

AUTOMOTIVE

# inSIGHTS

Automotive Competence Center **SPECIAL**

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> Automotive Innovation made in BRIC

# AUTOMOTIVE INNOVATION MADE IN BRIC

## Emerging players with their own approach to automotive R&D



### EDITORIAL

Dear Reader

Today I have the pleasure to introduce to you our insights on innovation in automotive coming from BRIC countries: Brazil, Russia, India and China. The motivation for this was to outline global changes in automotive markets that have traditionally been dominated by triad players. BRIC markets and some of those emerging players are re-shaping the global automotive industry and give reason enough to analysis the potentials of alternative ways forward in this field. Covering approaches of emerging OEMs when it comes to innovation as well as activities of global players when off-shoring R&D in BRIC, this analysis considers both aspects.

Briefly summarizing the key findings on automotive innovation made in BRIC, the following can be concluded:

- > The financial crisis has impacted BRIC automotive sales but it is expected that the impact will be less severe compared to the triad markets
- > R&D spending in BRIC have increased with double digits in the past years rising with the vast GDP growth but are still below average in percentage of GDP when comparing with industrial nations
- > Patent filings and engineering graduates have risen tremendously during the past years in BRIC of which China is no 1 in absolute terms
- > Policy driven research has given rise to bio-ethanol in Brazil but no domestic players exist
- > Indian OEMs have demonstrated how cooperation, indigenous innovation and an institution-building approach has resulted in competitive product innovations such as the Nano for example – the interview at the end with the CTO from TATA will further support this
- > Low cost innovation as seen by Chinese players is about to disrupt global competition in automotive – the electric vehicle revolution is one example

Regardless of all threads for global established players, they have the possibility to tap into the advantages of BRIC countries by expanding their scope of activities from just manufacturing locally, sourcing and localization to commence with R&D off-shoring activities. This is best achieved by integrating such activities in their global product development network ensuring to suit products to local market needs. Tremendous net cost savings exist when implemented appropriately requiring to achieve an organizational transformation when trying to globalize R&D.

Enjoy reading the insights in this publication!



Ralf Kalmbach

# AUTOMOTIVE INNOVATION MADE IN BRIC

## How the car industry is getting ready to revolutionize global markets

Recent years have shown a tremendous growth of vehicle sales in BRIC countries – for example today China being the second largest vehicle market in the world. Simultaneously, many new local players have emerged. While many still use conventional technologies the urge is huge to leapfrog technology as well as entering global markets meeting global standards and customer requirements. This requires the capability to self-innovate. This special insight on Automotive Innovation made in BRIC aims to outline how the car industry in those countries is getting ready to revolutionize global markets by taken their own approach on innovation and coming up with own solutions to global needs in automotive. Global OEMs have the possibility in participating in the opportunities of local talent pool, market proximity and low-cost advantages when expanding their scope from just local manufacturing and sourcing to R&D off-shoring allowing to globalize their R&D matrix.

### Automotive Innovation made in BRIC

#### I. Innovation in BRIC countries portends future competition with mature industrialized countries

Vehicle sales have soared in BRIC countries over the past few years, especially in China, which now boasts the second largest vehicle market in the world. Numerous local players have also emerged in China and India. While many still use conventional technology, the desire to enter the international market is compelling. Yet to do so, auto makers must first meet international standards, customer specifications and preferences. In some BRIC countries, original equipment manufacturers are starting to consolidate, a trend that could lead to a few strong players with the ability to compete on a global scale. Entering the international market also requires the ability to innovate. In the following discussion, we provide a brief description of how the automobile industry in these countries is poised to revolutionize global markets by taking a new approach to innovation, and by coming up with its own solutions to international automotive requirements. We also assess the impact of the financial crisis in BRIC countries, paying keen attention to its role in motivating the creation of new proprietary solutions. We also evaluate the opportunities that arise from this unusual time in history.

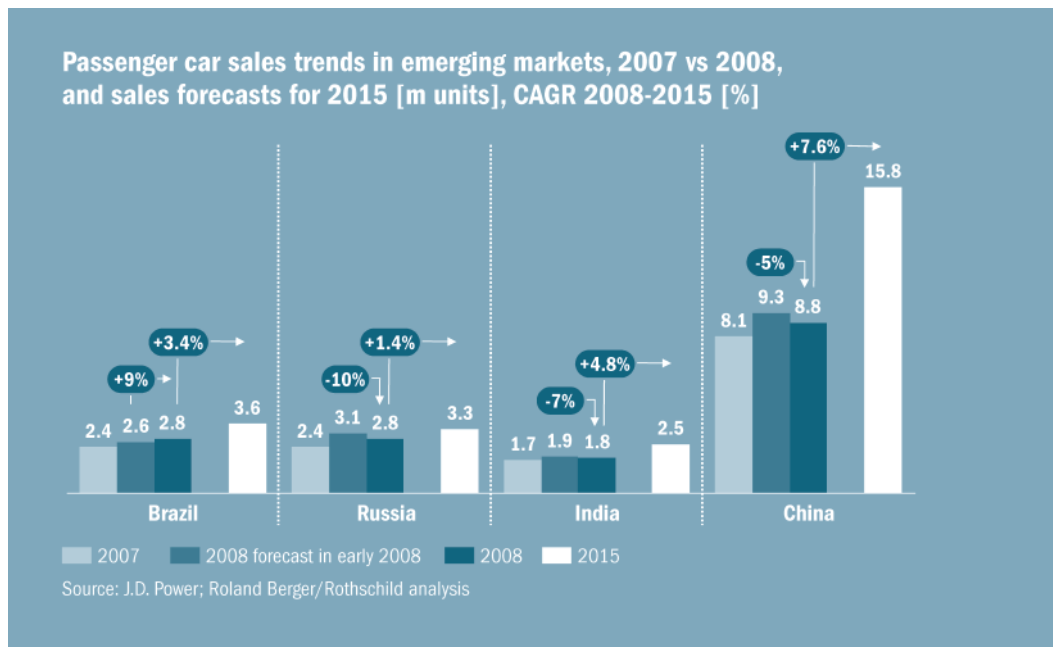
#### I.1. Financial crisis creates opportunities in BRIC countries

Structural problems in the auto industry, such as overcapacity, have been intensified by the financial crisis and have impacted car sales in BRIC countries. Even though actual car sales were higher in 2008 than in 2007, they were nowhere near the double-digit growth rates of the past. For example, China's year-on-year growth rate of 5.7% in 2008 was the lowest in ten years.

