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## **A study of consumer behavior towards CNG vehicles in Pune city**

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### **ABSTRACT**

*Major cities with the worst air quality include Delhi, the capital of India, according to a WHO analysis covering 1600 locations globally. An estimated 1.5 million deaths in India are attributed to air pollution each year, making it the nation's sixth greatest cause of mortality. According to WHO data, India has the highest death rate worldwide from asthma and chronic diseases. Compressed Natural Gas (CNG) vehicles not only solve environmental issues but also have a number of benefits, such as affordability, safety, low maintenance costs, affordability, and engine efficiency. A study on customer behaviour related to CNG automobiles was carried out in Pune with 120 buyers of these vehicles. The results show that consumers have a favourable opinion of CNG cars. Comprehending consumer behaviour is crucial for marketers since poor marketing may make even the best products fail. Thus, for marketers and market researchers, precise evaluations of several aspects of consumer behaviour are essential. The purpose of this study is to offer insightful information in this field.*

**KEYWORDS:** Consumer behaviour, CNG Vehicles, Consumer perception, Marketing strategy.

### **1. INTRODUCTION**

The air quality in Delhi, the capital of India, according to a WHO survey of 1600 world cities, is the worst of any major city in the world. Air pollution in India is estimated to kill 1.5 million people every year; it is the fifth largest killer in India. India has the world's highest death rate from chronic respiratory diseases and asthma, according to the WHO. In Delhi, poor quality air irreversibly damages the lungs of 2.2 million or 50 percent of all children. India's Ministry of Earth Sciences published a research paper in October 2018 attributing almost 41% of PM2.5 air pollution in Delhi to vehicular emissions, 21.5% to dust and 18% to industries.

The Indian automobile industry is 5th largest in the world with a size of \$93bn and contributing 7.1% to the GDP in India. Overall, 78% of the vehicles on road are two wheelers while approx. 14% are passenger vehicles (Source SIAM). The most heartening part is that in

last financial year (17-18) the Indian passenger car market grew by 7.89% and the overall vehicle sales by 14.78% however, at the same time the market in other major economies in the world de-grew. The passenger car density in India is 1.9% as compared to 7.6% in China, 45.5% in UK, 54.4% in Germany, 36% in US, 56.2% in Australia and 22.7% in Brazil (Source SIAM/Economics Times). The growth in the Indian passenger vehicles market could be largely attributed to low passenger car density, growing disposable income and unique demographic dividend in India. However, the flip side of this story is that automobiles on the road (Source IPPCC 5th Assessment Report) cause almost 14% of the environment pollution. As per a report by WHO air pollution can lead to respiratory and cardiovascular diseases and resulted in to 620000 deaths in 2010 and the expenditure on treatment was to a tune of 3 percent of India's GDP (Source data.gov). According to the World Health Organization (WHO), 13 cities in India are among the 20 most polluted cities in the world, Delhi tops the list and uncontrolled vehicular traffic is the main reason for these alarming levels. Apart from addressing the environmental problem, Compressed Natural Gas (CNG) vehicles have the following advantages.

- Price
- Compressed Natural Gas (CNG) is clearly a cheaper option to the ever-expensive fuel types like diesel or petrol.
- Good For Car's Engine
- CNG is regarded as one of the cleanest fuels for a vehicle's engine.
- Lower Maintenance Costs
- For a CNG vehicle, the lifespan of the engine increases as there is less contamination of the motor oil due to the fuel. This results in longer gaps between car serving processes like oil changes and tune-ups.
- CNG is Safer

One of the obvious differences between CNG and other fuel types like diesel or petrol is that CNG is not in a liquid form. On the other hand, being a gas, it disperses quickly in rare case of something like a leak. It does not spill and remain close to the car creating a possibility of a fire hazard. The background discussion clearly shows that CNG (Compressed Natural Gas) vehicles have emerged as a popular and viable substitute for the conventional petrol and diesel vehicles. This study studies the consumer behaviour towards the CNG vehicles with reference to Pune which is one of the largest cities in India and also high on pollution. Consumer behaviour is the decision processes and actions of people involved in buying and using products (Schiffman and Kumar, 2015; S Ramesh Kumar, 2017).

