

# The Changing Landscape of the Global Automotive Industry



## Industry Outlook

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## THE GLOBAL AUTO INDUSTRY'S BALANCE OF POWER SHIFTS TO EMERGING MARKETS

The global auto industry is in the midst of dramatic growth and change, the likes of which it hasn't experienced since the industry's inception. While annual vehicle sales in the world's mature auto markets have mostly plateaued, a new set of emerging markets—with larger and younger populations, rapidly growing economies, and low vehicle-ownership rates—have become the engine for growth. To serve these markets, automakers are in a grand race to set up local production, tailor vehicles to the needs of local consumers, and increase sales, market share, and profits in these areas. This opportunity could push sales to more than 1 billion light vehicles worldwide between 2010 and 2020—by far the most vehicle sales in any previous 10-year span in history.

But this growth may not come easily: It will involve significant capital investment and risk, growing environmental concerns, and fierce competition for human, material, and natural resources. Successfully managing these challenges will be critical to determining the automotive frontrunners and also-rans of the future.

### Emerging Markets Take the Wheel

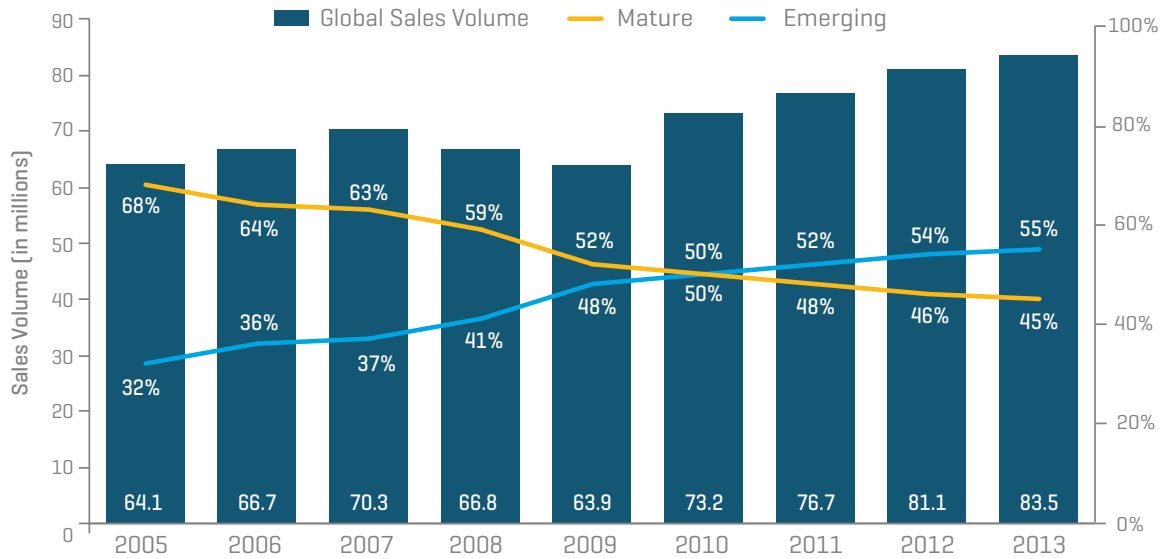
Since the early 1900s, the automobile has been a symbol of personal freedom, style, accomplishment, and mobility. In 2012 alone, consumers spent about \$2 trillion globally on new-vehicle purchases,

providing ample evidence of automobiles' continued importance in modern life. While the emotional connection between man and machine has held fast, the landscape of the auto industry has changed considerably, including the impact of auto manufacturing on the global economy and environment as well as on vehicle engineering.

In 2010, a shift in the balance of power within the global auto industry occurred when the world's emerging growth markets—led by China, India, Brazil, and Eastern Europe—accounted for slightly more than half of the 73.2 million light vehicles sold worldwide. This marked the first time in the 120-year history of the auto industry that the world's mature markets—led by the U.S. and Canada, Western Europe, and Japan—didn't account for the lion's share of sales. Since then, emerging growth markets have extended their lead in the global sales race for light-vehicle (cars, sports utility vehicles [SUVs], vans, and light trucks under six tons gross vehicle weight), with 52% of the worldwide market in 2011, 54% in 2012, and 55% (estimated) in 2013. And we expect this trend to continue, given these markets' economic momentum and their sheer numbers of potential buyers.