The graph below, which shows the gap between forecast numbers and actual numbers, reveals a positive trend in Brazil, but negative impacts in Russia, India and China.

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Despite the build-up of foreign currency reserves in China specifically, foreign direct investment in BRIC countries in general, have dropped slightly since mid-2008, they are expected to rise in the medium to long term. As a result, these countries may actually emerge stronger after the crisis than before. The level of currency reserves may provide an opportunity to acquire not only automotive technology, but also distribution channels and brands in developed industrial countries at reasonable prices. At the same time, the crisis may impact automotive products less in BRIC markets than elsewhere, because original equipment manufacturers in BRIC countries are mainly focused on local markets. When these factors are considered together with the new cost reduction approaches described below, it appears that BRIC countries are on the verge of becoming globally competitive players. Companies from highly developed industrial countries are well aware of the tremendous future potential of markets in BRIC countries and the prospects for growth in the auto industry there. They ascribe immense growth potential to these countries – as indicated in the forecast for 2015.

### 1.2. Framework for innovation – R&D funds, patents and talent sourcing

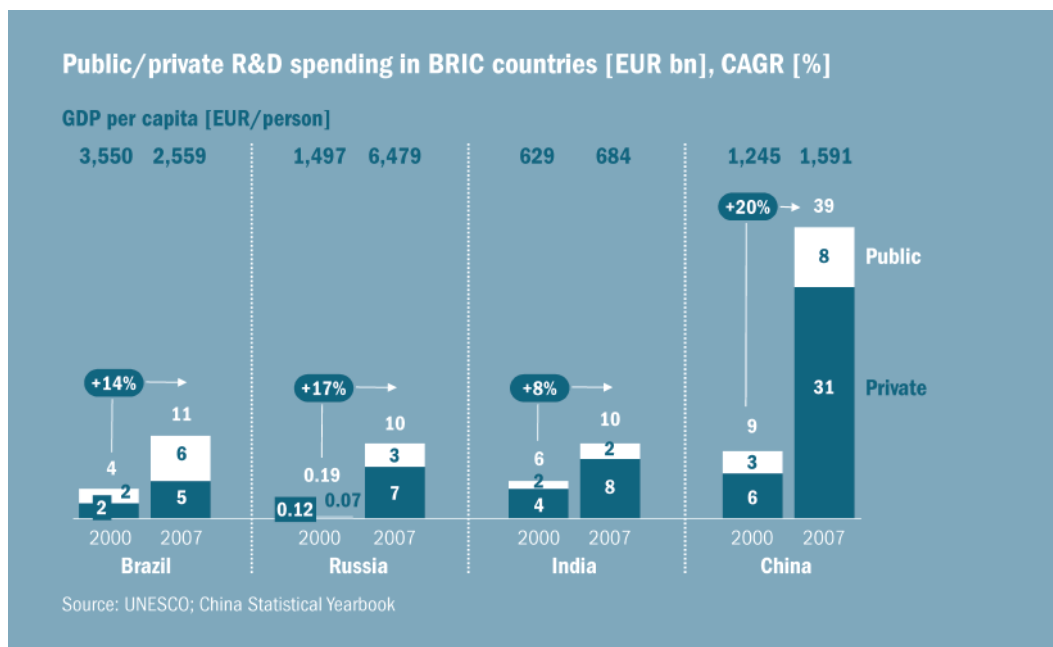
What follows is an analysis of the framework, background conditions and location factors that influence research in BRIC countries. This brief description of R&D performance provides an overview of the capability for automotive research and innovation in BRIC countries.

#### Increasing industry awareness is evident in R&D funds allocation

R&D funding, whether private or public, is crucial for a country's ability to come up with innovations. Government-set research targets that are defined in an R&D agenda and granted incentive funding may play a key role in fostering relevant industry domains and boosting an industry's competitiveness. The field of new energy vehicles is a prime example. This issue is explored in more detail below in the description of the "863 R&D Program" of the Chinese Ministry of Science and Technology. The following graph shows the trends in R&D funds allocation and GDP per capita in BRIC countries during the analyzed period.

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India's total R&D spending as a percentage of GDP did not change significantly during the period 2000-2007, but remained at 0.7-0.8%. This is below the average of the other developed industrial nations. During the same time, India's GDP rose at a cumulative average growth rate of 9%.

In China, R&D spending as a percentage of GDP rose from 0.8% to 1.5% of GDP in the period 2000 - 2007. During this same time, China's GDP experienced a compound annual growth rate of 12%. China is preparing for indigenous innovation - including in such areas as alternative-powered vehicles.

By comparison, R&D-to-GDP ratios in the US, Germany and Japan were 2.7%, 2.5% and 3.3% respectively in the year 2007.

