between the periods before and after the introduction of the VTS along Kaduna route. A linearly negatively very weak and statistically not significant relationship $(r(10) = -0.01, p = 0.99)$ also exists between the periods before and after the introduction of the VTS along Obajana-Kano route. Obajana-Katsina route had a relationship which is linearly negatively very weak in strength and statistically not significant $(r(10) = -0.17, p = 0.60)$ while a linearly moderate in strength relationship and statistically not significant $(r(10) = 0.34, p = 0.28)$ exists between the periods before and after the introduction of the VTS in Obajana-Adamawa routes. The null hypothesis which states that tracking system employed by Dangote Cement Transport is not significantly effective there is therefore accepted.

Observations from Table 7 shows that the adoption of the system has not truly reduced the number of diversion off the assigned routes in all the northern routes studied. Kano route has the weakest coefficient as well as the highest probability value when tested at 0.05 level of significance. A clear indication that the aim of adopting the VTS by the company has not been achieved. This finding is in agreement with Hoang et'al (2013), who opined that computerized devices can be easily manipulated by the users to achieve desired results whenever the operational standard of such device negates the user's interest, thereby reducing the system's efficiency.

6.0 Recommendation and Conclusion

Results emanating from the correlation analysis on the accidents before and after the introduction VTS, as well as diversion from assigned routes before and after the adoption of VTS revealed a linearly weak correlation coefficient. It can thus be concluded that although the VTS has been in use for some years in DCT, Obajana, it has not been able to significantly reduce the rate of accidents as well as curb diversion of the truck drivers off the assigned routes. Based on the foregoing it is recommended that: The DCT truck drivers should further

re-oriented about the importance and benefits of the tracking system after which strict rules and regulations should be set to checkmate the activities of the drivers who tampered with the devices, after which stricter punitive measures should be meted on defaulters. The service provider (NOVATrack Nig. Limited) should be more proactive in ensuring that all the installed vehicle tracking unit are up and running round the clock to achieve maximum success.

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