ANALYSIS OF FACTORS INFLUENCING PASSENGERS TRAFFIC IN THE ABUJA-KADUNA TRAIN SERVICE (AKTS)

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ABSTRACT

This paper analysed passengers' traffic of the Abuja-Kaduna train service (AKTS). The AKTS is gaining recognition and increasing patronage of high-profile individuals, private car owners, and other passengers plying the Abuja-Kaduna road for various reasons (Suleiman, 2023; Suleiman, 2021). Data used for this study was obtained through both primary and secondary sources of data. The primary data involved the administration of 45 questionnaires to the railway staff in charge of the AKTS operation. While secondary data was obtained from the Nigerian Railway Corporation (NRC). The secondary data cover operational data for passengers transported by the AKTS between 2016-2021. The study employed the use of both descriptive and inferential statistical methods of data analysis. The findings of the descriptive analysis revealed that 2019 recorded the highest passengers traffic, while 2016 recorded the lowest. As for monthly traffic, December recorded the highest while May recorded the lowest. The result of one-way between-groups analysis revealed that there was a statistically significant difference at the $p < .05$ level in the yearly traffic.

Keywords: Railway Corporation, Service Delivery, Train Operations, Performance Quality, Public Transport

INTRODUCTION

An effective transportation system plays a pivotal role in facilitating the socio-economic progress of all countries. It is rare to find a town or city that can operate optimally without a sufficient, dependable, secure, and cost-effective transportation infrastructure. An efficient and effective transportation infrastructure plays a pivotal role in facilitating trade and bolstering the economic activities of a nation. Rail transportation plays a crucial role in facilitating commercial and economic activities within the Nigerian economy. This is primarily attributed to its capacity to efficiently convey substantial quantities of freight and accommodate a considerable number of passengers at a relatively low cost (Suleiman, 2021; Pius et al., 2017; Abioye et al., 2016).

The rail transportation system has been instrumental in fostering national development and promoting regional collaboration. The aforementioned entity is considered one of the fundamental components of a nation's infrastructure, playing a crucial role in fostering economic and technical advancement. The presence of a transportation infrastructure is crucial for towns and cities to effectively compete with one another. Rail operators have the responsibility to develop and design financially viable rail networks and establish a strong strategy for efficient service provision that satisfies the demands and expectations of service users. This is crucial in order to promote recurring traffic and ensure the long-term viability of the sector (Nwaogbe, et al., 2017). According to Atoyebi (2015) and Pius, Nwaogbe, and Chad (2017), rail transit plays a crucial role in the growth and sustainability of contemporary urban areas. The rail transport system plays a crucial role in fostering the progress and technical advancement of nations, regardless of their level of development. Its ability to facilitate movement and enhance accessibility is a significant contributing factor in this regard. Rail transport in many emerging countries is facing significant challenges due to the increasing demands of passengers, as well as inadequate infrastructure and restricted network capacity. These issues can be attributed to the asymmetric funding model employed by successive administrations over the years (Pius et al., 2017; Atoyebi, 2015).

Rail transportation is a pivotal factor in facilitating the transfer of goods and persons across numerous countries worldwide. Rail transit has historically and presently played a significant role in fostering socio-economic development in numerous countries, including those in Europe and North America. The transportation system has a significant role in facilitating the movement of both passengers and freight, as highlighted by previous studies (Adesanya, 2010; Agbaeze and Onwuka, 2014; Okanlawo, 2006).

The rail transport network is widely recognized as a fundamental component contributing to the economic, cultural, social, and industrial progress of nations (Aderibigbe & Adurokiya, 2011). Moreover, the creation of jobs and the provision of space utilities serve multiple purposes, including facilitating social mobility and contributing to the preservation of peace and tranquility (Pius et al., 2017; Atoyebi, 2015). Pius, Nwaogbe, and Chad (2017) further contend that these aspects are crucial for the development and sustainability of contemporary urban areas. The rail transport system plays a crucial role in fostering the growth and technical improvement of nations, both in industrialized and developing countries, by facilitating mobility and accessibility. Rail transport in many emerging countries is facing significant challenges due to the increasing demands of passengers, as well as inadequate infrastructure and limited network capacity. These issues can be attributed to the asymmetric funding strategy implemented by successive governments over the years (Pius et al., 2017; Atoyebi, 2015). Rail transit in Nigeria is considered one of the earliest modes of transportation. According to existing historical records, the establishment of the railway system in Nigeria can be traced back to 1898. This development occurred subsequent to the first construction of the railway track connecting the southwestern regions of Lagos and Ibadan, which was undertaken by colonial administrators (Muktar, 2011; Oni, 2000). The historical context of the Nigerian railway system situates it within the initial cohort of railway systems worldwide. In accordance with the findings of Odeleye