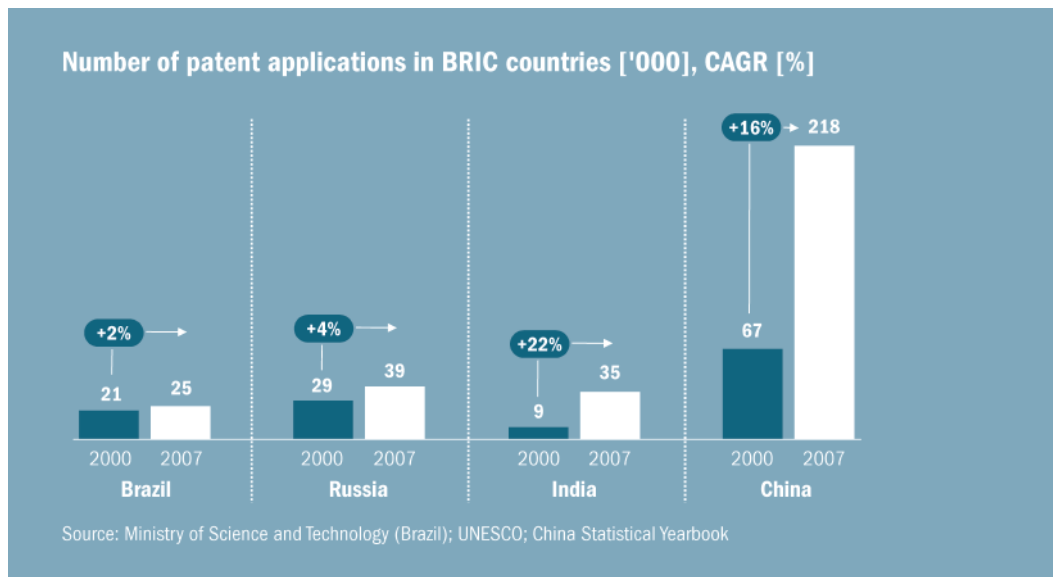
In conclusion, emerging markets are increasing R&D spendings tremendously growing just like their GDP - double digit. The level in percentage of GDP has not yet reached the standard of industrialized developed nations.

### Increases in innovation capability as reflected in patent applications

Patent applications can be considered a measure of innovation capability. Of course, the national origins of patent holders need to be taken into consideration. The following graph compares the BRIC countries in respect to activity in the field of intellectual property.

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In Brazil, Petrobrás is the most active patent applicant. Petrobrás focuses mostly on chemicals and technology applicable to mineral exploration and extraction, and to the refining of oil, lubricants and fuel. This focus is very much in tune with Brazil's move toward ethanol-based automobile fuel. Only 5% (ca. 2000 in 2007) of Russia's patent applications relate to the auto industry.

In India, only about 18% of the patent applications in 2006 were of local origin. The others originated in other countries, predominantly the United States, Germany, Japan and Switzerland. Roughly 9% of all patent applications are related to the auto industry.

In China, a large proportion of IT and electrical/electronic patents (37% in 2007) are held by companies with an international presence, such as Lenovo and Huawei. In other areas, public research institutions are the predominant patent holders. Universities have special departments dedicated to development of patents.

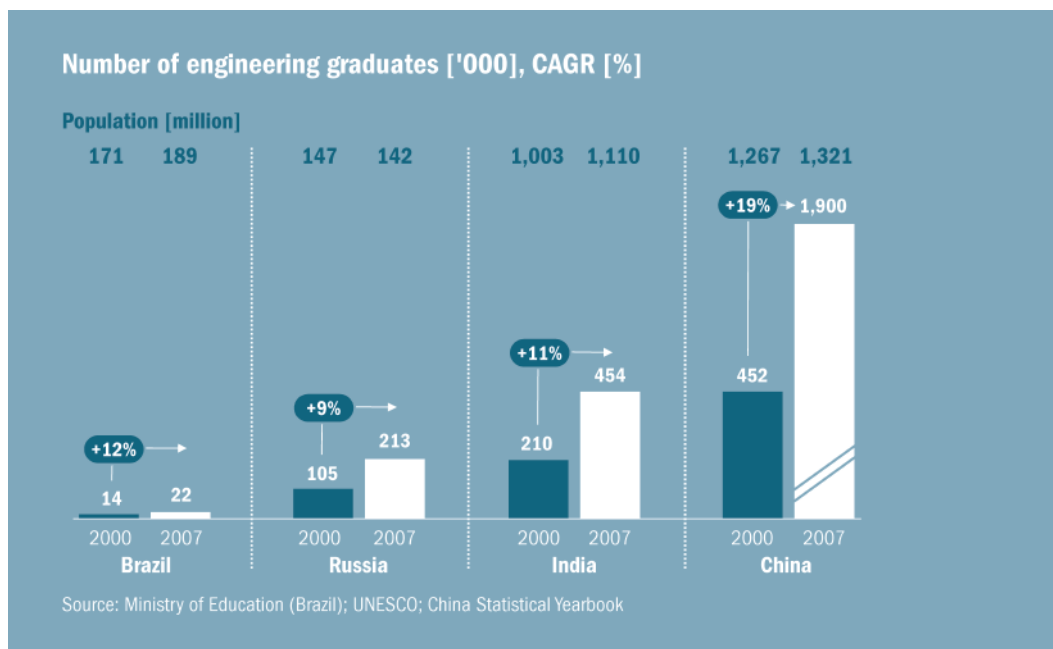
By contrast, Chinese companies – whether state-owned or private – rarely have the means or patience to conduct basic or applied research. This situation is also seen in automotive companies, where designs are commonly brought in by foreign joint venture partners free of charge. The resulting framework for low-cost innovation in China will be analyzed later on.

