Evaluation on the Challenges of Modern Car Maintenance in Nigeria

Nenuwa Isaac Omosule[1], Adepo Samuel Olusegun[1], Raimi Oluwole Abiodun[2]* & Fapetu Oluseyi Feyisetan[1]

[1]Department of Mechanical Engineering, Rufus Giwa Polytechnic, Owo, Nigeria
[2]Department of Civil Engineering, Rufus Giwa Polytechnic, Owo, Nigeria
*Corresponding Email: oluwole.raimi@rugipo.edu.ng

ABSTRACT

The paper evaluated the challenges of modern car maintenance in Owo metropolis, Nigeria. The study employed primary source of information through the aid of a well-structured questionnaire that was distributed to respondents who are modern car users of various models and types. Convenient sampling technique was adopted to select the total number of respondents for the study. Fifty (50) samples of the questionnaires were produced while only forty six (46) were retrieved back after proper administering by the modern car users. The collected data were analyzed using both descriptive and inferential statistics as the statistical tools with the aid of Statistical Package for Social Science (SPSS), version 17.0. The findings revealed that the type of maintenance approach adopted for the brake fluid, engine oil, coolant, power steering/transmission fluid, battery fluid and terminal, vehicle lighting and air filter/tyre shows a significant distribution in correcting maintenance challenges of modern cars which in turn is significantly reflected on the car maintenance cost through adequate and proper allocation cost to the servicing of the cars by the users. The study concludes that modern car users ensure possible measures in correcting challenges in their cars through adequate servicing and reasonable maintenance cost.

Keywords: Modern car, Maintenance, Convenient sampling technique, Owo metropolis, Nigeria

1.0 INTRODUCTION

In Nigeria, modern cars are at the increase which ranges from various model and type ploughing most roads in the country on a daily basis. Most of the users of these cars dedicate little or no attention to constant maintenance of their cars except there are issues which might be caused by a fault developed on the cars. Some of these faults probably might be averted if constant measure of maintenance were put in place (Olalekan and Toluwani, 2017). The design of most modern cars requires adequate maintenance as described by the manufacturers of the cars, but it is quite unfortunate that buyers of the so called manufactured cars feel less concern about it after purchase. Lee and Chung (2013) posited that automobiles are consumer goods; the more they are used, the more maintenance is required, and the costs of usage continue to increase. This implies that consumers should take maintenance service into consideration when purchasing new cars. Also, Dhall and Solanki (2017) view on maintenance, suggested periodic maintenance on car owners and advised them to take their cars for regular service and maintenance either after certain specified time period or distance covered. However, this paper will investigate the challenges of modern car maintenance in Nigeria by examining maintenance approach adopted and car maintenance cost on car issues against the background of this paper.

2.0 LITERATURE REVIEW

In discussing the challenges of automobile technology in entrepreneurship development, Okuta and Dawha (2014) examined the concept of entrepreneurship development, the roles of government and non-governmental organizations, which revealed that the challenges is caused by lack of practical based curriculum and inadequate funding. The study therefore offer suggestion that curriculum should be frequently reviewed and adequate funding be provided.

In assessment of modern automobile vehicle repair and maintenance practices in the micro, small and medium scale garages in Ghana, Michael (2015) investigated the various vehicle repair and maintenance practices using questionnaire administered on vehicle repair garages in the country. Some data in the study was as well generated through personal observations and informal discussions. The findings revealed that a large number of the auto-mechanics in the garages in the country have considerable years of auto repair working experience but lack the ability to inspect and repair modern automobile vehicles due to low educational and technical levels.

In the application of simulation model in determining the optimal number of artisans to employ to carry out routine checks on vehicles on a waiting line, Akinyemi and Koyejo (2011) examined the waiting line of an automobile repair and maintenance workshop in South-Western Nigeria. The data collection was based on arrival pattern of vehicles and service pattern of artisans in the maintenance workshop. A discrete distribution was assumed for both the inter-arrival and service time patterns. The results of the research work showed that it will be significant and important for decision making.

Also, Lopez-Arquillos *et al.,* (2015) statistically analyzed vehicle maintenance activities and their safety risks for hybrids, battery electric and hydrogen fuel cell cars. The repair activities and the risks for each power train technology were identified by a panel of experts. The results of the research reflect the urgent need for workers in the automobile sector to be trained for emerging risks in new technologies.