GLOBAL LIGHT-VEHICLE SALES



Source: LMC Automotive

Figure 1

For global automakers and their suppliers, the rapid rise of emerging growth markets has brought about some big changes. These include the construction of massive new production facilities, adjustments to the sizes and types of vehicles produced, and technological improvements and variations in drivetrain configurations. Research on future energy sources is ramping up, and government policies and regulations for fuel economy and vehicle emissions are becoming stricter.

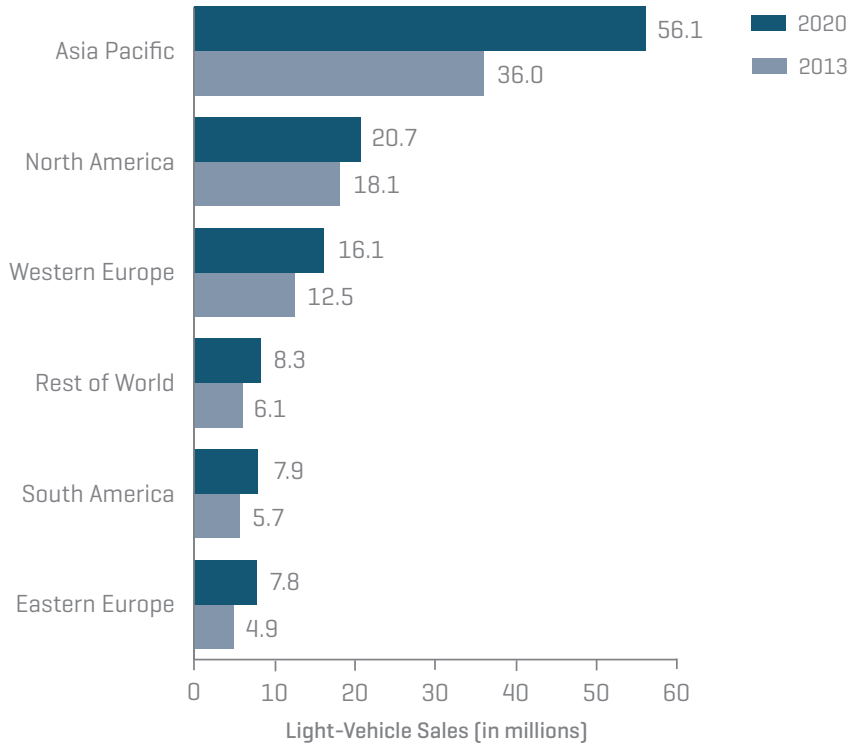
To better gauge the impact of growth markets on the global auto industry, it's important to understand three critical issues: where future sales and production are likely to occur, how growth might affect the global economy and the environment, and how the industry might respond to these changes.

### Light-Vehicle Sales Accelerate, Especially in Asia-Pacific

LMC Automotive (LMC) predicts global light-vehicle sales will reach 83.5 million units in 2013. This would represent the fourth consecutive year of record global sales, as well as a 20-million-unit (or 31%) increase from 63.9 million units in 2009 at the trough of the Great Recession. By 2020, LMC expects global light-vehicle sales to reach about 117 million units annually—a stunning 40% increase from the 2013 forecast.

Not surprisingly, the bulk of this growth will come from the world's emerging market economies, especially from Asia-Pacific and, to a lesser extent, Eastern Europe and South America. In 2013, LMC expects the Asia-Pacific region to account for 36 million light-vehicle sales, representing 43% of the world's total. By 2020, the region could account for 56.1 million units, or 48% of global light-vehicle sales, according to LMC.