### **Talent pool: A core prerequisite for innovation**

Funding can only realize its potential when there is sufficient talent to turn knowledge into a source of growth. For this reason, the following section includes an overview of engineering and science graduates in BRIC countries. This is the talent pool available to develop new technologies, processes and products in automotive applications.

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In Brazil, the number of engineering graduates grew by only 5% on average (CAGR) during the period 2000-2007. Even though electrical/electronic engineers constitute the largest segment of engineering graduates, only about 5% of all students study engineering.

In Russia, 35% of all graduates receive degrees in electrical/electronics engineering and IT. This shows the potential of this knowledge-based society, which is still in the process of transitioning from the former system to a market-based economy. It should be noted, however, that only 40% of engineering graduates actually work in their profession.

India's engineering talent pool has risen steadily, with a cumulative average growth rate of 11% in the period from 2000-2007. Remarkably, about one-third of engineering graduates are in the field of IT, while a large portion of the others are in traditional fields such as mechanical and civil engineering. Approximately 150 Fortune 500 companies operate offshore R&D centers in India -

for example, Ford and Daimler in the auto industry. This demonstrates the depth of India's IT talent pool.

In China, the number of engineering graduates rose to more than 1.8 million per annum in 2007. An interesting fact is that more than half graduated in fields related to electrical/electronic engineering & IT, according to the China Educational Statistics Yearbook.

## II. Approach to R&D and innovation in the auto industry in BRIC countries

The following section describes the auto industry environment in BRIC countries, as well as key trends and technological developments that are unique to the auto industries of the respective countries. The focus is on the passenger car segment only. The analysis will address innovation modalities, the structure of research and advanced engineering of domestic car companies and the related supply industry.



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### 3. Proximity to market facilitates local product adaptations

A local engineering hub is usually developed with a sourcing support office. A local hub allows for a better understanding of local market requirements and also facilitates evaluation of local products in their respective target market. Activities range from simple product adaptations to complete development of vehicles for local markets. Such development might include not only changes in design, but also de-contenting to compete with local players.

### 4. Offshoring non-core engineering services takes advantage of low labor costs and local talent pools

Offshoring non-core engineering services not only saves money, but also makes use of a local talent pool. Non-core engineering services include, for example, CAD design and computer software programming, which are often done in offshore centers in India. Offshoring of such activities is beneficial because the labor pool for some of these jobs has become scarce in developed industrial nations. Capacity utilization may be challenging, since demand for such specific development items may vary when only one customer is supplied.

### 5. Local R&D hub as part of an international R&D organization

Local sources supply not only local markets but also international markets. Similarly, R&D hubs may serve as an integral part of an international R&D organization, handling the development of an entire module or system. For example, they may be responsible for the dashboard or for the interior panels. A local R&D hub is the most promising type of offshore R&D in terms of cost benefits. However, it is also the most challenging for traditional companies, because top management must initiate organizational changes in order to fully exploit all benefits. Some OEMs may choose to establish a local R&D hub through their tier-1 suppliers.

### 6. Research collaboration promotes new technologies that shape future markets

Providing incentives for new energy vehicles has been a major part of public policy in BRIC countries. Although emission and safety regulations have lagged behind international benchmarks, they are expected to move towards conformity in the future. This explains why some players have started to use technology demonstration fleets and have initiated research collaboration with universities: they not only want to gain an understanding of future market developments, but also hope to shape public policy development.

In the following, we will introduce case studies reflecting specific case examples for each country.

#### II.1. Brazil lacks local OEMs, but still hosts local automotive engineering operations

In Brazil, the automotive market is totally dependent on foreign players, who operate local production facilities for both local distribution and export. These operations include both manufacturing and assembly of vehicles and engines. While some parts are procured from local sources, the government does not impose any policy requirements in this regard.

VW is the biggest producer of passenger cars in Brazil, while Fiat has the highest domestic sales. Some OEMs such as Daimler concentrate their efforts on local production for export only.

#### Auto industry players in Brazil focus on bio-ethanol-fueled transportation

During the 1970s, the Brazilian government decided to reduce dependence on oil by investing in technologies based on bio-ethanol. The effect of this policy is clearly seen in the number of bio-fuel refineries that have been built in recent years, bolstered by public and private funding. VW was the first to introduce a viable technical solution for cars, when it launched its first commercial flex-fuel vehicle in 2003. Since then, almost every model introduced by VW is designed to use flex fuels.

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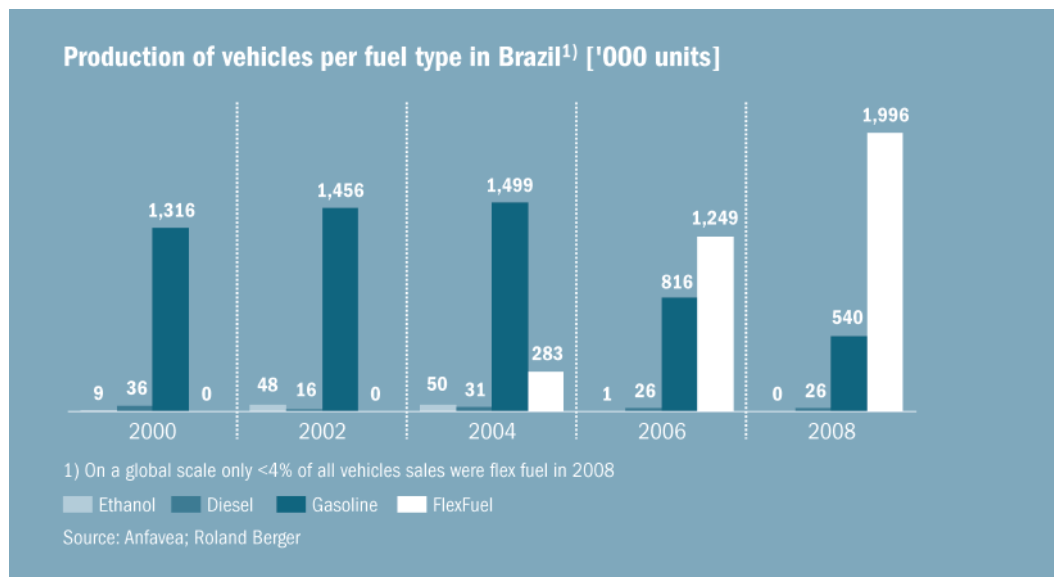
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Fiat developed the Siena Tetra flex fuel car together with Magnetti Marelli. This car runs on 100% gasoline or 100% bio-ethanol, or on any mixture of bio-ethanol and gasoline, or on 100% natural gas – depending on the user's choice. The following chart illustrates the growth in flex fuel vehicles in Brazil.