In exploring supply chain challenges faced by light vehicle manufacturers in South Africa, Ambe (2014) determined how difficult the challenges were in terms of overcoming it by employing mixed research design. The article provides an understanding of the challenges in the supply chain, which is paramount not only for locally manufactured vehicle supply chain practitioners but also for the automotive industry and South Africa as a whole.

In South Africa, Berndt (2009) determined the service quality in vehicle servicing company, specifically due to the increased sales figures that have been recorded. The research indicated that the statements associated with a traditional servqual used to evaluate service quality and dimensions are not clear which in turn gives an alternative dimensions been proposed in the South Africa context. However, this alternative can be used to improve the customer experience.

In Ghana, Edunyah (2015) identified changes in modern vehicle technologies, their challenges associated with repairs and possible opportunities available to roadside mechanics using survey research method as the data collection tool. The study showed that the major challenges facing roadside mechanics in the advent of technology is the lack of skills on the use of the on-board diagnostic scan tool.

In Germany, Karl (2015) presented a paper which is concerned with passenger car maintenance companies and their competitiveness. The study identified and analyzed internal and external influences, change drivers and general changes in the companies and their organization. The

study was able to identify the current and future challenges and the problems walking along with it for dependent passenger car maintenance companies, under the aspect of the competitiveness.

3.0 METHODOLOGY

The study employed primary source of information through a well prepared cross-sectional survey of a design questionnaire distributed to respondents in Owo metropolis, Nigeria. The questionnaire comprises of Section A and Section B. Section A contains item like gender, age, car model & type, year(s) of usage, type of maintenance approach adopted and car maintenance cost respectively. Also, Section B contains seven (7) independent variables formulated for car maintenance related to car usage, and which are brake fluid, engine oil, power steering/transmission fluid, brake fluid & terminal, vehicle lighting and air filter/tyre respectively, with two (2 = Yes; 1 = No) and four (4 = Very often; 3 = Less often; 2 = Occasionally; 1 = None of the above) points likert scale. The study adopted a convenience sampling techniques for the administering of the structured questionnaire. The reason for the non-random sampling type was because of the convenient accessibility and proximity to the considered respondents. Fifty (50) sample of the questionnaire were produced while only forty seven (47) were retrieved back after proper administering upon by the respondents. The retrieved questionnaire were analyzed using descriptive (frequency and percentage) and inferential statistic (regression techniques) as the statistical tools with the aid of Statistical Package for Social Science (SPSS), version 17.0. The collected data as analyzed is shown on Table 1, Table 2 and Table 3 respectively.

4.0 RESULTS AND DISCUSSION

Table 1 shows the demographic distribution of the respondents that administered the questionnaire for the research paper. The male respondent has the highest percentage frequency value of 78.3% (36) when compared to the female respondent which is having a percentage frequency value of 21.7% (10). Also, respondents whose age category falls between 34 & 41years has the highest percentage frequency value of 30.4% (14), which is subsequently followed by respondents whose age category falls between 26 & 33years, 42 & 49years, 50years & above and 18 & 25years having percentage frequency value of 28.3% (13), 26.1% (12), 8.7% (4) and 6.5% (3) respectively. In addition, in aspect of the maintenance approach adopted, majority of the respondents agreed that monthly maintenance approach were adopted which is having a percentage frequency value of 50.0% (23), subsequently followed by quarterly and weekly with percentage frequency value of 32.6% (15) and 17.4% (8) respectively. Furthermore, the cost of car maintenance was also taken into consideration having majority of the respondents indicating between #5,000 & #10,000 for the servicing of their cars with percentage frequency value of 47.8% (22), which is subsequently followed by cost ranging between less than #5,000, #11,000 & #20,000, #31,000 & above, #26,000 & 30,000 and #21,000 & #25,000 having percentage frequency value of 23.9% (11), 13.0% (6), 8.7% (4), 4.3% (2) and 2.2% (1) respectively. Also, considering the car model, type and year of usage, it is revealed that majority of the respondents uses car model and type ranges from Honda LX, Toyota Camry, Lexus 330, E-class 320 Mercedes Benz, Peugeot 306, Audi 80, SUV Toyota 4Runner, Toyota Corolla, Toyota Avalon 2006 Model and Nissan Xterra Jeep 2002 Model having years of usage between 1year and 7years respectively.