GLOBAL LIGHT-VEHICLE SALES BY REGION



Source: LMC Automotive

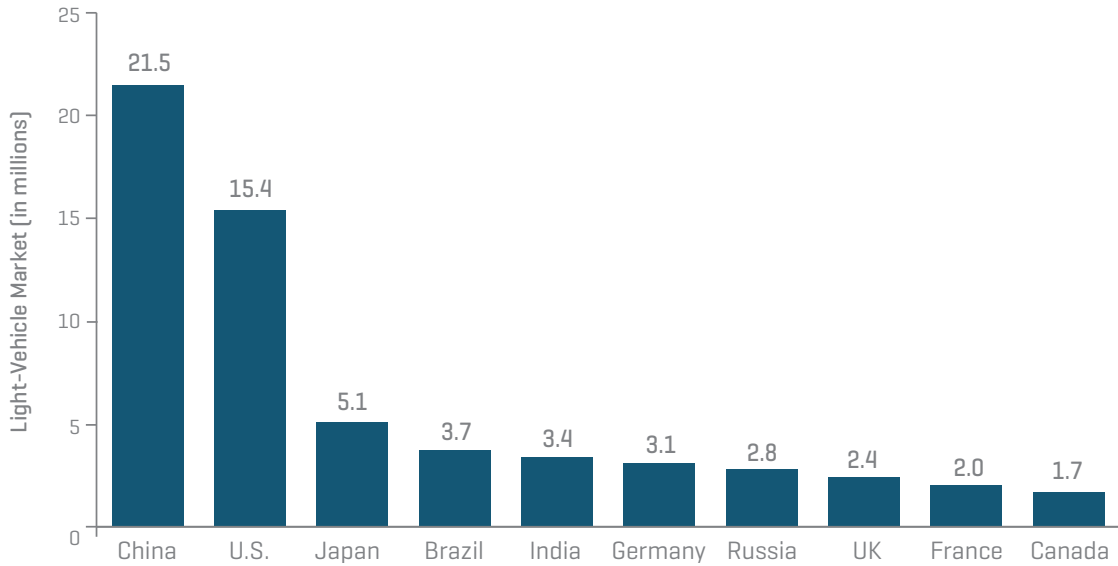
Figure 2

LMC forecasts vehicle sales in North America and Western Europe to increase slightly by 2020; however, we'd consider this gain to be more of a rebound to the strong market before the Great Recession than growth arising from population and income expansion. The U.S. posted annual light-vehicle sales between 16 million and 17 million units for much of the decade preceding the recession, and we expect annual sales volumes to be about the same between 2013 and 2020.

The intersection of two key forces underlies the strong growth forecasts for the world's largest emerging markets: The liberalization of industrial and market regulatory policies, and the increasing ability for large and underserved populations to purchase vehicles. This is particularly true of China, India, Brazil, and Russia, which are four of the world's six most highly populated countries, and among the world's 10 largest auto markets.

“The liberalization of industrial and market regulatory policies, and the increasing ability for large and underserved populations to purchase vehicles are two key forces in the strong growth forecasts.”

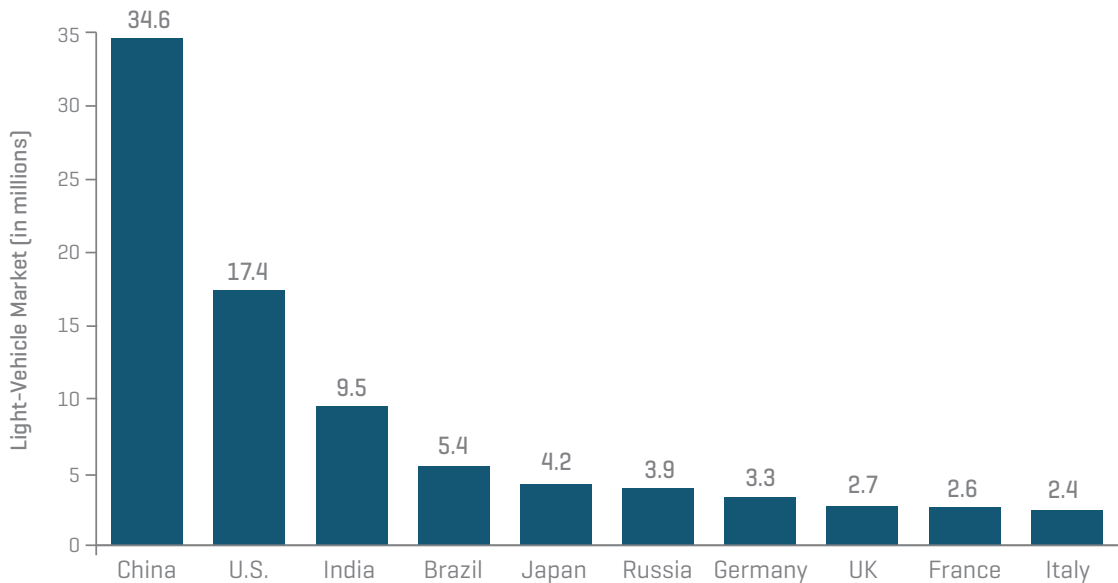
FORECAST OF TOP 10 LARGEST LIGHT-VEHICLE MARKETS IN 2013