(2000), it can be observed that the governance structure in Nigeria throughout its transition from British colonial authority to independence was characterized by a regional administrative system. This system consisted of three distinct and self-governing areas, namely the Northern, Eastern, and Western regions. Following the conclusion of the civil war in 1969, efforts were made to address the extensive damage caused by the conflict and promote reconstruction, reconciliation, and development. In 1970, the regional administrative system established by the former colonial administrator was dismantled, and a new structure comprising twelve states was introduced. This restructuring aligned with the objectives outlined in Nigeria's initial national development plan, as documented by Ademiluyi and Dina (2011) and Odeleye (2000). The National Rail Corporation (NRC) is the governing authority responsible for overseeing, administering, and regulating rail transportation activities (NAT, 2002).

An examination of the operational performance of the Nigerian Railway Corporation (NRC) throughout the period spanning from 1955 to 1977 reveals a notable level of productivity in its operations. However, a further analysis indicates a decline in its commercial operations commencing in 1984. According to available statistical data, the Nigerian Railroad Corporation transported a total of 11,288,000 people and 2,960,000 tonnes of freight in the year 1964. According to data from the Nigerian Railway Corporation (2006), there was a noticeable decline in passenger and freight numbers over a 10-year period. Specifically, the figures plummeted to 4,342,000 people and 1,098,000 tons of freight. Between the years 1974 and 1989, the performance profile of the Corporation exhibited a pattern characterized by fluctuations. In a study conducted by Agunloye (2010), it was observed that the Corporation's operational statistics in 1995 exhibited a little decline compared to the data recorded in 1989. Specifically, the number of passengers decreased from 6,755,000 to 6,520,000, while the amount of freight transported decreased from 1,612,000 tons to 202,000 tonnes. In past years, several factors have been identified as being responsible for the decline in the railway transport system in

Nigeria. Foremost among them is poor quality of rail service which caused a decline in the use of the railway as a means of transportation by passengers and for freight haulage (Suleiman 2012). This included inadequate rolling stock and poor condition of available locomotives, delay, overcrowding, insecurity, the unreliability of operation and lack of punctuality (Suleiman, 2014; Abubakar, 2006). One outcome was the loss of patronage by the Nigerian Railway Corporation. Some of the entities that withdrew their patronage included the Nigerian National Petroleum Corporation (NNPC), Flour Mills, the Nigerian Army etc. (Suleiman, 2017; Abioye et al., 2016; Adesanya, 2010). This situation was not unconnected with poor quality of service offered by the rail transport system in Nigeria.

In particular, rail operation in some rail corridors such as the Lagos-Kano line, Kano-Nguru line, Zaria-Kaura line etc. had poor quality of service which led to decline in the preference of the rail system as a means of transportation among many passengers. By contrast, the Abuja-Kaduna train service (AKTS) is gaining preference, recognition, and increasing patronage of high-profile individuals, private car owners, and other passengers plying the Abuja-Kaduna road for various reasons (Suleiman, 2023; Suleiman, 2021).

