

Automotive landscape 2025

Opportunities and challenges ahead

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Editorial

It's 2011. The financial crisis is over. Now is a good time to look to the future and start thinking about strategic issues again.

By strategic issues, we mean those that will kick in fifteen years from now – in automotive terms, in two to three lifecycles' time. What will the automotive landscape look like in 2025? How will the face of the automotive industry have changed? What megatrends will shape mobility in the years to come? And what will drive the success of future winners?

To find answers to these questions, we at Roland Berger Strategy Consultants and leading executive search company Amrop surveyed more than 60 leading automotive companies, organizations and experts from around the world. Our survey stretched from Sao Paolo to Detroit, from Tokyo to Frankfurt, from Brussels to Shanghai. We talked to automakers and suppliers as well as the companies that are currently (or will soon be) interfacing closely with the automotive industry – utilities, banks, research institutions and public-sector organizations.

The results? Although remaining a capital-intensive business model and thus limited in terms of margin growth, over the next 15 years the automotive sector will remain one of the most exciting places to be. The industry's center of gravity will shift, core technologies will change, new forms of organizational setup will emerge, employees will have to meet new requirements and new business models will develop. Fasten your seatbelts for an exhilarating ride.

We hope that this study will provide you with some valuable insights into the exciting journey ahead.



Ralf Kalmbach



Dr. Wolfgang Bernhart



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Dr. Marcus Hoffmann

Management summary

1. SHIFT TO ASIA

There will be a dramatic shift of sales & production capacity to Asia – regional trade blocs expected to grow, leading to shift toward low-cost locations. 300,000 jobs in Europe at risk

2. SMALL IS BEAUTIFUL

A/B segment to see disproportionately strong growth. At the same time extremely successful low-cost cars answer the rising demand for no-frills transportation – a global phenomenon

3. DEMOTORIZATION

Especially among younger people, the car loses its pole position in their emotional preferences – the motorization rate is decreasing in big cities, and by 2025 not just in mature industrial nations

4. POWERTRAIN ELECTRIFICATION

In the most positive of all cases, electric vehicles will account for ~10% of new vehicle sales by 2025, hybrids will reach 40% share – internal combustion engines will still account for 50%

5. ALWAYS ONLINE, ALWAYS CONNECTED

By 2025, many vehicles will be always online, sending and receiving information: Connectivity is a key factor – but intelligent traffic solutions will remain a vision well beyond 2025

6. NEW BUSINESS MODELS

Established players have to deal with low-cost challengers, technology challengers and the rise of new business models: mobility ecosystems incl. car sharing have to be taken seriously by 2025

7. LACK OF ENGINEERS & SPECIALISTS

Countries with aging populations are lacking in engineers & specialists, esp. when it comes to STEM subjects – OEMs/OESs cannot significantly increase their R&D departments abroad

8. "GLO/CAL" BUSINESS ORGANIZATIONS

Successful global players will move away from centralized organizations: global at a local level – in 2025 these companies will have a number of regional HQs to adjust & act fast locally

9. INDUSTRY FLEXIBILIZATION

The automotive industry needs to open up and be able to learn from other industries, e.g. IT, suppliers – it will be the most flexible businesses that survive

10. PROLIFERATION MEETS CONSOLIDATION

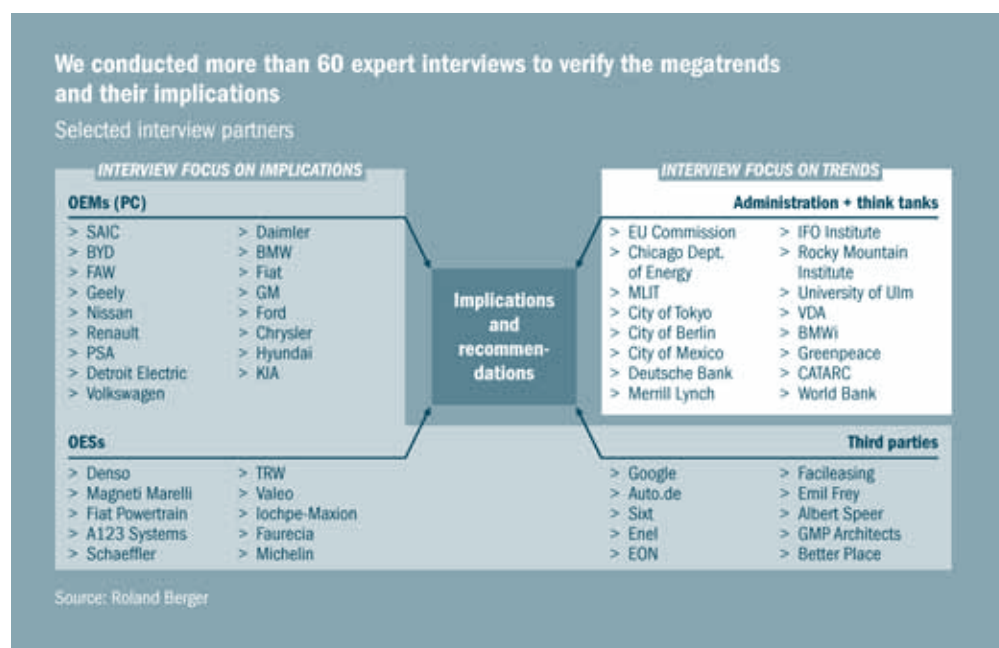
While the consolidation trend will continue among OESs, OEMs are likely to see a (re-) proliferation. New players, including those from outside the industry, will emerge

Introduction and background

What will the automotive landscape look like in 2025?

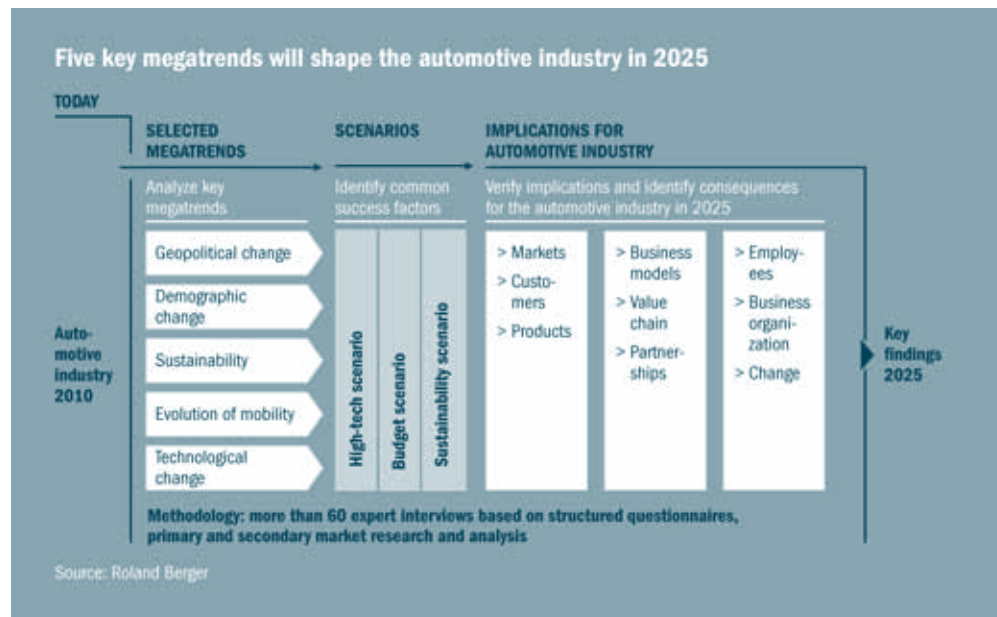
To answer this critical question, we took a highly comprehensive approach. We involved almost all the 39 Roland Berger Strategy Consultants offices around the globe over a full 12 months. We spoke to more than 60 leading experts in many different sectors and countries – from Sao Paulo to Detroit, from Tokyo to Frankfurt, from Brussels to Shanghai. We cross-questioned top people in the automotive industry (OEMs and OESs) as well as representatives of think tanks, government bodies and other third parties relevant for the automotive industry.

What did we ask them? That depended on who we were speaking to. With experts from public bodies and think tanks, we concentrated on megatrends – had we identified the most important trends? Had we understood them correctly? With executives from automotive companies and their partners, we focused on the implications of the megatrends. Our interviewees included representatives of SAIC, BMW, Denso, Faurecia, Google, EON – the list goes on.



We conducted the interviews in partnership with Amrop, a leading global executive search company. We joined forces with Amrop to ensure a broad perspective. It was essential that we didn't just examine the implications of megatrends on future products, markets and customers, but also their impact on the organizational structure of companies, requirements to be met by employees and on corporate culture as a whole. Furthermore, we needed to examine how the character of partnerships and business models will evolve as a consequence of the megatrends.

But we didn't limit ourselves to interviews. Our approach also included scenario analysis, primary and secondary market research and other analytical techniques. We summarize our insights into ten key findings that are presented in detail in the second half of this study. But first things first: let's look below at the five megatrends that we believe will shape the future of the automotive industry.

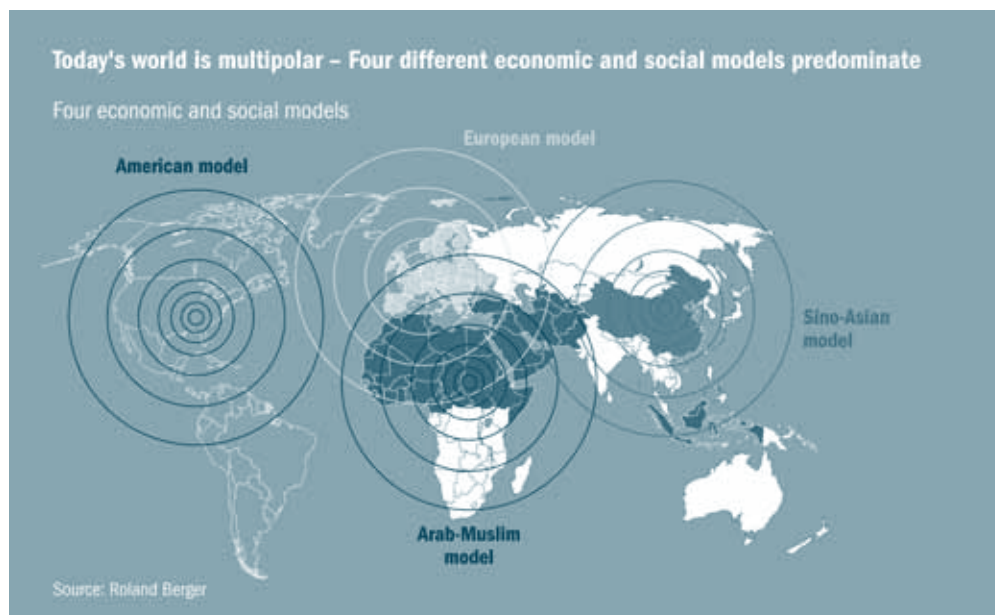


Five megatrends

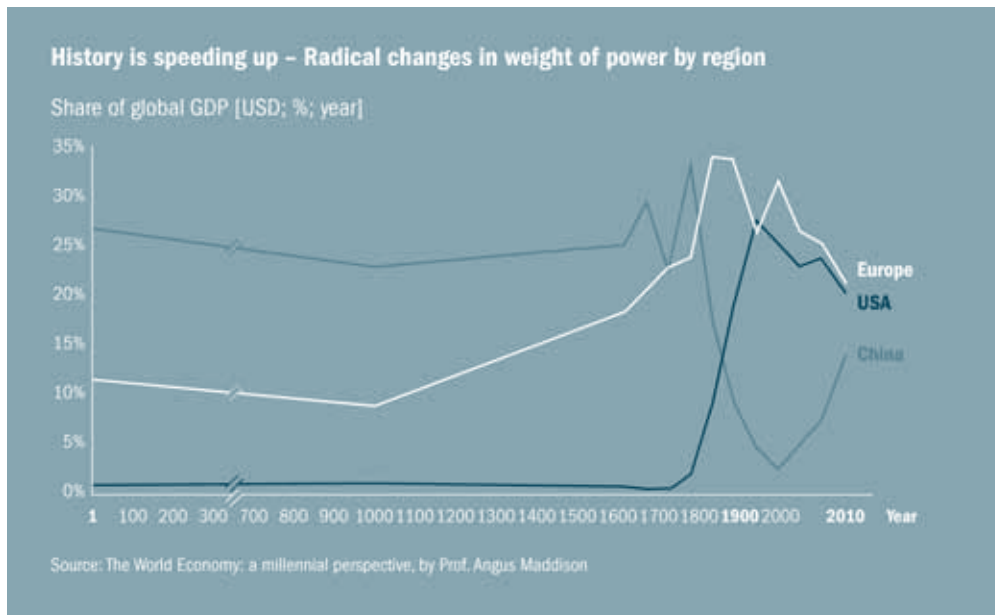
1. Geopolitical change: Asia will continue to grow stronger, regionalism will increase and regulations will support geopolitical interests

The distribution of power has evolved over time. For many centuries, the world order was shaped by influential city states such as Constantinople, Athens and Bruges. Later, transnational empires such as the British Empire or the Portuguese Empire called the shots. More recently, two major schools of thought dominated – Communism and the American Way.

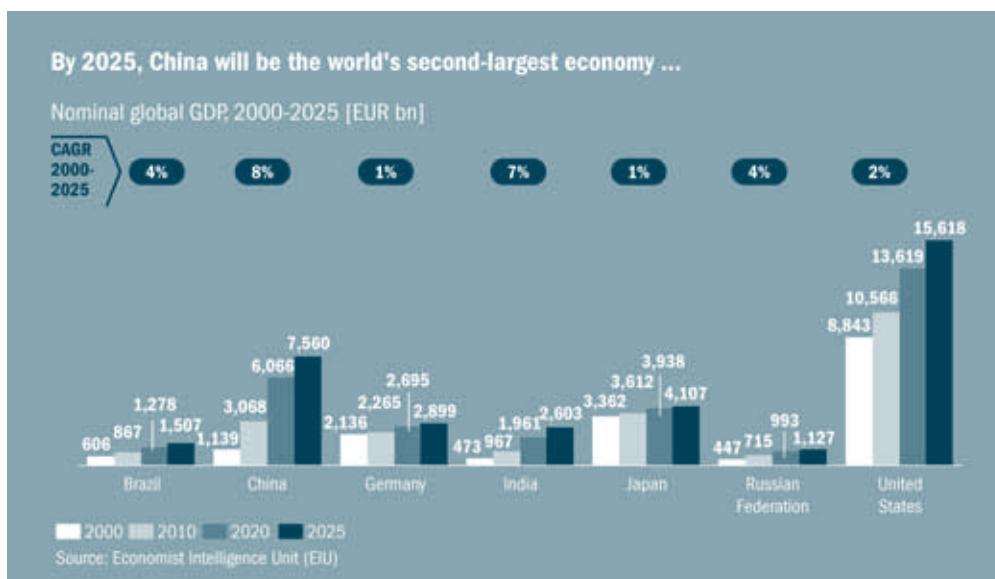
Today the world is multipolar again. Four different economic and social models predominate: the American model, the European model, the Arab-Muslim model and the Sino-Asian model.



The distribution of power and influence between these four models has changed over time, generally in line with the economic development of the regions in question. In terms of share of global GDP, Europe has always been influential and powerful. The United States grew in influence from 1800 onwards. More recently, the economic power and hence political importance of Europe and the US have declined. For many centuries, however, China had the highest share of global GDP, only relinquishing its position of strength between 1800 and 2000. Since 2000, China has experienced a breathtaking comeback with regard to economic and political power, reflected in its share of global GDP.



By 2025 China will be the world's second-largest economy in terms of purchasing power. The USA will remain in first place and India will come third. With an overall GDP growth rate of 8% annually, China is – and will remain – the fastest-growing of the BRIC and triad countries. India is the second-fastest-growing country, with a 7% annual growth rate. The US economy will still be the undisputed number one economy in 2025, with a GDP more than double the size of China's. By then, India will have nearly caught up with Germany in terms of GDP.



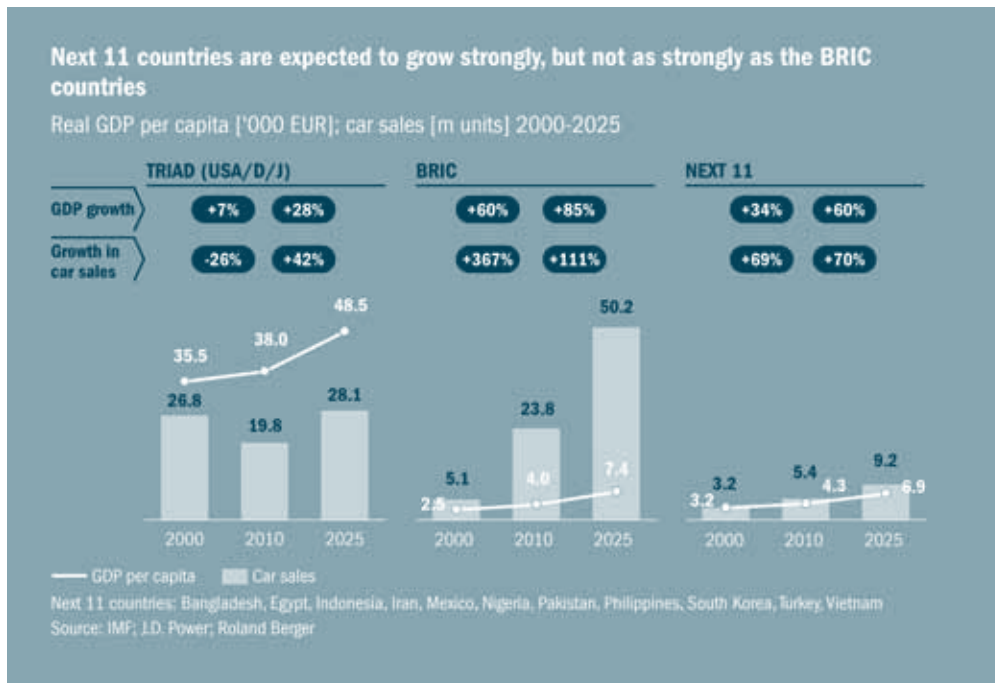
Although China will become the global number two economy, GDP per capita will still lag significantly behind that of triad markets due to the enormous size of its population. Even Russia is projected to stay ahead of China in terms of GDP per capita. The nation with the highest GDP per capita in 2025 will be the US.



In addition, there is a group of heterogeneous countries called the "next eleven" or N11. Because of their population size and growth rates, they could potentially join the group of biggest economies globally in the long term. Their growth in the last ten years was significantly higher than that of the triad countries with regard to both GDP per capita (34% compared to 7%) and car sales (69% compared to -26%). However, growth in BRIC countries was much higher.

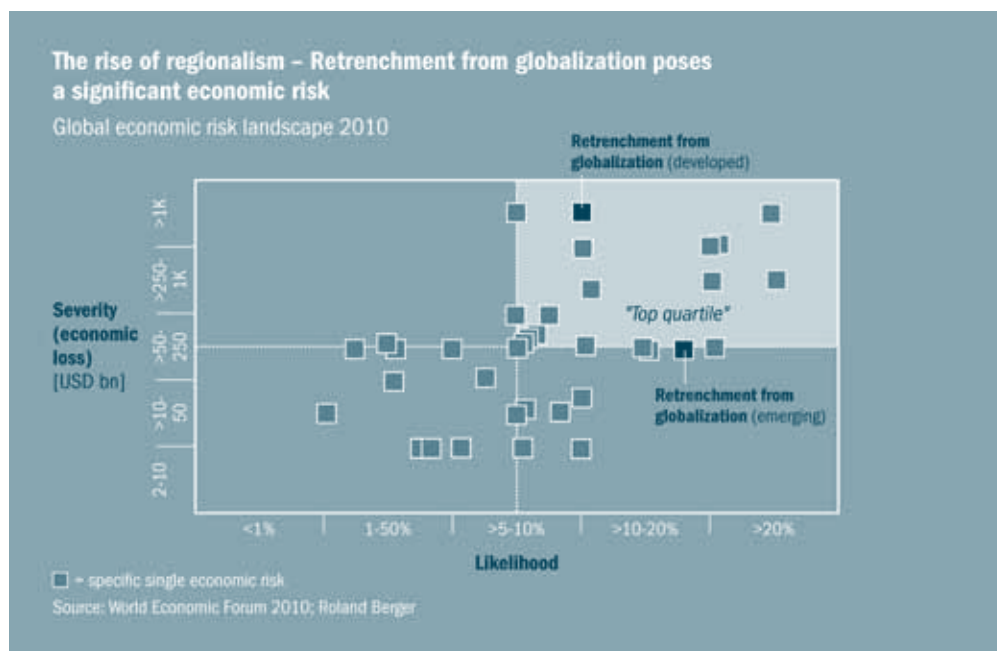
Looking ahead to 2025, the N11 will continue to outperform the triad countries. In GDP per capita growth, they will experience a 60% increase compared to 28% in the triad countries. Car sales are expected to rise 70% compared to just 42% in the triad countries. But the increase in the BRIC countries will again be much higher than in the triad and N11 countries, at a remarkable 111% in car sales and 85% in GDP per capita.

In terms of GDP per capita, the N11 are catching up with the BRIC nations, however. They are currently only 25 percentage points behind them, with a growth rate of 60%. Geopolitically the N11 will gain in importance and power as they represent a source of growth at a time when many developed nations are beginning to slow down.

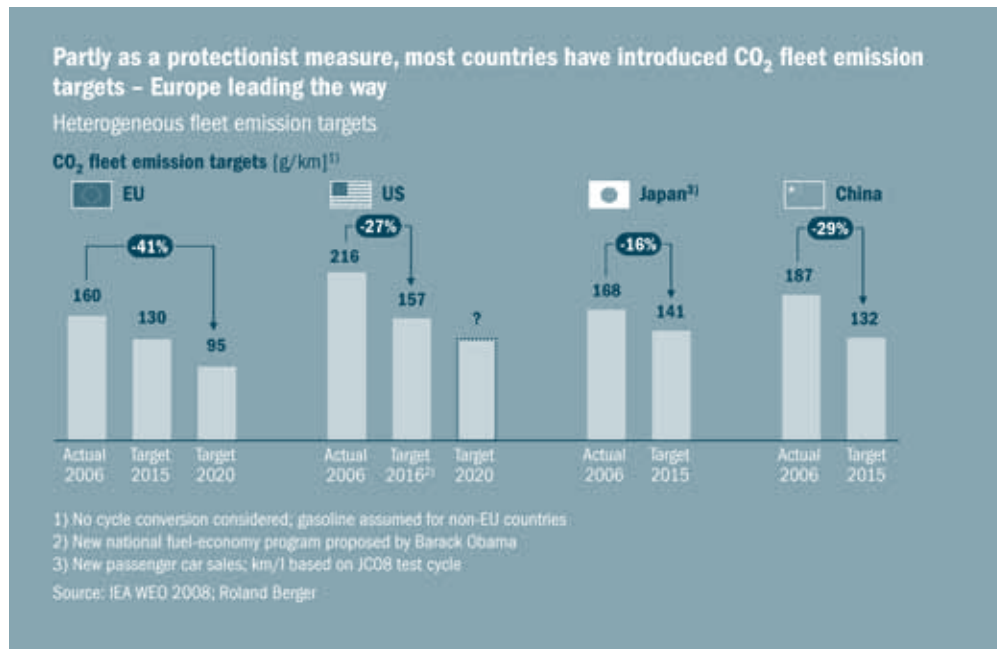


Regionalism is on the rise and bilateral trade relations are expected to become more important. Political institutions, free trade areas and development agencies are expected to grow at the regional level. Regional bodies and partnerships will increasingly challenge the power and legitimacy of international institutions such as the United Nations, World Bank and International Monetary Fund – especially where they are perceived as being biased toward the US or the West in general.

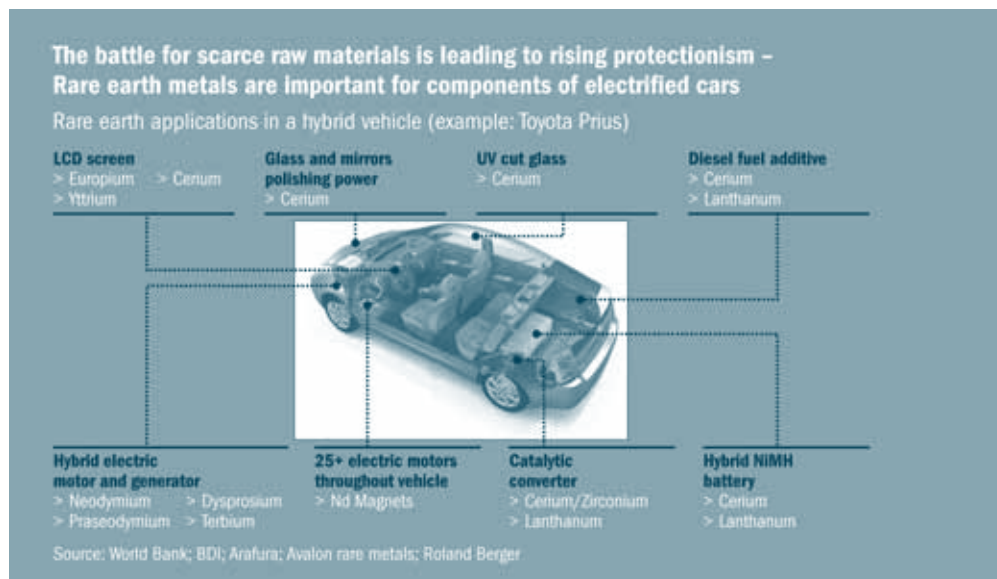
In the global risk landscape for 2010 produced by the World Economic Forum, the risk of retrenchment from globalization in developed countries is rated as having a maximum severity of economic impact and a more than medium likelihood. The risk of retrenchment from globalization in developing countries is rated as having only a medium economic impact, but a much higher likelihood. The highest overall risk in the global risk landscape is a global asset price collapse.



Governments are increasingly trying to influence conditions in the job-intensive automotive industry, using mechanisms such as loans, incentives and premiums. At the same time, protectionism is growing. Seventeen of the G20 countries have introduced protectionist measures since the financial crisis 2008/2009, distorting global trade in goods by an estimated USD 50 billion per year. Often this protectionism is disguised as environmental levies. One example is the CO₂ emission targets now operating in most countries. The targets vary strongly between the different political bodies and regions, and target fulfillment is often measured differently. This causes extra costs for non-domestic automotive players and favors domestic players.

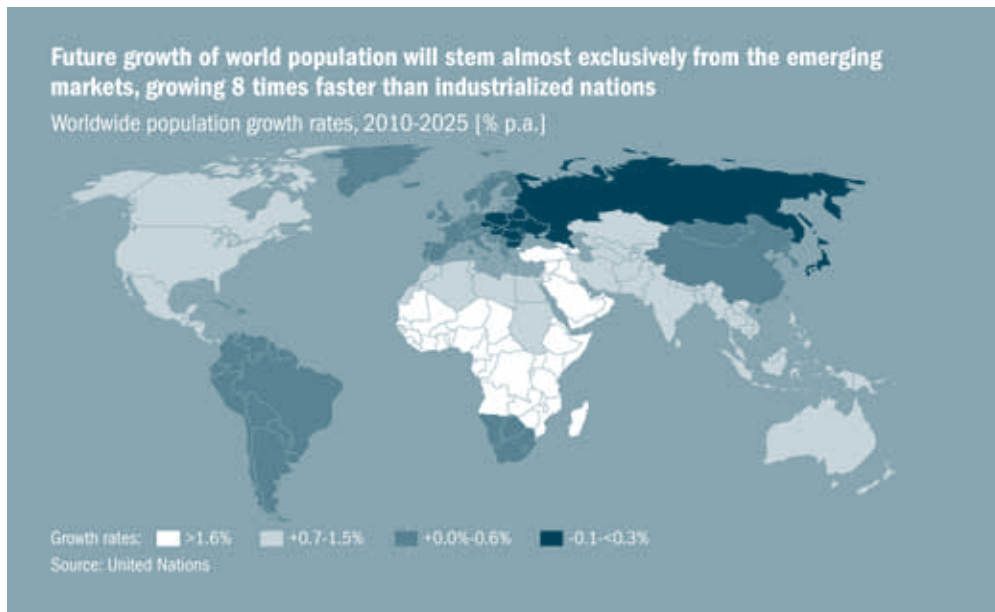


Access to raw materials could also become a strategic risk for the automotive industry. China controls 97% of the metals in the "rare earths" group, for example, and is said to have imposed strict export quotas. Rare earths are, despite their name, not really rare – extensive deposits exist around the globe, but facilities for mining them are lacking. Rare earths are needed to make components for a whole range of products, from hybrid vehicles, lasers, radar systems and satellites to cell phones and PCs. However, their most important use is the production of high-power, lightweight magnets for electric motors. Demand for rare earth metals is expected to exceed supply for several years until such time as sufficient production capacity has been created.