## **2. REVIEW OF LITERATURE**

The selection of vehicles like CNG and their sustainable use incorporates two concepts - ecological and social behaviours. Likewise, these two concepts consolidate to shape the base of ecological behaviours, which prompts sustainable turn of events (Dahlstrom, 2010). In disconnection, neither ecological nor social behaviours guarantee manageability. Improvement in mechanical points of view can protect the environment however can't assist with sparing assets. The current writing reports that some condition well-disposed advancements have adversely influenced asset preservation as the utilisation of items expands as a result of monetary proficiency, a marvel known as 'Jevons Paradox' or 'Bounce back Effect' (Jevons, 1906; Saunders, 1992). Late studies inspected the bounce back impact in different settings. For example, Sellen and Harper (2002) detailed that, in spite of general desires for individuals with respect to decreases in paper utilisation because of electronic media advances, office paper utilisation expanded by 14.7% in the US during the period 1995-2000. Comparative discoveries were accounted for in the vitality division and the vehicle business too (Grant, Jorgenson, and Longhofer, 2016; Arne et al., 2015; Galvin, 2016; York, 2006; Herring and Sorrell, 2009). These studies contend that improving innovation alone may not contribute to long-term sustainability goals. In this manner, understanding consumer behaviour from ecological just as social points of view is basic in sustainable behaviour research.

There are a good number of studies on electric vehicles in India (Upadhyayula et. al, 2020, Bharadwaj et. al, 2020, Rokadiya et. al, 2019, Gayathri, 2019, Rokadiya et. al, 2019 and others). There are at present more than 26 million natural gas vehicles and more than 31,000 refuelling stations over the world, with over half of these vehicles in China, Iran, and India (Global, 2018). In spite of the fast take-up of natural gas vehicles in creating nations, the Intergovernmental Panel on Climate Change (IPCC, 2013) predicts that by 2050, the greatest vehicle vitality consumers will keep on being North America (by a noteworthy edge), trailed by Europe and China (IPCC, 2013). Be that as it may, most of these vehicles are not freight vehicles, with natural gas HGVs representing about 1% of all out stock in 2015 (IEA, 2017). These rock-solid vehicles have been utilised for different applications including reject assortment, transports, and freight conveyance. In the United States, the utilisation of natural gas trucks turned out to be progressively appealing with the development of local shale and tight gas production, prompting a sensational drop in wellhead natural gas costs from 2009.

The Fixing America's Surface Transportation Act, which necessitates that the United States Department of Transportation sets optimistic focuses for the arrangement of foundation for elective energises along key halls, has advanced the improvement of natural gas stations since 2015 (IEA, 2017) with the end goal that there are presently 1,680 compacted natural gas (CNG) stations and 144 liquified natural gas (LNG) stations (NGV America, 2018). In the North American market, a few natural gas HGV models are offered from various unique gear makers. The market development for natural gas trucks in China has been driven by a few components including the good value differential to diesel, the low expenses of retrofitting existing vehicles to run on CNG, and government approaches planned for improving air quality. The utilization of natural gas in transport has expanded by a yearly development pace of around 11% somewhere in the range of 2010 and 2016, of which a huge offer is credited to natural gas trucks (IEA, 2017). The quantity of stations providing natural gas in China has developed from around 1,000 out of 2008 to 7,950 out of 2016, and the quantity of LNG uncompromising vehicles developed from 7,000 out of 2010 to 132,000 of every 2015 (IEA, 2017).

In the EU, there are roughly 9,350 medium-and hard-core natural gas trucks, with over 80% of these trucks working in Italy, Sweden, Spain, and France (EC, 2015). Contrasted with China and the United States, there is to a lesser extent a cost preferred position of natural gas in Europe and less government impetuses have been advertised. Nonetheless, the Alternative Fuels Infrastructure Directive requires EU part states to create national approach systems to advance and build up the significant framework for elective energizes including CNG and LNG. The mandate proposes that the normal separation between refuelling stations ought to be 150 km and 400 km for CNG and LNG, separately (Council of the European Union, Directive, 2014). Natural gas is a blend of paraffinic hydrocarbons, for example, methane, ethane, propane, and butane. Modest quantities of higher hydrocarbons, for example, ethylene, might be available and follow measures of hydrogen sulfide and nitrogen may likewise be available. The vitality substance of natural gas (CNG or LNG) per unit weight is roughly 15% higher than diesel fuel (utilizing run of the mill net calorific estimations of 50 MJ/kg and 43 MJ/kg for natural gas and diesel, separately) (Staffell, 2011), showing that natural gas can offer a similar measure of vitality for less weight.

Nomura Research Institute Ltd (NRI Consulting & Solutions) in its report (2019) on 'Transforming Mobility Through Natural Gas' also said the implementation of BS-VI emission norms from 1 April 2020, will increase price differential between CNG and diesel vehicles, making CNG vehicles more attractive. According to the report, a strong network of 15,000 CNG and 1,500 LNG stations by 2030 would have the potential to transform the Indian mobility scenario, with an expected 33 million natural gas vehicles as compared to 3.3 million in 2019. Studies on consumer behaviour related to non-conventional vehicles in India are quite limited. Further whatever studies are there, they are concentrated on Electric cars. Studies on consumer behaviour related to CNG vehicles are very few. At the same time potential for CNG vehicles is quite promising. Hence the researcher has taken-up this study of consumer behaviour related to CNG vehicles in Pune city.