MATERIALS AND METHODS
Study Area
The study was conducted along Abuja-Kaduna rail line corridor which spanned 186 kilometres. The rail line is one of the first standard gauge railway modernization projects (SGRMP) undertaken in Nigeria. The rail line operates on an express trip service which means it is a non-stop ride between Abuja and Kaduna. The passenger train on the line can carry about 5000 passengers and operate at a speed of 200 km/h to 250 km/h. Hence a ride between the two terminals takes an hour. Abuja is the administrative capital of Nigeria and it is located in the north central zone of Nigeria, while Kaduna is the capital of Kaduna State which is located in the north western zone of Nigeria (see Figure 1). Passengers who patronize the AKTS comprise of civil servants, business men, and tourists.
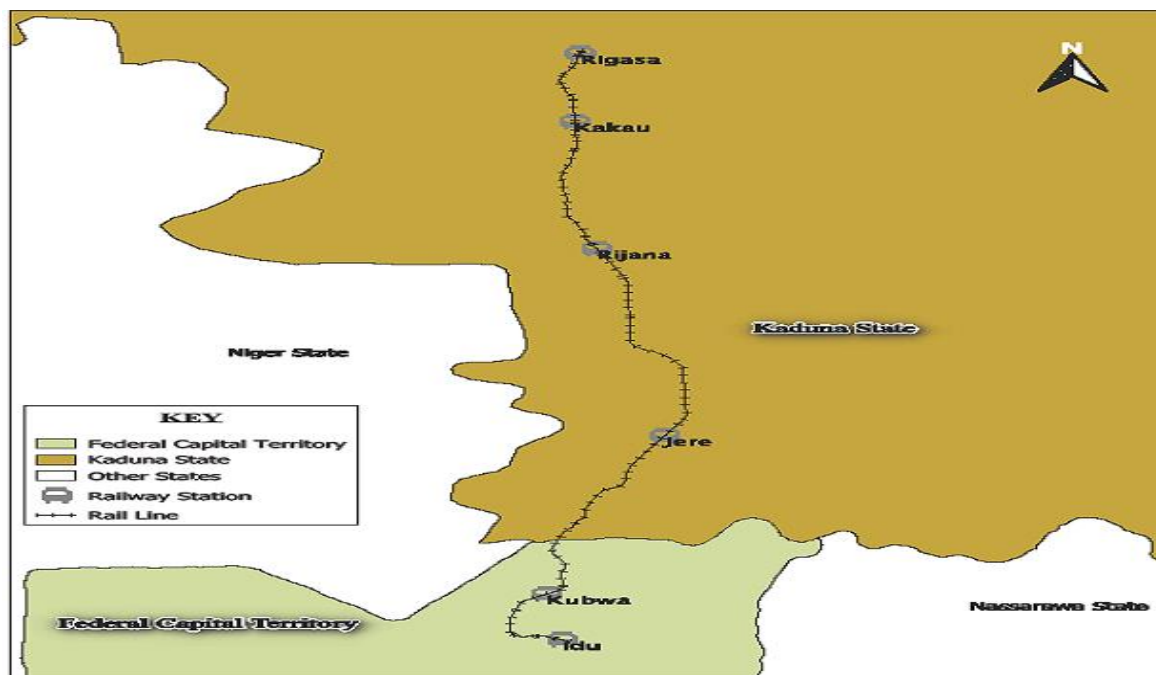

Figure 1: Map showing the Abuja-Kaduna rail line

Methodology

In order to analyse passengers traffic of the AKTS, the researcher collected both primary and secondary data. The primary data involved questionnaire administration to the railway staff in charge of the AKTS operation. A total of 45 questionnaires were administered to the railway staff in order to elicit information about the major factor influencing passengers traffic using convenient sampling technique. The secondary data was obtained from the NRC. The secondary data cover operational data for passengers transported by the AKTS between 2016-2021 which was the period when the train commence commercial operation.

The data collected were analysed using both descriptive statistics such as tabulation, percentages and mean were used to summarize and present data collected. While for the inferential statistics, spearman's correlation analysis was conducted to determine the strength of association between independent variables of factors influencing passengers traffic i.e. criminality along Abuja-Kaduna express way, availability of train coaches, festivity, reliability of operation and the dependent variable of passengers traffic. A One-way Analysis of variance was run on Statistical Package for Social Science (SPSS) to determine variation in the passenger traffic using explanatory factors such as increase in the number rakes, coaches, festivity periods, and insecurity along the Abuja-Kaduna express way. In addition, a mean plot chat was used to determine both yearly and monthly variations of passengers traffic.

Data Presentation and Analysis

Factors Influencing Traffic Flow of the AKTS

The analysis of factors influencing passengers traffic of the AKTS as shown on Table 1 revealed that, 46.7% of the railway staff identify criminality along the Abuja-Kaduna express way as the major factor influencing traffic, while 26.7% of the respondents considered festivity (Sallah, Christmas e.t.c,) as the major factor influencing traffic flow. About 17.8% of the respondents believe availability of train coaches as the major factor influencing traffic, only 8.9% of the respondents indicate reliability of operation as the major factor influencing traffic. This finding shows that, majority of the railway staff considered criminality along the Abuja-Kaduna express way as the major factor influencing passengers traffic.