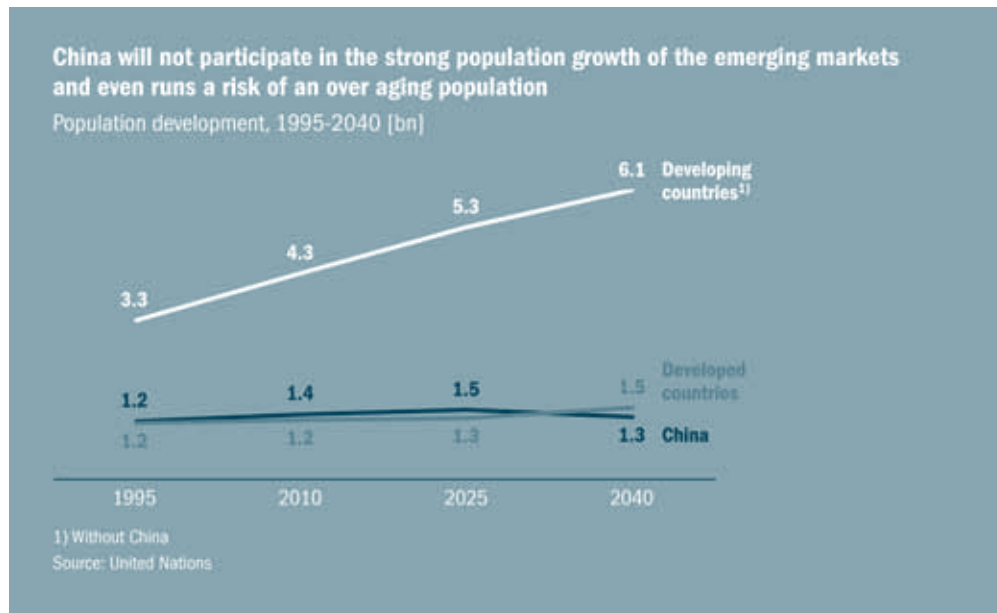


2. Changing demographics: More, older, urban

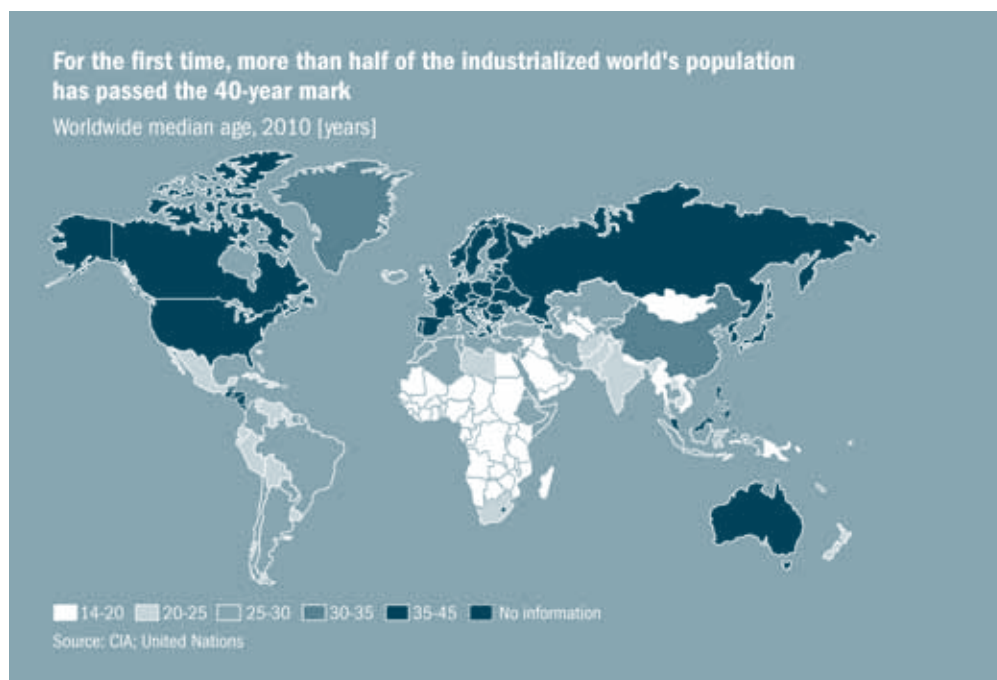
The world's population is set to balloon by another 1.1 billion people by 2025, reaching a total of eight billion. This population growth comes almost entirely from economies in transition, which are predicted to grow eight times as fast as in the industrialized nations. The strongest population growth in the coming 15 years is expected in Africa (36%) and the Middle East/Central Asia (19%). In 2025, as much as 84% of the global population will be located in emerging markets.



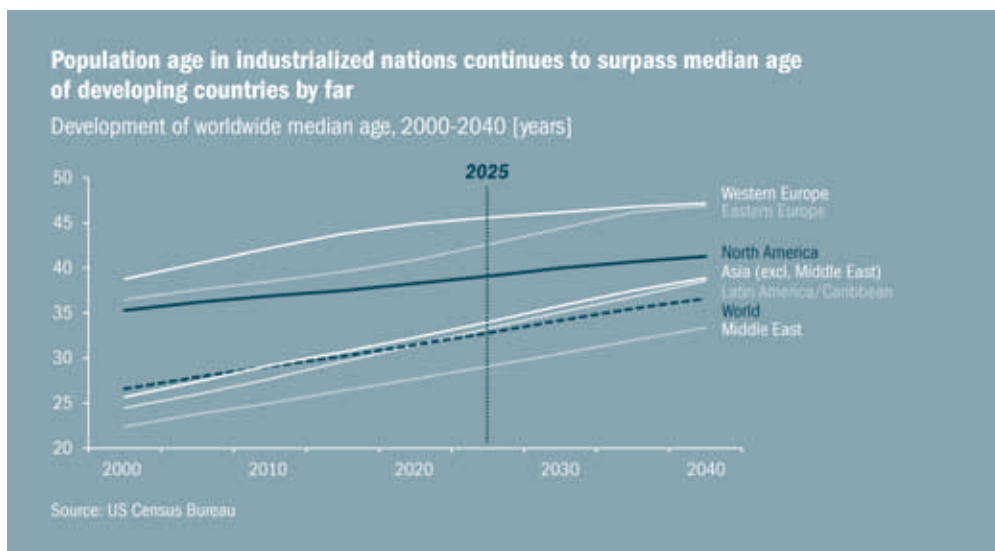
There is one major exception to this trend: China. Usually, emerging countries show growth rates of 1.5% to 2.5%, but China's population is expected to grow by just 0.5%. Indeed, due to its One Child policy, China will find its working population shrinking from 2015 onwards, and even runs the risk of going the same way as Japan since the 1970s. By 2030, the Chinese working population will already have fallen from 1 billion to 900 million.



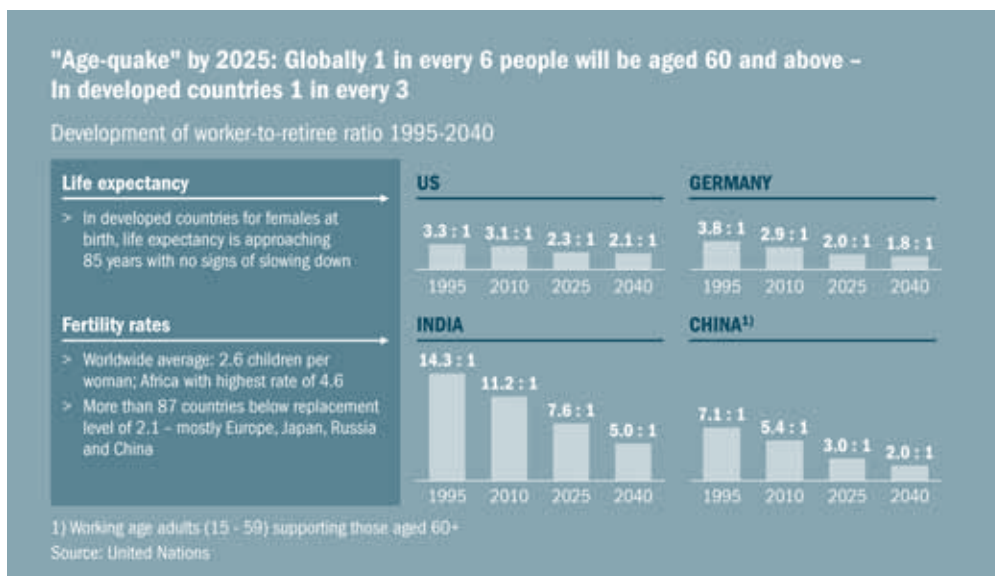
Due to increasing average life expectancy, the world's population is aging. More than half of the people in mature markets are already over 40 – significantly above the global median age of 29. Japan leads the industrialized countries with a median age of 45. The US is the youngest industrialized nation with a median age of just 37. The global trend toward aging populations is set to continue.



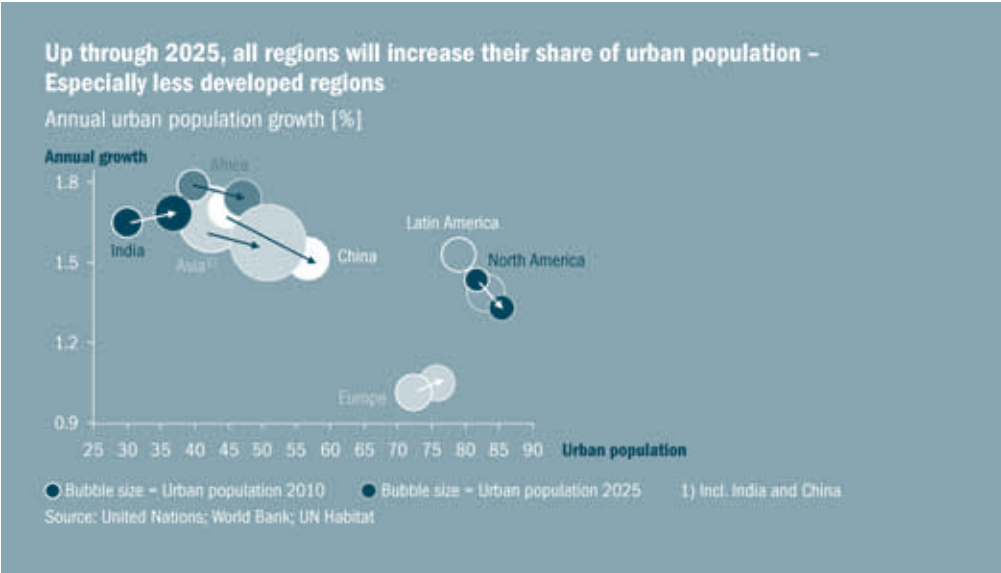
The median age will have risen to 33 by 2025 with ages in industrialized nations staying much higher than those of developing countries. In 2025 Japan is still expected to have the highest median age, at around 51, followed by Western Europe, at around 46. At just under 40, the US will remain an exception, helping to keep the median age in developed countries down at 43. The median age in emerging markets will stay at 31 – a full 12 years younger than in industrialized nations.



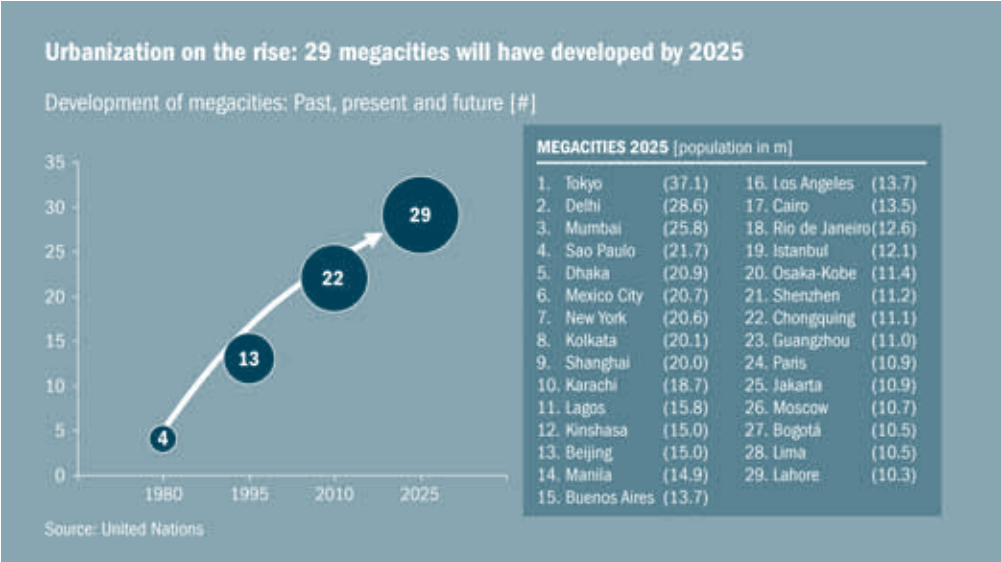
Currently 87 countries have a fertility rate below replacement level. Combined with increasing life expectancy, this may soon lead to a situation of over-aging. By 2025 one in six people worldwide will be aged 60 or over. In industrialized countries the ratio will be even more dramatic: no less than one in three people will have reached retirement age.



More and more people will be living in cities in the future. In the period to 2025, the share of the population living in cities will increase in all regions. The global average will be 57% in 2025, in industrialized nations 80%. North America will lead the way with 85%. In emerging countries, the urban population is expected to reach 52% of the total population, with India still under 37%.

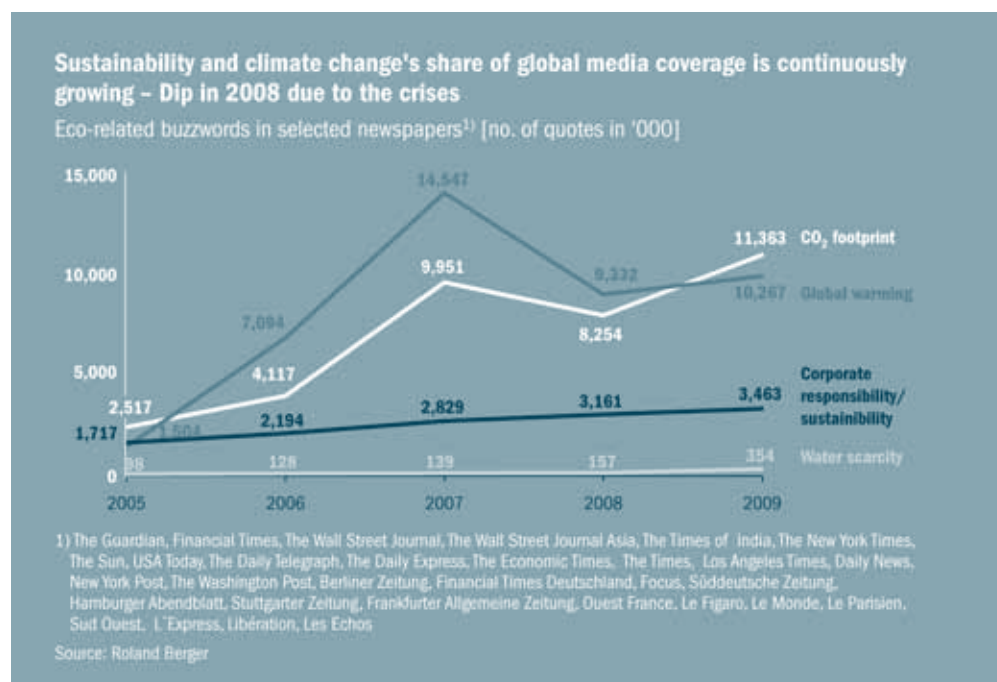


As the trend toward urbanization continues, the number of megacities (cities with a population of over 10 million) will rise from 22 to 29 by 2025. Eight of the ten largest megacities will be located in emerging markets. Only two – Tokyo and New York – will be in mature markets.

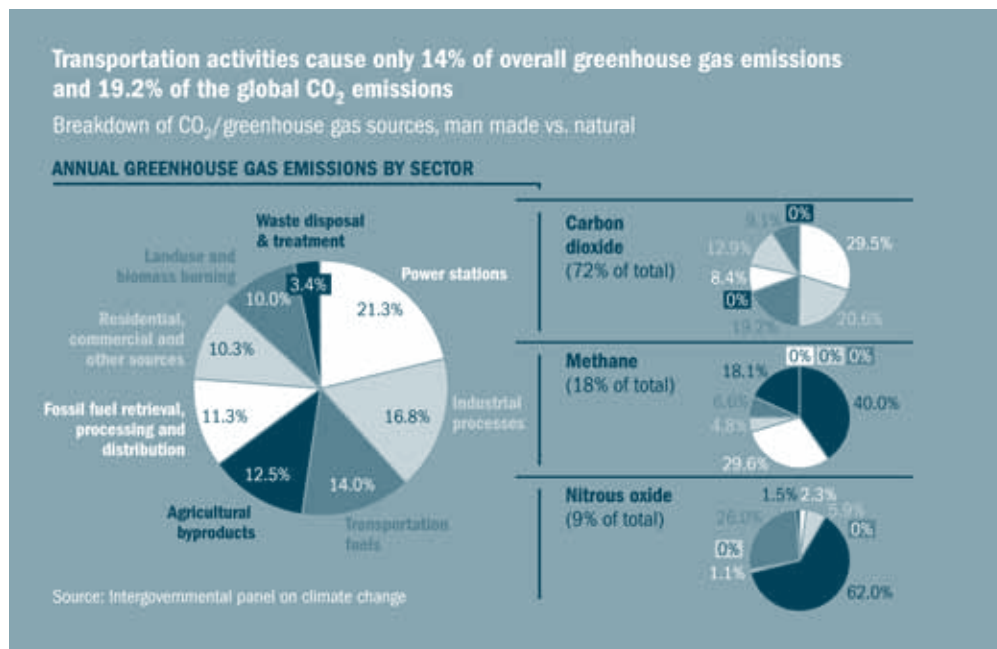


3. Sustainability: Environmental awareness on the rise

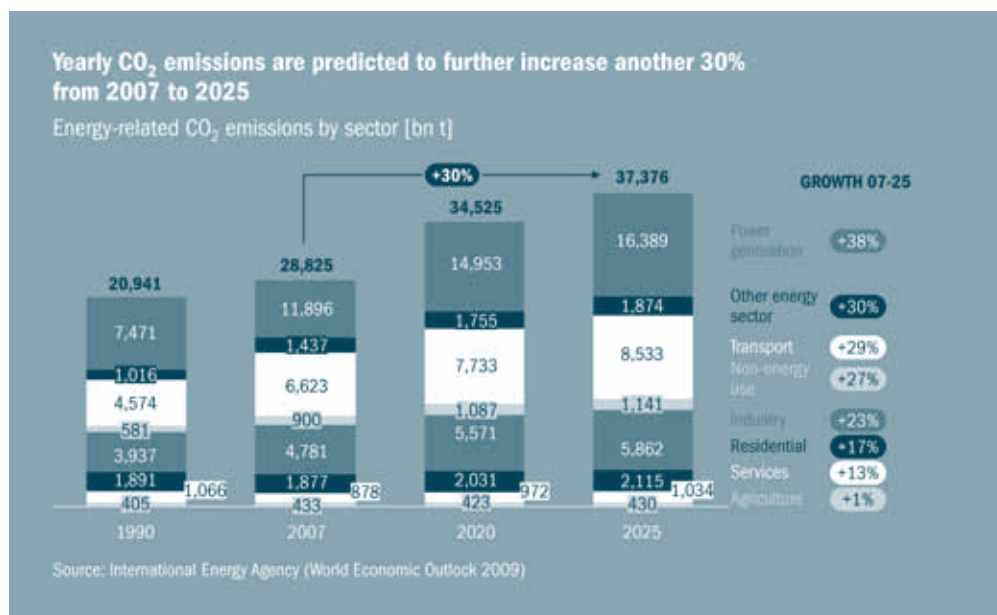
Sustainability and climate change are increasingly prominent in public debate. "Global warming" and "CO₂ footprint" are today's buzzwords in the media. People are more environmentally aware than ever before. This development has a number of consequences for business.



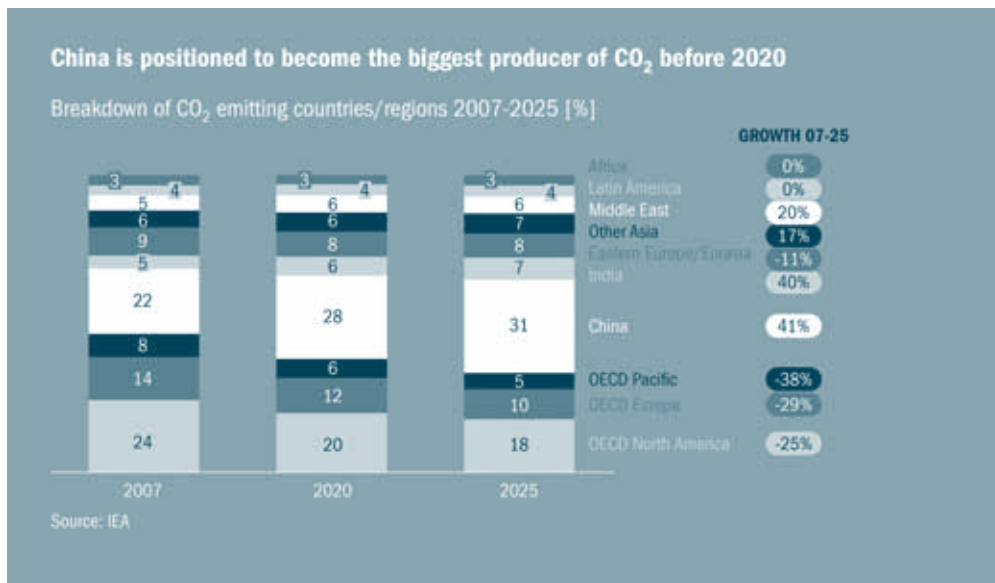
Despite the attention it attracts, transportation accounts for a comparatively small proportion of all CO₂ emissions – around 20%. Some 75% of transportation-related emissions are caused by road transportation. Power stations and industrial processes account for a larger share of emissions than transportation, both with regard to CO₂ and overall greenhouse gas emissions.



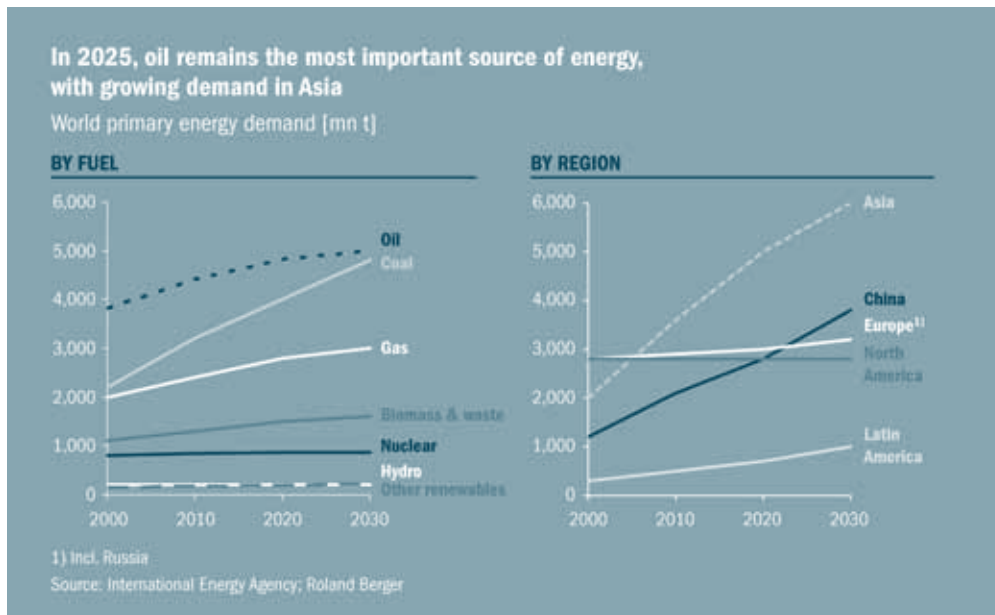
Annual CO₂ emissions have been rising and are predicted to continue rising over the next decades. An increase of around 30% is forecasted for the period 2007 to 2025. The main drivers of this future increase are expected to be the two biggest sectors causing CO₂ emissions: power generation (forecast 38% increase from 2007 to 2025) and transport (29%). Industrial processes-related emissions are also predicted to increase, albeit at a slightly below-average rate of around 23%.



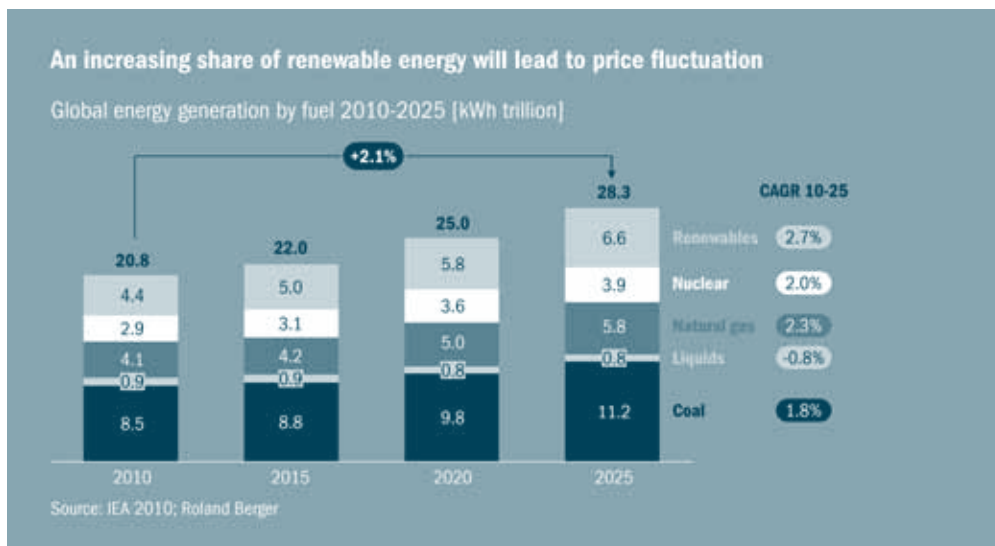
China will become the number one CO₂ emitting country by 2020, overtaking North America. OECD countries are expected to reduce their emissions by 1.8% from 2007 to 2025. The strongest annual growth rates will be seen in India (2.5%) and China (2%).



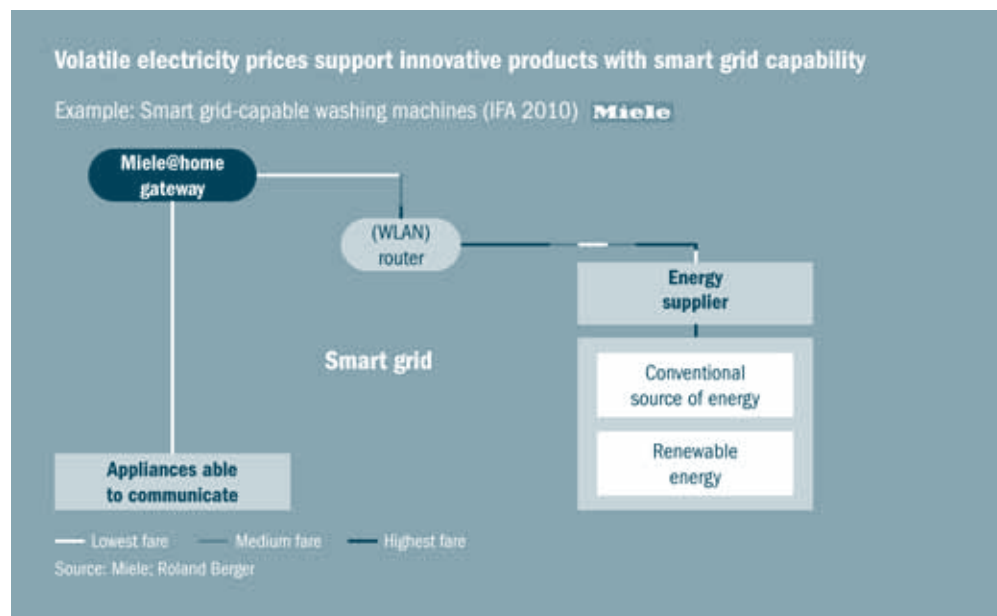
In 2025 oil will be the number one energy source, as it is today, followed by coal and then gas. Some 80% of primary energy demand will still be covered by fossil fuels. Demand for coal is growing very quickly. Soon after 2025, demand for coal as an energy source is expected to surpass demand for oil. Demand for primary energy is growing mainly in the BRIC countries, due to their strong economic growth – especially in Asia, where demand will grow by 51% between now and 2025. In the same period, China will become the world's biggest spender on oil and gas imports.



At the same time, the market share of renewable energy is likely to increase. This is due to its disproportionate growth rate compared to overall power generation and applies to biomass, waste, hydroelectric power and other renewable energies. The growing share of renewable energy will lead to both rises prices and price fluctuations: the production of renewable energy is still more costly than conventional energy and much less reliable.

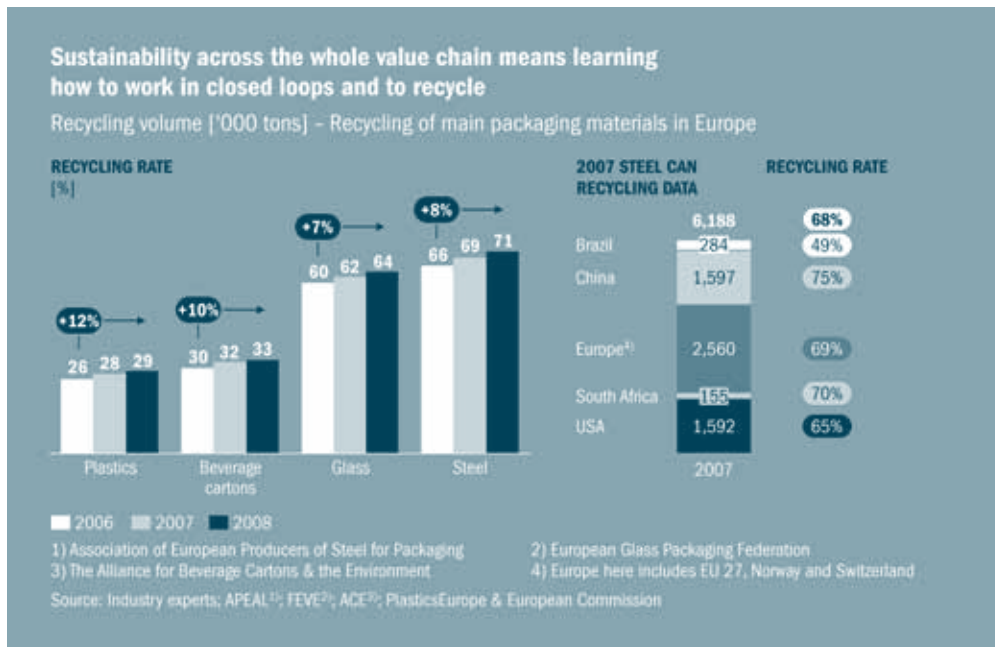


Sustainability and environmental friendliness have become ways of differentiating products and improving brand image. Innovative products are now appearing that come with smart grid capability, as a way of circumventing volatile electricity prices due to a higher share of renewable energy sources. One example is the smart grid-capable washing machine from Miele presented at the IFA trade show in the fall of 2010. Using WLAN, a home server selects the best time and fare for the appliance to run. Potential annual savings are currently just EUR 30, but the development reflects the belief that buying environmentally friendly products is the right thing to do.