Source: LMC Automotive

Figure 3

FORECAST OF TOP 10 LARGEST LIGHT-VEHICLE MARKETS IN 2020



Source: LMC Automotive

Figure 4

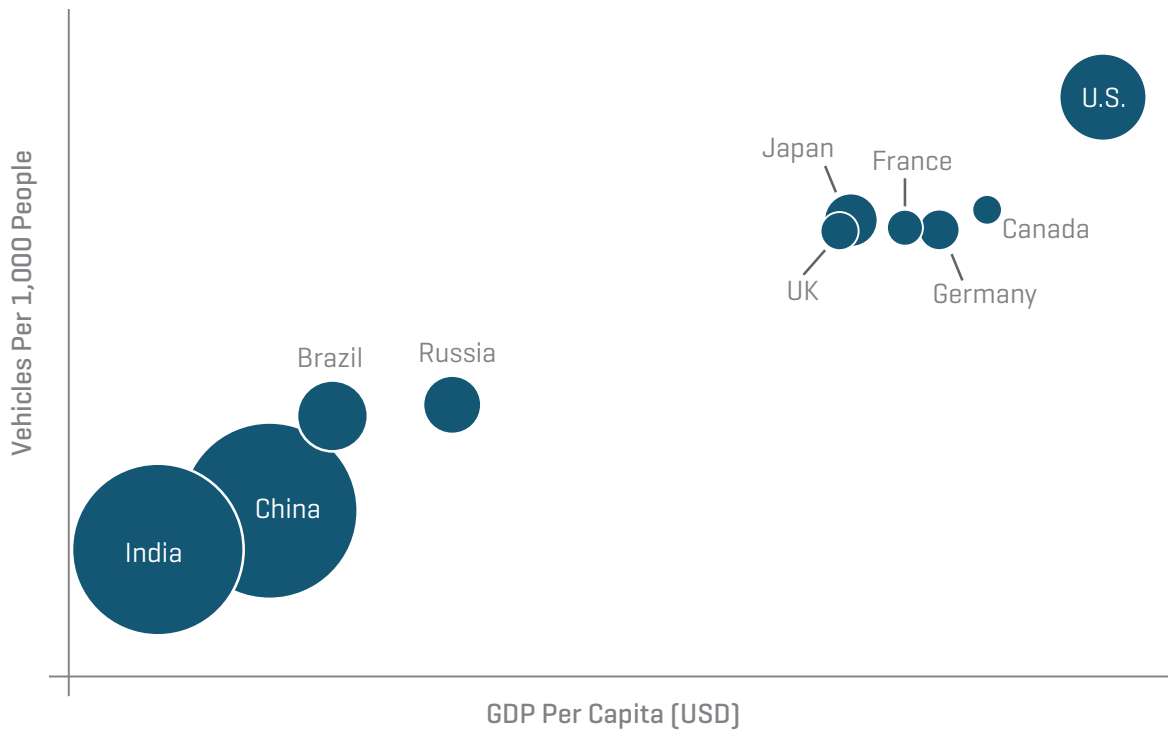
While the four emerging growth regions have long been among the world’s most heavily populated areas, recent regulatory changes have ignited their economies and are fueling their auto markets. These changes—most of which went into effect in the 1990s include an emphasis on foreign direct investment and the rapid development of export industries, which provided foreign currency reserves to help finance subsequent rounds

of growth. These objectives worked particularly well in China and India, allowing many consumers in these less developed economies to quickly acquire the means to purchase vehicles, an accomplishment previously unattainable.

Given these regions' economic momentum and tremendous growth potential, we believe their future looks bright. Sustaining growth might require these markets to develop advanced supplier networks and supply chain management, improve vehicle distribution, and upgrade their dealer networks, while making vehicle financing more widely available.

Indeed, J.D. Power research indicates that U.S. consumers finance approximately 80% of new vehicles purchased or leased each year, but it isn't unusual in some growth markets for consumers to finance only 20% to 30% of new-vehicle sales, with the remaining vehicles purchased outright. This is due not only to regulatory policies that limit lending in some cases, but also to the lack of established and reliable consumer credit-tracking mechanisms that enable lenders to provide financing with less risk.

COMPARING TOP 10 GLOBAL MARKETS BY GDP, VEHICLE PENETRATION RATES, AND POPULATION



Note: Relative size of the bubble indicates relative size of the country's population.