Table 1: Factors Influencing Traffic of the AKTS

Explanatory Factors	Frequency	Percent
Criminality along the Abuja-Kaduna Road	21	46.7
Availability of Coaches	8	17.8
Festivity	12	26.7
Reliability of Operation	4	8.9
Total	**45**	**100**

Source: Authors' Field Survey, 2020

Relationship Between Passengers Traffic and Factors Influencing Traffic of the AKTS

Correlation is used to interpret whether the relationship of two variables is strong or weak, in terms of the power of relationship and the direction (Hauke & Kossowski 2011).

The relationship between passengers traffic variables was investigated using Spearman's correlation coefficient. Spearman's correlation coefficient measures the strength of association between two ranked variables. It is a nonparametric rank statistic that measures the strength of the association between two variables (Lehmann & D'Abrera 2006).

Table 2 reveals the Spearman's correlation coefficients between independent variables of factors influencing passengers traffic i.e. criminality along Abuja-Kaduna express way, availability of train coaches, festivity, reliability of operation and the dependent variable of passengers traffic. The degree of correlation differs among the various variables used in the study. For instance, the relationship between criminality along Abuja-Kaduna express way and passengers traffic is a positive relationship with correlation coefficient r=0.366 at p<0.001 level. This analysis suggests that there is a positive association between criminality along Abuja-Kaduna express way and passengers traffic of the AKTS.

Also, the correlation between availability of train coaches and passengers traffic is positive relationship with correlation coefficient r=0.372 at p<0.001 level. This suggests that there is a positive association between availability of train coaches and passengers traffic of the AKTS.

The correlation between festivity periods and passengers traffic indicates a positive relationship with correlation coefficient r= 0.575 at P<0.001. This shows that there is a positive association between festivity periods and passengers traffic of the AKTS.

Finally, the correlation between reliability of operation and passengers traffic indicates a positive relationship with correlation coefficient r= 0.148 at P<0.001. This shows that there is a positive association between reliability of operation and passengers traffic of the AKTS.

Table 2: Correlation Analysis Between Passengers Traffic and Factors Influencing Traffic Flow of the AKTS

Variables	Passengers Traffic Flow	Criminality Along A-K Express way	Availability of Train Coaches	Festivity	Reliability of Operation
Passengers Traffic Flow	1				
Criminality along A-K Express way	.366*	1			
Availability of Train Coaches	.372*	.402**	1		
Festivity	.575**	.310*	0.188	1	
Reliability of Operation	0.148	0.13	-0.207	.516**	1

* Correlation is significant at the 0.05 level (2-tailed).

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

The Passenger Traffic of the AKTS from 2016-2020

Table 3 shows that the AKTS transported a total of 2,987,196 passengers from August, 2016 to Mach, 2020. Based on the Table, 2019 recorded the highest passengers traffic with 1,383,094 perhaps due to criminal activities along the Abuja-Kaduna highway as indicated by majority of the railway staff in Table 1. Year 2018 recorded 694,020 passengers traffic. according to railway officials, was due to introduction of additional rake in 2018 which added to the existing one making a total of 2 rakes. The introduction of the additional rake led to increase in the number of trips from 3 to 8 and consequently increased the passengers traffic. This further corroborate with the opinion of the railway staff that identifies availability of train coaches as the major factor influencing passengers traffic. Year 2016 recorded the least traffic with 126,785 passengers transported by the train. According to railway staff, the 2016 result could be attributed to the fact that the train began operation in the same year with only one rake and seven coaches. In the same vein, the issue of criminal activities along the Abuja-Kaduna highway was not prominent in 2016.

Accordingly, monthly traffic records revealed that March recorded the highest traffic with 348,972 passengers transported. This may be attributed to the festivities that usually occur in the month of March with people traveling to their various homes to celebrate with their loved ones. Besides, May recorded the least monthly traffic with 174, 690. This is because the period between April to December 2020 represented the time when train operations were shut down due to the Covic-19 pandemic.

