

## Nigerian Users' Perception of Performance of Carburetion and Injection Fuel Systems for Mercedes-Benz Cars

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**Abstract:** Arguments often arise at every corner as to which one, carburetor or injector is better in term of performance. In this study therefore user perception of performance of carburetion and injection fuel systems for Mercedes-Benz cars is investigated. This was done by randomly sampling the opinions of the Mercedes-Benz users and maintenance specialists, through questionnaire administration and oral interview. Analysis of responses was done using a simple percentage of positive or negative response over the total responses. The results of the study showed that injection system is preferred for its overall performance, durability and efficiency, while carburetion system is satisfactory based on its spare parts availability and ease of maintenance.

**Key words:** Carburetion system, injection, fuel system, mercedes

### INTRODUCTION

The quest for more output power in automobile has, overtime, caused a serious research for automotive engineers. This has culminated into design and development of various types of carburetion units in a bid to optimize the mixing of fuel and air in the ratio 1:15 by weight respectively in the engine cylinder<sup>[1-3]</sup>. Desideratum in effectiveness of carburetion system, perhaps, leads to development of an alternative method of mixing called injection fuel system in the recent time<sup>[4-6]</sup>. However, argument at every corner is this: which one (carburetor or injector) is better in term of performance? Based on this it is difficult to take a unilateral decision, instead, random sampling of the opinions of the concerned users, without prejudice, must be done before arriving at a concrete answer.

An engine needs more air flow capacity to make more power but only needs the proper fuel mixture to maintain good fuel economy. To achieve this, researchers had developed many upgrades of carburetors such as 1 barrel (1bbl), 2bbl and even 4bbl. The upgrade choice depends on the size of engine. For instance, V8 engines can be upgraded from 2bbl to 4bbl while six cylinder engines received the excellent upgrade by going from typical a 1bbl carburetor to a 2bbl or even a 4bbl. Fuel injection system, which operates based on principle of fuel metering, has different upgrades to enhance improved fuel economy. Some of the upgrades available, especially, for the Continuous and Direct Injection types which are either mechanically or electronically built (used by many

brands of Macedes-Benz, Volkswagen and Volvo) include K-Jetronic, KE- Jetronic, L-Jetronic, D-Jetronic and LH-Jetronic. Detailed design morphology of carburetion and injection fuel systems can be seen in Wikipedia<sup>[7]</sup> and Raso Enterprise<sup>[8]</sup>. Meanwhile, the theorists<sup>[1-3]</sup> and the manufacturers<sup>[7,8]</sup> of both carburetors and injectors have established (since late 1950s when fuel injection was first introduced) that the injecting fuel system is preferred to carbureting in term of power output, fuel efficiency, emission performance, durability, reliability, maintenance cost and other related measures of effectiveness. To accept these manufacturers' notions verbatim remain partial untill the opinion of the direct users of the systems is sought. In this study, therefore, the opinion of the users of Mercedes-Benz cars with carburetion and injection fuel system is sought to know the actual preferred system based on targeted measures of effectiveness.

### MATERIALS AND METHODS

In this study the performance of carburetion and injection fuel systems of Mercedes-Benz cars based on Nigerian users' perception was carried out. This was done by administering questionnaire and oral interviewing the users of Mercedes-Benz cars and the Mercedes-Benz maintenance specialists. Among the questions asked include educational background of the users/mechanics, technical experience of the mechanics, durability, spare parts availability and maintainability of injection and carburetion systems. The questionnaires were randomly

distributed and the interviewees were randomly selected to sustain impartiality and unbiased in data collection and analysis. Analysis of the responses was done using a simple percentage of positive or negative response over the total responses (to an event). The graphical representation named bar charts was used to illustrate the degree of agreement to each event. The percentage (%) response, %R is given as  $x_i \cdot 100 / \sum x$ , where  $x_i$  means number responded for event  $i$  and  $\sum x$  is the sum of responses for and against an event  $i$ .