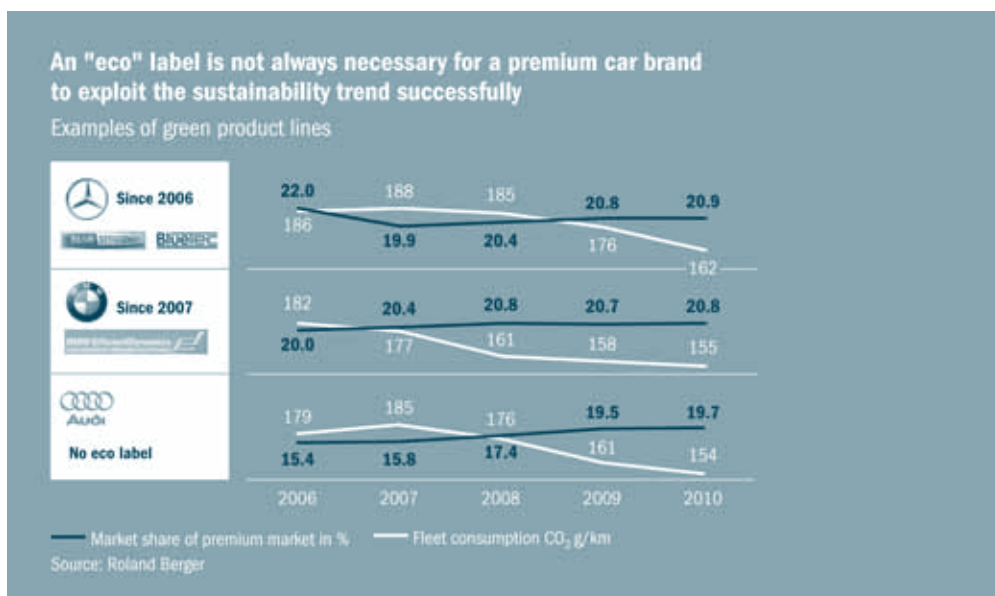


Companies have not been slow to notice the potential of this trend. More and more businesses now publish sustainability reports, for example. The eco-trend offers a range of new opportunities for business. Environmentally friendly products, from clothes and food to cars, sell increasingly well.

The recycling industry is also growing steadily. Sustainability across the entire value chain requires closed systems and recycling. With increasing prices and scarcity of raw materials, recycling is also an elegant solution for accessing resources – "urban mining", as it is called. With a more than 70% recycling rate, steel is the most recycled material, followed by glass. China's recycling rate for steel is above average, while the US rate is below the global average.

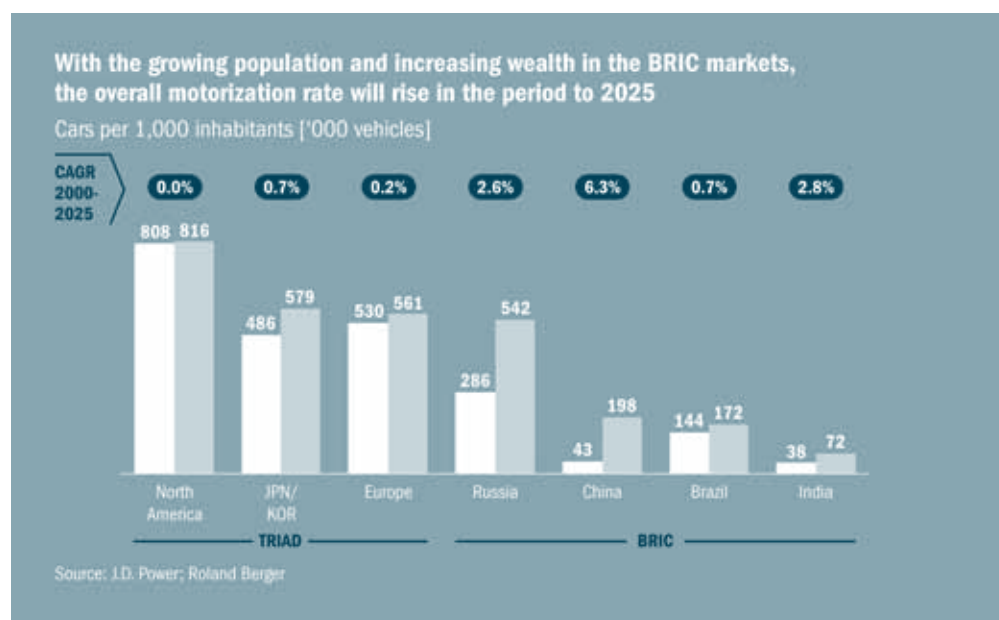


In the automotive industry, customers increasingly expect sustainability and environmentally friendliness as a matter of course. Especially in the premium segment, it is essential that brands exploit this trend successfully. It is also a good way for premium brands to display their innovative edge. But an eco-label is not necessary for success in the marketplace. Audi achieved significant gains in market share compared to its closest competitors in the segment, BMW and Mercedes, over the past five years. This was helped by its introduction of efficiency technologies across the board at a very early stage. Yet Audi is the only player without a special eco sub-brand for its efficiency models.

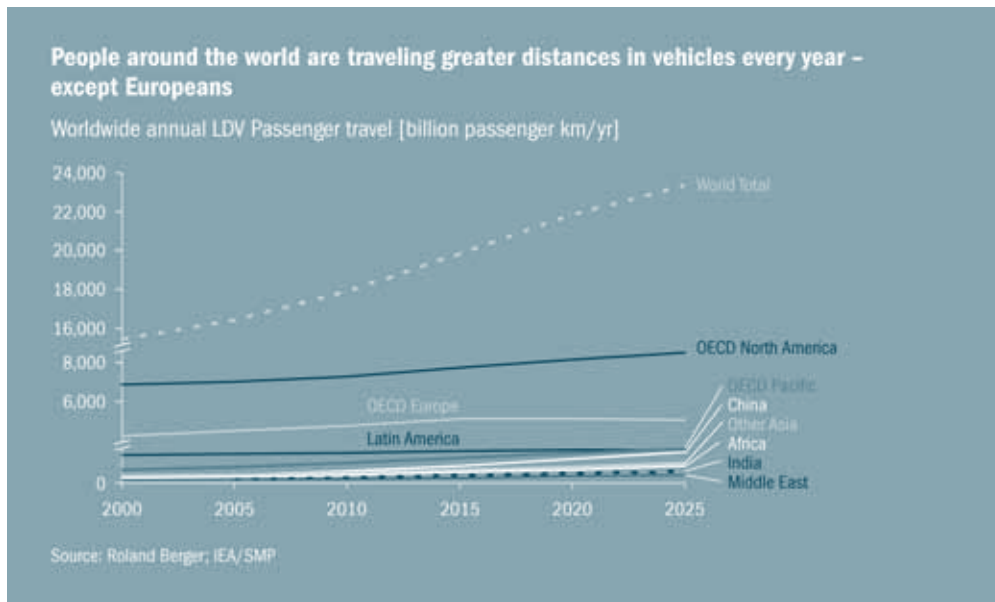


4. Evolution of mobility: Motorization will increase and low-cost cars will meet the demand for basic transportation, but younger people in metropolitan areas will lose interest in cars

With growing population sizes and increasing prosperity, overall car ownership levels will rise in the period to 2025. Growth in North America and Europe will not be as high as the global average rate of 1% per year, but the desire for individual mobility in the BRIC markets will continue to grow, accounting for 83% of future market growth. In China, car ownership will grow 36% annually, well above the global average. In India and Russia the rate will be 14%. Growth in Brazil will be 4%, still well above the global average.

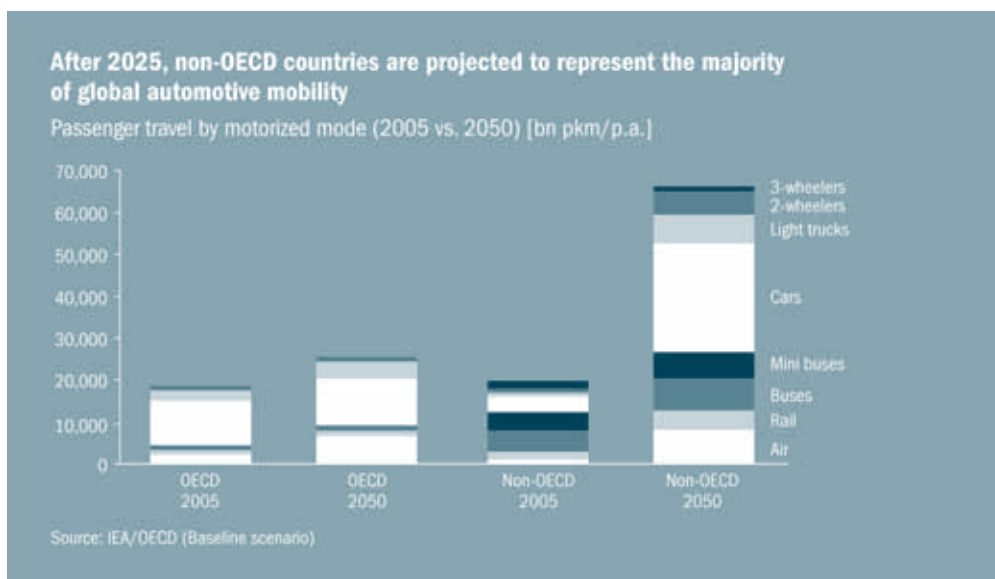


The time spent on mobility has remained almost constant over past decades and is expected to do so in the foreseeable future. However, people all over the world will travel greater distances each year. Worldwide light duty vehicle passenger travel is expected to increase by 32% until 2025, driven mainly by growth in Asia. Although people in OECD countries will continue to travel large distances, rates are beginning to stagnate and, in the case of Europe, even decline.



Looking further into the future, non-OECD countries are projected to represent the majority of global automotive mobility by 2050. Nevertheless, non-OECD per capita mobility will still be one-third of OECD per capita mobility. Total passenger travel with motorized modes is expected to rise from 6,000 km to 9,000 km per person per year.

Globally, growth in travel will be dominated by light duty vehicles, two-wheelers and air travel. Mass transit will also increase, but its modal share will decline as light duty travel will grow at a much faster rate.

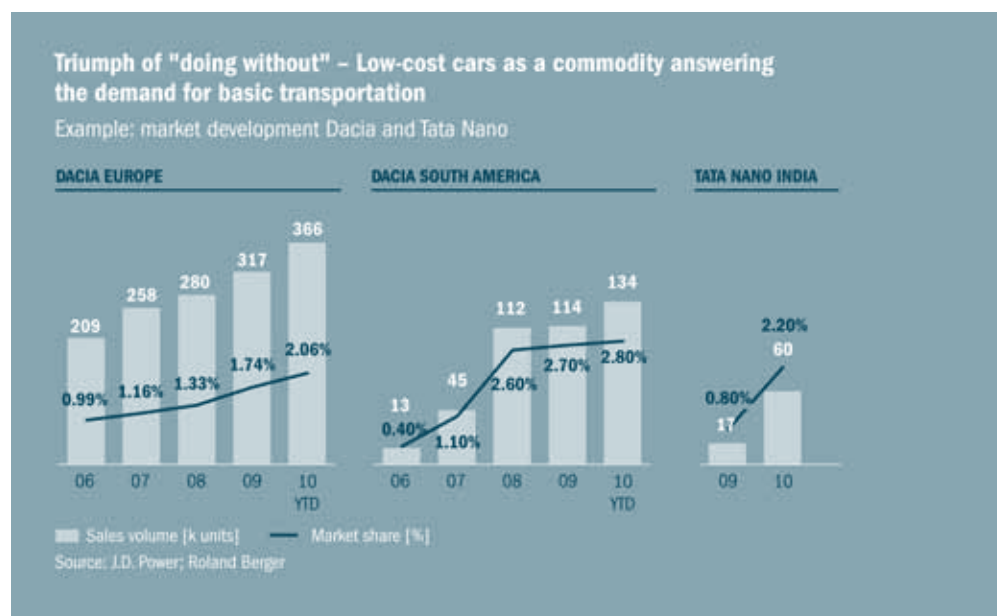


With the rising desire for individual mobility in the BRIC nations, a new breed of low-cost cars has enjoyed remarkable success, answering the demand for basic transportation.

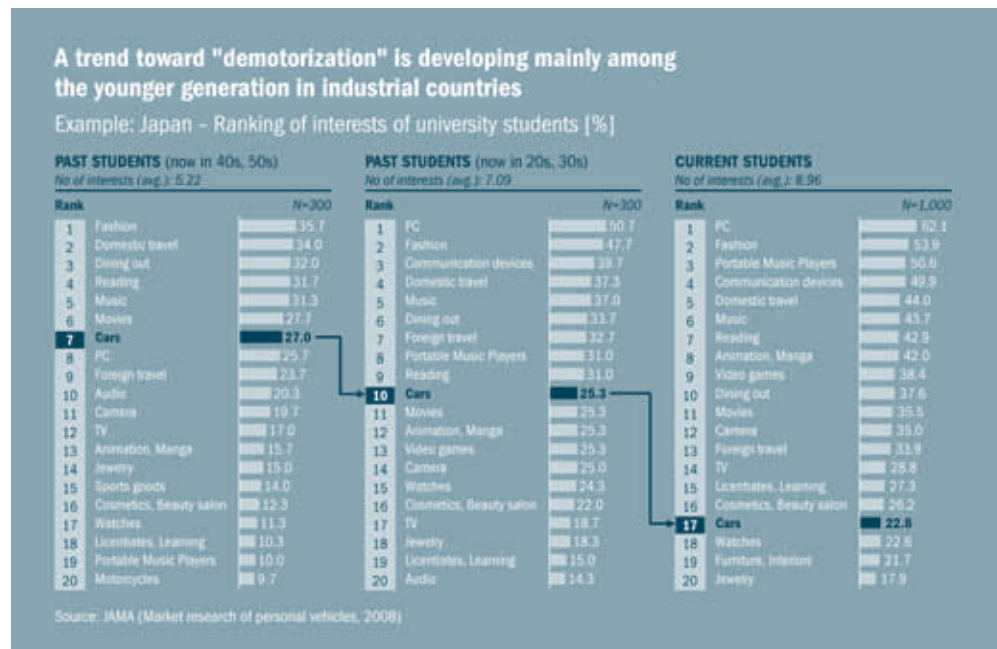
The Dacia brand for example introduced the Logan model in 2004 with a simple, no-frills concept: reliable engineering without a lot of electronics, cheap to produce and easy to repair. More models have followed since with the same concept. This approach has worked very well in South America, where the Dacia brand was able to capture 2.6% market share after just three years. In the meantime, the brand produces vehicles in Romania, Russia, Morocco, India and Columbia.

Another example is the Tata Nano from India, positioned as the cheapest car on earth (cost at launch: 100,000 Indian Rupees). Following its launch in 2009, the car was already able to gain a market share of 2.2% in India in 2010. As the car was so highly sought after, the purchase rights for the first 100,000 units were raffled. However, it is still early days and the Tata Nano has yet to prove its long-term success.

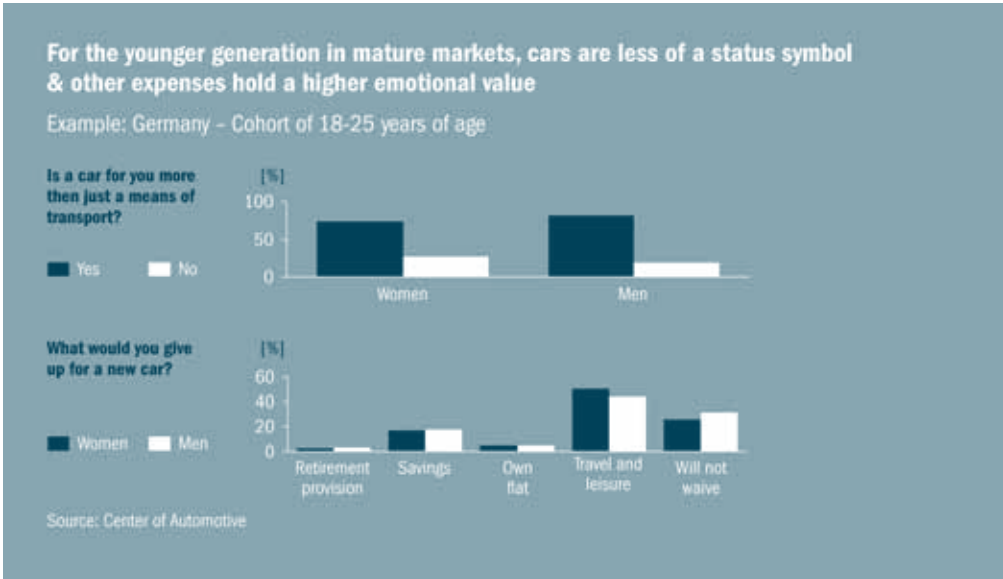
Interestingly, these low-cost, no-frills concepts also work well in mature markets. Tata intends to export revised versions of the Nano later to the US and Europe. Dacia is thinking about serving the US market with the Renault brand. Romanian by origin, Dacia is already present in Europe – with great success. Its market share has more than doubled since 2006 and hit 2.1% in 2010. In order to continue its great success story, Dacia has announced plans for eight new models and facelifts in the period to 2015.



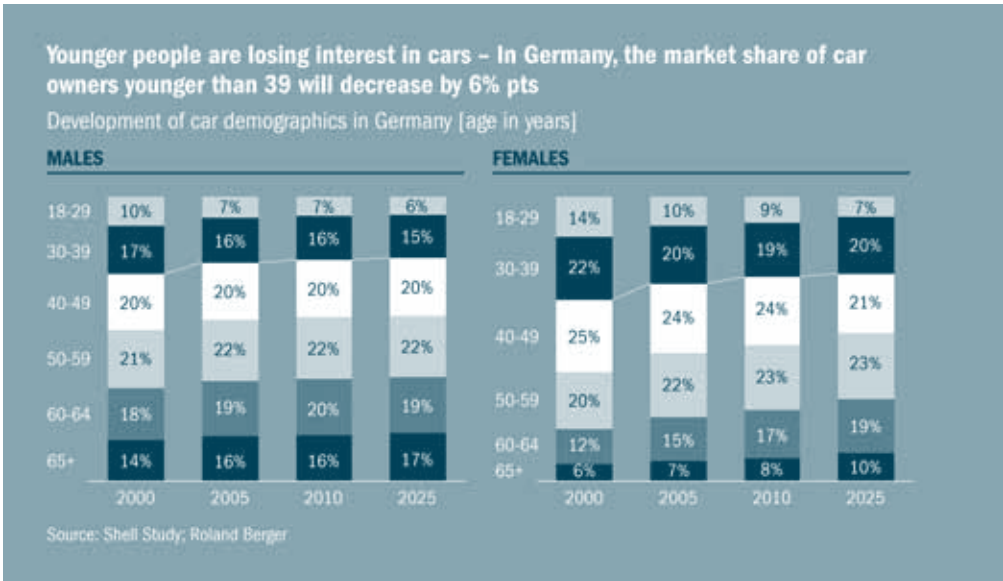
Besides the rising car ownership levels in the emerging markets and the strong global trend toward low-cost cars, a counter-tendency is becoming more and more evident in the auto market: "demotorization". As people's values change and they increasingly move into the cities, the younger generation in particular is expected to lose interest in individual car ownership. Demotorization is already visible in mature markets. Surveys in Japan, for example, found that graduates now in their 40s and 50s ranked cars as their number seven interest, ahead of computers. Graduates in their 20s and 30s ranked cars number ten, with computers at number one. Current students ranked cars as their number seventeen interest, below various electronic items such as laptops, portable music players, communication devices, video games, and so on. The trend is clear.



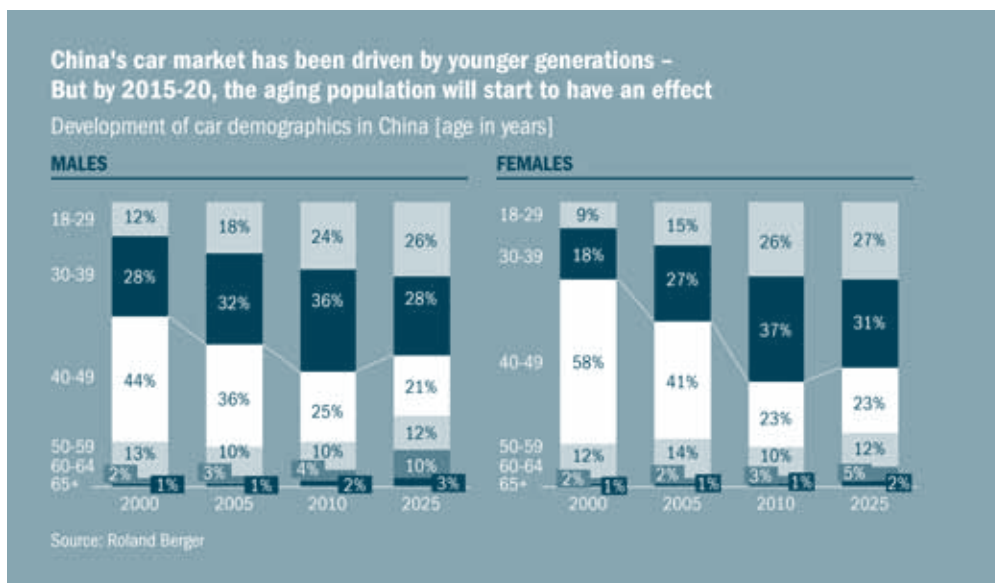
In Germany, too, interest in cars is waning. Cars are no longer as strong a status symbol as in the past. One in five young Germans has no emotional ties with cars. Research shows that for 18-25-year-olds, cars are just a means of transportation; almost 30% of this group would not exchange other costly items such as travel or an apartment for a new car.



Another indication of this trend in Germany is the expected development of car demographics between 2000 and 2025. The market share of male car owners under 39 years of age is forecast to decline by six percentage points during this period, while the share of car owners aged 65 or over will increase by three percentage points. The market share of female car owners under 39 will fall even more dramatically, by nine percentage points from 2000 to 2025. The share of female car owners aged 65 or over will rise by four percentage points. In a nutshell, the romance with the automobile appears to be over for Germany's younger generation.



The trend toward demotorization is also beginning to manifest itself in emerging markets. In China, the car market over the last decade has been driven by the younger generation. The market share of male car owners under 39 ballooned from 40% to 60% from 2000 to 2010. Growth in female car owners was even stronger, their share rising from 27% to 63%. This trend will continue until 2015 or 2020, when the aging population factor will kick in. In 2025 the share of car owners under 39 will fall back to 54% for men and 58% for women.

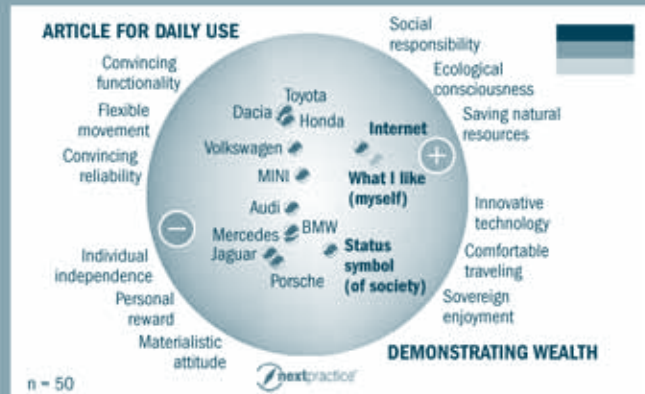


These projections of car ownership shares among younger generations were backed up by primary market research on the values and preferences of people aged 18-29 conducted by Nextpractice GmbH on behalf of Roland Berger in October 2010. The survey took place in Germany and Shanghai (considered an indication of future developments in the whole of China).

The survey results for Germany show that young people's preferences are changing. Premium cars are no longer the ultimate objects of desire. They are perceived as self-centered and associated with a materialistic attitude. Demonstrating wealth by means of status symbols is becoming less important for Germans under 29. The Internet for example is far closer to personal preferences than cars in general.

In Germany the attractiveness of premium cars is declining – demonstrating wealth through status symbols is losing importance

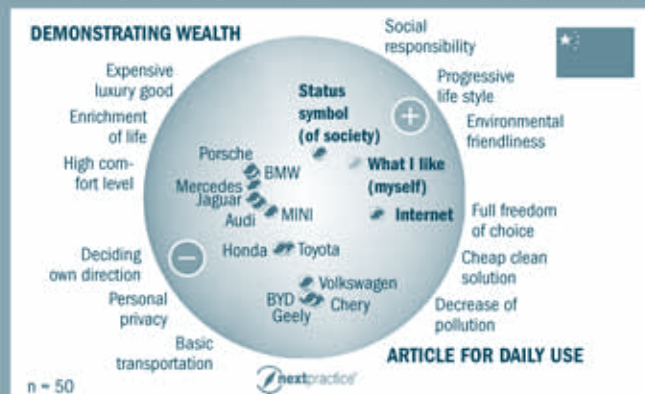
Youth study: value system for cars (relative personal preferences) – Germany, 2010



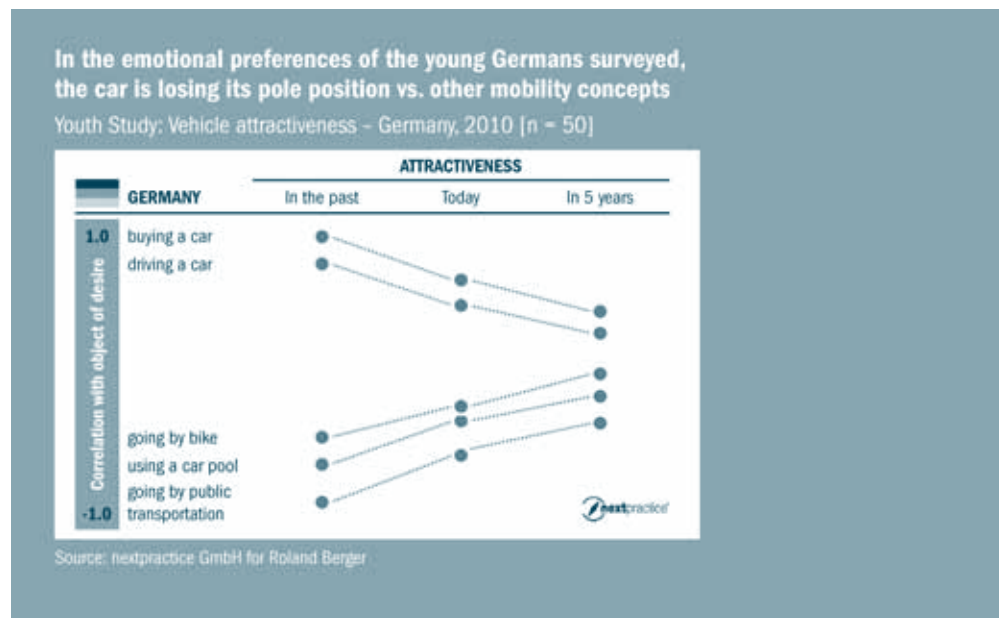
In Shanghai, younger people are still highly attracted to status symbols. This applies particularly to premium cars as opposed to domestic brands such as Geely or Cherry, which are seen more as a means of basic transportation. However, social responsibility and ecological sustainability are already just as important in Shanghai as in Germany. The Internet is viewed as a form of smart mobility, closely related to the dimensions "full freedom of choice" and "cheap clean solutions". Shanghai, of course, is progressive and it may take some time until this change reaches a larger section of Chinese society.

In China, status symbols and premium cars are still highly attractive – But for early adopters, sustainability is also a crucial topic

Youth study: value system for cars (relative personal preferences) – Shanghai, 2010



Developments in Germany appear to be more advanced than in Shanghai. Looking at changes in attractiveness over time, it is clear that cars are ceding their top slot in the emotional preferences of young Germans to other mobility concepts. Thus the dimensions "buying a car" and "driving a car" are rapidly losing attractiveness while alternative mobility concepts such as "going by bike", "using a car pool" or "going by public transportation" are strengthening their competitive position. Within five years, the gap between the two groups will be very small.

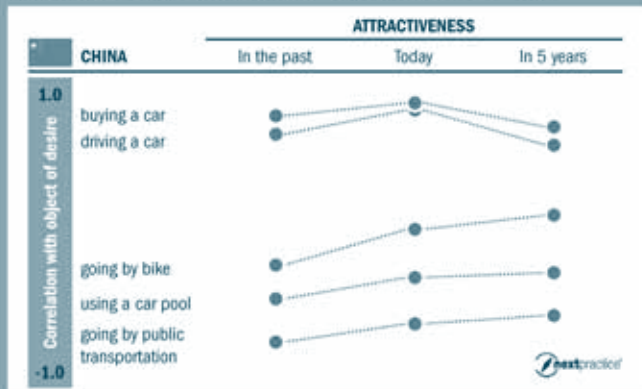


The results from the survey from Shanghai shows that young people under 29 are likely to follow the German pattern of changing preferences, albeit with a time lag. For the young Chinese people interviewed, the car's position is still strengthening in their emotions. However, in the near future they predict that cars will start to lose attractiveness and "going by public transportation", "using a car pool" and "going by bike" will gain ground.