Table 2 and Table 3 was analyzed using regression analysis for the formulated research questions for brake fluid, engine oil, coolant, power steering/transmission fluid, battery fluid & terminal, vehicle lighting and air filter/tyre respectively, based on type of maintenance approach adopted (Table 2) and car maintenance

cost (Table 3).

Table 1: Demography Distribution of the Respondents

Gender	Frequency	Percentage (%)
Male	36	78.3
Female	10	21.7
Total	**46**	**100.0**
Age		
18-25years	3	6.5
26-33years	13	28.3
34-41years	14	30.4
42-49years	12	26.1
50years & above	4	8.7
Total	**46**	**100.0**
Type of maintenance adopted		
weekly	8	17.4
Monthly	23	50.0
Quarterly	15	32.6
Total	**46**	**100**
Car maintenance cost		
<#5,000	11	23.9
#5,000-#10,000	22	47.8
#11,000-#20,000	6	13.0
#21,000-#25,000	1	2.2
#26,000-#30,000	2	4.3
#31,000 & above	4	8.7
Total	**46**	**100.0**

Source: Author Computation from SPSS 17.0

Table 2: Regression Analysis of Maintenance Approach Adopted on Car Challenges

S/N	Research Question(s)	t-statistics	F-statistics	P-value(s)	Test of Significance
	Brake Fluid: $R^2 = 0.673$; Adj. $R^2 = 0.658$				
1.	How often do you check the brake fluid of your car?	-4.615	44.306	0.000	0.05
2.	Have you once experience low brake fluid from your car?	-4.023			
	Engine Oil: $R^2 = 0.557$; Adj. $R^2 = 0.547$				
3.	Do you check the engine oil each time the car is refuelled?	-7.432	55.235	0.000	0.05
	Coolant: $R^2 = 0.528$; Adj. $R^2 = 0.517$				
4.	Do you open the cooling system if the engine is hot?	-7.018	49.249	0.000	0.05
5.	Have you once experience low coolant level?	-7.018			
	Power Steering/Transmission Fluid: $R^2 = 0.857$; Adj. $R^2 = 0.843$				
6.	Have you once experience low power steering fluid?	0.280**	61.347	0.000	0.05
7.	How often do you experience low	-7.231			

S/N	Research Question(s)	t-statistics	F-statistics	P-value(s)	Test of Significance
	power steering fluid?				
8.	Have you once experience steering stiffness in your car?	-5.790			
9.	How often do you experience steering stiffness in your car?	1.449**			
	Battery Fluid & Terminal: $R^2 = 0.660$; Adj. $R^2 = 0.627$				
10.	Have you once experience corrosion or sign of leaks around the battery?	0.101**	19.889	0.000	0.05
11.	Have you once experience excess discharge of the battery without the engine running?	-1.256**			
12.	How often do you experience excess discharge of your battery car?	-0.774**			
13.	How often do you fill the battery fluid when it is low?	-1.592**			
	Vehicle Lighting: $R^2 = 0.340$; Adj. $R^2 = 0.324$				
14.	Is there any challenge of any dark spots on the cluster of your car?	-4.756	22.617	0.000	0.05
	Air Filter/Tyre: $R^2 = 0.831$; Adj. $R^2 = 0.823$				
15.	How often do you check the air filter for dirt and debris?	-7.890	105.654	0.000	0.05
16.	I am not bothered about checking vehicle manufacturer's specification for my car tyre.	-7.291			

Dependent Variable: Type of Maintenance Approach Adopted
**Not significant at 0.05 level
Source: Author computation from SPSS 17.0

Table 3: Regression Analysis of Car Maintenance Cost on Car Challenges

S/N	Research Question(s)	t-statistics	F-statistics	P-value(s)	Test of Significance
	Brake Fluid: $R^2 = 0.770$; Adj. $R^2 = 0.759$				
1.	How often do you check the brake fluid of your car?	-8.643	71.823	0.000	0.05
2.	Have you once experience low brake fluid from your car?	-1.774**			
	Engine Oil: $R^2 = 0.419$; Adj. $R^2 = 0.406$				
3.	Do you check the engine oil each time the car is refuelled?	-5.631	31.705	0.000	0.05
	Coolant: $R^2 = 0.268$; Adj. $R^2 = 0.251$				
4.	Do you open the cooling system if the engine is hot?	-4.015	16.120	0.000	0.05
5.	Have you once experience low coolant level?	-4.015			
	Power Steering/Transmission Fluid: $R^2 = 0.546$; Adj. $R^2 = 0.502$				
6.	Have you once experience low power steering fluid?	-0.093**	12.345	0.000	0.05
7.	How often do you experience low	-3.710			