### 3. METHODOLOGY

To draw meaningful inferences and conclusions, a minimum sample size of 100 is recommended (Alreck and Settle, 2003). In line with this guidance a sample size of 120 was chosen. Convenience sampling method was followed.

E-questionnaire was kept on a laptop at select car showrooms from Pune. Customers were requested to fill-up the questionnaire. First 120 responses were chosen as the sample size for conducting the study. Neither the name of the respondent nor that of the car showroom was recorded for ensuring confidentiality. In fact, it was only when the consumers were assured of their confidentiality, they agreed to cooperate. A questionnaire was designed in MS Excel. It was divided into following parts:

- Demographic Profile
- Consumer behaviour towards CNG cars

The questionnaire had following features:

- Responses were sought by way of a selection from a drop-down list
- In seeking agreement or disagreement on a particular issue, the sequence of responses was designed as under –
  - 0 – No option
  - 1 – Somewhat agree
  - 2 – Completely agree
  - 3 – Somewhat disagree
  - 4 – Completely disagree

“No option” choice was deliberately kept as the 1st response in order to provide an early exit option to those who either didn't know the answer or didn't want to answer. The questionnaire was tested for reliability, and it returned a Cronbach Alpha score of 0.829 and hence was considered reliable. The questionnaire is given at the end of the article.

The hypothesis set was:

- $H_0$ : CNG vehicles do not have a positive effect on consumer behaviour
- $H_a$ : CNG vehicles have a positive effect on consumer behaviour

The hypothesis was tested based on the average agreement/disagreement responses to the ten statements of the questionnaire which stated positive impact of CNG vehicles. The average agreement/disagreement response of the 120 respondents for all the related statements was taken as the sample mean and it was compared with a hypothesized population mean of 50% agreement/disagreement connoting an event by chance and not due to any statistical significance. A t-test was applied at 95% confidence level and based on the p-value the null hypothesis was tested for rejection or non-rejection.

### 4. DATA ANALYSIS & FINDINGS

112 respondents were male whereas 8 were female. 21 were from the Northern region of Pune, 33 were from the Eastern region, 32 were from the Western region, and 34 were from the Southern region. 39 respondents were from the age-group of <30 years, 45 were from the age-group 30-40 years, and 36 were from the age-group of >40 years.

The average agreement responses to the questionnaire were as under:

**Table 1: Summary of responses to the questionnaire**

Statement	1	2	3	4	5	6	7	8	9	10	Average
Agreement %	91%	85%	86%	74%	74%	77%	89%	74%	73%	87%	81%

Based on the above summary average sample mean the hypothesis was tested as under:

**Table 2: Testing of Hypothesis**

Parameter	Value
Sample Mean ( $\bar{x}$ )	81%
Hypothesized population mean ( $\mu$ )	50%
SD of sample	0.9362
n (sample size)	120
t-value= $\text{abs}((\bar{x} - \mu) / (s/\sqrt{n}))$	3.60701
p-value = $\text{tdist}(t, (n-1), 1)$	0.00023
Decision	Reject Null

Thus, the null hypothesis, CNG vehicles do not have a positive effect on consumer behaviour was rejected in Favor of the alternate, CNG vehicles have a positive effect on consumer behaviour.

## 5. CONCLUSION

Consumer behaviour is positively affected by CNG vehicles. Consumers are sensitive to issues like pollution, price, and other factors. The study will supplement the efforts of researchers and marketers in understanding of consumer behaviour towards CNG vehicles. Understanding of the consumer behaviour is of great significance for marketers. Recent example of rejection of Tata Nano as a “cheap car” by the Indian consumer shows the importance of getting the right pulse of the market. The best of the products can get grounded if marketed poorly. Hence it is of immense importance for marketers and market researchers to get accurate assessment of various dimensions of consumer behaviour. This study provides inputs in this regard.

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<b>Questionnaire</b>		
<b>Study of consumer behavior towards CNG vehicles in Pune city</b>		
<b>PROFILE INFORMATION</b>		
1	Name of the Respondent (optional)	
2	Gender (Male, Female)	
3	Zone (North, East, West, South)	
4	Age (<30 years, 30-40 years, >40 years)	
<b>I. Consumer behavior towards CNG Vehicles</b>		
<b>Rate the following statements on a scale of Cannot Say, Somewhat Agree, Strongly Agree, Somewhat Disagree, Strongly Disagree</b>		
No.	Statement	Response
1	CNG vehicles have a better fuel efficiency	
2	They have a favorable effect on the environment	
3	They are good for the vehicle engines	
4	They have a low operational cost	
5	They lead to increased life of oils	
6	CNG is considered to be a safe fuel	
7	They can run both on CNG as well as petrol	
8	CNG mixes in the air easily and evenly	
9	It enhances the longevity of spark plugs	
10	Being non-toxic it improves public health	