Looking at the industry sector, although most companies rely on knowledge transfer, some include their Brazilian engineering facilities in their global strategy. The effect of strong public funding in Brazil – referred to as **policy-driven research** – is seen in the penetration of bio-ethanol and related technical solutions. No other specific approach to innovation is found in Brazil. Nevertheless, there have been some cases in which R&D for new products has been done with the entire development chain in Brazil. In such cases, some concept engineering has included local competence centers and technology centers that have come up with new technology such as the flex fuel engine.

This has occurred in companies like companies like Bosch, Magna Marelli, Renault, GM, and VW. The following examples support this statement:

- > VW Brazil developed the "Tupi" project – later called "Fox" – an international platform for a small car that is now available worldwide
- > Brazilian engineers working for VW developed the Gol, the best-selling Brazilian car for almost 20 years in a row. This model is also exported to China
- > GM operates part of its global engineering activities in the center part of its São Caetano plant. There, 2,500 engineers are fully dedicated to developing new products such as the Opel/Saturn Astra (in Brazil, the same vehicle is called the GM Vectra GT)



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### II.2. Russia

Between 2001 and 2008, foreign players (VW, Toyota, Ford, Hyundai, GM) entered Russia for local assembly activities. These activities have mainly consisted of CKD plants, since the critical mass to localize has not yet been reached. Considering that 80-85% of all components are used by local producers, international OEMs have no choice but to concentrate on local assembly only. The R&D activities of international players remain outside of Russia, with little transfer of technology to Russia's plants. GM is an exception: its Chevy Niva is a product resulting from R&D activities jointly undertaken with AvtoVAZ. Some other international players also have research monitoring offices in Moscow to keep an eye on developing trends.

#### **Local players are still operating with about 75% of the value chain in-house**

Local players include AvtoVAZ, GAZ and Sollers, for example. The total market of locally produced vehicles was 53% in 2008. In other words, Russia is a big market for importers, with less interest in local brands. This has not always been the case. Under the old Soviet Union, local OEMs enjoyed a monopoly. Since the early 1990s, however, this situation has changed, leaving local OEMs behind. Today they still offer mostly outdated products and still use outdated manufacturing techniques. This leaves up to 75% of the value chain in-house. The low-cost cars of new entrants from China and India make it hard for local OEMs to compete in this segment. Today, there are roughly 250 cars per 1,000 capita in Russia, with further growth to come. The current economic crisis, which has resulted in a drop of imports, is expected to be over by 2011.

The R&D system for local players is mainly government-driven, with many research institutions and universities involved. This system is not efficient enough so far to turn knowledge into serious products that are sufficiently innovative to compete with foreign manufacturers.

The only way for local players to innovate is by getting into partnerships with foreign players – as occurred, for example, when Renault acquired a 25% stake in AvtoVAZ.

Local suppliers face the same issues when it comes to modernizing their product range. Some international suppliers are now starting to be active in Russia. MAGNA, for example, established a technical center with approximately 15 engineers in the automotive cluster near Nizhny Novgorod to support initiatives with its GAZ alliance. However, that alliance is currently in question.

### II.3. India's OEMs have their own approaches to innovation

Automobile production in India has grown at a rate of 9.4% cumulative average growth since 2002. The volume reached in 2008 was 1.3 million units in the passenger car segment. This is still small compared to China, but the potential is huge.

Meanwhile, the Indian automobile industry has begun exporting to other countries. So far, only Hyundai, Maruti, Ford and Tata are exporting passenger cars. Roughly 50% of all exported vehicles are Hyundais. This can be explained by the fact that India is an integral part of Hyundai's globalization plan and is an export hub for compact cars.

#### **The development of the Indian automobile industry dates back to the early 50s**

During the period 1983-1993, there was only one foreign entrant: Suzuki was permitted in as the result of a joint venture, Maruti Suzuki. With the further relaxation of investment restrictions in the early 1990s, foreign OEMs started to build their own manufacturing bases in India. Among others, these OEMs include GM, Daewoo, Volvo, Skoda, Daimler, Hyundai, Ford, BMW, Volkswagen, Nissan, Renault, and Hyundai. Unlike the situation in China, direct foreign investments in India are automatically approved these days, with no investment minimum. Also, there is no policy on joint ventures, which is why most of the foreign players choose to retain 100% ownership of all operations. Only Ford, Renault-Nissan, Toyota and Honda operate within joint ventures, and Renault-Nissan is the only one that does not have majority stake.

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Furthermore, there are no minimum requirements for local content and no export obligations. Also, Indian auto parts manufacturers have reached the level of quality required for export. The overall volume of auto components made in India has reached USD 18 Bn, with a CAGR of 23% since 2002. India's share of the segment is still highly concentrated in traditional or conventional auto components with a high level of mechanical parts.