Interestingly, in both Germany and Shanghai the bike and the (e-)bike was rated as a more attractive alternative mobility concept than car pools or public transport.

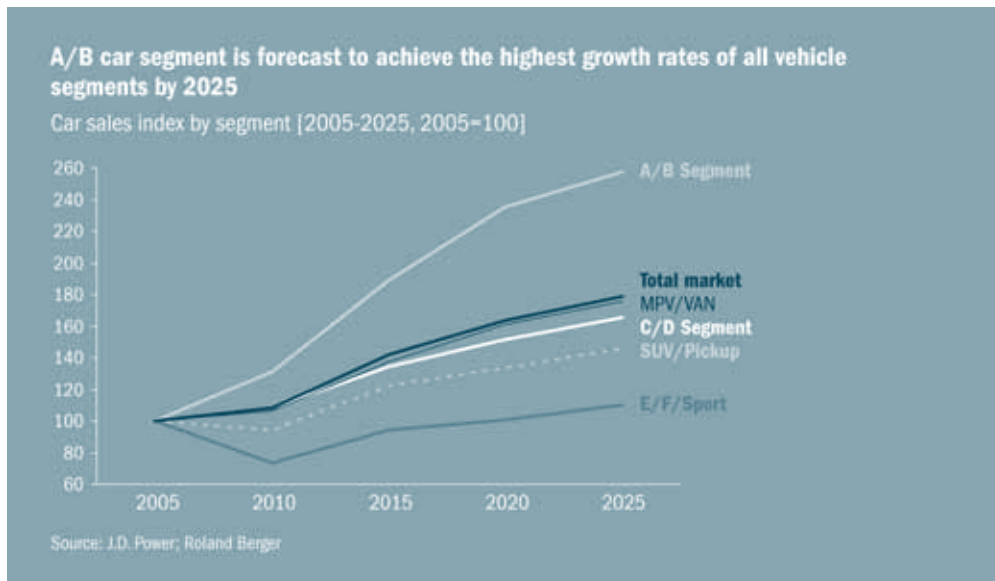
Young people from Shanghai are expected to follow the Germans in development of preferences: Cars become less attractive

Youth Study: Vehicle attractiveness – Shanghai, 2010 [n = 50]

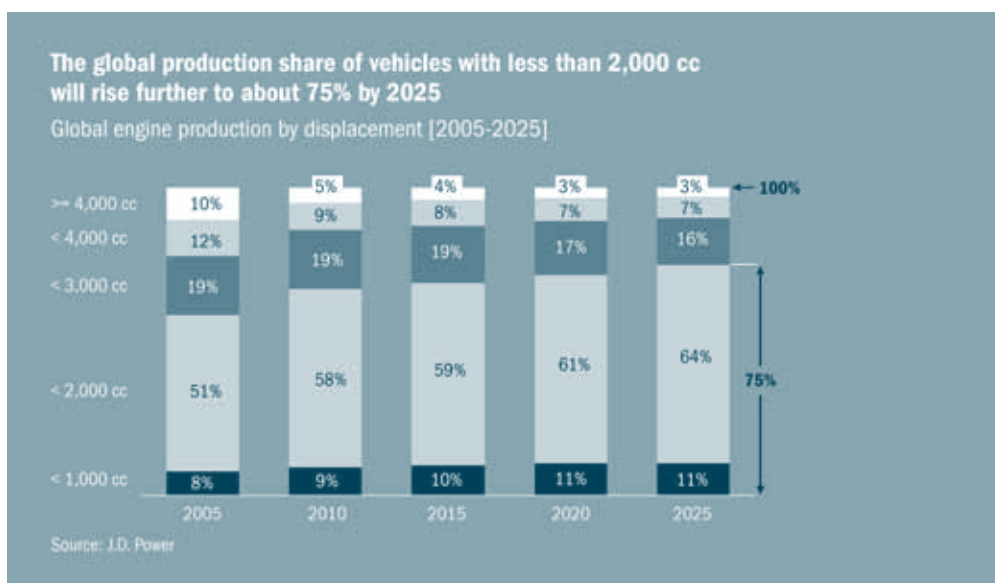


Source: nextpractice GmbH for Roland Berger

As values change, purchasing patterns are moving away from conspicuous consumption and toward conscious consumption. This is resulting in a sizeable upswing for smaller cars in terms of body and engine size as a share of overall sales. Over the last five years, the A/B segment in particular developed much better than any other segment. Indeed, it is expected to show the highest growth rates of any vehicle segment by 2025. Why should this be so? For developed countries, the main factor is the better fuel efficiency of the cars in this segment. In addition, they offer greatly enhanced passive safety. The features and options available were until recently only found in bigger cars. The driving experience has been improved. A/B segment vehicles have also grown steadily in size over time. And finally, in developing markets – which account for the majority of growth – price is a key driver for purchase. For the first time car ownership is within people's reach.

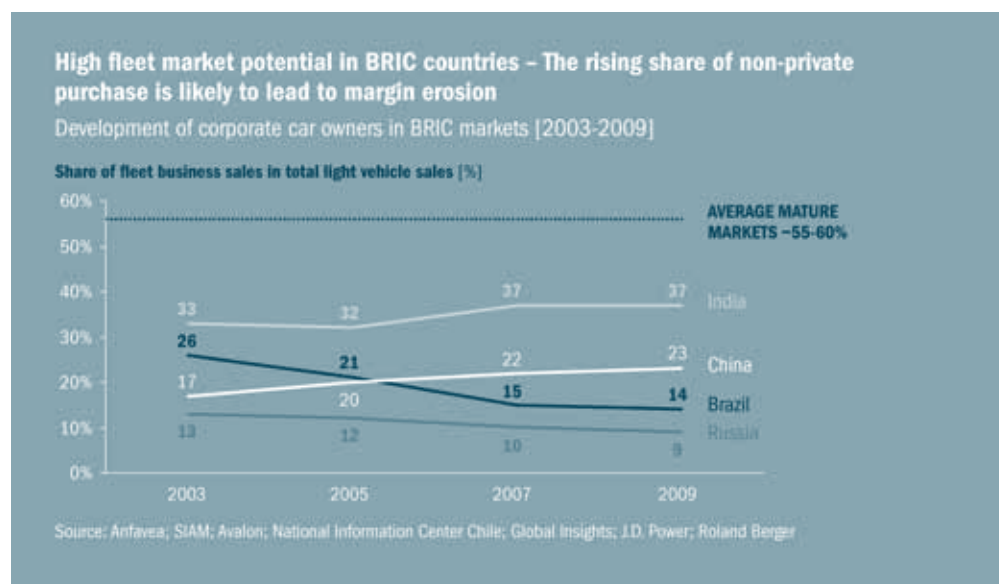


In conjunction with the upswing in the A/B segment, the global production share of vehicles with less than two liters cc grew strongly over the past five years, and is expected to hit 75% of all engines by 2025. Engines bigger than 4,000 cc have lost market share dramatically since 2005, falling from 10% to 5%. Expectations are that their market share will decline further to just 3%.



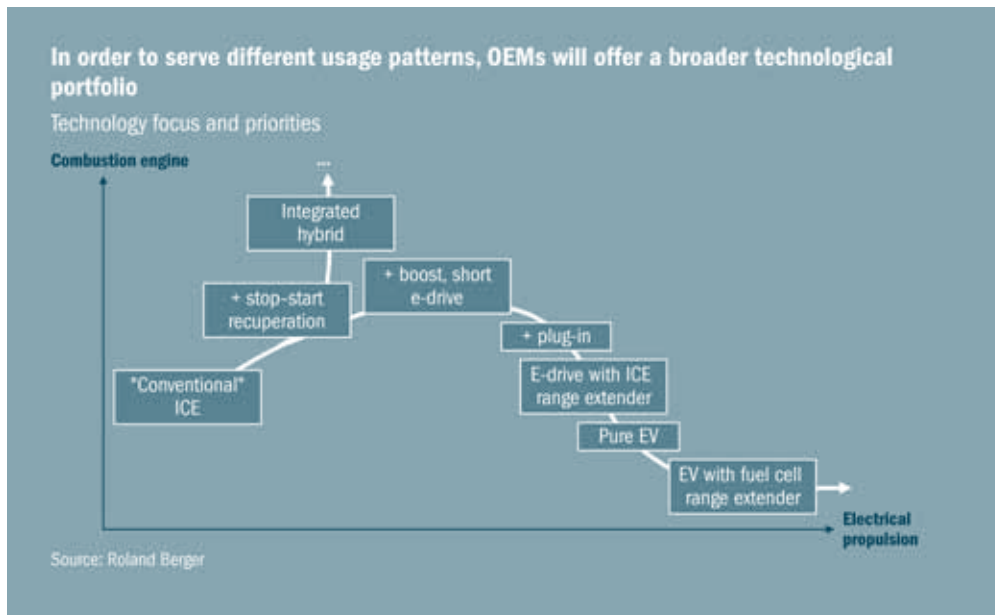
Another facet of changing behavior is observable in the fleet business. This is expected to grow disproportionately compared to private car ownership. As a consequence, the margin on new car sales will erode and the position of retailers weaken.

The current average share of fleet business in total light vehicle sales varies between 55% and 60%. This is much higher than in BRIC countries, which range from 9% (in Russia) to 37% (India). However, BRIC countries are expected to catch up with mature markets by 2025. There are a number of reasons for this, including general economic growth and improved access to financing. International companies are also implementing global vehicle policies. The establishment of a proper used car market and the corresponding expertise in remarketing leased/fleet cars supports this development.



5. Changing technology: Electric, electronic, online

By 2025, automakers will need to be offering a wider range of drivetrain technologies. This will be necessary to serve the different usage patterns arising from changes in mobility behavior, as well as new regulations. Vehicle manufacturers' portfolios should include conventional internal combustion engines (ICEs), different kinds of hybrid powertrains, pure electric vehicles and possibly fuel cells, too. Technologies are becoming increasingly complex; they are also converging. A variety of combinations is likely to emerge.



At the same time the fuels used in vehicles will change, reflecting developments in drivetrain technology. Precise projections are impossible here – our forecasts for 2025 take the form of broad ranges.

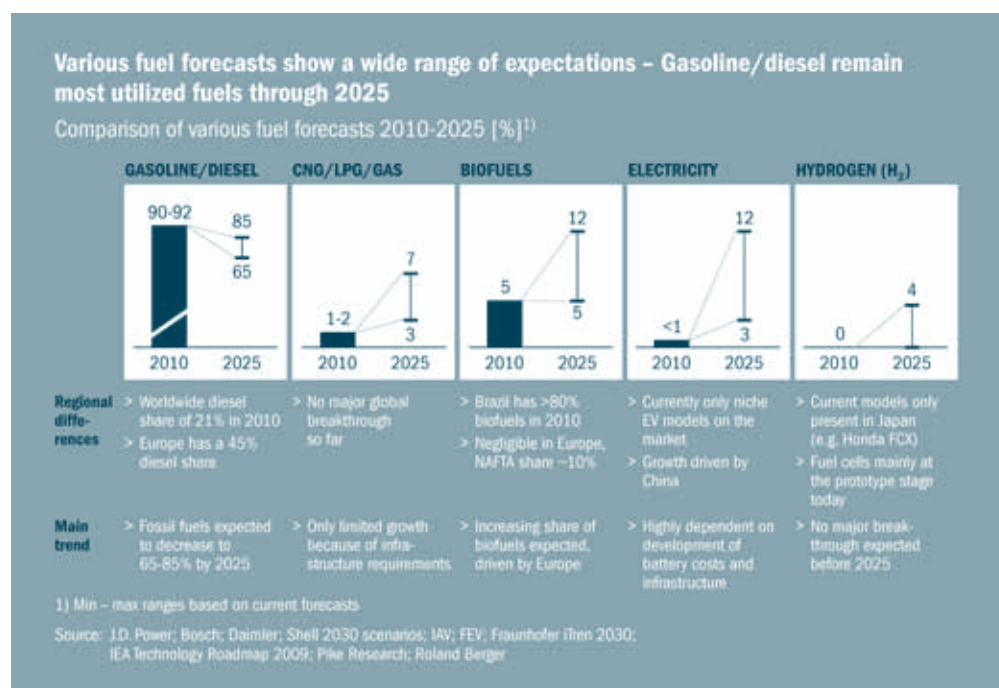
First things first: gasoline/diesel will remain the most important fuel, with a share of 65-85%. However, even this represents a significant decline from its current level of over 90%.

Then there is natural gas. Despite its 15-25% advantage over gasoline in terms of CO₂ balance, natural gas has yet to experience a major global breakthrough. Current market share is just 1-2%. Lower mileage, customer safety concerns and poor infrastructure will remain the key obstacles to growth. Future market share will range from 3% to 7%.

Biofuels, on the other hand, are expected to play an increasingly important role. Global market share is already approaching 5%, with strong regional variation. While usage in Europe is negligible, the share in NAFTA is 10% and in Brazil it is over 80%. Predictions for 2025 range from 5% to 12%. Growth will be driven by Europe: the European Union has committed itself to increasing the share of biofuels to 10% by 2020.

Electricity is expected to grow strongly, from its current niche level up to 3-12% in 2025. Growth will be driven mainly by China. In the Roland Berger "high" market scenario, the global market share of EVs/PHEVs is as much as 10%, which would lend weight to the upper end of the predictions. However, growth will be highly dependent on the development of battery costs and the availability of infrastructure.

Following the widespread hype about hydrogen in the 1990s, today it is viewed very much as a niche application. Hydrogen models are only found in Japan. No relevant market share is foreseen for 2025. And a breakthrough is not expected any time soon.



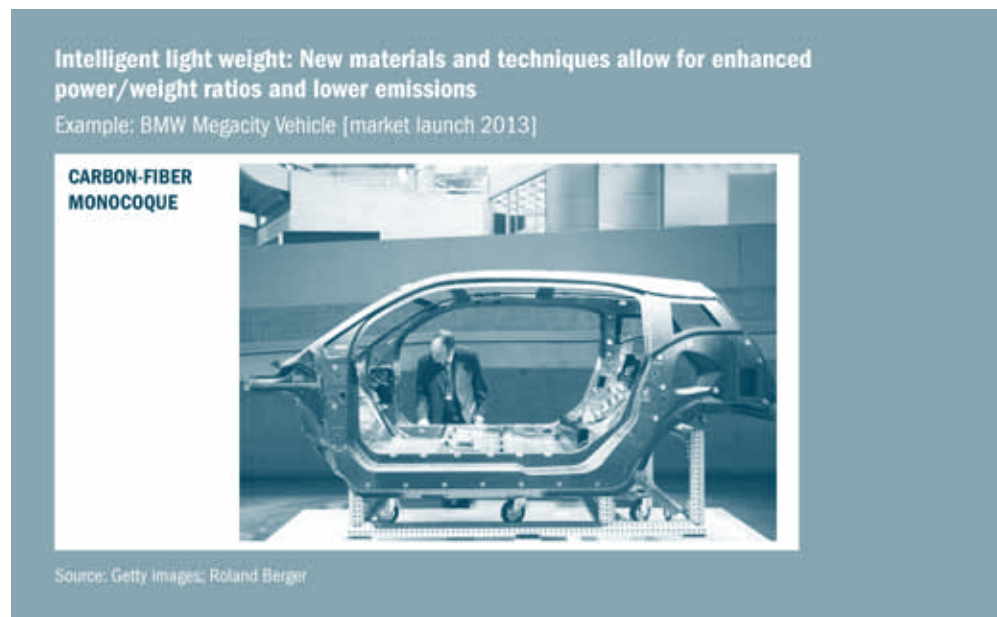
Emissions need to be cut. This can be achieved by optimizing existing ICEs or using more alternative fuels. Another option is to slim down the engines: 100 kg less weight translates into half a liter of fuel less per 100 km. OEMs are trying to come up with intelligent lightweight concepts – new materials and techniques that improve the power-to-weight ratio and result in lower emissions. Attempts to date have included using more and more steel of varying layer thicknesses and materials such as aluminum and magnesium. Carbon fiber is next in line.

Carbon fiber weighs 30% less than aluminum and 50% less than steel. In the past, it was used only in motorsports and supercars due to its high production cost. More recently, however, premium car manufacturers have started using carbon parts to save weight in their sporty models. The usage of carbon fiber allows the premium OEMs to show their innovative edge and to give premium a new meaning.

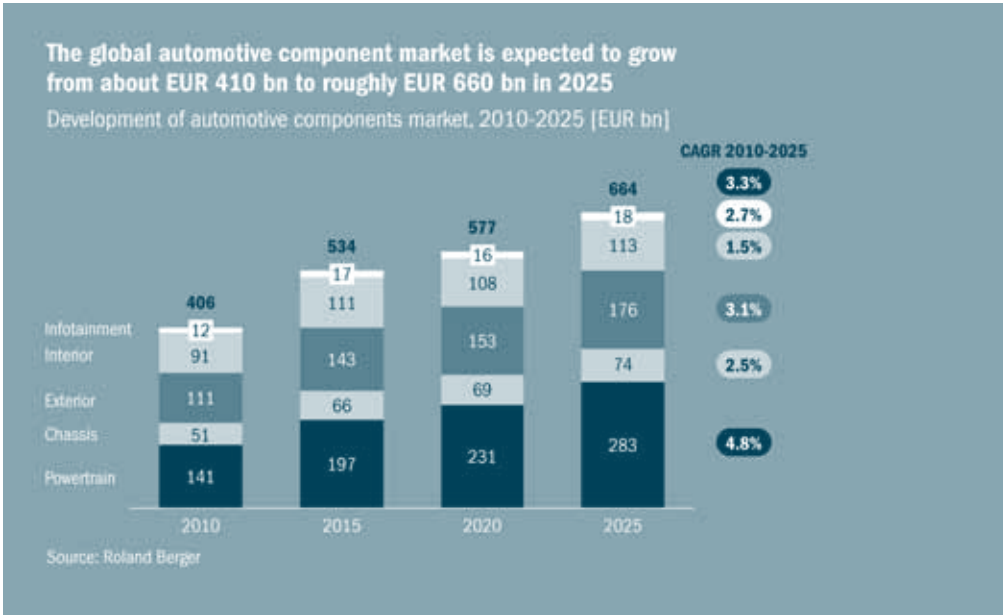
The fully electric BMW Megacity Vehicle will be the first car with a carbon fiber monocoque to be produced in high volumes. Carbon fiber (in combination with aluminum), was chosen to compensate for the additional 200+ kg in weight that a electrified car carries. The Megacity Vehicle will be launched in 2013.

As early as 2012, Mercedes will start to introduce a significant share of carbon parts across its range. Audi, the first OEM to use aluminum in industrial-scale production, is also trying to industrialize carbon fiber for use in its models. By 2025 carbon fiber will be a standard ingredient in all intelligent material mixes – alongside steel, plastic, magnesium, aluminum and innovative hybrid materials in the form of molded combinations.

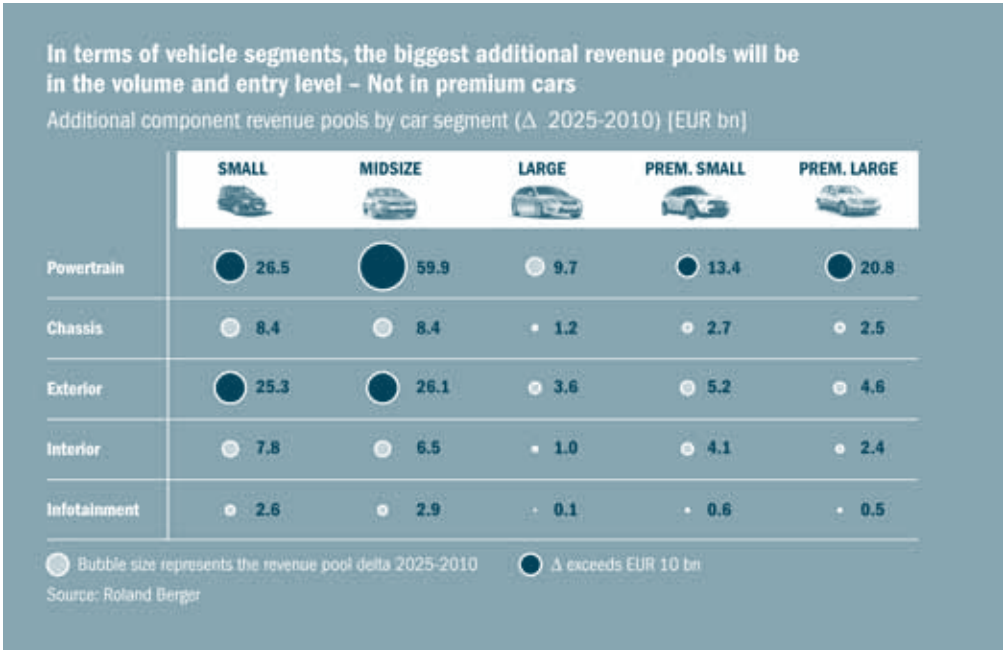
We have focused above on carbon fiber – but that's not the only interesting new material or technique on the horizon. Printed electronics, for example, can be used to create flexible thin-film solar cells. There are many more examples but a full discussion would go beyond the scope of this study.



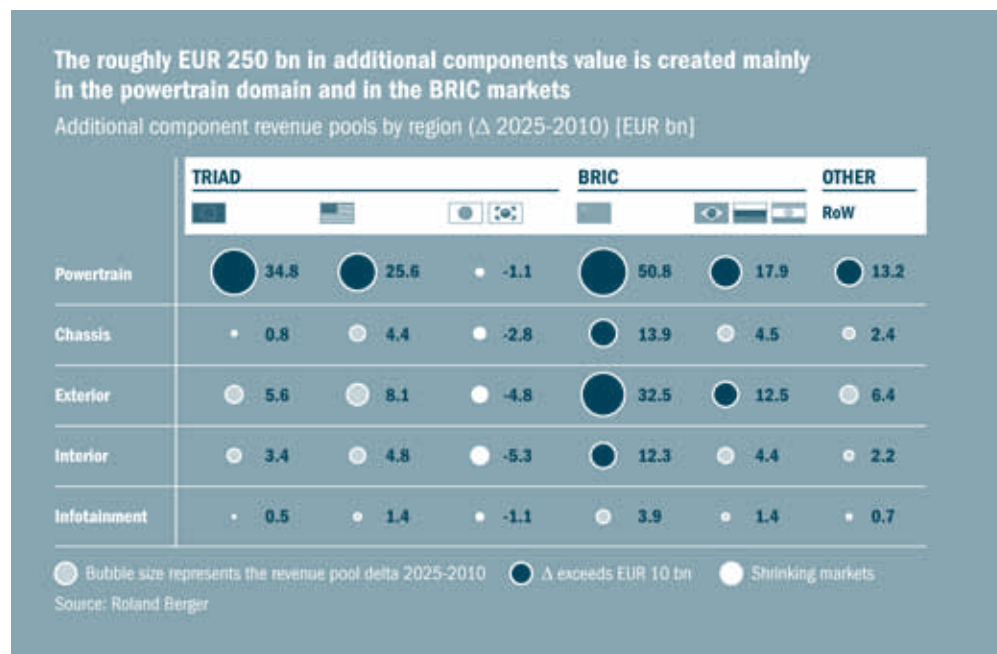
Given these developments, it is no surprise that powertrain components are expected to show the strongest growth rate of all components in the period to 2025, at 4.8% growth annually. The second-fastest-growing component segment is exterior components (3.1% annual growth), followed by entertainment components (2.7%), although on a much smaller level. As the powertrain accounts for the largest share of components, the automotive components market is expected to achieve 3.3% growth annually. In absolute terms, the automotive components market will expand by over EUR 250 billion, from its current level of EUR 406 billion to EUR 664 billion in 2025.



Vehicle segments will see EUR 250 billion additional profits. Most of this will be in the volume and entry levels rather than the premium sector. The biggest increase will be in powertrain components in midsize cars (EUR 59.9 billion) and small cars (EUR 26.5 billion). The next segment to benefit is expected to be exterior components for midsize cars (EUR 26.1 billion) and small cars (EUR 25.3 billion).

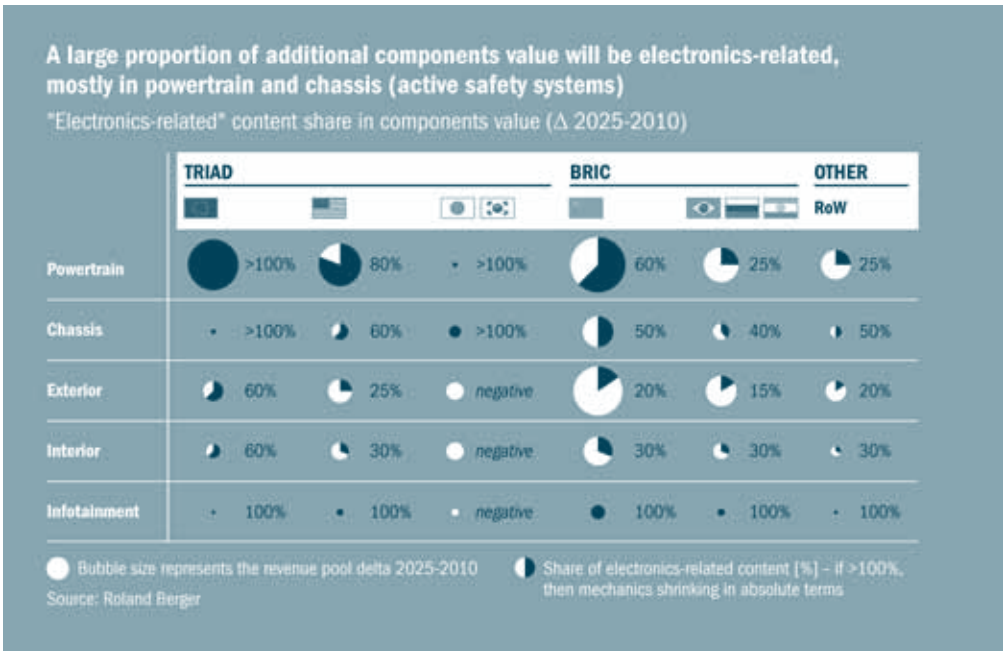


In terms of regions, nearly 70% of the additional EUR 250 billion component value will be generated in the BRIC markets. Additional value from all triad countries together comes to just half of this amount. China dominates the figures, gaining EUR 113 billion in total and outperforming all other countries in every component domain. Japan is expected to see a shrinking automotive component market in all domains.

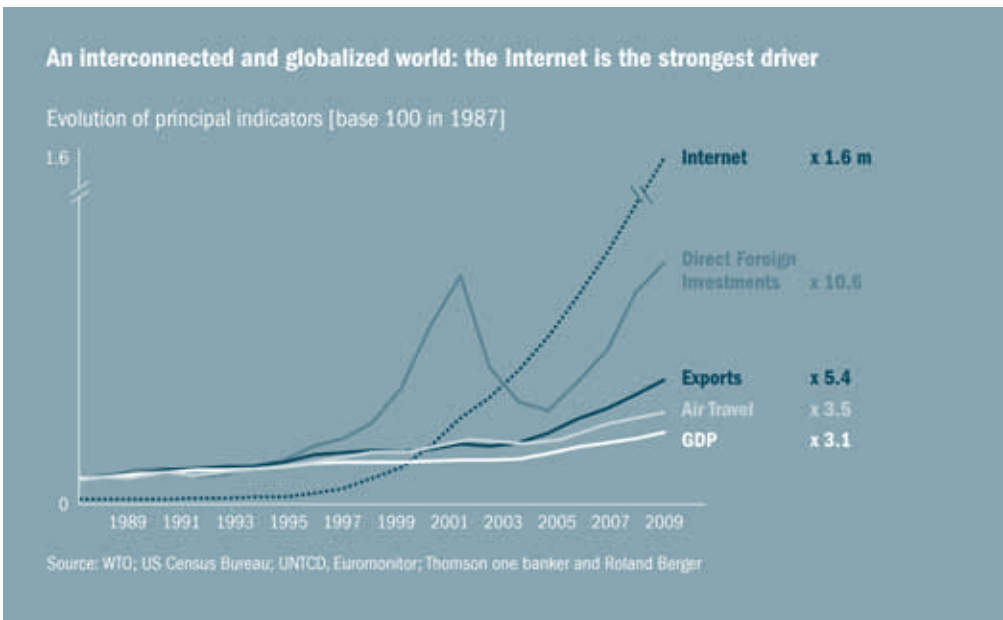


A sizeable portion of the additional components value will be electronics-related, regardless of the domain. After the entertainment domain – where the electronics-related content share is naturally 100% – come powertrain and chassis components. Powertrain in particular will experience a growing share of electronics-related content as a result of the increasing electrification of cars. Exterior and interior components, by contrast, have a relatively low share of electronics.

From a regional perspective, the share of electronics-related content in the additional profit pool until 2025 is much higher in triad countries than it is anywhere else. China's share is greater than that of the other BRIC markets and the rest of the world. To illustrate this: While the electronics-related share of powertrain components in Europe is nearly 100%, China is projected to have a 60% share and other markets 25%.