No.	Question				
	power steering fluid?				
8.	Have you once experience steering stiffness in your car?	-1.062**			
9.	How often do you experience steering stiffness in your car?	0.553**			
Battery Fluid & Terminal: $R^2 = 0.399$; Adj. $R^2 = 0.340$					
10.	Have you once experience corrosion or sign of leaks around the battery?	-0.030**	6.794	0.000	
11.	Have you once experience excess discharge of the battery without the engine running?	0.517**			0.05
12.	How often do you experience excess discharge of your battery car?	-0.419**			
13.	How often do you fill the battery fluid when it is low?	-1.354**			
Vehicle Lighting: $R^2 = 0.118$; Adj. $R^2 = 0.098$					
14.	Is there any challenge of any dark spots on the cluster of your car?	-4.756	-2.423	0.020	0.05
Air Filter/Tyre: $R^2 = 0.606$; Adj. $R^2 = 0.588$					
15.	How often do you check the air filter for dirt and debris?	-6.633	33.095	0.000	
16.	I am not bothered about checking vehicle manufacturer's specification for my car tyre.	-1.183**			0.05

Dependent Variable: Car Maintenance Cost
**Not significant at 0.05 level
Source: Author computation from SPSS 17.0

4.1 Type of Maintenance Approach Adopted

Brake Fluid

The coefficient of determination (R^2) is moderately high with a value of 67.3%, which is in agreement with the adjusted R^2 value of 65.8%; this however, contributes to the study findings. The acceptability of the respondents based on weekly, quarterly and monthly maintenance approach adopted, showed that they often check the brake fluid of their cars irrespective whether there is a low brake fluid in their car or not which is having a significant t-statistic value of -4.615 and -4.023 respectively (Johnson, 2008). This is also in agreement with the F-statistic value of 44.306 of the brake fluid which is having a p-value of 0.000 lesser than the test of significance at 0.05. This value displays the significant effect of the research statement. In a related study, Oduro (2012) agreed that brake failure is caused by low or storage of brake fluid as a result of brake overheating and suggested that vehicle users should maintained their vehicles most especially the brake.

Engine Oil

The coefficient of determination (R^2) of the engine oil is moderately high with a value of 55.7% against it adjusted R^2 value of 54.7% which depicts a significant effect of the research statement. The acceptability of the respondents based on weekly, quarterly and monthly maintenance approach adopted, showed that engine oil are check each time the car is refuelled which is having a significant t-statistic and

F-statistic value of -7.432 and 55.235 against it p-value of 0.000 than is lesser than 0.05 test of significance (Johnson, 2008). However, the research statement shows a good fit to the study. However, the knowledge of the maintenance of car engine oil is very important due to its lifetime (Kumbar et al., 2013).

Coolant

There is a moderately high coefficient of determination (R^2) for the coolant with a value of 52.8% against it adjusted R^2 value of 51.7% which best explains the formulated research statement. It was also in good acceptability by the respondents that the cooling system of the car is not open whenever the engine is hot and that the car low coolant is rarely been experienced which is having a t-statistic and F-statistic value of -7.018 and -7.018, and 49.249 against it p-value of 0.000 than is lesser than 0.05 test of significance (Johnson, 2008). Also, Prudhvi et al., (2013) shows acceptability in the line of the research that if adequate maintenance is not adopted for most internal combustion engines, that is, if the heat were not removed quickly, overheating and extensive damage would occurs.

Power Steering/Transmission Fluid

The power steering/transmission fluid displays a very high coefficient of determination (R^2) value of 85.7% against it adjusted R^2 value of 84.3% which shows a good fit of the research statement. Low power steering fluid and steering stiffness for the considered cars owned by the respondents was not seen as a challenge due to the weekly, quarterly and monthly maintenance approach been adopted on the cars which is having a t-statistic value of 0.280 and 1.449 respectively. This also shows similar agreement to the research statement that respondents despite their experience in low power steering fluid and steering stiffness in cars, necessary awareness of maintenance approach adopted has guided against damage or

unforeseen circumstance which is having a significant t-statistic value of -7.231 and -5.790, and F-statistic value of 61.347 against it p-value of 0.000 which is lesser than the test of significance at 0.05 (Johnson, 2008). In addition, Akhare & Chouhan (2012) revealed the need of power steering fluid maintenance in cars so as to increase the efficiency of the power steering system more easy and effortless.