Table 3: Passengers Traffic of the AKTS 2016-2020

	JAN.	FEB.	MAR	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	Total
2016	Nil	Nil	Nil	Nil	Nil	Nil	Nil	26,181	24,021	23,911	29,263	23,409	126,785
2017	30,009	28,006	25,179	27,613	21,804	20,533	27,145	35,712	28,364	28,810	29,439	36,045	338,659
2018	48,721	50,183	51,675	56,317	48,160	53,876	71,916	71,171	61,936	35,881	61,301	82,883	694,020
2019	71747	59,272	80,878	120,598	104,726	113,846	123,024	135,783	140,217	138,368	143,437	151,198	1,383,094
2020	131,764	121,634	191,240	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	444,638
Total	**282,241**	**259,095**	**348,972**	**204,528**	**174,690**	**188,255**	**222,085**	**268,847**	**258,538**	**226,970**	**263,440**	**293,535**	**2,987,196**

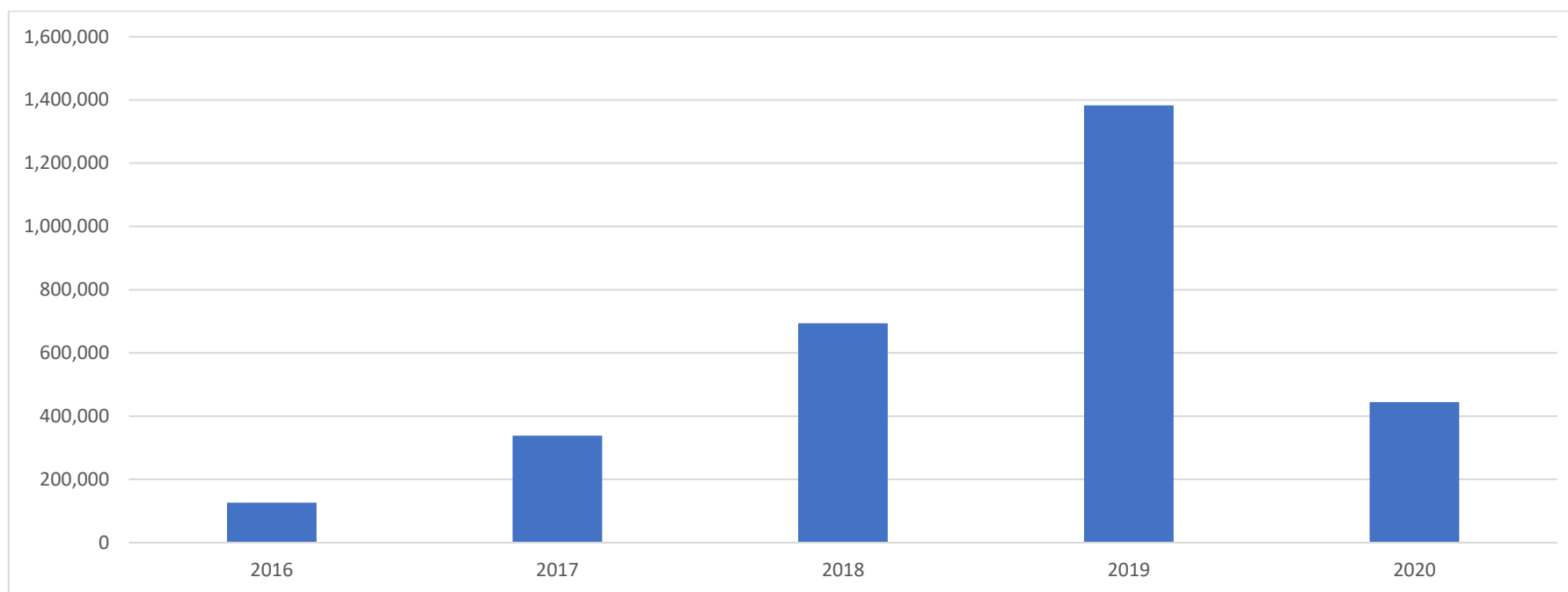Source: Nigerian Railway Corporation, (2020)