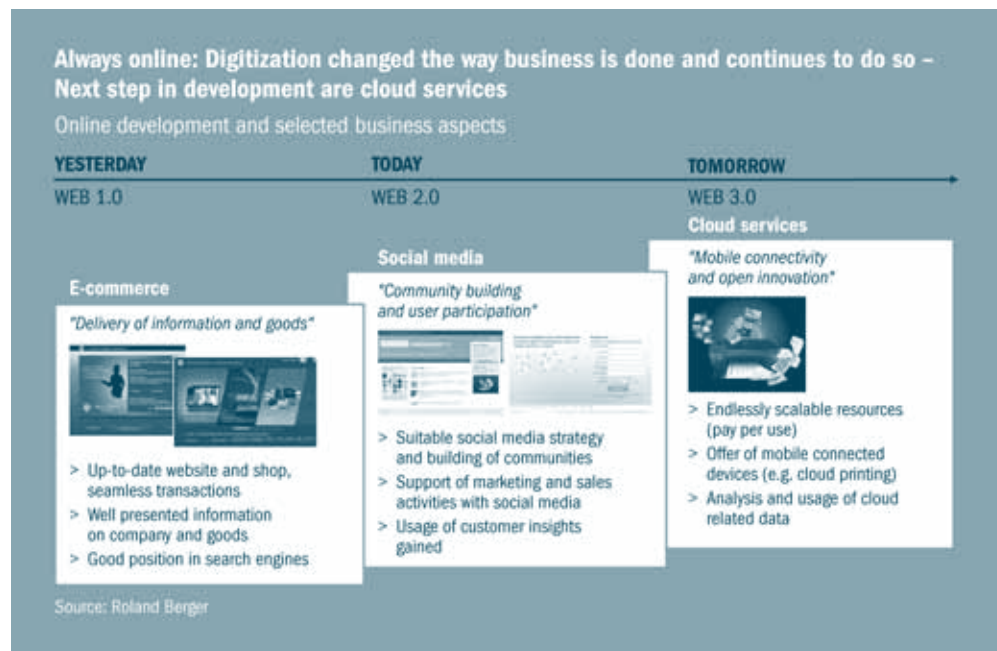


One of the most important technological trends in recent years has been the abrupt rise of the Internet. In the last 20 years, the Internet has been a powerful driver in creating an interconnected, globalized world – stronger than indicators such as direct foreign investment, export, air travel and GDP growth by far. This trend is expected to continue. The Internet will also be a major driver behind the increasing share of electronics-related components in vehicles.



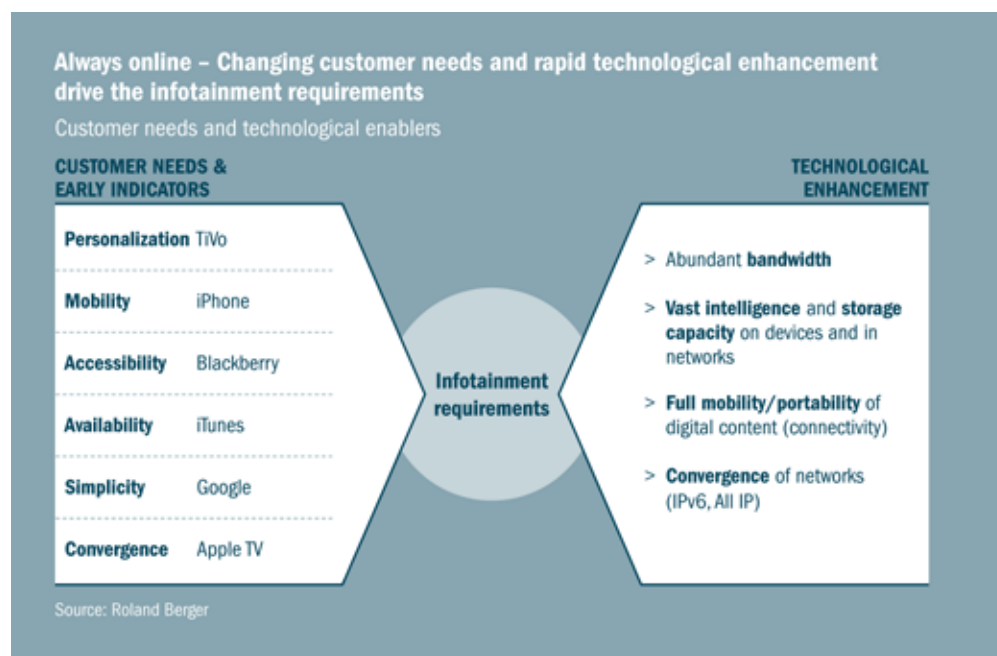
The rise in importance of electronics in all domains – especially infotainment – reflects the megatrend toward digitization. The way information is exchanged has changed dramatically and this has had a major impact on business. Initially, e-commerce was about offering goods online and presenting the brand where the customers were. Today it's all about being involved when customers build their online communities. Web 2.0 stands for user participation. Successful social media activities support marketing and sales efforts and provide valuable customer insights. In the future, a Web 3.0 will evolve: The next step in development are cloud services. Endlessly scalable resources are available, convenient as pay-per-use offers and always up-to-date.

This development is especially important for the automotive industry as it supports mobile connectivity. No longer do on-board navigation units have to be updated via a CD with data from 18 months ago. Well before 2025, cars – or the customers' mobile devices – will be accessing the Web directly for online navigation services.



"Connectivity" is the current buzzword. Customers' needs are changing. More and more they expect to be always online. They want their mobile devices to integrate seamlessly into the information backbone of the vehicle. It remains to be seen whether this is technically possible or if tomorrow's cars will have a second, open information circuit purely for entertainment applications in order to ring-fence the closed circuit with safety-related data.

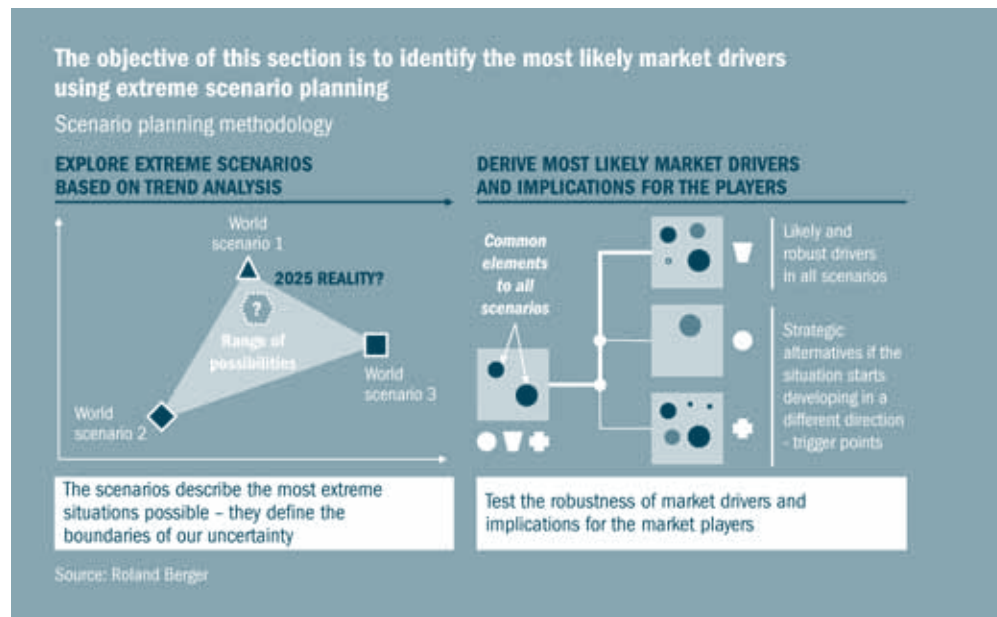
Whatever the solution, customers expect to experience the same level of simplicity of use and degree of personalization in their cars as they do elsewhere. Advances in the man-machine interface (MMI) will play a major role here. Rapid technological enhancements are needed to respond to infotainment requirements such as abundant bandwidth, intelligent storage capacity and full portability of digital content. In a word: connectivity!



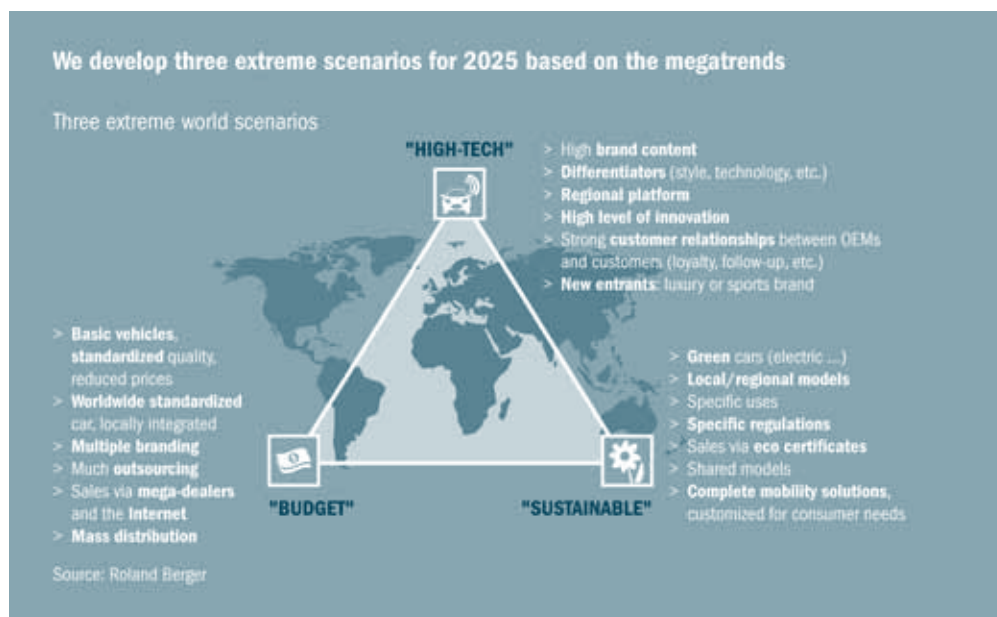
Scenarios and key success factors

Of course, 2025 is still a long way off. Nobody can say exactly what is going to happen in 15 years' time. Extrapolating from the past is a fool's game.

With this in mind, we based this study firstly on research, secondly on interviews with experts and thirdly on an analysis of scenarios. Rather than the traditional approach of defining between two and five different scenarios and then simulating each of them on a quantitative basis – an approach that results in so much detail that one can easily lose sight of the most significant findings – we identified the drivers common to three scenarios and compressed them into a collection of key success factors for automotive players.



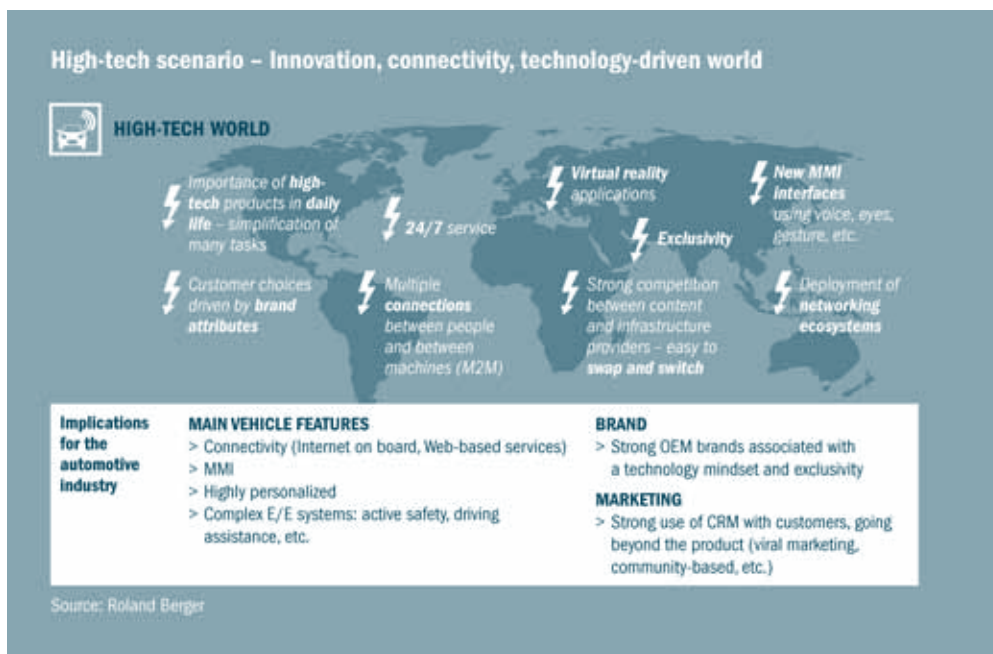
Our three scenarios are based on the megatrends discussed above. Each scenario depicts the world in 2025 in an extreme way. We call them the High-tech scenario, the Budget scenario and the Sustainability scenario.



The High-tech scenario describes a world in which high-tech products simplify many areas of daily life. Devices are controlled by voice, eye, gesture and other sensors. People live in a highly interconnected world and are a part of networking ecosystems. There is strong competition between content and infrastructure providers. People expect and receive 24/7 service. It is easy to swap applications and switch providers.

For the automotive sector, the High-tech scenario foresees a wide array of car features allowing drivers to stay connected to their networks while driving, use the Internet (cloud-based services) and personalize the MMI. Complex E/E systems in active and passive safety, driving assistance and auto diagnostics are commonplace. In marketing, technologies such as CRM play a major role in helping OEMs to go beyond the product (viral marketing, community-based, etc.).

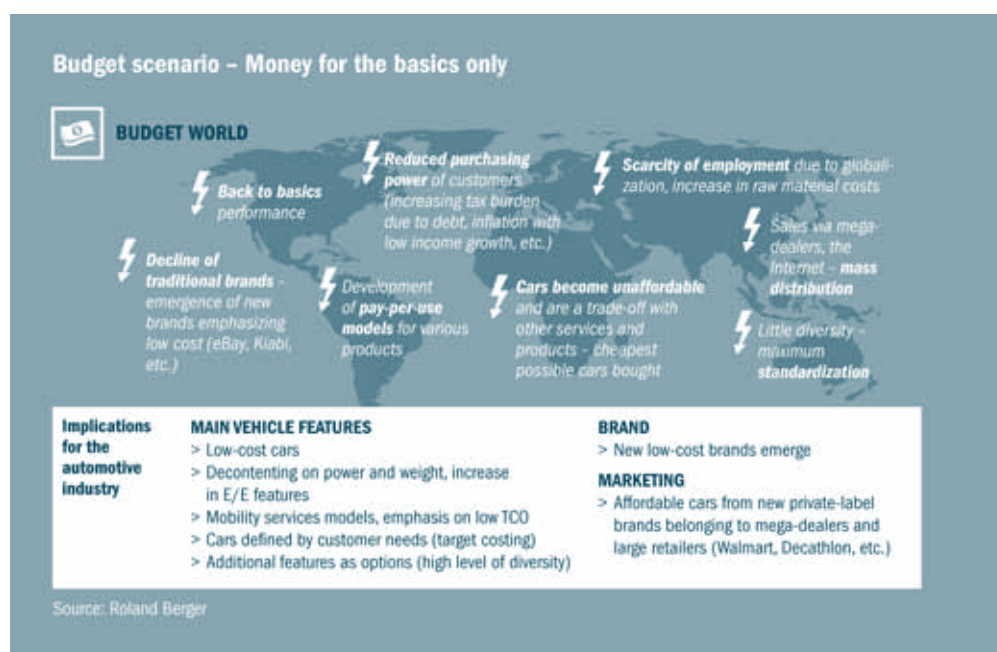
The key success factors to surviving the High-tech scenario are powerful R&D processes. This enables quick innovation and easy collaboration with changing partners from the automotive and non-automotive sectors. Module-based approaches allow features to be upgraded fast. Strong configuration management is a prerequisite. Plants must be highly flexible and allow frequent updates and personalization of products.



The Budget scenario describes a world in which the purchasing power of customers is strongly reduced due to taxes and inflation combined with low income growth. Globalization creates scarcity of employment and raw material costs rise. Cars are less affordable and the money spent on cars is in competition with other spending. Leasing and finance schemes are the norm and pay-per-use models establish themselves for many products. New low-cost brands emerge.

The main features for cars in the Budget scenario are a high degree of simple, no-frills technology and limited standard equipment levels, enabling a low-cost position. New low-cost brands emerge and players from outside the automotive industry enter the market selling affordable cars under their own label, e.g. Walmart.

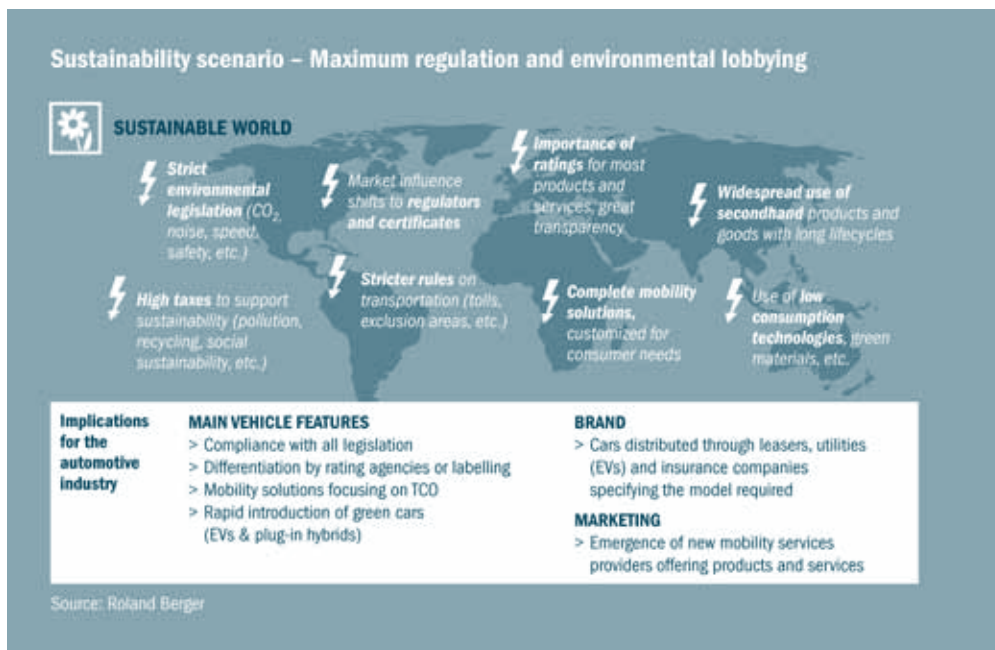
The key success factors to surviving the Budget scenario are reducing the costs of development and production to an absolute minimum. Standard platforms will be the norm for producing global products with limited equipment. Multi-badging allows OEMs to address local markets with different brands and players while sharing the same product base. Engineering and production will take place in low-cost centers with a high level of local sourcing. Cost is the main driver and development and production of many modules and even complete vehicles is outsourced.



The Sustainability scenario describes a world in which consumer behavior is strongly influenced by regulation, legislation and tax, but at the same time by rating recommendations. Transportation is restricted. Sustainability is partially imposed by law, partially the result of a changing attitude to the environment on the part of consumers. People are highly educated and use the transparency offered by the media to buy long-term durability and high quality. The marketplace for second-hand products grows.

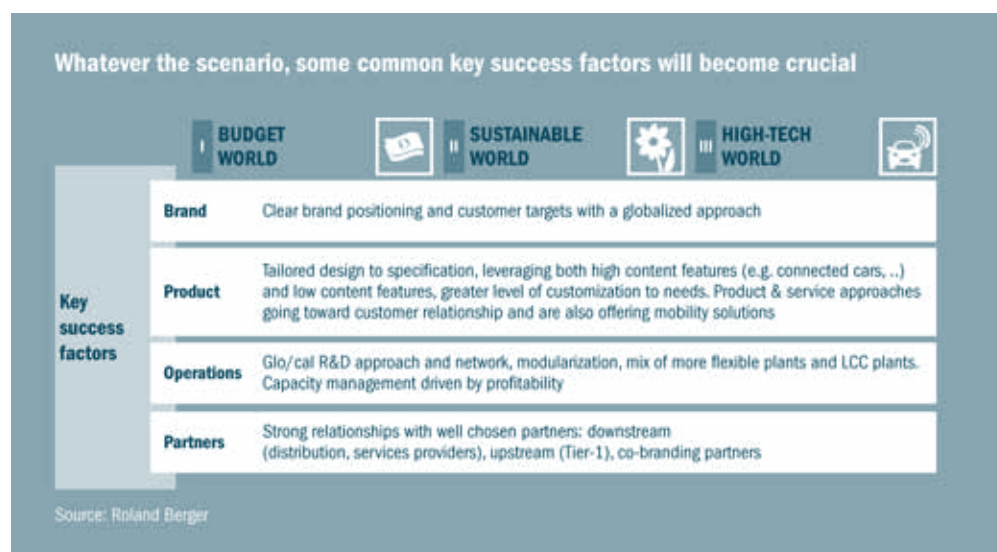
For the automotive sector, this means that vehicles must comply with all current and future legislation. Brands can gain a competitive edge by offering the most sustainable product and a high share of electrified cars, be it pure electric drive or hybrids. OEMs become new mobility solution services working together with other providers.

The key success factors to surviving the Sustainability scenario are R&D activities aimed at creating innovation through green tech. Successful products will be zero- or low-emission vehicles and mobility solutions, allowing intelligent traffic management.



By comparing these three extreme scenarios for 2025, we can identify some common success factors. With regard to branding, for instance, it is crucial in each scenario to ensure clear brand positioning. The products of 2025 will be closely tailored to the demand for low cost and flexible enough to allow upgrades and personalization. Customer relationship management will form an integral part of the product or service offering, as will mobility solutions. R&D will take place close to the market and local R&D centers will be connected by strong, flexible networks. Partnerships will grow in importance as a way of providing timely access to new technologies, markets and business models.

In the following section we bring together these common success factors, the different scenarios and five megatrends. Using them as a basis for our discussion, we identify the implications for the automotive industry so that players can define their own strategic moves as they face the future.

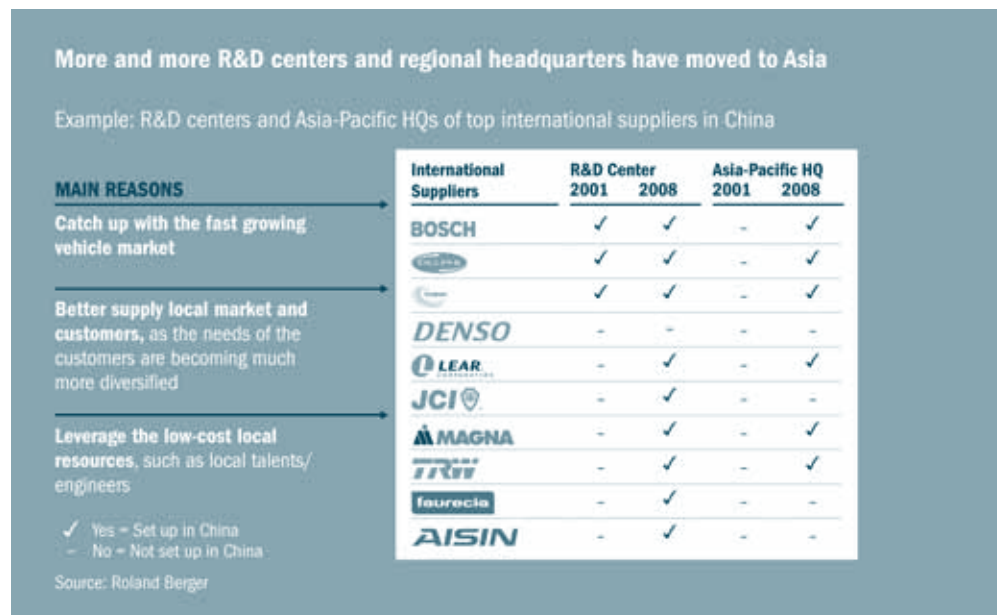


Implications

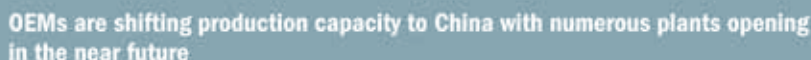
In the following section we present ten key findings based on the five megatrends, the different scenarios and the key success factors common to them. Generally the key findings can be characterized by looking at the following different impact clusters: markets, customers and products; partnerships, business models and the value chain; and organization structures, employees and change.

1. The shift to Asia

Within the last decade, Asia has gained tremendously in importance as an economic region. To address this growing market and take advantage of the favorable cost position in the region with regard to resources and labor, more and more companies have moved their R&D centers and regional headquarters to Asia. Thus in 2001 only three of the top ten international automotive suppliers had an R&D center in Asia and none had an Asia-Pacific HQ. In 2008, by contrast, nine of the top ten had an R&D center in the region and six of them had an Asia-Pacific HQ.



This development is set to continue in the near future. OEMs are shifting production capacity to China and will open numerous plants in the next two years, all over the country. Suppliers will follow suit.



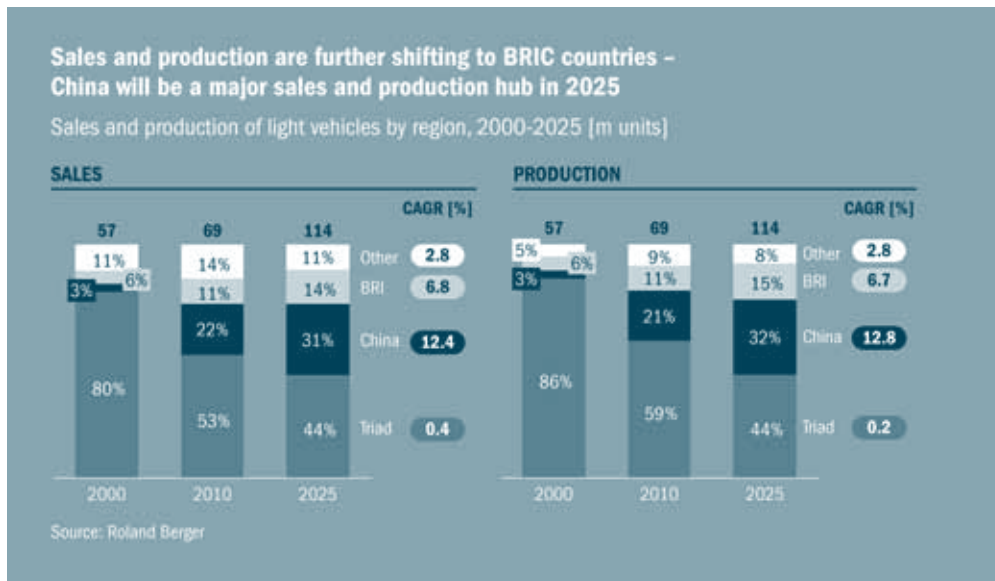
OEM's establishments in China over 2010-2012 period



This dramatic shift to BRIC countries, particularly Asia, will persist in the long term. Purchasing power in the region is growing fast and the desire to own a vehicle – something that for many was not possible in the past – is strong. As a result, the motorization rate is rising swiftly. Sales will continue to boom for the next few years.

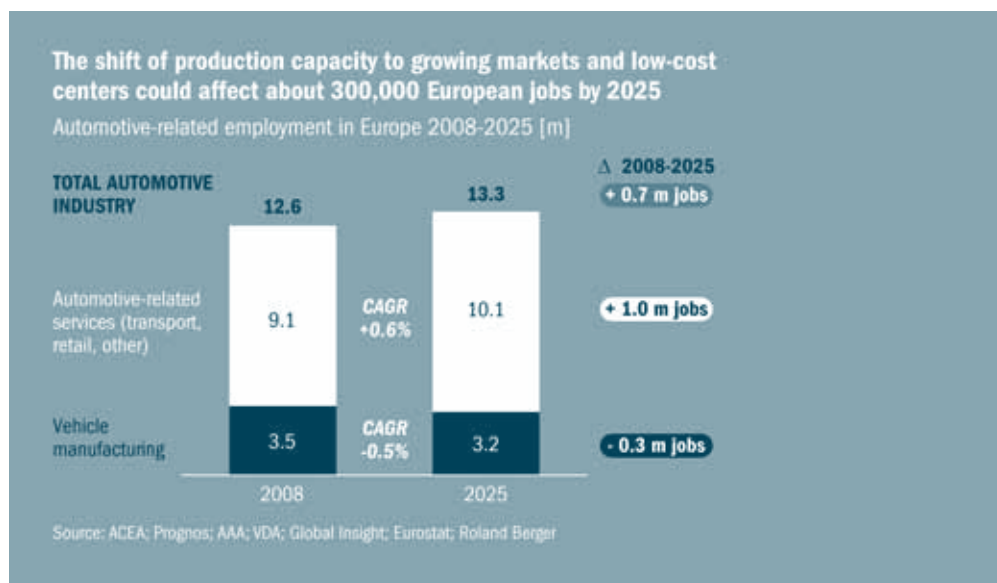
By 2025 China alone will account for 31% of sales of light vehicles, compared to just 3% in 2000. In other words, in just 15 years' time one in three cars will be sold in China. By contrast, the share of triad countries in sales of light vehicles will plummet from 80% in 2000 to just 44% in 2025.

Models will adapt accordingly. Production capacity and jobs are shifting to Asia or being created there for the first time. Products are already being designed specifically for these markets: cars based on B versions of vehicles developed for triad countries are no longer successful. This trend will continue, leading companies to set up local R&D facilities too. New brands are also being created specifically for these markets. For example, the China-based joint venture between Daimler and BYD plans to launch a new electric vehicle brand specifically for China in 2013.



Regional trade blocs such as MERCOSUR and ASEAN are expected to grow. This will also mean a shift toward low-cost locations within those blocs. This trend will be accelerated by rising transport costs, political regulations and fluctuating exchange rates. Suppliers will follow the automakers down this road.

Of course, this all represents an enormous growth opportunity for automotive companies. But it also poses a risk for mature markets. Innovation in the automotive industry tends to result from manufacturing and engineering capabilities. As these capabilities shift to emerging markets, there will be a major impact on jobs. In Europe some 300,000 jobs – one job in eleven – could be lost in automotive manufacturing. At the same time, automotive-related industries such as transportation, retail and other services will create an additional one million jobs, outweighing the loss in manufacturing jobs.