Battery Fluid & Terminal

Battery fluid & terminal shows a moderately high coefficient of determination (R^2) value of 66.0% against it adjusted R^2 value of 62.7% which best explains the respective research statement. Due to the proper awareness of modern car maintenance and the necessary approach adopted by respondents for the considered cars, it showed that corrosion or sign of leaks around battery, excess discharge of the battery without the engine running, excess discharge of the battery car and refilling of battery fluid when low was not seen as a high driven maintenance challenge by the respondents which is having a t-statistic value of 0.101, -1.256, -0.774 and -1.592, and F-statistic value of 19.889 against it p-value of 0.000 which is lesser than the test of significance at 0.05 (Johnson, 2008).

Vehicle Lighting

Vehicle lighting shows a low coefficient of determination (R^2) value of 34.0% against it adjusted R^2 value of 32.4% which in turn does not affects the significant effect of the research statement. Despite various maintenance approach adopted by the respondents, it was statistically revealed that one challenge or the other of dark spots on car cluster was experienced which ranges from gauges, speedometer and fuel gauge with a t-statistic and F-statistic value of -4.756 and 22.617 against it p-value of 0.000 which is lesser than the test of significance at 0.05 (Johnson, 2008).

Air Filter/Tyre

There is a significant high coefficient of determination (R^2) for the air filter/tyre with a value of 83.1% against it adjusted R^2 of 82.3% which best explains the formulated research statement. Based on the weekly, quarterly and monthly maintenance approach for cars of respondents, the findings showed that air filter is constantly check for dirt and debris and that the specification of car tyre for vehicle manufacturers of modern cars are also checked which is having a t-statistic and F-statistic value of -7.890 and -7.291, and 105.654 against it p-value of 0.000 which is lesser than the test of significance at 0.05 (Johnson, 2008).

4.2 Car Maintenance Cost

Brake Fluid

The respondents shows a significant measure of acceptability that the car brake fluid is adequately checked based on the necessary maintenance cost adopted which gives no fear for low brake fluid of the car with a t-statistic and F-statistic value of -8.643 and -1.774, and 71.823 against it p-value of 0.000 which is lesser than the test of significance at 0.05 (Johnson, 2008). This is also best explained through the high coefficient of determination (R^2) value of 77.0% against it adjusted R^2 value of 75.9% of the formulated research statement. This was also in agreement with the study of Singh & Kumar (2015) that investigated on the probability of human error during the maintenance cost process of disc brake assembly unit and wheel set of railway bogie under various error producing conditions in railway maintenance workshop in Lulea, Sweden.

Engine Oil

The respondents also shows significant level of acceptability of the cost of maintenance of the car engine oil been checked each time the car is refuelled with a t-statistic and F-statistic value of -5.631 and 31.705 against it against it p-value of 0.000 which is lesser than the test of significance at 0.05 (Johnson, 2008). Irrespective of the low R^2 value of 41.9% against it adjusted R^2 value of 40.6%, the research statement still best explains the view of the respondents. This also shows similar acceptability in the research study of Fraer *et al.,* (2005) that there was little difference that could be attributed to engine oil in operational and maintenance cost based on proper inspection and evaluation.

Coolant

In order to avoid unnecessary cost for the car engine before breakdown, respondents shows a significant measure of acceptability that the car cooling system is not open when the engine is hot and that the car low coolant level is less often experienced with a t-statistic and F-statistic value of -4.015 and -4.015, and 16.120 against it p-value of 0.000 which is lesser than the test of significance at 0.05 (Johnson, 2008). The low R^2 value of 26.8% against it adjusted R^2 value of 25.1% does not depict the nature of the research statement because of it measure of significance. In a similar study, Pathania & Mahto (2012) revealed the necessity for a coolant in vehicle without increasing the component cost and maintenance costs associated with the vehicles.

