

The Novel Designed Car for Future

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Introduction

The heading of this article may give the idea that we are going to deal with the future automobile concepts like 'driverless cars', 'fuel cell vehicles' etc. But this article focuses purely on the design and engineering aspects of the future cars related to technologies already existing today. These technologies once fine-tuned can greatly help us in engineering the future automobiles. Two important concepts which dominate how the new automobiles are designed and built are the 'frugal engineering' and 'world car'.

Carlos Ghosn, Chairman and CEO of the Renault-Nissan Alliance, famously coined the term "frugal engineering" in 2006. Over-engineering cars were very common in the final decades of the last century and even in the beginning of the present century. Mercedes Benz E-class (W124) series cars of the 1990s was the product of a time when Mercedes triple-checked every last nut and bolt and purposely over-engineered its cars, 'just-in-case' it came to help in some situations [1]. They were meant to last many decades on the road. But in the present scenario where the technology changes so fast, using an automobile for more than a decade is very rare. Even if the decade old vehicle is in good running condition, the electronic interfaces would have become outdated, meaning people wouldn't want to continue using that vehicle. So over-engineering automobiles are no longer sustainable from both the economic as well as the environmental point of view. Here comes the importance of frugal engineering where we are interested in developing 'good enough' automobiles that deliver excellent value for money to the customers. In our article, we will look at frugal engineering practices employed in the development of a few recent automobiles like Renault Logan, Toyota Etios and Tata Nano [2].

The 'world car' is the idea of developing an automobile in such a way that it is suitable for sale in all the major markets in the world. The Ford Fusion introduced into the US market in 2012 is a world car because the same car is sold in all the major automobile markets of the world like Europe, Asia and Australia etc. We may not see the word 'Fusion' in Ford's European automobile brochures but the new Ford Mondeo introduced in 2014 is the same car but for minor changes in suspension tuning, choice of engines etc. Other examples of world cars include most models from premium automobile manufacturers like Mercedes-Benz, BMW and Audi etc. Toyota Corolla, VW Golf, Honda Jazz are also world cars among many others. In our article, we will compare the world cars and frugally engineered cars and try to get the ideas for the car of the future.

Frugal Engineering Practices Employed in Recent Automobiles

The Renault Logan introduced in 2004 shocked the automobile world with its value pricing. Starting at about 7000 Euros, it was among the cheapest cars that could be bought in Western Europe [3]. But size wise it was even larger than family cars like VW Golf, Ford Focus etc. Here was a car that was priced lower than cramped mini cars while at the same time it was as roomy as family cars and even had a large 510 liters of luggage space to handle all the luggage of the family. No doubt, it was very difficult to classify the Logan-will you classify it with

the mini cars like Fiat Panda which cost similar money but are much smaller or with the family cars like the VW Golf which are about the same size but are priced much higher? Of course it is not built with the same quality expected of a western carmaker but it is cheap to buy, run and highly practical to use. As a result the, Logan now in its second generation, has gone on to become Renault's best-selling model in Europe as well as in many emerging markets across the world. Some of the frugal engineering techniques employed in the Logan are,

- Single windscreen wiper.
- One piece rear side window.
- Use many existing components like engines, suspensions.
- Single piece dashboard.
- Manually winding windows.
- Air-conditioning as optional item.
- Angular body panels that are easy to be pressed in stamping machines.
- Simple exterior and interior styling etc.

The Toyota Etios was introduced into the Indian market in 2010 and subsequently is also being sold in South Africa, Brazil and Indonesia [4]. The vehicle really shocked the market with its unreal kerb weight of just 930 kg for the petrol engine vehicle, making it lighter than many mini cars while being as large as a family car with a huge 595 liter luggage space. Etios employs many frugal engineering techniques like

- The use of open C-sections for the suspension arms (instead of tubular or boxed sections).
- Instead of using unnecessary heavy duty (and expensive) components which are designed to work at -30°C (like in the Corolla and Camry), the same bits have been engineered to work down to only -5 or -10°C.
- The vehicle was conceived from a clean sheet of paper but components are shared with the Toyota Yaris.
- Single windscreen wiper.
- One piece rear side window.

The Tata Nano introduced into the Indian market in 2008 was

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Frugally engineered vehicle	World car
Tailor made product for each market	One product for the whole world
Only required features for each market	Many unnecessary features
Parts sourced from a common pool	Same parts as same product is sold world over
Possibility of cost reduction at each stage	No such possibility
Design and Engineering cost is incurred in stages	Design and Engineering cost is incurred at the start
Value for money to customers	Less value for money
Design can cater to local tastes	Design is usually a compromise

Table 1: Comparison between frugally engineered vehicles and world cars.

designed to lure India’s burgeoning middle classes away from two-wheelers [2]. The amount of space it has managed to create on the inside from the meager exterior dimensions (length is only 3.1 m) is truly extraordinary. Brainchild of Indian automotive czar Ratan Tata, who aimed for a price tag of Rs.1 lakh (US\$ 1,600) and the launch model matched the price although subsequently the price has been increased. Ofcourse to have such a low price tag many frugal engineering techniques were employed like,

- Tata worked with Bosch to take the ECU down to an unprecedented price by reducing the sensors used by the ECU to govern the engine down to half the usual number.
- Small wheels are lighter, which positively impacts economy. Further, these wheels were mounted with only three lug nuts resulting in lower costs.
- The smaller tyres mean less rubber, so they should be cheaper as well.
- The central meters and the dashboard on the Nano eliminates the need to adapt that large plastic assembly for right- and left-hand drive markets.
- Radio or CD player is optional (the idea picked on some basic car models in North America and all basic cars in India).

- No airbags on any model.
- No external fuel filler cap. Fuel inlet is accessed by opening the front hood.
- Single windscreen wiper.
- One piece rear side window.

Comparison between Frugally Engineered Vehicles and World Cars

As we have seen in the earlier examples frugally engineered cars i.e. ‘good enough’ automobiles that deliver excellent value for money is a genuine front runner in the quest for the car of the future. It will help many more people get into the world of motoring and thereby sustain the automotive industry also in the long run (Table 1).

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