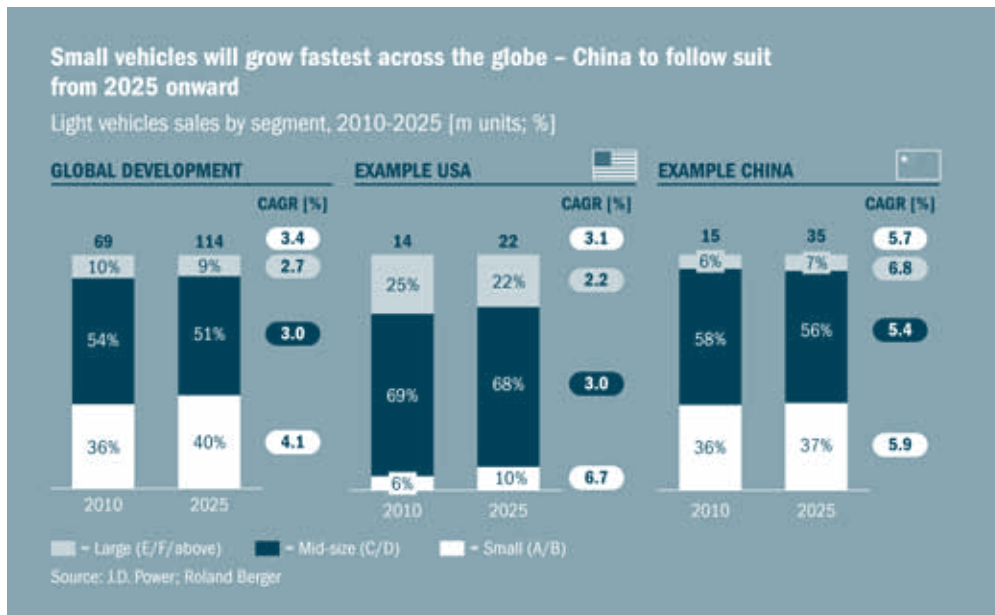
For western OEMs and OESs, the rise of Asia as a car market and Chinese automotive players as business partners (and competitors) will lead to substantial changes in the skills they look for in their employees. Attractive employees will be flexible enough to work at hours that suit Asia. They will also understand local cultures and maybe speak some Mandarin. And at some point in their career, they will be willing to be sent to Asia as an expat to work in the local national sales company, production plant or R&D center.

2. Small is beautiful

Values are changing. Purchasing patterns are moving away from conspicuous consumption toward conscious consumption. This transformation is taking place primarily in industrialized nations, but is also seen in certain sections of society in BRIC countries.

For many people in emerging countries, of course, choosing a small car rather than a big one is a decision based not on personal values, but on their budget considerations as they are moving up in the mobility modes. Here, mass motorization is imminent.

As contrary as the reasons might be, the A/B segment will experience disproportionate growth compared to the total market and other segments. Over the next 15 years, small vehicles will show the fastest growth worldwide. Even in the US, the share of small vehicles will grow from 6% to 10% while the share of large cars (E/F and above) will decrease from 25% to 22%. By contrast, China will remain stable in its car segments, with a relatively high share of A/B cars of 37%.



The absolute margins – and often the relative margins too – on smaller cars tend to be lower than on bigger models. Consequently, the disproportionate growth of the A/B segment will lead to greater cost pressure on OEMs and, by extension, OESs. Across the board, cost efficiency will play an even greater role than today.

There are three possible ways to tackle this cost pressure and to be a successful player in the small car game. a.) Go the volume way. b.) Apply premium product prices. c.) Or do both.

In terms of the volume strategy, companies can only generate the necessary volume by sharing technology, modules and capacities, be it in-house or with an external partner. A good example is the joint venture between Citroen, Peugeot and Toyota, who together designed, developed and produced the C1, 107 and Aygo.

To achieve price premiums in the A/B segment, OEMs need to transfer the product features seen in larger models to their smaller vehicles. These include safety levels, efficiency technology, the driving experience and the available range of options – a highly successful approach in the last couple of years ("mass customization"). The Mini brand, Fiat 500 and Citroen DS3 might serve as examples.

Doing both at the same time can obviously be the silver bullet, as the financial results of Audi indicate.

OEMs can also choose a totally different approach: the "low cost through low tech" option. Here simple, proven technology is used to offer reliable, no-frills cars for basic transportation needs. The example of Dacia shows that such a concept can be universally successful too.

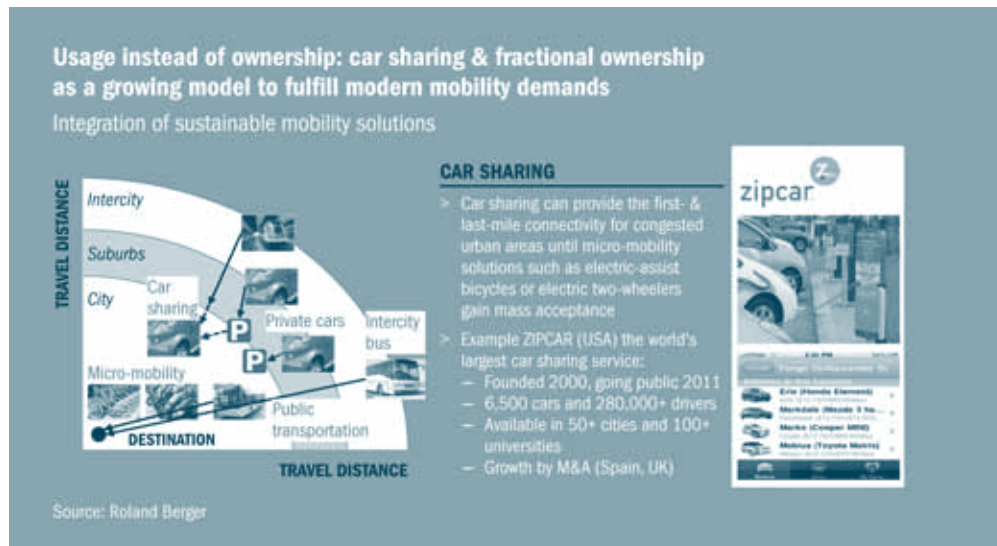
In terms of organizational structures, automotive players involved in the A/B segment will have to work more and more in transnational and often cross-company project teams in order to leverage volumes. Advanced project management expertise will be needed across the different companies, alongside a high degree of diplomacy and cultural adaptability. Strict cost control and strong branding and marketing teams are crucial.

3. Demotorization

OEMs will have to deal with another important countertendency affecting the automotive market: demotorization. This trend is driven less by budget and more by values and, to some extent, convenience. As we saw earlier, car ownership is losing its appeal as a status symbol, especially among younger people. For them it is enough to be able to use a car when they need to – they don't need to own one. Car ownership rates are already fairly low among the under-30s and will fall further still by 2025. Items from the electronics sector such as computers, portable music players and smart phones are much more interesting to spend money and time on. Due to the cohort effect, the next age group will repeat these behavioral patterns, even if there is no financial necessity for them to do so.

Demotorization was first identified in the big cities of established industrial nations. But it is also emerging for young people in the new megacities, almost all of which are in Asia. Our research confirmed this development, e.g. for Shanghai.

The implications of this small but growing trend are manifold. To make the most of the trend, the automotive industry has to embrace integrated mobility concepts. Emerging mobility ecosystems integrate different transportation modes, such as bikes and e-bikes, city buses, metros and cars, and increasingly make use of car sharing models. In Asia, e-bikes and electric scooters are already a common phenomenon – on China's streets alone there are already 120 million electric scooters. In this particular case, there is little need for a car sharing model as a supplement. But in the developed world, car sharing will soon be providing first and last mile connectivity for congested urban areas. Other solutions such as micro-mobility – e-bikes, electric two- and three-wheelers, and so on – may also gain mass acceptance.



With demotorization on the increase, car sharing is developing from a somewhat idealistic neighborhood initiative into a proper business model. Modern technology aids this development and allows car sharing to operate in a simple, flexible and convenient way for the customer. Serious players such as independent providers, rental companies and OEMs will soon be adding these services to their portfolio. For some, car sharing represents a welcome new business opportunity – but for the OEMs it is first and foremost a way to minimize the damage caused by lost sales.

Current car sharing initiatives enjoy an average rate of one shared car per thirty-eight users. Obviously, not all of these thirty-eight users will replace their privately owned car (or cars) entirely with a car sharing model. Some of them would not be able to enjoy individual mobility otherwise due to the cost of ownership. However, some replacement of private cars will no doubt take place. This represents a threat for OEMs in developed markets, and OEMs need to understand that and react in time.

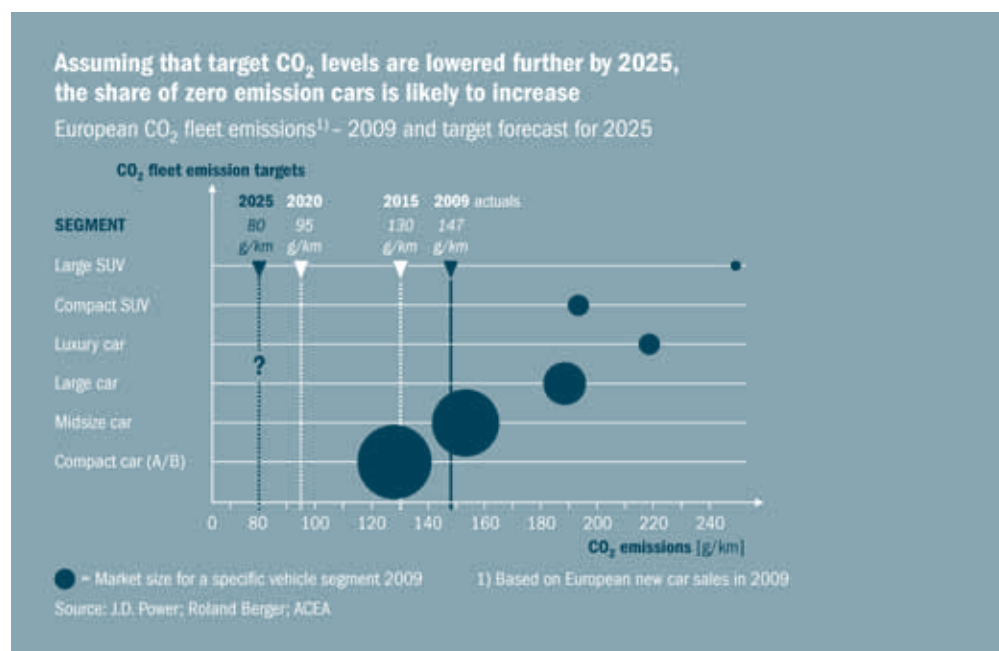
At the same time, car fleets are growing around the world, including cars used for car sharing purposes. This will increase the pressure on sales margins for new cars as purchases will be conducted more and more often by professional buying centers.

The position of automotive retailers is at risk from both the growing number of car sharing users and the increased professionalism of sourcing departments when it comes to fleet cars. Retailers risk being simply left out of the equation at the point of sales and point of service.

Our interviewees repeatedly voiced the opinion that in the United States this trend toward demotorization would be limited, however. It is true that one of the biggest independent car sharing providers, Zipcar, is based in the US, and Daimler has chosen Austin, Texas, for its second trial of its Car2go concept. But our experts believed that public transit would not grow as quickly as some currently think, unless there were new government regulations limiting vehicle traffic.

4. Powertrain electrification

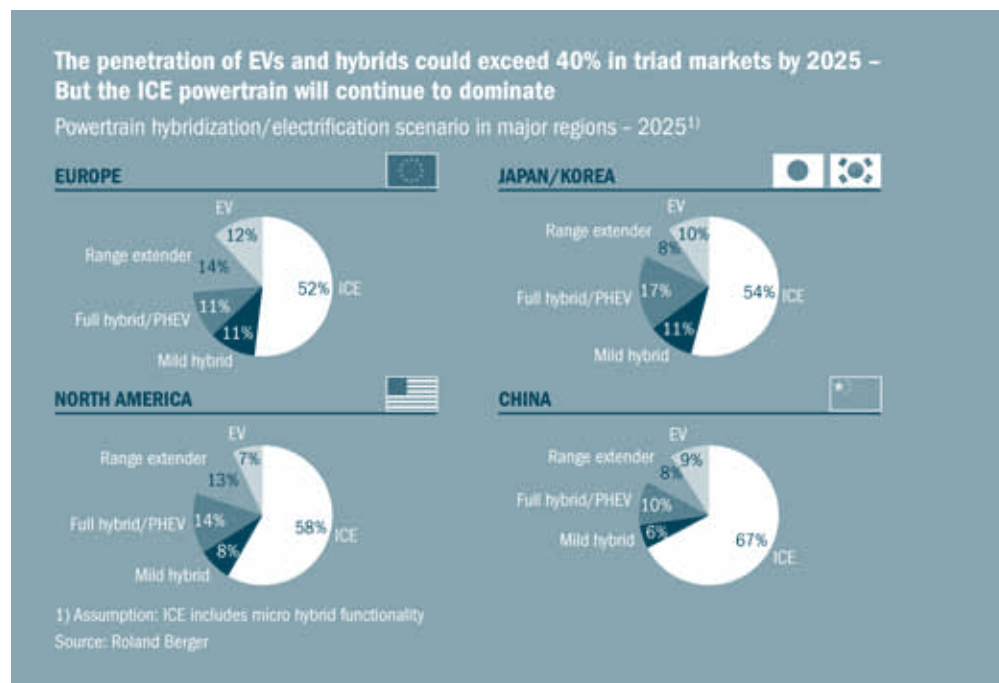
Governments around the globe have issued tough CO₂ footprint reduction targets. The automotive industry has made significant progress in the last couple of months and is expected to match the European target for 2015 of 130 grams of CO₂ as early as 2013. Internationally, Europe is a forerunner. It has one of the lowest target levels and has also set a longer term target. Thus by 2020, the EU is aiming for a 95 gram limit on CO₂ emissions, representing an average annual reduction rate of more than 6% – more than the currently possible reduction levels. It is obvious that with the current set of technology the longer term emission reduction targets will not be met. Optimizing ICE technology will be insufficient on its own. OEMs will need to expand their technology portfolio and add electrification of the powertrain in all forms, including plug-in hybrids and pure electric drive vehicles. In 2025 we will also see the first electric vehicles equipped with fuel cells on the road – mainly in Europe and California.



Globally, the share of pure electric drive vehicles will increase to a maximum 10% of global new vehicle sales in 2025 in our best-case scenario, provided we do not see a breakthrough in post li-ion battery technologies before that timeframe, which is not very likely. Therefore further growth will be limited by the low range, heavy weight and high cost of the vehicles equipped with li-ion batteries. Hybrids will be significantly more popular, achieving a 40% share. PHEVs (plug-in hybrid electric vehicles) in particular combine the advantages of ICEs with those of electric powertrains, without being dependent on the nearest charging point. ICEs will still account for 50% of new car sales, while light duty vehicles with fuel cells will still be in the low single-digit percentage range.

Some industry experts are more bullish about electric drive, however. Albert Lam, CEO of Detroit Electric: "Electric and plug-in hybrid cars will not replace gasoline engines in the foreseeable future. However, the share of electric cars could grow to up to 20% in 2025 – provided enough charging infrastructure has been set up."

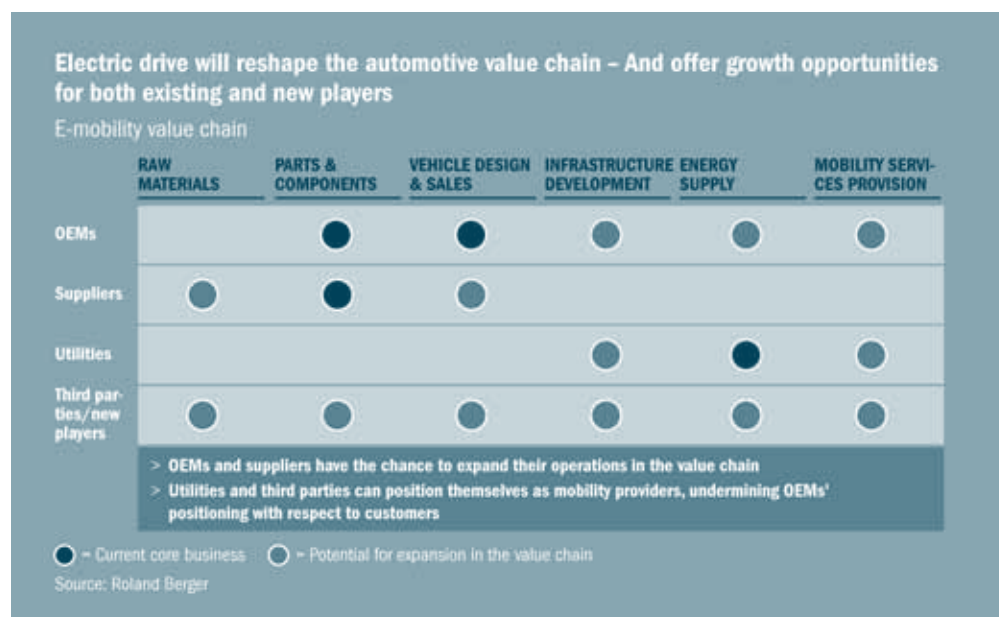
The US will have a lower share of electric vehicles in 2025 than other regions. The US has been a trailblazer in buying new technology such as hybrids. Prominent new players such as Tesla and Fisker stem from California. But the distances in the US are still too great for electric vehicles with their limited range, and gasoline prices are simply too low. A top bank executive: "As long as fuel prices stay where they are, you will not see electric cars win in penetration."



The growing overall share of electric drivetrains will reshape the current mobility value chain in all segments. The pure electric powertrain itself is much simpler to design, manufacture and service – apart from the challenge of high voltage. Some components will be new, others electrified. All parts of the e-mobility value chain offer growth opportunities for OEMs and suppliers, as well as for utilities and third parties. Established suppliers will expand into the parts and components needed for vehicle electrification.

Of course, electric cars need a new type of "fuel" and a new type of refueling process. A new infrastructure for refueling will be created – mainly by utilities companies, who will define a substantial part of the cost of ownership in the future.

Many third parties will also want to turn the growing share of electrified cars to their benefit. These players will offer a variety of mobility services such as car sharing or even entire cars. The relatively simple technology used in electric drive vehicles will allow third parties to create a proper car for short-distance mobility. These players will act purely as a "brand integrator". Development, manufacturing, servicing and to some extent even design can be outsourced. For the likes of Gucci, Red Bull and Apple these new electric cars will mostly be a marketing exercise, extending the brand experience and creating hype. For others such as Bosch Car Service and Midas, it could be a clever way to create more awareness and customer touch points.



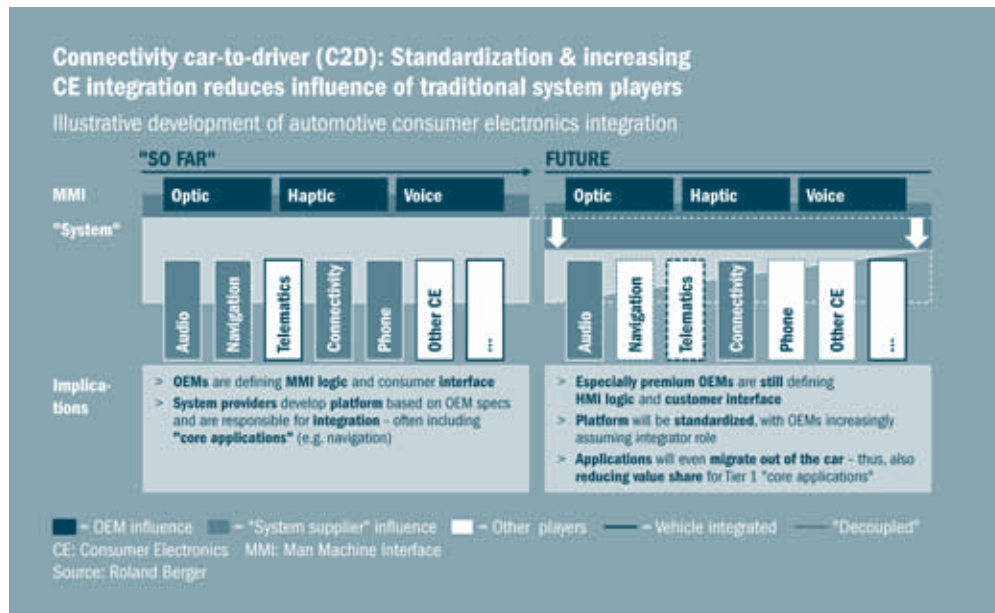
Electric powertrains are easier to design, manufacture and service. This means that they lose the power to differentiate one car model from another. Applied technology is becoming more and more interchangeable. Converging electric powertrains offer little room for real innovation. Moreover, OEMs' share of value add will be lower than in conventional drivetrains as the components in the electric drivetrain will often be sourced externally.

As a consequence, premium brand OEMs in particular will have to find ways to substantiate their premium claim and justify their premium prices. They can do this through other technological components in the vehicle. One promising approach is that of the BMW Mega City Vehicle, to be launched in 2013. BMW will use lightweight materials such as carbon fiber and aluminum extensively in the vehicle to compensate for the heavy electric drivetrain, and offer a driving experience worthy of a premium brand. Other areas in which premium brands can deliver on their brand proposition in a credible way will be a customer brand experience backed up by sophisticated yet reliable CRM processes and, where possible, premium customer service.

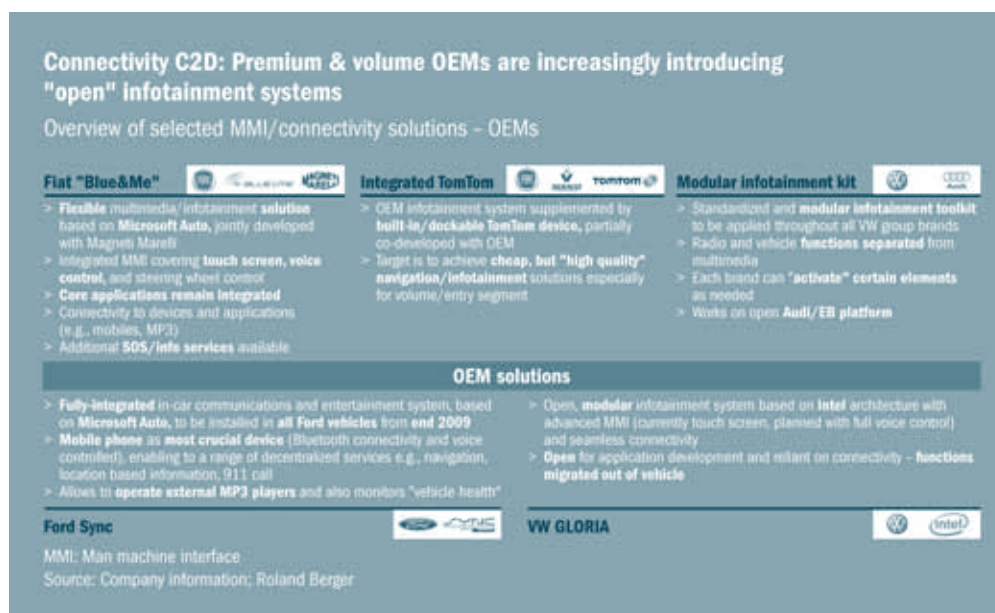
5. Always online, always connected

By 2025, many vehicles will always be online, sending and receiving information via the Internet. Connectivity car-to-driver (C2D) is essential. Vehicles will communicate with each other and their environment – although we do not yet know exactly how.

In the past, OEMs have defined the man-machine interface (MMI) and the consumer interface of the car. System providers then developed a platform based on OEM specifications and were responsible for integration, often including core applications like satnav systems. In the future, however, drivers will expect to be able to integrate their electronic devices in the car. Platforms will be increasingly standardized, leaving OEMs with the role of integrator. Some applications will also move out of the car, reducing the value share for Tier 1 "core applications" and the profit margins of OEMs.






In line with this development, OEMs are increasingly introducing "open" infotainment systems in their vehicles. This is true for both premium and volume players. In most cases, drivers will be able to order additional services such as location-based information, navigation on demand and SOS calls. Most often a device such as a smart phone or a TomTom will be docked in the car. The systems will usually be controlled by voice, touch screen or from the steering wheel. Gesture command, which customers are familiar with from Apple products, will follow later.



The future connectivity solutions provided by suppliers will also be more flexible in integrating consumer electronic devices. Traditional "system suppliers" will expand their approach. Continental, Bosch and Nokia are all currently working with partners on infotainment concepts featuring open architecture. Solutions will have the ability to run applications from external parties and some will even have their own Web access so they can use cloud-based services.

Most connectivity solutions from both OEMs and suppliers will feature a dual architecture with a division between core automotive applications and multimedia applications. The first circuit will be closed due to safety concerns, and the second will have an open architecture for running external apps.

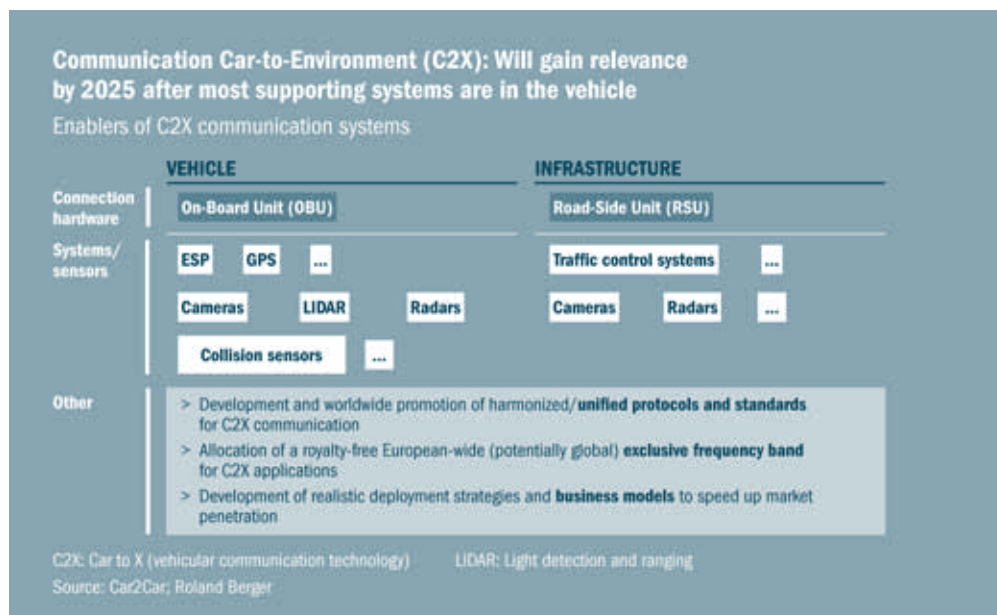
Connectivity C2D: classic "system suppliers" are extending their "traditional" approaches – Trend towards flexibility and CE integration
Overview of selected MMI/connectivity solutions – Suppliers

| Conti AutoLinQ (concept) | Bosch multimedia reference system (concept) | Nokia VNC layer (concept) |
|---|--|--|
|  |  |  |
| integration, core applications, head unit platform, operating system, app store, developer base | integration, architecture, core applications, hardware platform, cloud based data | software platform, vehicle interface, app store, external device embedded infot. and ADAS apps, interface with devices, HMI NaviPro maps |
| <ul style="list-style-type: none"> > Android based, open infotainment architecture with core applications integrated > Proprietary Tier 1 system available to multiple OEMs, but open for third party applications and new business models – e.g., app store > System has four key interfaces: in-vehicle, to mobile device, remote access, and third party connectivity | <ul style="list-style-type: none"> > Linux based infotainment concept open to all OEMs > Mostly integrated functions, but open to innovations applications > Dual architecture with division between core automotive applications (e.g., nav) and multimedia apps (e.g., MP3, phone) > Connectivity to external devices available, but not relied upon – system has own web access | <ul style="list-style-type: none"> > Platform to facilitate vehicle-device connectivity between any head unit and mobile device > Mobile device display will be shown on vehicle MMI – external applications can be run > Vehicle information can be accessed, facilitating respective location based services/DAS systems > Open for third party application development |

MMI: Man machine interface VNC: Virtual networking computer CE: Consumer electronics
Source: Company information; Roland Berger

When it comes to communication between the car and its environment or the car and other cars (C2E and C2C – together C2X), there is still a long way to go. C2X communication would help prevent accidents, automatically make a call in case of emergencies and help optimize overall traffic flow. But many steps are needed to make this dream a reality. Most cars today, at least in developed countries, already feature an on-board unit, electronic stability system, camera, radar and so on. But other technical requirements are not yet met and will require major investment.