Power Steering/Transmission Fluid

Car maintenance cost on low power steering fluid and steering stiffness on the cars was given lesser consideration by the respondents because it was not really seen as a challenge because of the adequate car maintenance cost adopted which is having a non-significant t-statistic values of -0.093, -1.062 and 0.553 against a significant t-statistic value of -3.710. The F-statistic value of 12.345 also explains the distribution of the t-statistic in the direction of the cost of car maintenance for power steering or transmission fluid against it p-value of 0.000 which is lesser

than the test of significance at 0.05 (Johnson, 2008). The nature of the research statement is also best explained through a moderately high R^2 value of 54.6% against it adjusted R^2 value of 50.2%.

Battery Fluid & Terminal

Based on the adequate maintenance cost employed by the respondents, issues like corrosion or sign of leaks around the car battery, excess discharge of the battery without the engine running, excess discharge of the battery car and refilling of the battery fluid was really not seen as a challenge due to the non-significant t-statistic values of -0.030, 0.517, -0.419 and -1.354 respectively, against it F-statistic value of 6.794 which is having a p-value of 0.000 which is lesser than the test of significance at 0.05 (Johnson, 2008). However, the low R^2 value of 39.9% against it adjusted R^2 value of 34.0% has no negative implication on the research statement in explaining the maintenance car cost on battery fluid and terminal.

Vehicle Lighting

Majority of the respondents showed a significant level of acceptability that appropriate maintenance cost is considered in solving the challenge of any dark spots on the car cluster when there are need for it which is having a t-statistic and F-statistic value of -4.756 and -2.423 against it p-value of 0.000 which is lesser than the test of significance at 0.05 (Johnson, 2008). Also, the low R^2 value of 11.8% against it adjusted R^2 value of 9.8% has no negative implication on the research statement as well in explaining maintenance car cost on vehicle lighting.

Air Filter/Tyre

Respondents who often check the air filter of the car for dirt and debris based on the respective maintenance cost considered, also shows measure of acceptability that they do not get bothered about checking the vehicle manufacturer's specification for the car tyre due to the fact that searching for the desire car tyre for their vehicles irrespective of the cost was not an issue to them. This also is better explain by a significant and non-significant effect in the research statement having a t-statistic and F-statistic value of -6.633 and -1.183, and 33.095 against it p-value of 0.000 which is lesser than the test of significance at 0.05 (Johnson, 2008). The nature of the research statement is also best explained through a high R^2 value of 60.6% against it adjusted R^2 value of 58.8%.

5.0 CONCLUSIONS

The study which investigated on the challenges of modern car maintenance in Nigeria based on maintenance approach adopted and car maintenance cost revealed that respondents often check the brake fluid of the cars through necessary servicing which has given the car users proper awareness in averting issues on low brake fluid through the necessary maintenance cost adopted for it. Also, the engine oil of the considered cars of the respondents was often check each time the car is refuelled with an appropriate maintenance cost. The appropriate maintenance cost is also extended to proper measures taken on the cooling system most especially when the cooling system is hot or if there is low coolant level in the car. However, as a result of respondents' adequate maintenance on the considered cars for power steering/transmission fluid, it is revealed that lesser cost is allocated to power steering fluid and steering stiffness of the cars because the servicing is properly carried out to advert such issues which in turn might incur higher cost at the long run. It is also revealed from the findings that the respondents rarely experience low power steering fluid and steering stiffness in the considered cars. It is also comprehensively revealed that respondents of the considered cars rarely

spend excessively on maintenance cost on the battery fluid and terminal because appropriate maintenance approach were earlier adopted by the cars to correct corrosion or sign of leaks around the battery, excessive discharge of the battery without the engine running and refilling of the battery fluid when it is low. In addition, respondents of the considered cars rarely experience any challenge of dark spots on the cluster of the car like gauges, speedometer, fuel gauge etc. because of the proper servicing of the cluster through adequate maintenance cost assigned to it. In conclusion, checking the air filter for dirt and debris was not seen as an issue for the respondents because both the servicing of the car and maintenance cost are properly distributed to it. The maintenance cost on the vehicle tyre specification has non-significant effect on the considered cars because respondents are conscious of the exact manufacturers' specification for their car tyre which in turn gives more attention to adoptable servicing rather than unexplainable higher maintenance cost or purchasing new tyres for their cars.

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