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## Has the world really discovered the advantages of Brazilian automotive engineering?

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The Brazilian automotive engineering has a long standing tradition, it exists for over 50 years and the country unveils its 3rd generation of automotive engineers. Its competence was built by vehicle producers which over the 50s and 80s locally manufactured cars, long gone from their production plans in Europe and the U.S and required several adaptations for the local market. It is the case of GM's Opala model. The specific conditions of Brazil drove the need to search for unique solutions and created spaces for local development activities. The country has a wide territory, poor road conditions and in terms of temperature; the south of Brazil reaches -5 Celsius, and the north +40 Celsius. Vehicle producers have to take all of that into account when projecting the durability of a vehicle body. Therefore, the utilization of different materials is one of the ingredients to give a local face to the Brazilian Automotive Engineering. Later on, the development activities evolved to the derivation of vehicles conceived abroad such as the pick up Corsa and the Astra Sedan, originated from Germany.

Throughout its history, creativity and capacity to offer low cost solutions have always walked side to side with local automotive professionals. The local engineering culture was formed under strong cost pressures and requirements to increase productivity levels with limited resources. Such scenario has contributed to another very important differential: flexibility. The speed in terms of capturing the new trends and bringing it to new models is certainly a major competitive advantage in a time which product life cycles decrease with strong intensity.

The Brazilian automotive industry has been the pioneer in producing small pick ups and 1.0 liter engines. The latter has amazingly pushed forward the sales of popular vehicles in the early 90s and still accounts for 52 percent of all cars sold in the country.

However, the flagship automotive technology is related to alternative fuels. During the 70s, the oil crisis forced the Brazilian government to find solutions in order to diversify its energy matrix. The way out was to introduce gasoline blended with a high volume of ethanol; in order to foster the development of straight ethanol fueled vehicles. Later on in 2003, important suppliers such as Magneti Marelli, and Bosch, through some special electronic sensors developed in Brazil the flex fuel technology. In practical terms, the flex fuel allows the choice of fuel (at each vehicle refueling) according to characteristics of price, quality, performance or even fuel availability. Soon after its introduction in the Brazilian market, flex fuel vehicles reached 86 percent of market share in only four years. At the moment, local efforts are concentrated on Biodiesel which is already obligatory by Brazilian legislation.

In such a spirit, Brazil has successfully evolved from the tropicalization of products designed elsewhere, to the unit by unit construction of new vehicles. Finally, the Brazilian automotive industry has achieved a status of a global platform designer.

**Figure 1.1 - Few examples of vehicles recently locally develop.**

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Source: Frost & Sullivan

Currently, the local industry is capable to offer experienced manpower for the construction of the new generation of vehicles, small, cheap and efficient. There are four world class development centers - Fiat, Ford, General Motors and Volkswagen and several projects of other vehicle producers are on the run. Ford has established Brazil alongside with the US, Asia, England and Germany as one of its five worldwide engineering centers and nearly doubled its engineering team since 2002. Its factory in Camacari, Bahia, is a reference in terms of technology. In a short period of time, the North American vehicle producer has managed to create the mindset of an automotive culture in a State which has never produced a single automobile before. Today, the plant employs around 680 engineers, and 90 percent of its engineers are fluent in English. The small hub in the near and unknown countryside of Bahia has become one of the cornerstones of competitive vehicle development in the world.

General Motors has also elected Brazil as one of the five Global Engineering Centers (the others are U.S, Europe, Australia and South Korea). It has awarded the Brazilian operations global responsibilities for the medium pick up size S10, which means that the global development architecture of such vehicles is all done locally. As a result US\$ 100 million were invested to build new installations, equipment of the last generation and to double the numbers of engineers dedicated to product development. In 2009, 1,200 professionals will be working in a new building in São Caetano do Sul, Sao Paulo, with responsibilities to design global vehicles. Around 40 percent of the GM's development resources in Brazil are required for international projects such as painting lines in Egyptian operations, and the development of the new Hummer H3T. General Motors in Brazil has also developed concept cars such as the Sabiá and the Celta Spyder in 2001, the Journey in 2002; and the Prisma Y in 2006.