## RESULTS AND DISCUSSION

Findings obtained from the questionnaires and interviews conducted on the users and maintenance specialists of Mercedes-Benz cars for the respective measures of effectiveness aforementioned are presented as follow:

**Educational qualifications of interviewees:** Broad based categories of people ranging from Primary School Leaving to Bachelor/higher degree certificate holders were interviewed. Fig. 1 shows the distribution of 100 certificate holders responded to the questionnaires and oral interviews. The distribution shows that 44 and 23% of the users have a maximum qualification of West Africa School Certificate (WASC) most of which fell under automotive technicians. The least users of Mercedes-Benz cars were the people of higher degrees. With the distribution and the level of education of respondents different views are expected which could boost the reliability of the exercise. The level of education of mechanics makes it difficult to understand the intricacies in the injection system, but many of them are familiar with carburetion system having worked on it for years. The years of experience of respondents in motor servicing are as depicted in bar chart shown in Fig. 2.

**Overall performance of the systems:** From the graph, Fig. 3, the performance of the two systems was drawn and their statistics goes thus: majority of the interviewees argued that injection system performs better than carburetion system. The performance of injection system is measured from its torque, power output, speed, acceleration on high speed quick starting and ease with which it climbs hills<sup>[7,8]</sup>. A good number of interviewees score its performance as excellent, while few others saw it as simply good. No one could see injection system as poor. The responses further revealed that carburetion system performs averagely in terms of speed. On high speed, it is more glaring how injection system beats its counterpart hands down as long as the injectors are in

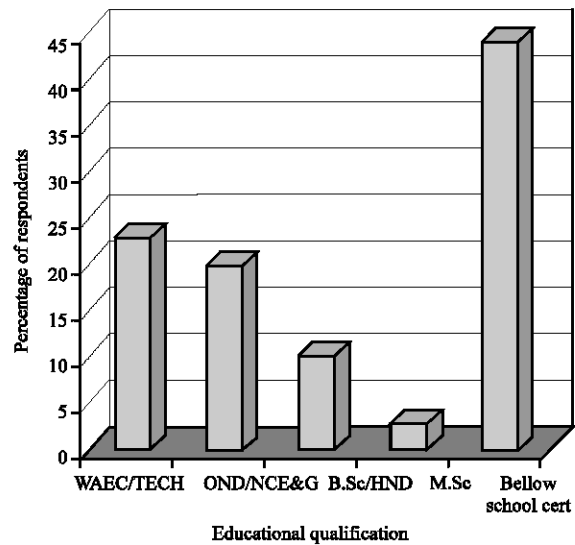


Fig. 1: Educational qualification of respondents

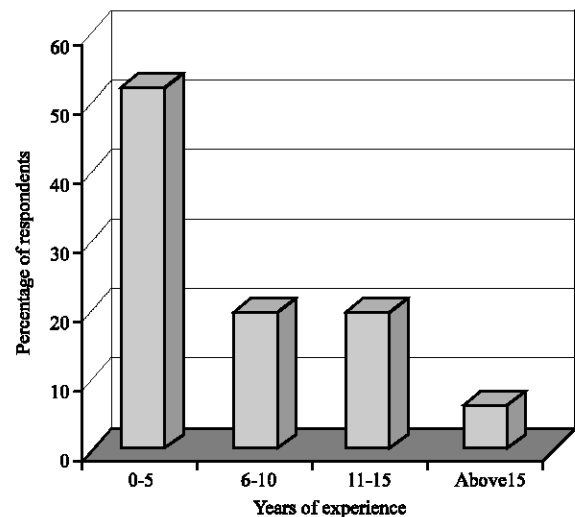


Fig. 2: Years of experience of respondents

good condition. The graph further revealed that 30% of respondents felt that carburetion system is poor with reference to performance. Therefore, the user perception is in agreement with both theorists and manufacturers' claim.

**Spare parts availability:** The bar charts of spare parts availability are shown in Fig. 4. 30% of respondents strongly believe that the Injection system parts are highly available, while equal number of people believe it is lowly available, few people (just 10%) considered it as unavailable. For carburetion system, good percentage of people 40% argued that the parts are readily available in