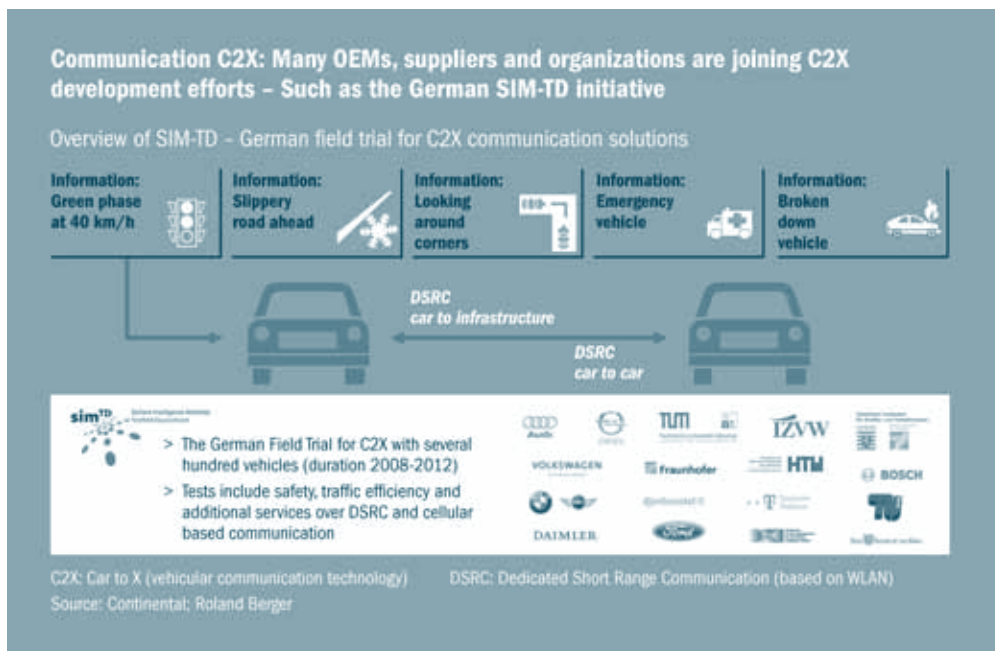
They include road-side units receiving information from vehicles and sending it out to other vehicles, cameras and radars, unified protocols and standards, and an exclusive frequency band in Europe or even globally. Business models must also be developed for using and maintaining the infrastructure. For these reasons we do not expect to see C2X playing a major role even by 2025, especially as a critical mass of vehicles will need to be involved for there to be appreciable benefits.



Google's approach is slightly different. The company believes that C2E and C2C communications will be integrated into cars via smart devices and so will not require built-in solutions. The advantage of this approach is that new developments can quickly become widespread at low cost. Dr. Wieland Holfelder, Engineering Director at Google: "[...] we believe that by 2025, all vehicles will be always online, either directly or via equipment passengers bring with them, via 3G and 4G mobile phone networks. In other words, most data for infotainment and IT services that are not real-time-critical will be shared online by that time. The future is in Internet-based applications."

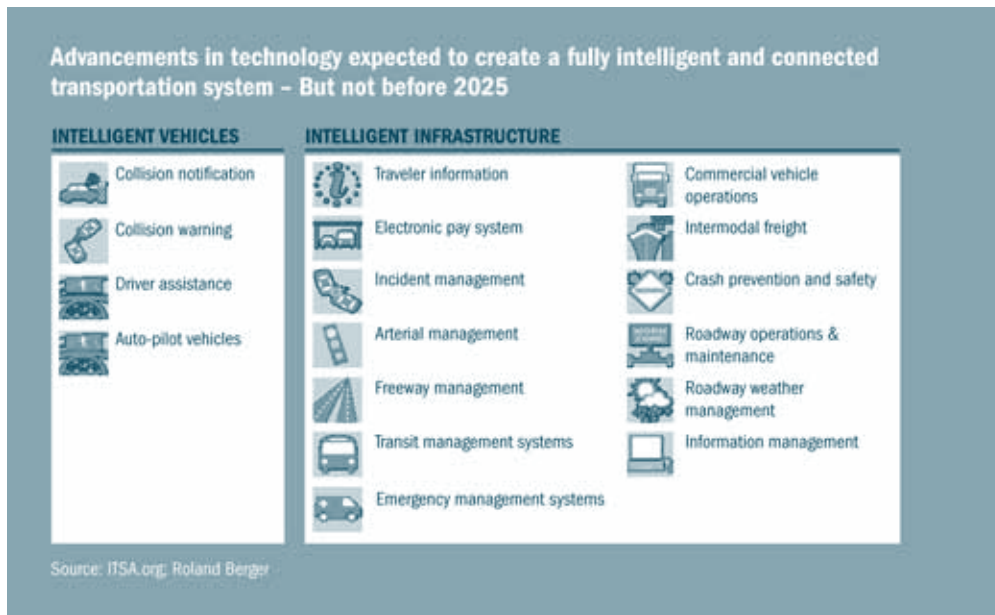
However, many other experts we spoke to believe it doesn't make sense to integrate safety-enhancing C2E and C2C applications via an interface between the vehicle and a smart device. This is because OEMs could find themselves liable if clean connections cannot be made between the vehicle and the device (if the smartphone crashes or is hacked into, for example). They prefer to integrate safety-critical C2E and C2C functionalities at the factory – an approach that will push back market launch and the widespread use of such functions for many years.

In an attempt to understand the opportunities and challenges of C2X better, numerous OEMs, suppliers, telecommunication companies and other organizations have bundled their efforts in a field trial with a fleet of 400 cars. This trial is taking place between 2008 and 2012 in the Frankfurt region in Germany.



The cars of the future will themselves become a sort of electronic device. Always online and always connected with the WEB 2.0 or eventually 3.0, cars will fulfill the function of a mobile data collection point and storage capacity and also act as a communication device, sending out and receiving information.

The idea that cars of the future – connected via intelligent traffic solutions – will have fewer accidents and that the weight and cost of active and passive safety features will fall is not likely to be realized until well after 2025. Piloting could take place in one of the new megacities if city planners design a corresponding strategy for electric vehicles in the city center.



6. New business models

With all the changes taking place in usage patterns and technology, new business models are likely to arise. They will not just be about selling cars but about integrating software and hardware, or different hardware modules.

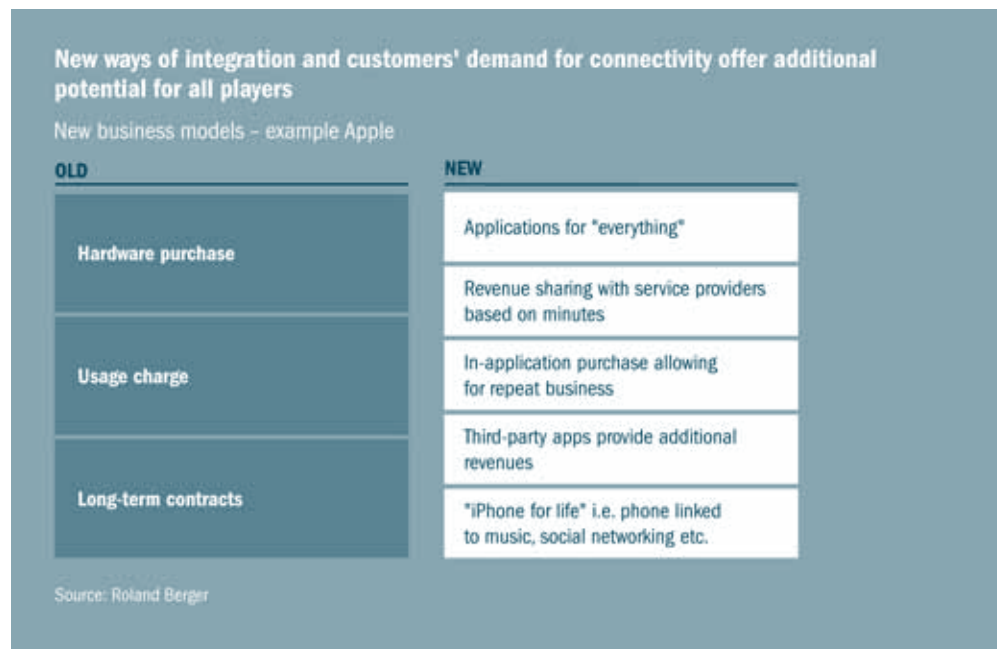
One example is mobility services, such as car sharing (see above – 3. Demotorization). Car sharing is a business that will have to be taken seriously by 2025, when the private economy will have moved in. Given that one shared vehicle can replace up to 38 cars, OEMs will have to try to integrate this new business into their model and generate other alternative sources of revenue before somebody else does. C2E and C2C communication could represent future revenue pools as well.

The rising proportion of corporate vehicle owners such as companies with car fleets, car hire firms, municipalities and car sharing companies will make it harder to achieve premium prices (buying center effect). Margins will be eroded and there will be more direct sales. This will tend to weaken the car retailers' position. At the same time, retailers are crucial for customer contact and will become increasingly vital as customers' needs become more individualized.

Apple could well serve as a role model for the convergence of the automotive and IT industries and its products. Apple's success is based on its holistic, generalist approach. It combines different ideas and products to create a closed entertainment ecosystem. Apple's business model is based on more than one success factor – indeed, we identify at least six. First, there is the categorical integration of hardware and software: downloads from iTunes can only be used on Apple products.

Second, the revenue-sharing model that exists between the creator of the apps and the owner of the artistic rights, a way of attracting popular content. Third, Apple has a simple, user-friendly pay-per-use concept. Fourth, there are endless possibilities for personalizing the product interface. Fifth, Web-based functions such as social networking are supported: Apple calls this "for life". And finally, the products are exceptionally easy to use and understand.

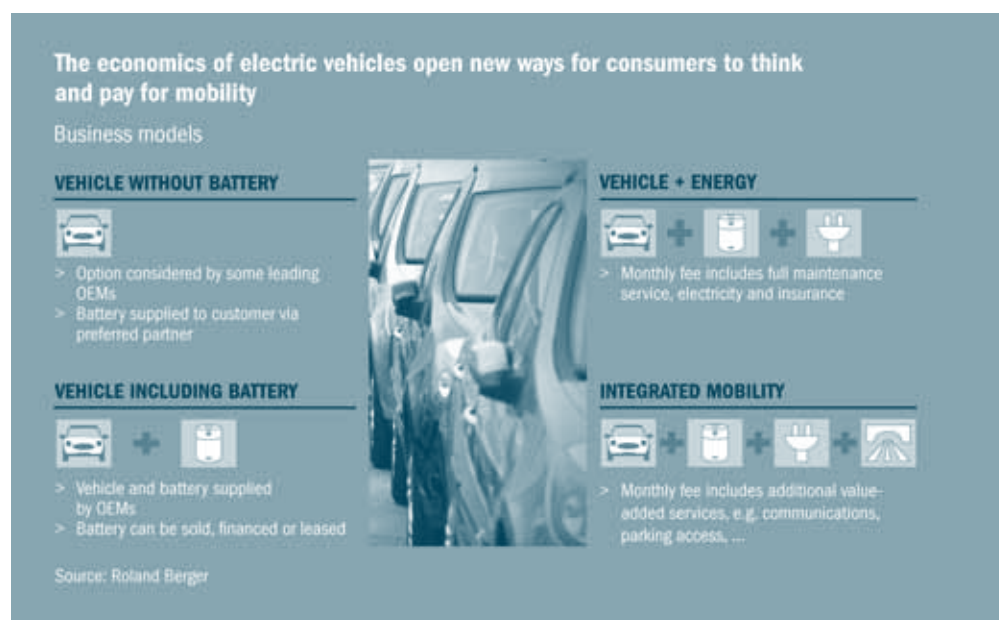
For automotive players, learning from Apple means anticipating the trends, being ahead of the curve. Older people, for example, want technical products that are easy to use and offer a simple, intuitive user interface. Young people, on the other hand, want to configure their own cars and personalize the MMI, just as they do with their communication platforms and iPhones. To keep young people interested, vehicles have to converge with their personal life, offering full connectivity. The possibility of configuring the interface of a car with tones, skins or other apps will open up the competitive field to new players. OEMs are strategically in a good position to follow Apple's example, as long as they can still design the hardware and software.



Another area where OEMs should start thinking about new business models is electric vehicles. The economics of electric vehicles open up new ways for consumers to think about and pay for mobility. They could, for example, purchase, finance or lease a vehicle without the battery and then have the battery supplied by somebody else. Or they could buy, finance or lease the battery together with the vehicle.

Drivers could pay a monthly flat rate that covers use of the car including the battery, charging of the battery and maintenance. Or they could pay a higher monthly fee and in addition receive value-added services such as navigation on demand, parking access, music downloads, and so on.

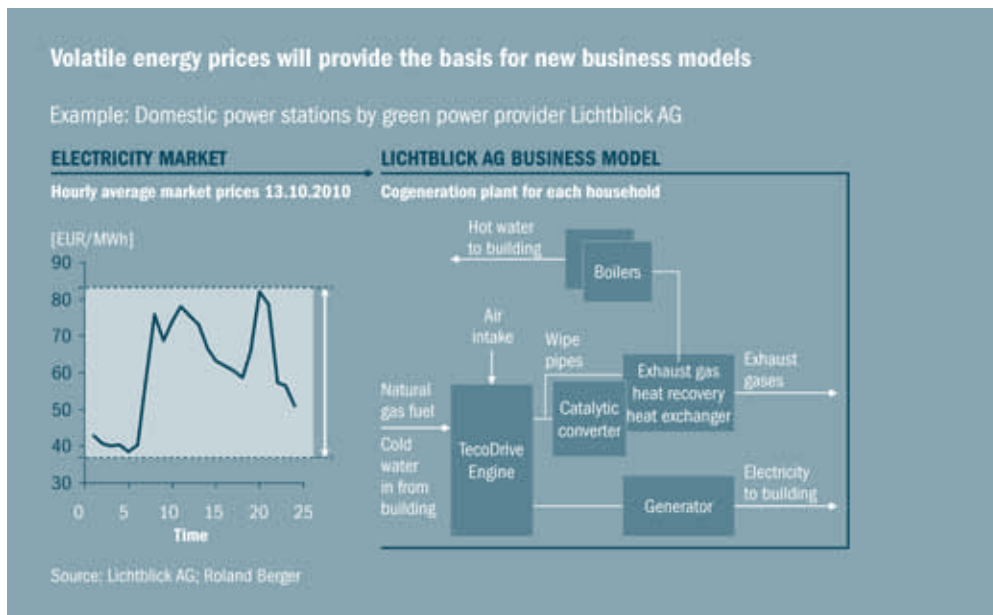
Companies must define these different building blocs and offer them in a flexible way. OEMs are not likely to offer all types of services themselves. But they have to make sure that they are the ones integrating the service blocs into a comprehensive offer. Their target is owning the customer contact. Otherwise cars could become simply commodity-like mobility devices.



Another recent business model takes advantage of the fact that resource prices will continue to rise. Prices will fluctuate even more in the future, driven by the increasing share of renewable energy, which is difficult to control for the purpose of covering demand peaks.

Fluctuating prices, in turn, will provide the basis for product innovations such as smart metering-capable products, for example the Miele washing machines presented at the IFA consumer electronics fair in 2010. They will also enable new business models. Green-power provider Lichtblick, for instance, wants to install 100,000 domestic gas-fired power plants in Germany. The cogeneration plants used are over 90% efficient and are sourced from Volkswagen.

These cogeneration plants sell power back to the grid when the price is good while heating the household's water, a principle called "swarm electricity". The 100,000 domestic power plants will together have a capacity of 2,000 megawatts – the equivalent of two nuclear power plants. More business models like this are expected to follow.



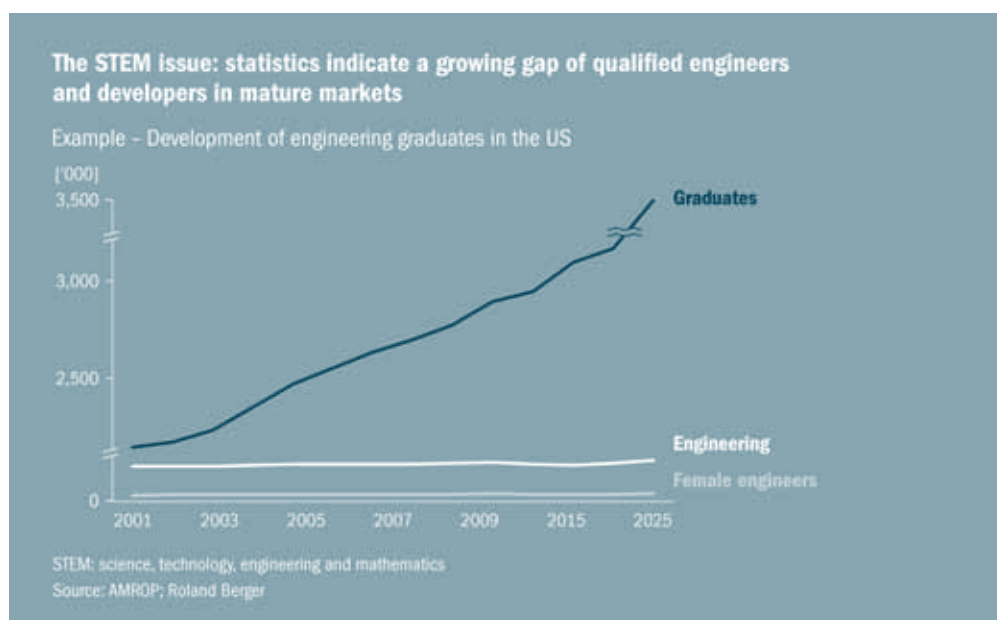
The rise of new business models will also have implications for the organizational structure of automotive companies. Many of the new business opportunities are not focused on the car itself but are rather add-ons generating downstream revenues. Companies need to build up capacity to develop business innovation ideas. These new departments need to be located high up in the organizational hierarchy so that they can question the established ways of doing things. They also need this position to get enough speed into the decision-making process that they can exploit first-mover advantages against non-automotive competitors.

As these functions become more prominent within the corporate organizational structure, a process of cultural change may occur. Product-centric activities may relinquish their position as the focus of attention and, as a result, the dominance of engineers with traditional skill sets in automotive companies could decline. The focus would then shift to downstream business, creating better career opportunities for industrial engineers and non-engineers alike.

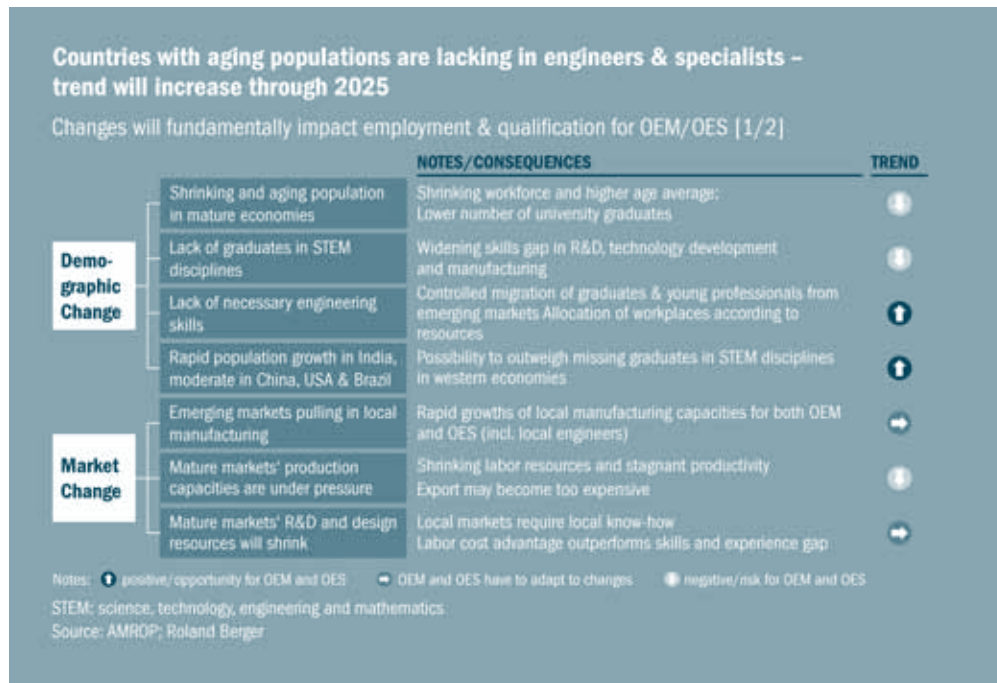
7. The lack of engineers and specialists

The expanding range of technologies and the need to develop specific products for local markets will require additional capacity in R&D departments. However, many OEMs and OESs will not be able to increase their engineering capacities across the board by 2025. They simply do not have the employees available. This is a particular problem in countries with aging populations.

Looking at the example of the US, despite the growing absolute number of university graduates, the share of engineering graduates continues to fall. In 2011 there will be 50 MBAs and 18 law graduates for every engineering graduate. This gap will grow over time, with serious short- and long-term implications.



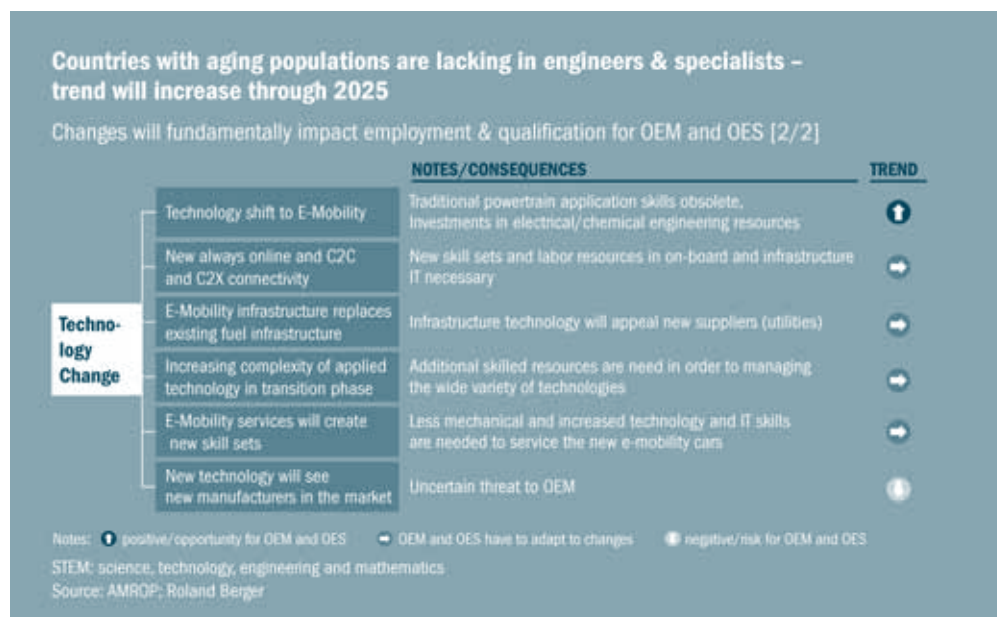
Countries with shrinking and aging populations will find themselves with a higher average employee age and a lack of graduates on the job market. Demographic change will result in a particular lack of graduates in STEM disciplines – science, technology, engineering and mathematics. The war for talent will escalate, with a negative effect on the cost of labor. Diminishing labor resources and stagnant productivity will put mature markets' production capacities under pressure, and it may become too expensive to export. At the same time, local markets need local know-how, and growing emerging countries need growing local manufacturing capacities, appreciating the benefits of rapid population growth and affordable labor costs.



Countries with aging populations will therefore be looking to extend the working lives of the workers they have, through flexible working models that reflect employees' personal interests and financial needs. Other approaches, which vary from country to country, are also already being tried. They include numerous initiatives by private foundations and government bodies to attract children and young people to STEM subjects. Women who have started a family and then returned to work are also a highly valuable source of additional well-educated labor, especially for management positions. Offering adequate childcare facilities and flexible and part-time working hours are a prerequisite here.

Countries with aging populations will also need to encourage immigration more actively in line with labor market requirements as a way of compensating for their falling birth rates. Countries such as Canada, Australia and Sweden are already working actively to reverse the shortage of engineers and qualified specialists. Today, Germany and the Netherlands are examples of countries with negative net migration and insufficient birth rates. Both countries have fewer young engineers (aged 25-34) than older ones (aged 55-64). According to forecasts, Germany alone will have a shortage of 1.8 million specialists by 2025.

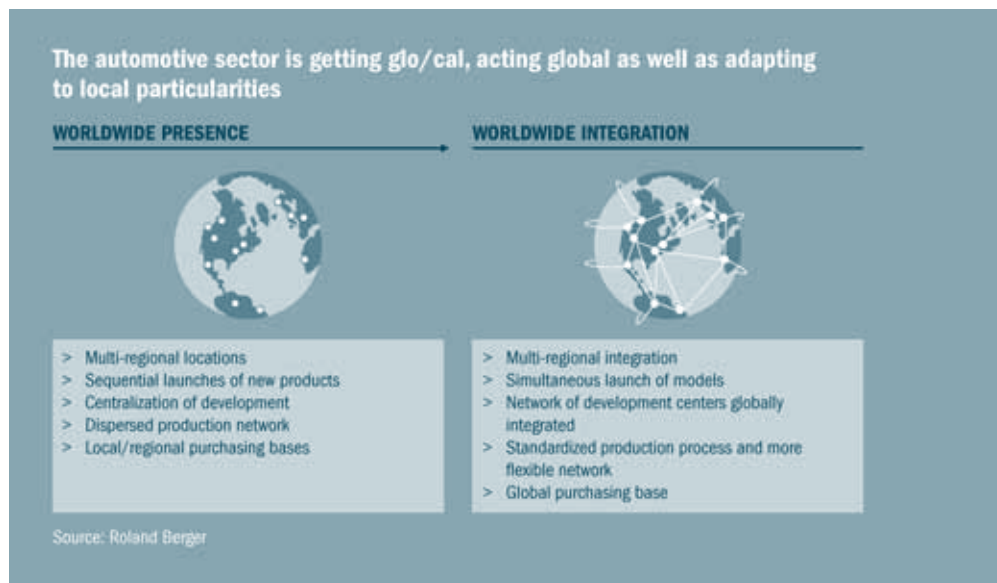
New skill sets and labor resources in the area of IT infrastructure are needed for developing, say, C2X functionalities and open-architecture infotainment modules. Electric drive requires a new sort of infrastructure; people are needed who can understand and build this. In the transition phase from conventional ICEs to hybridization and ultimately pure electric drive, OEMs and OESs must master a wider, more complex technology portfolio. E-mobility services likewise require new skill sets with more IT skills and fewer mechanical skills. Changing technology, especially in e-mobility, will have a fundamental impact on R&D departments. OEMs and OESs need more engineers – and they need a new breed of engineers.



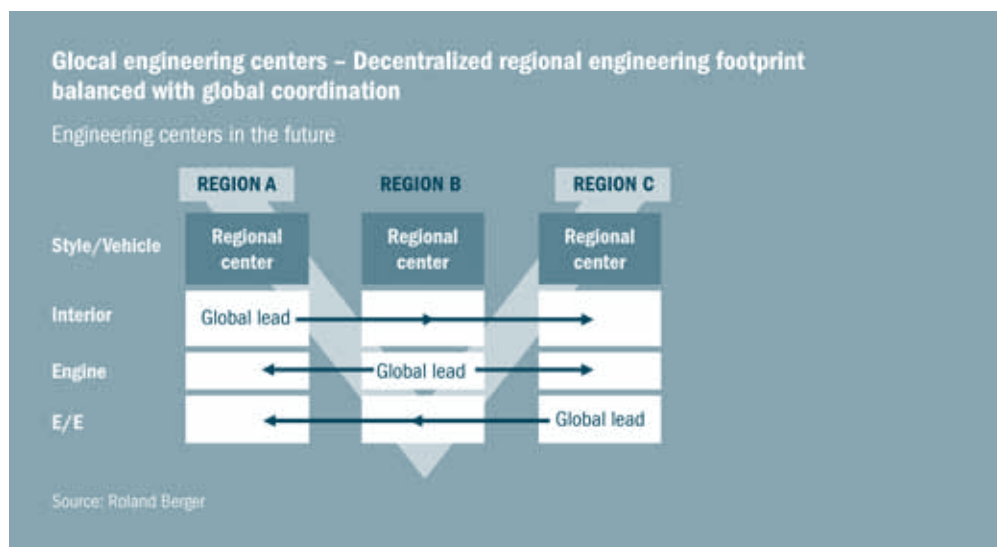
8. "Glo/cal" business organizations

Trends in emerging markets and mature economies are diverging – and with them the implications for global OEMs and OESs. The increasing regionalization of products impacts the processes and organizational structure of companies. Volkswagen Mexico, for example, has two separate business organizations under a single roof, one unit making vehicles specified and designed for the local market and the other making vehicles for export.

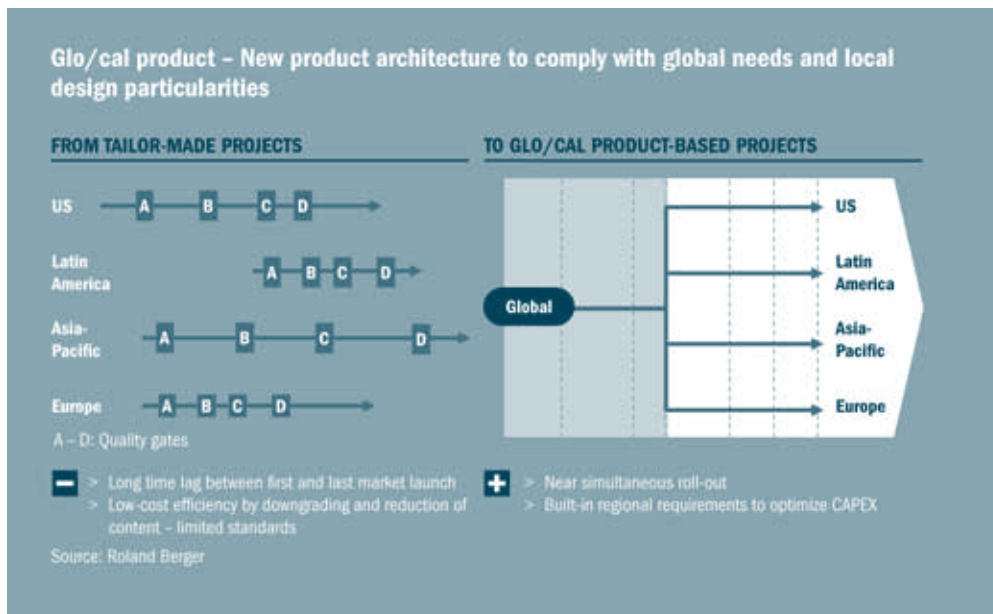
In other words, the automotive sector is becoming glo/cal. The term glo/cal refers to adapting a global framework to local particularities. Glo/cal business organizations use a global purchasing base. They operate with an integrated multi-regional setup in which a related network of R&D centers develop products adapted for local markets. Manufacturing is mainly organized in a decentralized manner and based on standardized process guidelines. Finally, a quasi-simultaneous launch of models in various regions takes place.