Figure 2: Passengers Traffic Flow 2016-2020

Plate 1: Abuja-Kaduna Train

One-way ANOVA of the AKTS Yearly Traffic

A unidirectional between-groups analysis of variance was performed to examine the disparities in annual passenger traffic of the AKTS from 2016 to 2020. According to the analysis of variance (ANOVA) findings presented in Table 4, a statistically significant difference was seen in passenger traffic at a significance level of $p < .05$. The F statistic (4, 4) was found to be 7, with a corresponding p-value of .001. According to Cohen (1988, pp. 284–7), the difference in mean scores between the groups was determined to be of medium effect size, as indicated by the computed eta squared value of .09. Post-hoc comparisons were conducted using the Tukey HSD test, revealing a significant difference between the mean score for the year 2016 (M = 10565.4, SD = 13139) and the year 2018 (M = 57835, SD = 12811.5). Also, the mean score for 2016 (M = 10565.4, SD = 13139) did not differ significantly from 2017. Similarly, 2017 (M = 28221.6, SD = 4607.2) was significantly different from 2018 (M = 57835, SD = 12811.5). In same vein, 2018 (M = 57835, SD = 12811.5) was significantly different from 2019 (M = 115257.8, SD = 30264.6). However, 2019 (M = 115257.8, SD = 30264.6) did not differ significantly from 2020.

Table 4: Analysis of Variance (ANOVA)

	Sum of Squares	df	Mean Square	F	P-value
Between Groups	86205968102	4	21551492025	68.954	0.000
Within Groups	14064642676	45	312547615		
Total	**1.00271E+11**	**49**			

Mean Plot of Yearly Passengers Traffic

Figure 3 shows the mean plot of yearly passengers traffic with 2019 recording the highest passenger traffic. On the other hand, year 2016 recorded the lowest passenger traffic. This result corroborated the findings in Table 1 which also revealed that 2016 recorded the lowest passenger traffic. The reason behind this might not be far from the fact that the AKTS began operation in the same year with only one rake and seven coaches only. Meanwhile, the issue of kidnapping and other of criminality was not prominent along the Abuja-Kaduna expressway in 2016.
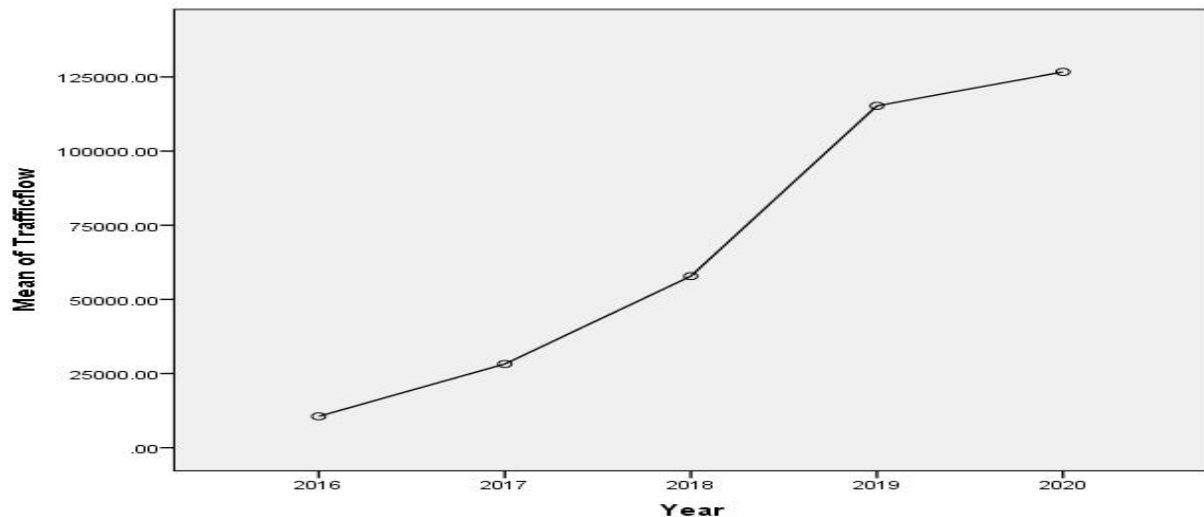
Figure 3: Mean Plot of Passengers Traffic

A One-Way ANOVA of the AKTS Monthly Traffic Flow
A one-way between-groups analysis of variance was conducted to explore the differences in monthly users traffic flow of the AKTS from 2016-2020. Table 5 shows that, there was a statistically significant difference at the $p < .05$ level in the users monthly traffic: $F (11, 48) = 0.134$, $p = .005$. Similarly, the actual difference in mean scores between the groups was a small effect because the effect size calculated using eta squared was 3 which according to Cohen's (1988, pp. 284–7) terms, classifies 3 as a small effect. Post-hoc comparisons using the Tukey HSD test 4 indicated that, there was no statistically significant difference in monthly traffic of the AKTS from January to December.