Automotive R&D is driven by **public-private partnerships** such as the Core Group on Automotive R&D (CAR) and the Automotive Research Association of India (ARAI). These groups bring together domestic and global players for the purpose of conducting joint research on future technology. These activities have led to products such as the bio-fuels that are extracted from jatropha seed oil and hydrogen/compressed natural gas blends. These "HCNC blends" make better use of this precious energy carrier in conventional combustion engines. When used in modified CNG vehicles, they result in further reduction of emissions.

The following section describes three core elements of the way Indian local automotive players approach automation:

**1. Coopetition**, a cooperative type of competition referred to as "fraternity building," is an approach similar to open-source architecture: OEMs engage suppliers who provide intellectual capital in support of development projects at little or no cost. For example, Hero Honda Motorcycles has managed to persuade their dealers to invest capital in component plants and dealerships.

**2. Indigenous** innovation is an approach that delivers consumer value along the product lifecycle. Technology, product and service features that support a brand do not necessarily need to come from the OEM itself. At the same time, OEM lifecycle costs are reduced by using the service skills of independent roadside mechanics with low-cost garages, for example.

Or an OEM might use spare parts businesses that do not necessarily source through original equipment suppliers (OESs). In another example, Tata shifted the assembly of mirrors, wipers and other accessories from production sites to dealerships. This allowed Tata to benefit from the dealerships' advantageous cost structure.

To sum up, Tata, Mahindra and others have consistently managed to innovate processes, and have leveraged the savings to benefit end customers.

**3. Institution-building approach** is a way to turn a firm's external environment into a competitive advantage. Tata has achieved this by creating social infrastructure around company locations. By building infrastructure such as schools and medical facilities, Tata has created a partnership with the community. As a result, employees and the local workforce are loyal, committed AND cheaper from the perspective of the total cost of operations.

In another approach observed, similar to the one taken by Apple, Mahindra is providing computers to schools free of charge. Mahindra is also building driving schools in India, to foster a new customer base in a country with mostly first-time buyers.



Source: Tata Motors

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These approaches are often disregarded by global players, who come to India with their traditional processes and a mindset that is not open to innovation. The Nano is just one example of how Indian's car industry has leveraged the principles described. With this product, Tata uses its engineering hub in Coventry, UK, to transfer technology to the main R&D center in India. There, 75% of the development activities are completed. This combination helps to keep R&D costs extremely low.

The approaches by local Indian and Chinese OEMs are similar with respect to sharing expertise with other companies and the utilization of a large number of suppliers and development providers. On the other hand, Indian OEMs' approach to integrating partners and suppliers having a very close relationship throughout the entire vehicle development process is more distinct as compared to Chinese players.

### II.4. China disrupts global value chains with low-cost innovations

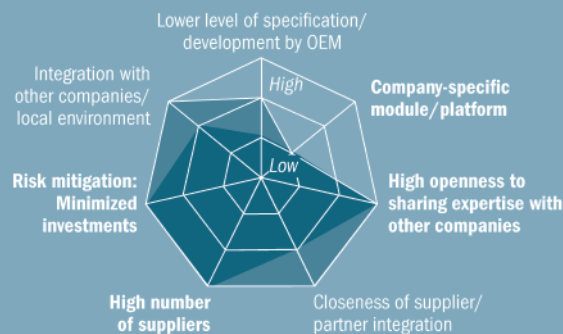
Since the opening up of the Chinese market, automobile sales and production there have experienced double-digit growth. Having overtaken Japan, China has leapt to second place behind the US and is now the second-biggest automotive market in the world. In 2008, passenger car sales only comprised 5,326,308 units. Foreign players have been present for more than 20 years (VW being the first to enter in 1985). However, there are many requirements that make China different from other BRIC markets.

For example, foreign OEMs can only produce vehicles in a joint venture operation in which their stake does not exceed 50%. Another auto industry policy is that key systems must each have 40% local content in order to qualify for a reduced import tariff of about 10% for the remaining parts. Otherwise, imported parts are subject to a 25% tariff just like completely build-up vehicles (CBUs) when imported to China. While many expect those requirements to be abolished because of WTO obligations, they still exist at the current time.

### Comparison of Chinese and Indian OEMs': Approaches to automotive R&D

1. Chinese OEMs: "Clone, Plug & Play"

2. Indian OEMs: "Competition & Open Source Innovation"



Source: Roland Berger; Edica-Intrim

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As a result, foreign players are forced to invest in the development of local suppliers in order to obtain parts for their local production facilities. VW in particular has benefited greatly from its joint ventures with FAW and SAIC and has maintained its market leadership with a 17.4% share of the market in 2008.

### **Local players are starting to unleash their potential in research**

Local OEMs that were originally organized as state-owned enterprises (SOEs) have gained technology through Sino-foreign joint venture operations. SAIC, FAW, and BAIC are examples of this kind of technology transfer. More recently, purely private players such as Geely, Cherry and BYD have made progress in technology development. Observations at motor shows in China indicate that intellectual property rights infringements are still occurring. Until 1980, knowledge and inventions were transferred for free from academia to state-owned companies. Universities and research institutions had sole responsibility for R&D and passed their results on to industry for manufacturing purposes or for transfer into products.

By contrast, public research programs, such as the "863 R&D Program", have now been initiated by the Ministry of Science & Technology. These programs, together with incentive policies, have led to the development of new energy vehicles. The most prominent beneficiary of these measures is BYD, which expects to revolutionize the car industry with its electric vehicles. This is only one example. China also plays a leading role in the lithium-ion battery market. With a 22% market share, it is now second only to Japan. Lithium-ion batteries are a key component of electric powertrains.