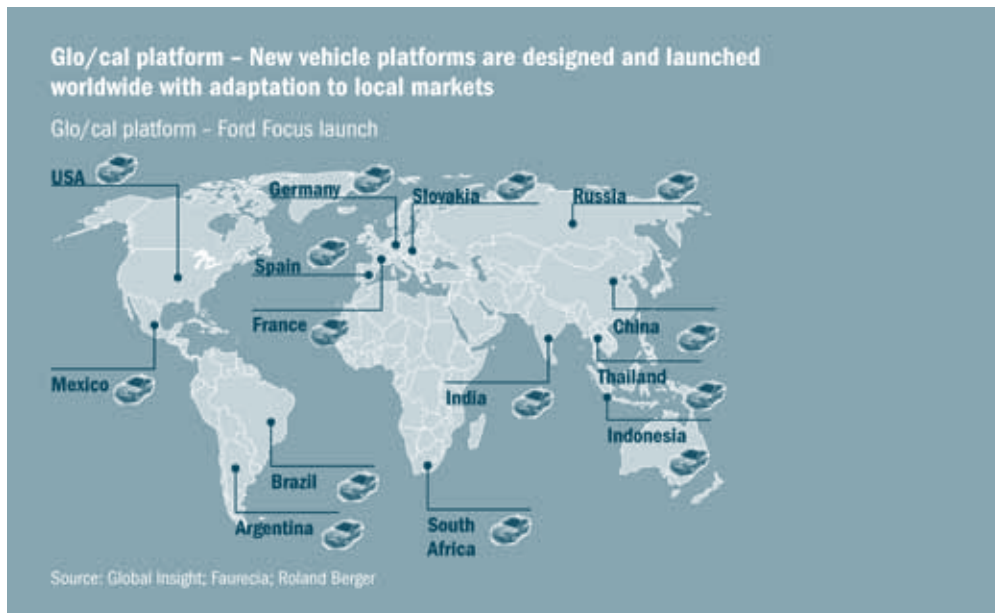
Regionalization will play a significant role for OEMs, also in areas like vehicle design and the different types of powertrain. In South America, for example, biofuels will continue to be very popular. In Europe OEMs will continue to focus on improving the efficiency of diesel vehicles. In the US there will be a push for high-output turbocharged engines and hybrids. And in China the focus will move toward electric vehicles. As a consequence, there will be many local R&D departments functioning as centers of competence in a worldwide R&D network coordinated globally. This decentralized organizational setup will enable companies to achieve a sufficiently regional footprint and develop products adapted for local markets.



Project management for glo/cal development processes follows a strict pattern. At the beginning of the development process, a global standard is agreed for each component, module and functionality. Each region then takes the global lead for developing a particular component or group of components. Glo/cal projects are based on a global product that is then adapted to the local design needs and technological requirements of the different regions simultaneously. This reduces the traditional time lag between market launch in the first and the last region and optimizes capital expenditure.



At the end of a glo/cally structured process, global platforms can be launched simultaneously. The adaptation time to local regulatory, design or safety needs is reduced to a minimum. Differentiation and adaptation can be done at a very late stage of the project. To reduce the complexity of local differentiation and market launches, OEMs will in the future be looking for global partners who are able to mirror the glo/cal setup.



Another example of diverging regional markets and customer needs has to do with the fact that society is aging. Seniors, who make up a growing proportion of the population in almost all mature markets, prefer to live close to care services and in denser communities. Density can even be artificially created to enable a more sustainable lifestyle in aging societies. Cars, or rather the mobility services of the future, will adjust to this environment in terms of scale, technology and business model.

At the same time, expanding younger populations in emerging markets will want to access mobility and the convenience associated with it. OEMs will have to balance these diverging needs and offer the right product or mobility service to everyone. The glo/cal approach will have to be taken to the next level, adapting global or regional formats to local micro-markets.

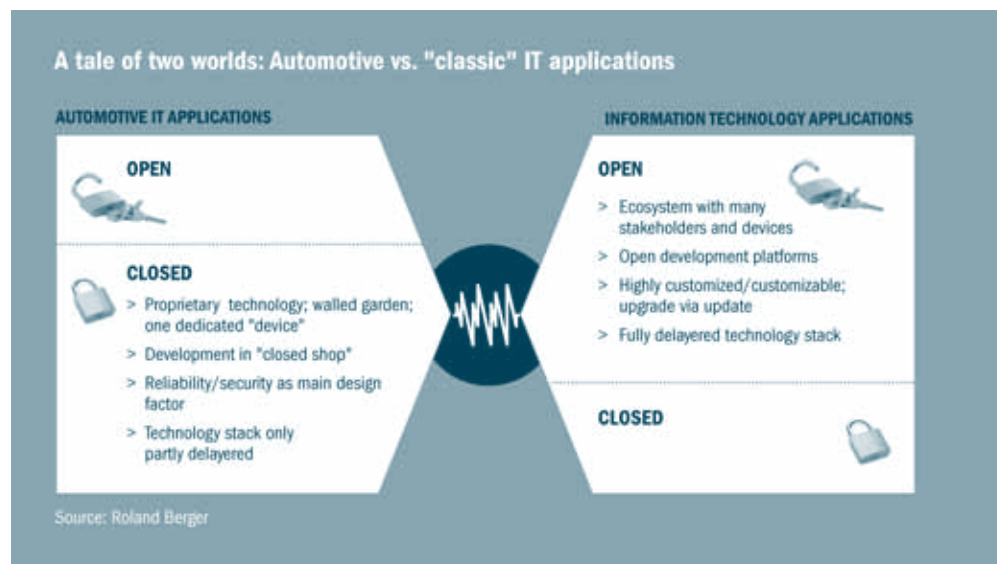
9. Industry flexibilization

Over the next 15 years, the automotive industry will undergo the biggest structural changes it has ever seen. Automotive players can benefit from these changes, but to do so they need to be highly flexible in their approach to developing and manufacturing cars. The dominant business model at present is a push model: spend money, build factories that have to operate at a high utilization rate, churn out cars and place incentives to make them sell. But new customers – younger generations and city dwellers, say – are increasingly looking for a pull model, a solution that meets their needs. They simply don't care about the old industrial structure.

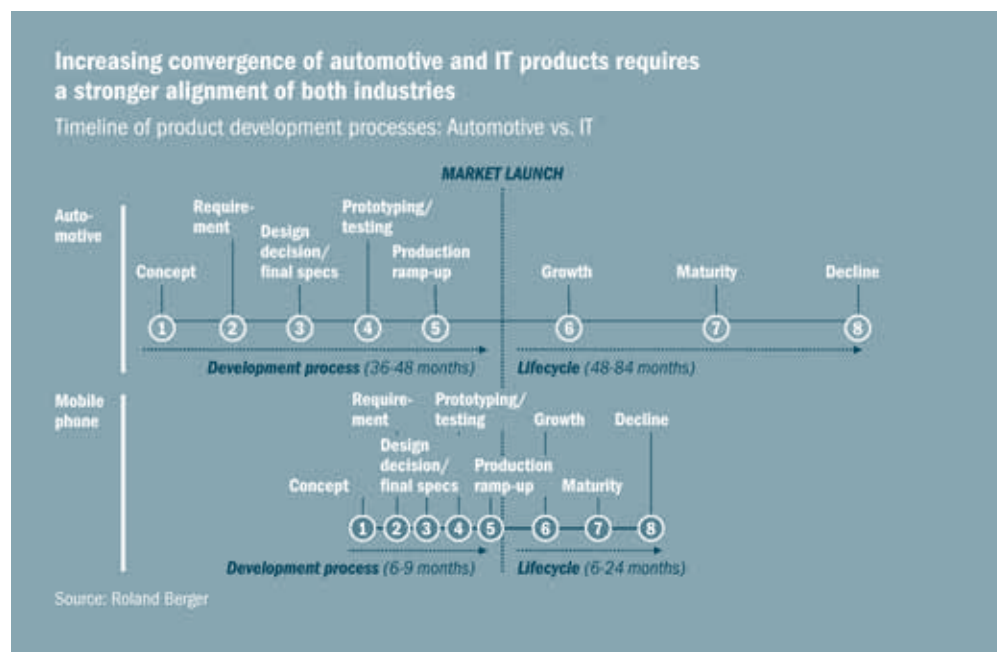
Non-automotive companies might be able to adapt more easily than automotive companies. OEMs and OESs are caught up in their own legacy. They own factories – but manufacturing is no longer a core competence. Already we see production capacity of 90 million units compared to demand of just 69 million units. On a global scale, building new plants means wasting resources. Even in China, booming auto sales are leading to blind investment in the industry, which could result in annual production capacity of over 31 million units by 2015, compared to the already optimistic 25 million units of sales expected by the Chinese Association of Automotive Manufacturers.

What can OEMs do? They should start sharing resources. Within automotive groups such as VW, this is already becoming common practice. But there are very few examples of outside partners sharing a plant as is planned by Toyota and Tesla.

To make the best use of future changes, the automotive industry needs to open up, allow convergence and learn from other industries. The IT industry, for example. The increasing amount of electronics in vehicles and the need for compatibility between cars and other electronic devices (such as smart phones) challenges the way OEMs have ring-fenced auto data through proprietary technology in the past. By contrast, consumer electronics applications are designed as an ecosystem with many stakeholders. In the future, open development platforms will be the norm and products need to be highly customizable.



In addition to the products themselves, tomorrow's integrated mobility concepts will also force the automotive and IT industries closer together. At present, the two industries could hardly be more different. For example, the IT industry has lean hierarchies in which innovations come quickly to the notice of those at the top; the automotive industry has extremely formal hierarchies. Video conferencing is an integral part of daily business communication in the IT industry; the automotive industry has a "being there" meeting culture. In the IT industry, customers can test beta versions of products; the Mercedes E-Class went through 36 million km of testing prior to market launch. Lifecycles in the IT industry are around six months; in the automotive industry they are four to seven years. The list goes on.



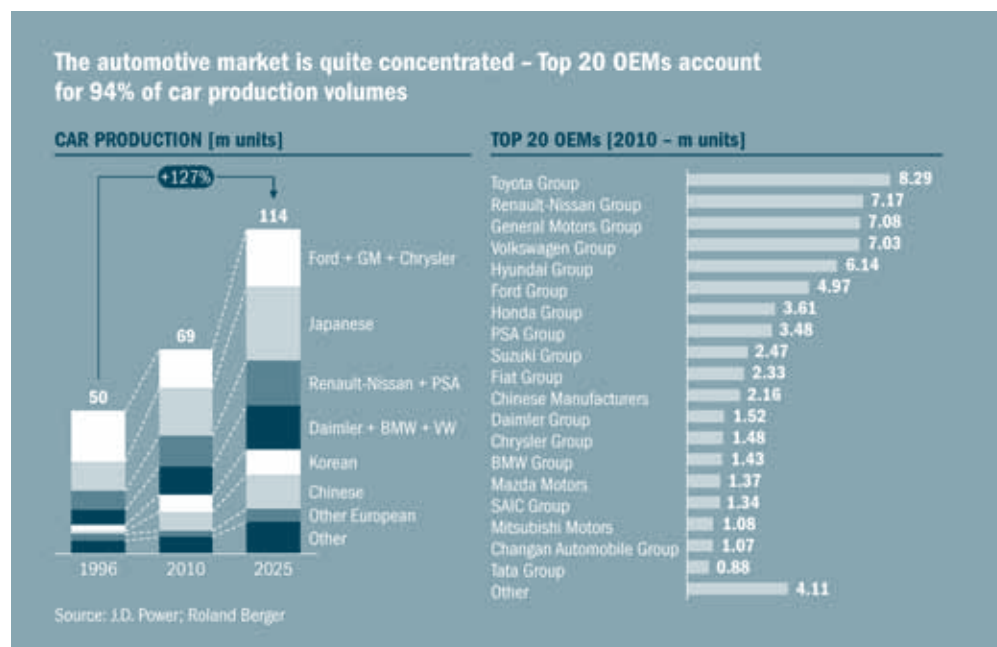
Automotive companies can learn from utility companies, too. Utilities have faced significant changes in what people want from their products. Smart metering, for example, allows unprecedented transparency for customers. The desire to use a higher share of sustainable energy sources is growing fast. Ruth Werhahn, Project Manager at E-Mobility@EON: "The automotive industry now is where the utilities were a few years back, when renewable energy arrived."

There are many other areas where OEMs and OESs need to increase their flexibility – flexible ownership models for products and services, flexible work time for employees, a flexible organizational structure allowing entry into and exit from project-based partnerships. The maximum flexibility an OEM can attain when being organized as a virtual company. In this setup, the OEM owns the brand rights and organizes all the different contributing parties. Car design is carried out by an Italian design studio, say, R&D by a German engineering services company, production by a contract manufacturer in Finland, sales directly or through a partner retailer (depending on the brand positioning) and customer service by a workshop chain. An extreme example? Yes, but one that can work well for smaller companies that are still growing fast. New automotive players such as Fisker, Tesla and Detroit Electric – companies with no legacy as an asset owner – show that it is possible. Others are expected to follow their example.

10. Proliferation meets consolidation

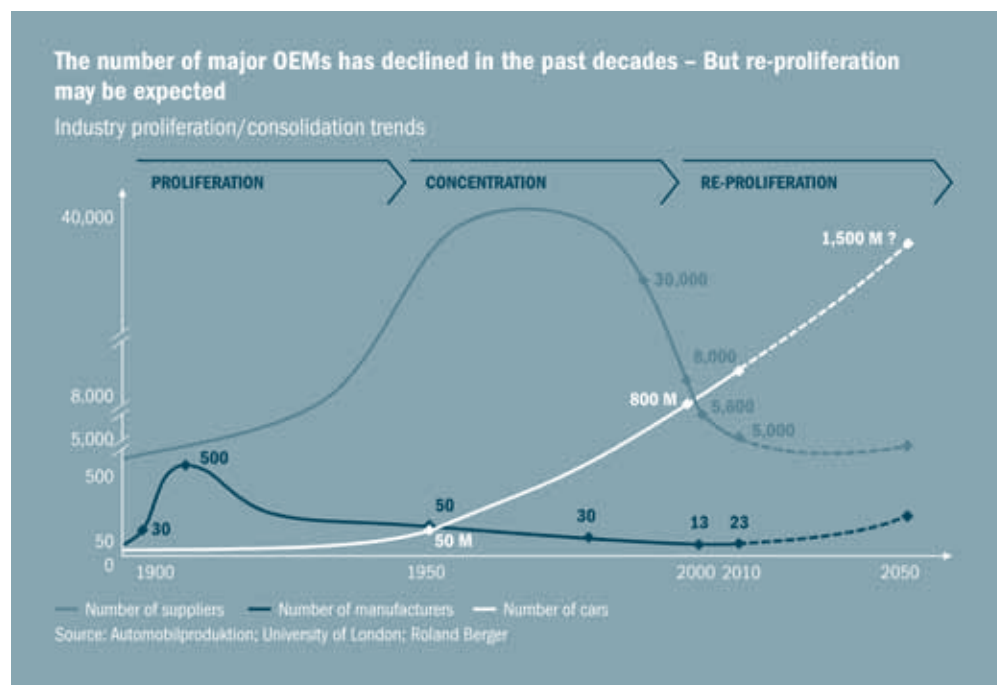
It comes as no surprise that economies of scale matter in the automotive industry. Investing heavily in R&D is the key to lasting success. That's why the industry has been consolidating for decades and companies have been getting larger and larger. Most players who wanted to achieve critical mass and globalize quickly opted to integrate their competitors, growing through mergers and acquisitions. The VW Group, for example, has expanded its portfolio of brands massively in recent years. It is now full or partial owner of no fewer than 12 automotive brands.

In today's automotive market, the top twenty OEMs account for 94% of car production volume and the top five account for 52% of volume. This makes for a rather concentrated sector.

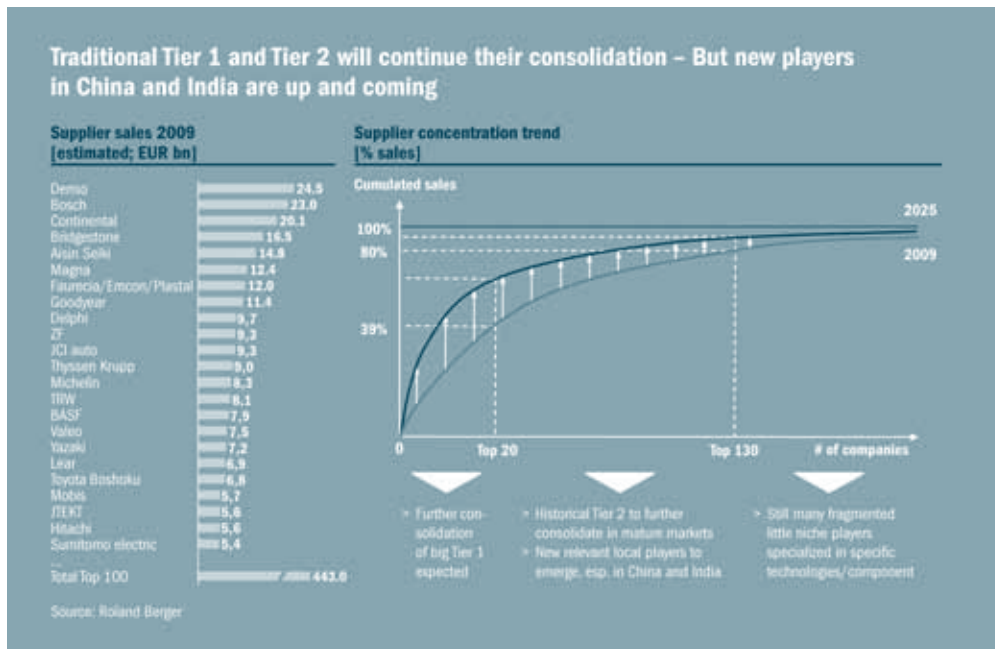


The automotive industry passes through alternating phases of proliferation and consolidation. The number of cars in operation has been steadily increasing over time, but OEMs have developed quite differently to suppliers.

Automotive OEMs had their heyday at the beginning of the twentieth century, when there were some 500 different manufacturers around the globe. In the 1920s, a strong wave of consolidation began that continued right up to the early 2000s, when only 13 big manufacturers ($\geq 0.6\text{m}$ units) were left. Today, the number of manufacturers has risen again to 23. The number of suppliers, by contrast, reached nearly 40,000 in the 1960s. This exponential growth mainly resulted from persistent outsourcing by OEMs. Since then, consolidation has been constant, and it continues today. There are currently around 5,000 OESs worldwide, of which 80% only operate locally in China.

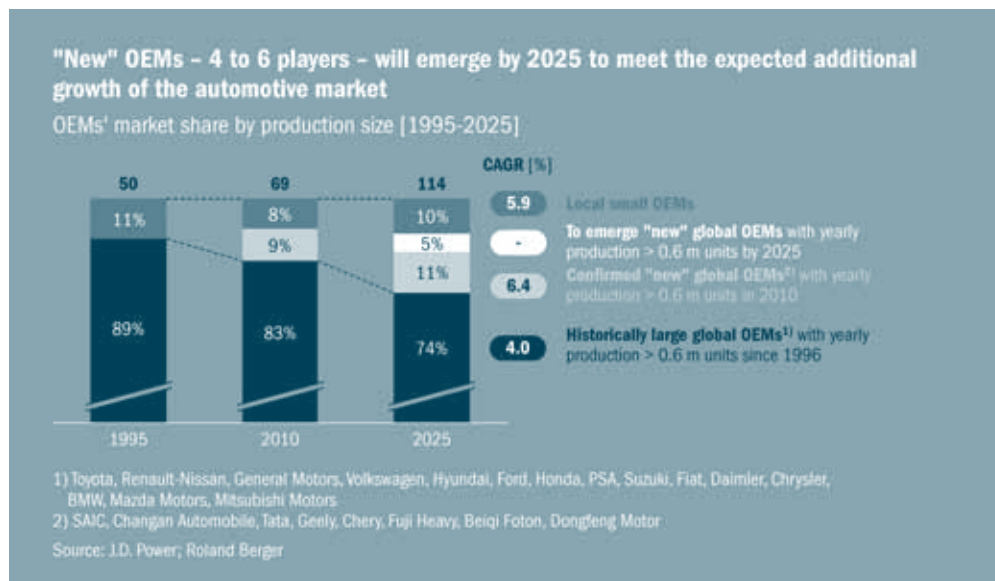


The historical trend toward consolidation among suppliers will continue in the foreseeable future, with a focus on Asia. This applies particularly to conventional Tier 1 and Tier 2 OESs. In the Tier 2 segment, new local players will emerge, mainly in China and India. In the Tier 3 group, many small, fragmented niche players exist who are highly specialized in their product scope or regional coverage.



On the OEM side, the industry may experience a process of re-proliferation of some kind. Over the last ten years, the number of relevant manufacturers has grown from 13 to 23. Some of these "new" OEMs have already gained considerable volumes, with annual production of over 0.6 million units in 2010. Their market share will grow from its current level of 9% to 11% in 2025. By 2025, between four and six new players – particularly from China – could emerge and become powerful (e.g. BYD). Their market share is expected to reach 5% in 2025. In addition there will be a number of small OEMs, often with very limited regional coverage.

Of course, some of the traditional OEMs could also drop out in turn. The market share by production size of the traditional top 15 OEMs is expected to fall from 83% to 74%.

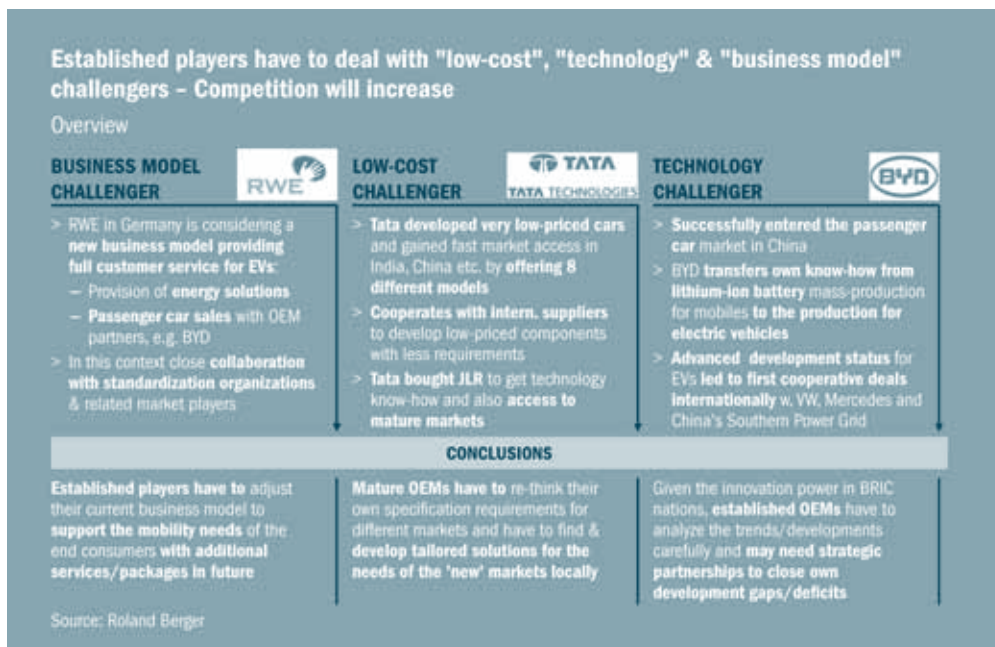


Competition will increase for OEMs. Established players will have to deal with a range of different challengers – challengers in the areas of technology, low cost and business model. OEMs need to find viable responses to each of these types, as we discuss below.

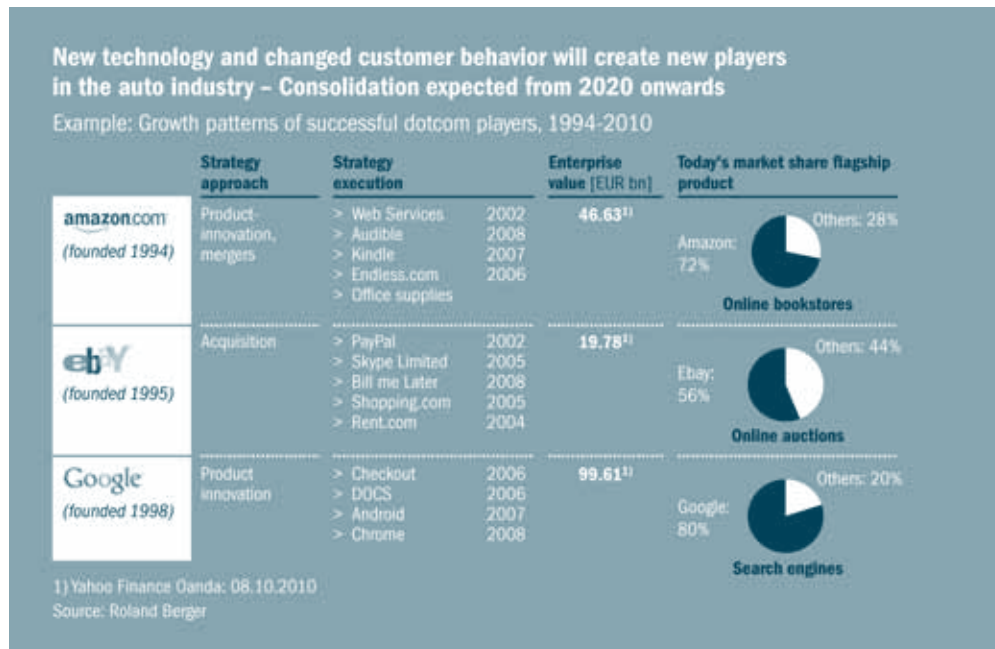
"Technology challengers" are companies like BYD. BYD used its exclusive expertise in lithium-ion battery mass production for mobile phones to develop and produce electric vehicles and so enter the Chinese car market successfully. In response, established OEMs should analyze the trends seen in BRIC countries carefully and be open to entering into strategic partnerships as a way of quickly closing the gaps.

"Low-cost challengers" are companies like Tata. Tata built the world's cheapest car, the Tata Nano, by reducing specification details to unprecedentedly low levels while adapting them to local needs. The local content in India is 97%. The project makes use of numerous joint ventures, but also integrates partners such as Tier 1 OES Bosch and motorbike supplier Kinetic Engineering. In response, traditional OEMs should rethink their own specification requirements for different markets and devise tailored local solutions for the needs of emerging markets.

"Business model challengers" are businesses such as the utility company RWE, which is considering offering full customer service for electric vehicles. Here, the automotive OEMs need to create offers for customers who are interested in buying individual mobility, not vehicles. Flexible leasing, all-inclusive flat rates and pay-per-use models are all possible responses.



In the medium to long term, critical size will be essential in the automotive industry. We expect things to go much the same way as with the dotcom companies, where new players with sufficient mass gained the upper hand in each segment over the course of the last 15 years. And 2025 is fifteen years away, too!



We believe that in order to avoid such a development, it will only be a matter of time before traditional OEMs start absorbing promising new automotive and non-automotive players as they emerge. Some of the new players might be able to generate enough funding to grow fast. But it is more likely that traditional OEMs will swallow up the new players with a successful business model as a way of safeguarding their position. Indeed, partnerships have already been created as a precursor to integration – Tesla with Toyota and Daimler, BYD with Daimler, VW and Toyota. This trend is set to continue.

Closing remarks

This study took a highly comprehensive approach. Almost all the 39 Roland Berger Strategy Consultants offices around the world were involved for a period of 12 months, we spoke to more than 60 leading experts from the automotive industry and other organizations worldwide, we examined primary and secondary market research and we applied a variety of techniques, including scenario-based analysis.

Our conclusion? Over the coming 15 years, the automotive industry will undergo the greatest transformation it has experienced in its history.

In the preceding chapters, we examined in detail what this transformation will involve. A dramatic shift to the Asian markets will take place – quickly and permanently. Both production locations and sales will be affected, with a significant share of the customer base coming from Asia, requiring specific products suited to their needs. Their demand supports low-cost cars as an important entry point as well as A/B segment cars in general. This segment will grow in mature markets, where values are changing. Cars will lose their appeal for younger generations in developed countries. In major urban areas, car ownership will become unnecessary. Mobility ecosystems will provide cars on demand. The cars in question will predominantly be electric, and one in two will have a fully or partially electrified powertrain.

We also saw that new materials will play an important role in almost all vehicle systems. Many vehicles will be permanently online, sending and receiving information via the Internet. Connectivity will be the key. The automotive industry will converge with other industries and a cross-industry perspective will be mandatory for management. New business models and value chain partners will emerge, challenging the status quo – especially where they come from sectors other than the automotive industry. Automotive companies will engage in multiple partnerships as a way of accessing technology and customers and securing economies of scale. They will move away from centralized organizations in the pursuit of size and access to fresh sources of engineers and other specialists. Instead, they will begin to operate globally, combining global reach with adaptation to local needs and regulations. Consolidation will continue among OESs, while new OEMs are likely to emerge from both inside and outside the industry.

These changes are fundamental and affect all areas of the automotive industry – OEMs, suppliers, third parties, both new and established players. The key is for companies to remain open and flexible. They must think and act holistically in order to benefit from the opportunities ahead.

We hope that you found this study useful. If you would like our help in assessing your position and the personal opportunities and challenges facing you and your company, please do not hesitate to contact us. Together, we can make sure that the journey ahead is not just an exhilarating but also a rewarding one.

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