



Macro ergonomics and product quality: a study of popular Brazilian cars

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Abstract

Once the challenge of developing and trading national cars has been overcome, the new challenge becomes the accessibility/costs ratio. The answer to it was 1.000 cc engine cars which are called popular cars in Brazil. Nowadays, this segment represents over 50.0% of the Brazilian fleet. Economical issues are the major concern in the Brazilian market, rather than attributes like safety, comfort and energetic efficiency, project quality, production, etc. This paper presents the results of an analysis developed over the principal popular national car, with the focus on ergonomics application in its interior and its impact on the general quality of the product.

INTRODUCTION

Automobile development is a phenomenon observed in parallel with the development of society. People are incessantly looking for new ways of human transport and cargo. Therefore, automobiles profoundly affect not only economic development and changes in production lines, but also society's way of living, environment, architecture configuration and urban spaces. To exemplify, only in 2006, 2.611,034 vehicles were produced in Brazil (cars, trucks and buses) (1).

In times of globalization, automobile is no longer just a mean of transportation, but is now considered as a home and work extension, especially if we evaluate the fact that people spend an important part of the day inside it. Thus, questions that concern automobile »habitability« are seen as important aspects in vehicle development.

This paper presents the results of an analysis conducted on major popular national car with the focus on ergonomics application in its interior and the general quality impact, security and comfort. The challenge to project teams is the association of low production costs and suitable ergonomics.

Methodology

The scientific methodology carried out by the researchers was structured into two phases: the first phase deals with a survey of references and products for further analysis. The second phase deals with the interpretation of the data and concepts generated. Direct analysis method on the popular Brazilian vehicles enables correlation between bibliographical information and local trade market reality. For this purpose a study on the major points related to ergonomics in the car interior was made. In this phase, interpretation of concepts generated by biblio-

graphical survey was carried out. Discussions among the team, representatives and specialists were crucial to finalize the study, followed by the manuscript preparation.

Technical Requirements

The challenges for the Brazilian automobile industry were, to develop and commercialize national products. It started in the afternoon of February 1961, when a project group of producers in Brazil decided to »develop with their own strengths and style, use their own tools, materials and process, addressing to socio – geographical – economical conditions established previously and a specific public« (2). Other vehicles also contributed in the 70's to disrupt this technical paradigm (3).

Aiming to offer accessible products to the national market, the production of 1.000 cc popular cars, or »1.000 cars« as known in Brazil was proposed. The dissemination of popular cars increased the production of national automobile industry, mostly due to the need to have vehicles with a good cost / benefit relationship. Nowadays, popular cars represent 60.0% of the national fleet (1), in 1998 they reached 72.0% of the total production of the automobile industry (4) and in 78.0% in 2001 (5). It is important to say that Brazilian fleet has 10 years average for cars and 14 years for heavy vehicles (Figure 1) (6).

The 1.000 cars pay 10.0% tax in Brazil, other categories pay an average of 20.0%. The purpose of such is to offer a basic product to low income consumers. Actually, the car industries offer low quality cars only to make it cheaper

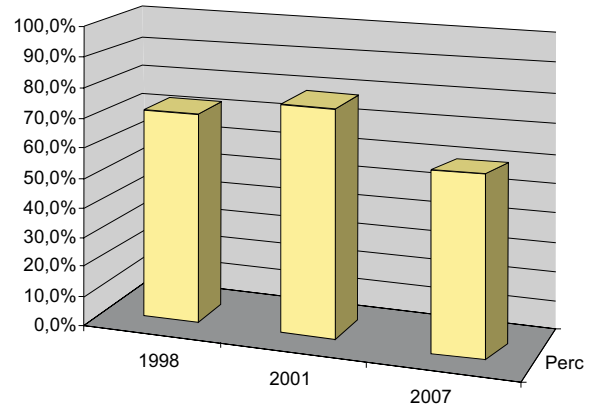


Figure 1. Indicative chart of the total national production of the automobile industry in 1998, 2001 and 2007.

and more competitive. Thus, there are products without state of the art ergonomics studies and its evolution (safety and comfort) at the moment of their conception.

The main point here is to stress the importance of distinct market categories for the success of competition innovation strategy. The characteristics of products and markets are subject to income standard of the target class. Urban market was estimated to U\$ 298.0 billion. U\$ 119.0 billion belongs to class A1, A2 and B1. Classes C, D and E represent U\$ 124.0 billions, and class B2 U\$ 55.4 billion. It is clear that even with low incomes the consumption potential was bigger in lower classes in the beginning of the 21st century (5).



Figure 2 AB. Popular cars that were projected before the 80's. Source: Reference 10.