### **Disruptive innovation pattern: Cost innovations**

Disruptive patterns of innovation by Chinese players are well known in appliances, IT and the telecom industry. They have shown how local players can rise to influence global markets by providing innovative products at lower prices than global players would normally ask. Global players usually expect a premium when providing customers with additional features. A similar approach can be seen in the car business. Joint ventures get their original design from their foreign partners virtually for free. However, they have the advantage of local market intelligence, which allows them to innovate the product to suit local customer groups. In addition, Chinese suppliers can adopt foreign manufacturing equipment to fit their local manufacturing footprint. The large amount of manual processing in comparison to the automated processing of the western world allows Chinese manufacturers to capture cost benefits. In the auto industry segment of small cars with alternative powertrains such as electric drives, there are opportunities to use the power of low-cost innovation. It is expected that increasing numbers of innovative auto industry players will emerge to take advantage of these opportunities. Chery and Geely are good examples of players that have successfully used the tactic known as "clone, plug and play": While basing their designs on established products, they take advantage of China's low cost basis.



Source: Voltix

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### Innovation approaches by local OEMs in BRIC countries

<b>1</b>	<b>Policy-driven research</b>	> Public policy decides the direction of research trends and related innovation > Industry relatively weak compared to global benchmark and dependent on government direction and funding
<b>2</b>	<b>Low-cost innovation</b>	> Focus on cloned solutions that take advantage of low-cost manufacturing base > Existing solutions are adapted to suit low-cost manufacturing approach, providing superior value at a low price
<b>3</b>	<b>Cooperation</b>	> Cooperation with partners along the value chain encourages partners to help fund development costs in return for assured business
<b>4</b>	<b>Indigenous innovation</b>	> Leveraging process innovation along the value chain and with related partners delivers customer value
<b>5</b>	<b>Institution building</b>	> Building an environment outside the firm's strategic competitive environment helps lower costs and > Creates effective partnerships within society at large

### III. Summary of automotive innovation made in BRIC countries

This section provides a brief summary of the above findings regarding the innovative approaches of local players in BRIC countries. In addition, it includes recommendations to international OEMs on steps that can be taken to create international R&D and innovations in BRIC countries.

#### III.1. Approaches of local players threaten traditional OEM's

The following chart provides an overview of the identified approaches taken by domestic players in BRIC countries with respect to R&D and innovation.

To sum up, what have been described above are disruptive patterns that are shattering traditional notions about value: China and India are providing customer value at low prices instead of charging a premium.

This strategy, when combined with large market volumes and environments with a vast number of first-time buyers, is making it possible for domestic players to grow. Eventually it will allow them acquire a presence in mature markets as well.

However, international OEMs can also participate in the advantages of emerging markets, specifically in the area of R&D. In defining their strategy for offshoring, they must think beyond just manufacturing.

#### III.2. Suggestions as to how international auto industry players can approach R&D in BRIC countries

Many things need to be considered when setting up a global network of development centers, research hubs, and support offices for sourcing and localization. Most of the time, the process begins by identifying the core and non-core capabilities of an OEM. The answer will likely determine what kinds of things are transferred around the globe.

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Outsourcing of engineering started more than 40 years ago and has evolved ever since. Realizing the potentials of such outsourcing in an emerging market has many benefits such as consolidation within the supply base. These benefits may include production of complete systems/modules, optimization of capacity utilization and management (instead of investment) of working capital (make or buy).

Some OEMs have begun to outsource engineering in the field of niche variants. For example, they might use a system supplier to develop and manufacture various seat variants in India or they might use offshore research bases to draw up CAD designs.

And now for the prime motivation for R&D offshoring: Proximity to the market, proximity to talent, and lower cost factors, which are crucial for local product adaptation and for development of complete offshore modules. Offshore modules for global sourcing, together with the lower price of parts themselves, reduce development costs. Examples of offshore modules range from engine calibration to adaptations of navigation and infotainment systems to suit local market conditions.

### **Talent sourcing in qualitative terms**

When it comes to talent-sourcing, the number of engineering graduates may not be an adequate indicator for assessing the knowledge potential. For example, in China only a small portion of engineering graduates can meet the requirements of international companies. In regard to China, one thing that must be considered are English skills, which are obviously less developed than in India, where English is a national language.

Once they are recruited, the local engineering teams need to be trusted and integrated into the global R&D network. In many cases this is the most challenging task for foreign players, who are generally afraid of a knowledge drain. However, the most effective way to get on top of local trends, behaviors, needs and requirements is to give local engineers a voice in the overall organization.

### **"Markets that do not exist cannot be analyzed" – Not true!**

This statement is untrue when it comes to automotive markets in BRIC countries. Indeed, the long term success of an offshore engineering center greatly depends on the size and growth potential of both the local market and the region. This can be explained by the fact that developers who live among their target customers have much better insights into local behaviors. In addition, the interface between suppliers and the local OEM can be much better managed.

### **Using cost advantages to compete with domestic players**

In regard to HR cost advantages, it should be noted that annual working hours may differ up to 30% in emerging markets and specific offshore locations. Also, corporate taxation may differ. R&D costs are subsidized or tax-deductible in some cases, depending on the foreign player's activities in that specific country. In some cases, the only way that companies can compete with local players is by allowing complementary R&D strategies: one for high-end products in developed markets, and one for dedicated products in domestic segments for emerging market penetration.

### **Framework of operation**

Intellectual property rights are a key consideration when it comes to deciding what kind of R&D activities should be transferred out of the original R&D department. Some technologies may be critical and should be kept at the R&D headquarters. This results in an approach in which technology requiring less know-how and previous generation production volume experience an extended lifecycle offshore. For example, recent platforms or engine technologies might be transferred offshore. What is crucial for reducing the risk of intellectual property rights violation is retention and promotion of core R&D staff members. This is often neglected by international players who enter BRIC countries.