Source: World Bank 2012 data; LMC Automotive

Figure 5

## The Future of Vehicle Production is Local

The benefits of developing an indigenous auto industry are significant. Perhaps no other industry can do as much for an economy as auto production, which can spur direct and indirect job creation, infrastructure development, and research and development, while promoting supply chain creation, and generating tax-revenue. Manufacturing a new model line, for instance, can cost from \$500 million to \$1 billion (or more), including land acquisition and construction costs; tooling, vehicle design, and engineering; powertrain development; regulatory certifications; and salary and administrative expenses. All of this investment occurs before a manufacturer produces a single vehicle. As a result, it is not surprising that local and national governments welcome and support automakers that want to manufacture passenger vehicles locally.

Automakers typically prefer to build production facilities in or near the markets where they sell their vehicles as a way to increase efficiency, lower costs, and customize offerings to local preferences. Because light-vehicle sales set the pace for overall industry growth, with increased production anticipated for the coming decade, we expect the greatest increase in vehicle production to occur in Asia-Pacific, Eastern Europe, and South America.

“Auto-producing nations must strike a delicate balance between economic growth and ecological responsibility.”

GLOBAL LIGHT-VEHICLE PRODUCTION FORECAST (MILLIONS OF UNITS)			
	2013	2020	=/- %
Asia Pacific	42.7	63.4	48
North America	15.9	18.6	16
Western Europe	11.9	14.1	26
Eastern Europe	6.8	10.1	48
South America	4.5	6.5	44

Source: LMC Automotive

Figure 6

Moreover, while automakers intend most of their vehicle production in North America, Western Europe, and South America for local sale, the same is not true in Asia-Pacific and Eastern Europe. In Asia, we expect Japan and Korea to remain major auto exporters, with up to half of their annual production destined for offshore markets. China could become a significant exporter as well—assuming the country improves the quality of its manufacturing and engineering. We expect annual production in Eastern Europe to increase by nearly 50% to more than 10 million units, with exports of up to one-fourth of this total to Western Europe and other global markets.

While local auto production offers many benefits, it also comes with some drawbacks. Vehicle manufacturing can have unintended consequences, including the creation of hazardous chemicals and harmful emissions. Auto-producing nations must strike a delicate balance between economic growth and ecological responsibility.

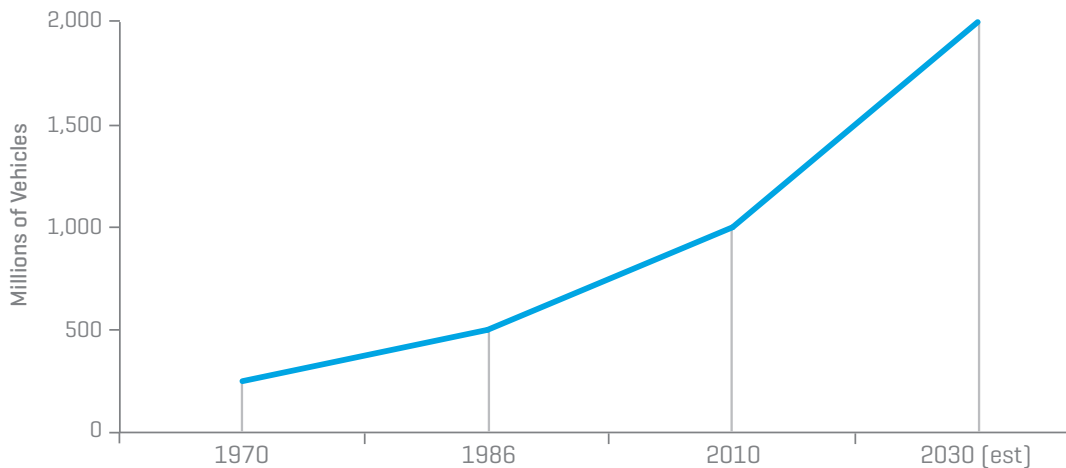


## What Do Growing Vehicle Numbers Mean for the Global Economy and Environment?

The number of vehicles in operation worldwide (including all passenger vehicles and light-, medium-, and heavy-duty trucks and buses globally) reached approximately 250 million units in 1970, before climbing to 500 million units in 1986, and surpassing the one-billion-unit mark in 2010<sup>1</sup>. The vast majority of these, of course, were privately owned passenger vehicles.