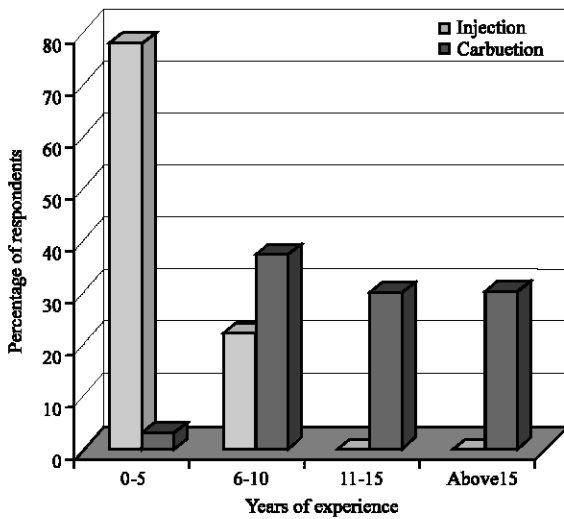


Fig. 3: Overall performance of fuel injection and carburetion system

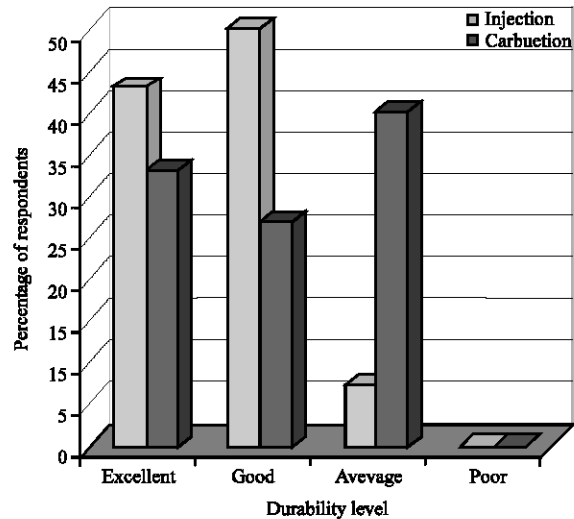


Fig. 5: Durability of fuel injection and carburetion systems

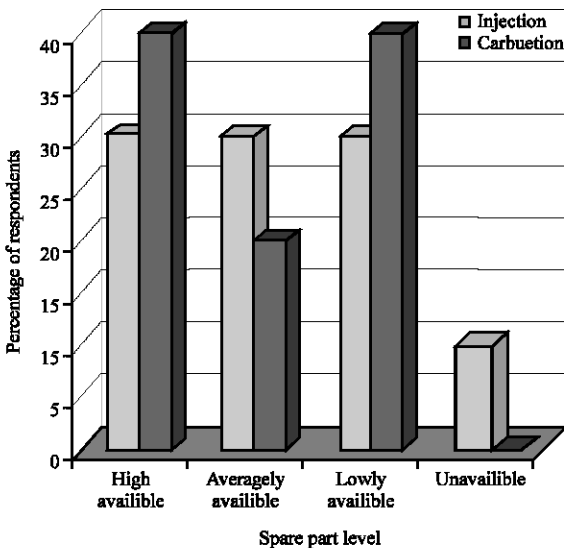


Fig. 4: Spare parts availability for fuel injection and carburetion systems

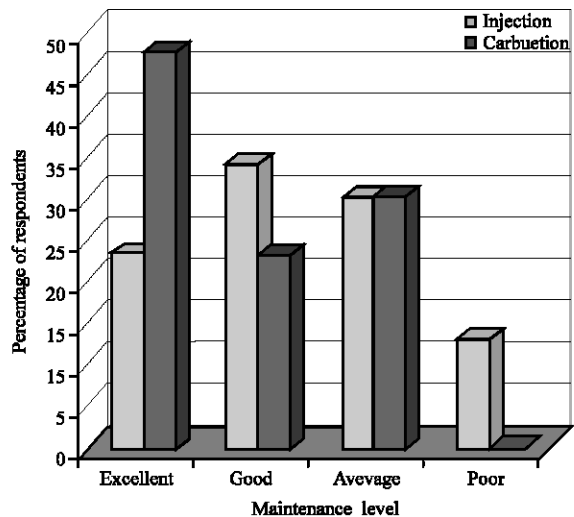


Fig. 6: Maintenance of fuel injection and carburetion systems

market while nobody considered the parts as unavailable. This clearly shows that the users of carburetion system can maintain their vehicles by obtaining the parts at affordable prices because of its availability. More vehicles can be repaired over a given period of time by the mechanics so far it is carburetion system. Leventis Motors- the sole agent of Mercedes- Benz in Nigeria has to place on order most of the time the injection parts from Germany. The increased overhead cost and delivery time discouraged most users of the injection system. This also accounts for the expensiveness of the system, making

users to pay through their noses. What is happening in Nigeria has negated the global claim of the injector manufacturers that injector parts are readily available.