# AUTOMOTIVE INNOVATION MADE IN BRIC

## How the car industry is getting ready to revolutionize global markets

### **Core steps for successfully managing R&D activities in BRIC countries**

In recent years, both OEMs and suppliers have invested in a tremendous expansion of production capacity in China and India. This is mainly due to the desire to exploit the labor cost advantage when competing in local markets. Many suppliers fund manufacturing activities in offshore locations by using those hubs for both local and global demands. In doing so, they employ the economies of scale and also adapt manufacturing processes. In many cases, OEMs may have difficulty achieving a true cost benefit when they focus purely on their traditional tier-1 suppliers, which have moved to BRIC countries as well. Often, true cost benefits can be achieved by using purely local suppliers. The following recommendations are made to international players who would like to exploit these opportunities in order to take advantage of engineering cost benefits while also fitting the product scope to local needs:

1. Analyze local market requirements and identify the products and scope of items that need to be adapted to local market needs
2. Investigate whether the identified topics for local engineering are a good fit for the local talent pool, regulatory framework, resources and global R&D matrix
3. Seek to achieve true cost benefits by teaming up with local partners and strengthening the local management team
4. Ensure proper interfaces in the global R&D network to maximize efficiency

To sum up, global players can achieve tremendous cost savings by globalizing R&D and transferring activities offshore.

### **Reducing engineering costs by offshoring in BRIC countries is the next step in localization. In this case, localization of engineering enlarges the scope beyond just sourcing.**

At the same time, proximity to market and talent are the key to understanding local market needs and adapting products to meet the expectations of newly evolving target groups.

With products that meet local market needs international players will be able to compete with domestic players whose own approaches to innovation are disrupting traditional market share distributions.

The next step is to consider emerging markets as a source of innovation – for example, by looking at the vast pool of electric vehicle components that are available in China.

# AUTOMOTIVE INNOVATION MADE IN BRIC

## How the car industry is getting ready to revolutionize global markets



**Dr. Clive Hickman, CTO Tata Motors interviewed by Dr. Wolfgang Bernhart, Partner, Roland Berger Strategy Consultants**

**Background:** Recent years have shown a tremendous rise in vehicle sales in BRIC countries, particularly in China, currently the second largest vehicle market in the world. Many local players have emerged in China, India and Russia, often still using conventional technologies. However, the current trend is to go global: entering global markets while at the same time meeting global standards and customer requirements. This accompanies an ongoing consolidation of many small OEMs in BRIC countries, eventually leading to a few strong players that are able to compete on a global scale. Doing so requires the capability to innovate. Our special insight on "Automotive innovation made in BRIC" aims to outline how the car industry in those countries is getting ready to revolutionize global markets by taking their own approach on innovation and developing their own solutions to global automotive needs. With the recent introduction of the Nano, Tata Motors is a prominent example of a rising star in automotive when it comes to innovation and global competitiveness from BRIC countries. The following interview explores this phenomenon in more detail.

### **How is the financial crisis impacting the Indian automotive industry, and what is your forecast of the industry's future growth?**

"Of course, the Indian automotive industry is similar to the rest of the world in terms of being affected by the financial crisis, just maybe to a lesser extent. Unfortunately though, the non-availability of bank financing impacts people's ability to buy capital goods even though people are able to pay back loans. Nevertheless, I believe the Indian automotive sector is expecting 5-7% growth for the coming fiscal year."

### **Could you give us a brief overview of the research & engineering facilities and activities of your company and how the financial crisis has impacted these activities?**

"Tata Motors has a full suite of R&D facilities comparable to that of many OEMs in Europe, and we conduct research and engineering in the same way that European companies do. Our facilities in India are supported by R&D centers in Korea and UK.

The center in Korea focuses on commercial vehicles, while our European R&D hub in Coventry, UK supports R&D for both passenger cars and commercial vehicles and is fully integrated into the R&D center in Pune, India. The UK center helps us transfer high-end technologies to India and continue product development there at a significantly lower cost, making product innovations like the Nano possible. With regards to the financial crisis, R&D spending must continue even if other activities have to be postponed. New products are our lifeblood."

### **What is the R&D vision of your company and are you tackling fossil fuel dependency and emission reduction?**

"Our R&D vision is: think big and innovate. The cost of fossil fuels in India relative to Europe means that a clear focus for our R&D is to reduce fuel consumption. Hence, electric vehicles are high on our product development list. We demonstrated this at the recent Geneva Motor Show where we presented a Indica Vista EV."

### **Are there any possible research partners such as universities, research institutions, suppliers or other OEMs? How do you protect intellectual property within such a cooperative relationship?**

"Yes, many cooperative public-private partnerships exist. Examples include the Core Group on Automotive R&D (CAR) and the Automotive Research Association of India (ARAI). These groups bring together other domestic and global players in addition to Tata for the purpose of conducting joint research on future technology. In such cases we protect intellectual property in the same way as European companies protect their innovation – e.g. with patent filings or design protection."

### **How do you ensure innovation development at Tata in India? Are there specific processes, incentives or a systematic approach to innovation?**

"It is not sensible to ask an engineer to innovate – how would he know where to start? The answer is to set a big challenge that will stimulate innovation. The Nano is a great example of this. Today, I think India is already a very innovative place to be. The engineers want to be successful and they have not become complacent like many of their competitors in Europe. What makes India unique in terms of innovation is the people's desire and strong will to succeed."

# AUTOMOTIVE INNOVATION MADE IN BRIC

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