Besides previous statements, one can also emphasize the fact that economical development represents a determining factor in the cultural development of a society. This has conditioned companies and market to establish new quality criteria for the conception of new automobile products. Support to this argument, from 118.560 vehicles commercialized in January in 2007 (corresponding to 30 most sold in January, of the total cars commercialized) 56.45% belong to compacts class¹ and all of them were projected before 2000. Although most of them present many minor improvements on the original project, cars like A and B (1st and 4th in ranking – Figure 2) that were projected in the beginning of the 80's, do not have safety equipment. They also do not have a real technical/formal adequacy to national consumer's characteristics.

We can define as active safety the elements that contribute to prevention of accidents as: ABS brake, intelligent suspension with stability control, more efficient light – with XENON, etc, considering that Passive Safety are the elements that may reduce the consequences of an accident like: safety belts, airbags, pre deformed safety structures, etc.

Recently, a comparative crash test with another vehicle of the popular category, a car sold in Brazil (Figure 3 A) and its version exported to Germany (Figure 3 B) was made by a Brazilian institute. As the Brazilian market car did not present basic safety equipment (airbags and safety seatbelts) it scored 1.5 against 4 (maximum 5 possible) stars scored by the German mode (7).

None of the eleven cars that constitute the Brazilian popular car market have these safety items in their cheap versions. ABS brake systems are available as an option only in 2 vehicles. As for airbags, they are available in 5 out of the 11 mentioned cars. Another failure point in projects is the air conditioning system of the cockpit. In a country like Brazil where the average temperature is around 42 °C in the northwestern region only one car offers air conditioning, in all the others its only available as an option.

Ergonomic factors are little valued by the market, and all solutions prioritize costs reduction. Ergonomic studies, especially for the cockpit, are determinant for an automobile project. Economic factors may be seen as essentials for the product success, but they limit the level of ergonomics on the project.

The success factors of innovation strategy from companies in the popular market are (5):

1. Innovations are not radical and do not depend only on high technology;
2. Logistics must have low costs and quick answers;
3. Best markets are those in the suburbs of big cities;
4. Buying conditions (low price and small installments) are the most important issues for low income clients. Companies dealing with this segment have developed strategies to suit the buying conditions of this population. It is also vital to pay attention to the preferences and needs of the public. One must recognize its idols and taste. Creating a special mark may be a plus;
5. As the price is crucial, one must be extra careful with scale economies to reduce unit costs;
6. Product development speed is a competitive advantage. For many companies in the popular market it is essential to be able to embrace the preferences of their clients and respond quickly, with changes to grow.

Ergonomic factors that should be considered in new vehicle projects (8):

1. Visibility: in general the products present good visibility and right side rear view mirror. But most of them do not have back windshield wiper and good quality lights that compromise the vehicle conduction. The windshield wiper in the back is mandatory for hatch's vehicles, but most of the producers just offer them as optional;
2. Communication: in order to reduce costs there is a strong tendency to use just one light for reverse speed. Direction lights are usually not well positioned in national projects;
3. Movement access: drivers usually complain about position of the commands and levers like; parking brakes, distance between clutch and brake pedal, radio controls, air conditioning, etc;
4. Comfort: one of the worst items. The material quality in vehicle interior, especially the tissues in seats and doors cause discomfort and make occupants and driver tired during long trips. There is no pelvic retroactive effect, in general, in the seats;



Figure 3. Crash test with a car sold in Brazil (A) and its version exported to Europe (B). Source: Reference 11.

5. Information about the vehicle: reduced or eliminated to reduce costs. It is common not to find temperature indicators, warning lights easy to read, board computer with check control, and a good position of the forth-mentioned elements;
6. Safety and protection devices: as presented before, most important items for safety are not available in the basic models, and most of them are not even available as optional. Just to show the importance of these items, in 2005, 109.745 accidents happened on the Brazilian roads, with 414.663 injuries and 10.416 fatal victims.

A project must consider comfort, safety and ergonomics. It also has to take into account the quality of materials that help the comfort of passengers, focus on the free internal space, comfort of seats, easy controls use, acoustic isolation, among other factors. Other issues that contribute to interior automobile development are a clever combination of quality variations and possibilities as: shape, texture, style, comfort, visibility, safety, multiple use and creating a more agreeable interior atmosphere (9).

CONCLUSION

This research shows that safety in automobiles is directly linked to economical and cultural conditions of the society. On the other hand there is a vicious cycle between producers and consumers. For lack of offers or lack of demand, the market stands with very few choices. In this vicious cycle the producers don't produce because nobody buys, and nobody buys because nothing is produced. The clients unfortunately, are the losers in the equation, because they don't have a choice and the producers can't sell their products in more exigent markets. A study of automobile interior using ergonomics and design is strategically relevant in a global market. This segment

consequently, is very important to economical development of the country and represents a special segment in organized, developed and healthy society.

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