Table 5: Analysis of Variance (ANOVA)

	Sum of Squares	df	Mean Square	F	P-value
Between Groups	3801257363	11	345568851.2	0.134	**0.123**
Within Groups	1.23931E+11	48	2581892665		
Total	1.27732E+11	59			

Mean Plot of the AKTS Monthly Traffic Flow
Figure 4 shows that December recorded the highest monthly traffic. This finding corroborates with the findings in table 1 that also revealed same findings. The high traffic recorded in the month of December might be attributed to the festivities that usually occurred in the month of December with people traveling to their various homes to celebrate with their love once. On the other hand, March recorded the least monthly traffic which might be due to absent of festivity in the month of March.
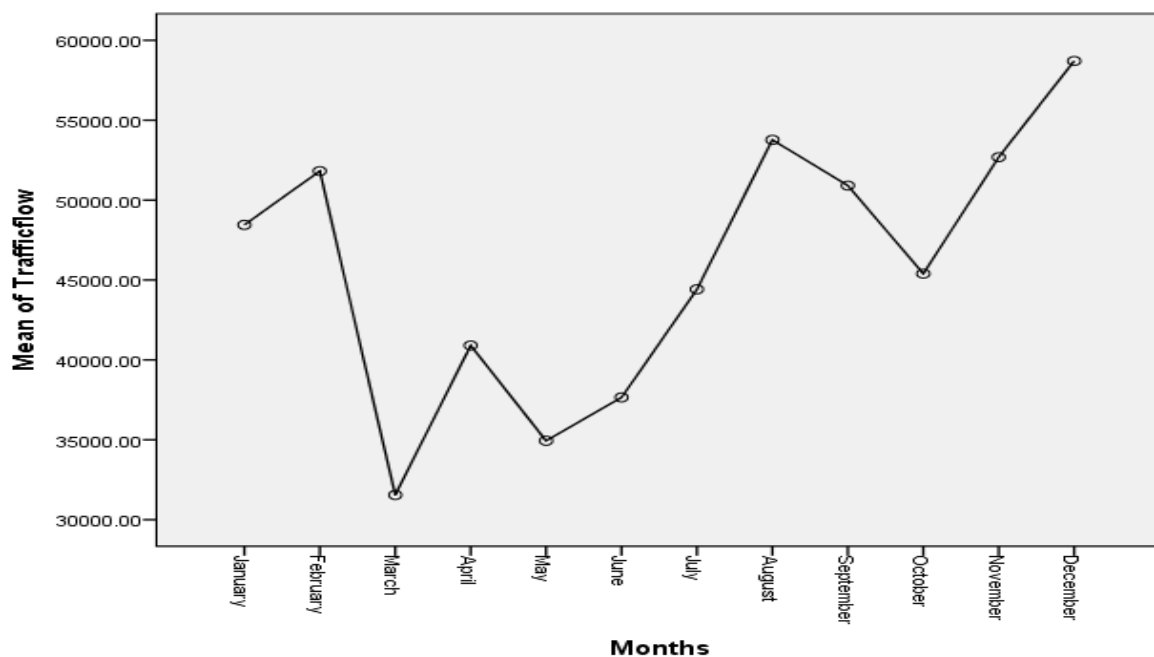

Figure 4: Mean Plot of Monthly Traffic Flow

CONCLUSION

The study analysed passengers' traffic of the AKTS using both descriptive and inferential statistics. The findings shows that, majority of the railway staff considered criminality along the Abuja-Kaduna express way as the major factor influencing passengers traffic flow. The findings also revealed that 2019 recorded the highest passengers traffic, while 2016 recorded the lowest. According to the monthly traffic flow, December recorded the highest while May recorded the lowest. The result of one-way between-groups analysis revealed that there was a statistically significant difference in the yearly traffic between 2016-2020.

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