**Durability of the systems:** As shown in Fig. 5, the graphs of durability of the injection and carburetion systems were obtained from responses of the users. Majority 43% of the people interviewed considered injection system as highly durable. It lasts the lifetime of the vehicle itself if well maintained. The very few that saw it from the angle of not being durable may be considered as not being lucky with the system as no outstanding figure or numbers are obtained from the interviewees.

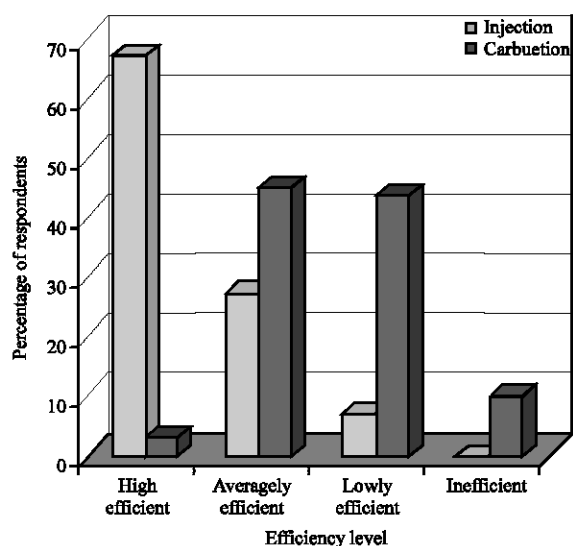


Fig. 7: Efficiency of fuel injection and carburetion systems

The two fuel systems (carburetion and injection) are durable as long as dirt is prevented from entering. The results further showed that if the injection system is maintained properly, by not allowing dirt in it, it lasts longer than the carburetor systems whose diaphragm gets weakened with time. This is in agreement with the manufacturers' claim that injector is more durable than the carburetor.

**Maintenance of the systems:** Based on Fig. 6, the maintenance of the two systems can be explained thus: since carburetion system has simple carburetor unit where the mixture is done before it is sent to the cylinders for combustion, it requires little maintenance, so far the system is kept off dirt. Majority of interviewees scored its maintenance as excellent. It does not require much technical know-how. Injection system's maintenance was considered a bit difficult since it requires a lot of expertise to maintain it. The user can not touch anything in the system until he/she reaches the mechanics. On the contrary, the user of carburetor can easily open up the carburetion system and the dirt be removed from the system. Once injectors are blocked, the best solution to it is outright replacement. Lack of maintenance capability for injection system has caused most of the mechanics in Nigeria to encourage most of their customers to change over to carburetion system. Therefore, in terms of maintenance, carburetion system is better. This perception of the users is not in agreement with the theorists and manufacturers of injectors.

**Systems' efficiency:** Figure 7 gives graphical representation of the two systems' efficiency. A good number of respondents scored injection system very high in term of efficiency. Its fuel economy is second to none as well as its speed. It accelerates faster giving the users a good run for their money. Users of carburetion system considered it averagely efficient. In summary, from users' perception, injection system is preferred for its overall performance, durability and efficiency, while carburetion system is the preferred based on its spare parts availability and ease of maintenance.

## CONCLUSION

From the results obtained from the study it is clear that users' perception of performance of a product or a system could not be, in all respect, in total agreement with the manufacturers' claim. In some cases disagreement may arise based on the level of experience and technical competence of the users. This study, therefore, is an eye opener to the manufacturing industries that normally believe that customers have no say on the functionality of their product/system. Conclusively, the results of the study indicated that manufacturers and users of injection and carburetion systems were in agreement in terms of overall performance, durability and efficiency, but they disagreed while spare parts availability and ease of maintenance were considered.

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## REFERENCES

1. Baker, D.B., 1970. Book of the cars, Drive Publication Ltd., London.
2. Hamm, G., 1992. Tables for the automotive trade, Wiley Easter Ltd, India.
3. Hillier, V.A.W., 1991. Fundamentals of motor vehicle technology, Stanley Thorne's Publication Ltd., England.
4. Bosch, R.G., 1989. Electronics Petrol Injection L-Jetronic, Wilson Publication, Germany.
5. Bosch, R.G., 1991a. Electronics Petrol Injection KE-Jetronic, Wilson Publication, Germany.
6. Bosch, R.G., 1991b. Electronics Petrol Injection D-Jetronic, Wilson Publication, Germany.
7. Wikipedia, 2006. Fuel Injection, <http://en.wikipedia>.
8. Raso Enterprise, 2006. Fuel Carburetion and Injection, <http://rasoenterprises.com>.