Considering current trends—including economic and population growth projections and vehicle scrappage rates—and barring any cataclysmic global event, industry experts and researchers generally agree that the number of worldwide vehicles in operation could reach 2 billion units during the next 20 years.

WORLD VEHICLE POPULATION [PERSONAL AND COMMERCIAL VEHICLES]



Source: Ward's Auto [historical data]; J.D Power estimate for 2030

Figure 7

If this estimate is accurate, what impact will the increased numbers have on the worldwide auto industry and the global economy as a whole?

### Petroleum demand will keep rising

The world currently consumes approximately 90 million barrels of oil per day, most of which goes toward operating the global auto fleet, according to the International Energy Agency and the U.S. Energy Information Administration<sup>2,3</sup>. With their vast auto fleets and vehicle production, the U.S. and China combined account for about 30% of daily global oil consumption. Among the world's top 10 oil consumers are many of the world's largest markets and auto production hubs, including Japan, Brazil, Canada, Germany, India, South Korea, Mexico, and Russia.

If vehicle fleets reach projections of 2 billion units within the next 20 years, demand for oil is likely to increase at a rapid clip. For example, a 2010 presentation from the

<sup>1</sup> "World Vehicle Population Tops 1 Billion", [http://wardsauto.com/ar/world\\_vehicle\\_population\\_110815](http://wardsauto.com/ar/world_vehicle_population_110815); 2011

<sup>2</sup> International Energy Agency, <http://www.iea.org/aboutus/faqs/oil/>

<sup>3</sup> U.S. Energy Information Administration, <http://www.eia.gov/>

University California, Davis, Institute of Transportation Studies estimated that 120 million barrels or more of oil per day would be required to keep those 2 billion vehicles running. Barring any major disruptive technology innovations such as breakthroughs in battery or alternative fuels, increases in demand are likely to trigger higher oil and vehicle prices.

**Other natural resources will become more crucial**

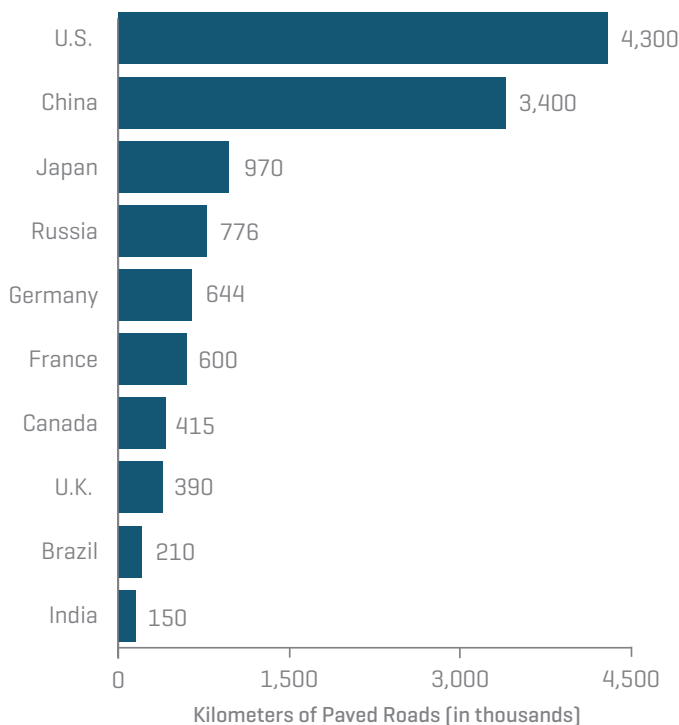
Efficient mass production of modern vehicles might be among the most challenging manufacturing pursuits in business today. Not only does it require enormous capital investment, tens of thousands of man-hours, and the coordination of hundreds of interdependent entities; it demands an in-depth understanding of and access to most of the elements on the periodic table, including such precious metals as aluminum, magnesium, titanium, iron, nickel, copper, zinc, silver, tin, gold, and platinum, among others. To be sure, producing vehicles in the future will depend largely on a company’s (or country’s) ability to secure these natural resources. Some forward-looking countries have already begun to secure long-term contracts with nations rich in certain resources to protect their future vehicle-production capabilities.

**Road infrastructure**

Where there are vehicles, there is a need for roads, highways, and parking structures or space. The U.S. government’s World Factbook estimates that there are nearly 12 million miles of paved roads in the countries that comprise the world’s 10 largest auto markets. Nearly two-thirds of these roads are in the U.S. and China, with more than 36% in the U.S. alone.