Fiat Automobiles places Brazil at the forefront of its strategy, currently the local production accounts for 30 percent of the entire Fiat production in the world. Recent announcements of US\$ 3 billion dollar investment for the Group in the country should drive the factory in Betim from the current installed capacity of 700 thousand vehicles, to become the largest vehicle factory in the world. As a result, to empower local operations with development activities is more than natural. In 2003, US\$ 200 million were invested to enhance the activities of the local development center which is composed by six units, Electric and Electronic, Vehicle Body, Chassis, Prototype construction, Vehicle Experimentation engineering, and the Style Center which is the only conception design center of Fiat outside Europe. Fiat Brazil has become a clear benchmark in terms of low displacement engines, compact models and suspensions.

The German manufacturer Volkswagen is one of the oldest players investing in the Brazilian manufacturing potential. In 1973 the factory of São Bernardo do Campo designed one of the biggest successes of the Brazilian automotive industry, the Brasilia model, which sold close to 1 million units from 1973 to 1981. In 1980, a stronger Brazilian platform named Gol was also launched in the local market to become the best selling vehicle of the Brazilian automotive market of all times, a market leader since 1987. In October 2003, VW created and produced the model Fox which finally consolidated Brazil as one of the five world development hubs for this brand. The success was transferred to Volkswagen Trucks. Its factory in Resende, Rio de Janeiro, inaugurated in 1997 was a pioneer in terms adopting the Modular Consortium, in which first tiers are placed inside the factory doing the final assembly while VW takes care of development and quality control. The experience was

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then replicated in Mexico, and South Africa.

The local automotive industry has the ability to position itself as an important world development and production hub, particularly for compact vehicles and alternative fuels technology. The successes of such initiatives are transforming the structure of the Brazilian Engineering from a face-lift and adaptor to a true vehicle developer. Brazil is no longer competitive in terms of price; a Brazilian engineer makes an average of US\$ 48.000, an Indian engineer costs 26% less, and a Chinese engineer 24% less. However, Brazil is one the best options considering quality, speed, and engineering competence. As engineering accounts for 25 percent of the total cost of a vehicle project, the industry is pushing the local government to improve the business environment for the activity, in order to generate a more competitive cost structure.

A critical point for the Brazilian automotive industry would be to speed up the process of involving engineers within development activities. Currently to capacitate a project coordinator to the automotive industry takes an average of 8 years. In order to be 50 percent more effective the ideal target is to reach a 2-3 year level.

The industry needs to enhance the attractiveness of working for the automotive industry and the engineering activity itself. Local associations such as SAE Brazil are trying to incentive newcomers at the very bottom of the education system creating technical courses for youngsters and fostering a culture of technology. It is essential for a country which lags behind in its educational system. Most developed countries have an average of 25 engineers per every 1000 thousand inhabitants; Brazil has much lower average than that. The percentage of graduated Brazilian Engineers in comparison to all graduated University students is also below international standards.

**Figure 1.2 Comparison of Engineering Structure of China, Korea, India, Brazil.**

	Engineers per 1000 inhabitants	Engineers Graduated in 2006	% of Engineers graduated in comparison to all University students
<b>China</b>	25	400.000	38%
<b>Korea</b>	25	80.000	30%
<b>India</b>	22	300.000	21%
<b>Brazil</b>	6	30.000	10%

Source: Frost & Sullivan, based on data CNI (Confederation of the National Industry), PNUD (United Nations)

There are about 13,000 engineers engaged on the Brazilian automotive industry. The movement private sector/University has intensified over the recent years and promoted specific success stories such as GM/Politecnica, Ford/Unicamp, Fiat/PUC Minas and UFSC, but still has a lot to improve. Around 68 percent of the research groups involved in automotive are concentrated on the South/Southeast region. All the vehicle producer/University associations draw the example of the link Embraer/ITA. The Brazilian airplane manufacturer was the first local company to really speed up the development of specialized engineers giving them interesting career opportunities. Working with more than 4,000 engineers, with the assistance of the University it has manage to create a very innovative culture, allowing them to produce the latest technology and become world reference in terms of regional jets. As the example is followed by the automotive industry, results are starting to appear.

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