“Efficient mass production of modern vehicles might be among the most challenging manufacturing pursuits in business today.”

2013 TOP 10 LARGEST VEHICLE MARKETS, KILOMETERS OF PAVED ROADS



Source: CIA World Factbook 2012

Figure 8

Because many of the world's largest auto markets—especially China, India, Brazil, and Russia—are already experiencing debilitating traffic gridlock, the need for improved infrastructures is obvious. Failure to improve infrastructure would likely constrain the economic potential for national auto industries, and, by extension, entire national economies.

### Reducing exhaust emissions is a growing concern

Light vehicles powered by traditional internal combustion engines (ICEs) emit a host of potentially harmful emissions, including nitrogen oxides, carbon monoxide, carbon dioxide, hydrocarbons, volatile organic compounds, and particulate matter. With tens of millions of new light vehicles entering the global auto fleet annually, the reduction of exhaust emissions will continue to be one of the industry's most pressing issues. The problem is especially pronounced in the world's growth markets, where relatively poor fuel quality, combined with traffic congestion, frequently translates into poor air quality.

## Engineering Innovation Revs Up to Reduce Emissions

### Powertrains are evolving

Reducing emissions while at the same time increasing fuel economy for the average vehicle fleet remains a key challenge for global automakers, which they are addressing in various ways.

Traditional ICEs that burn gasoline, diesel, or another combustible fuel will power 97% of passenger vehicles sold worldwide in 2013, according to LMC, while just 3% will have alternative configuration involving a hybrid powertrain—typically an ICE and an electric battery pack—or a full battery electric motor that relies exclusively on a battery pack for power. We don't expect this ratio to change dramatically by 2020: Traditional ICEs will likely still account for about 95% of sales, with the remainder consisting of hybrid electric vehicles (including a handful of fuel-cell hybrids) and pure battery electric vehicles.

While auto engineers are working to develop the next generation of ICE alternatives, many automakers and suppliers believe there is a great deal of potential to improve fuel economy and reduce emissions. One simple remedy is a shift to smaller and more efficient three- and four-cylinder engines. Indeed, this move has already begun, especially in the U.S., where the number of four- and six-cylinder engines is increasing and the number of eight-cylinder engines is declining. Globally, LMC estimates that three- and four-cylinder engine configurations will account for 87% of the global engine total in 2020, up from 84% in 2013.

Other technology and efficiency improvements include stop-start technology, which turns off the engine when the vehicle is idling, and restarts the engine once the throttle is re-engaged; adding turbochargers to smaller engines, which provides extra power when needed while still curbing emissions; and the introduction of more eight-, nine- and 10-speed transmissions to improve efficiency and fuel economy.

“One simple remedy is a shift to smaller and more efficient three- and four-cylinder engines.”



## Vehicles are getting smaller

As automakers and consumers pursue better fuel-economy, we expect the production of smaller and lighter vehicles to ramp up. Even in the U.S., where gasoline has traditionally been much less expensive than other countries, a perceptible shift is underway.

Since the Great Recession, which brought with it lower incomes for many consumers, the share of subcompact, compact, and midsize vehicles (passenger cars, SUVs, and cross-over utility units) has increased 5%, while the large vehicle segment has undergone a corresponding decline. Another factor prompting the shift to smaller vehicles is strategic: As global automakers target emerging growth markets for their expansion, they are spending more time developing modular platforms, which allows them to produce multiple model variants on a common chassis for markets that prefer smaller vehicles. To achieve economies of scale, automakers are reconfiguring these platforms for mature markets. Indeed, some automakers have already created research and development, engineering, and design centers in such emerging markets as China expressly for this purpose.

## Alternative vehicles could be a solution down the road

While we don't expect alternative powertrains to make a serious dent in ICE demand any time soon, the sector does bear watching because significant technological advances might provide a solution to fuel economy and emissions concerns. But the industry still faces two big hurdles: lowering prices and boosting performance.

Hybrid vehicles are typically priced 10% to 20% higher than comparable ICE-powered vehicles, while electric vehicles cost 20% to 50% more—a premium many consumers are reluctant or unable to pay. Moreover, most alternative-fuel vehicles (though not all) don't provide the same kind of performance—acceleration, towing capacity, passenger and cargo room, and driving range—as ICE-powered vehicles do. That said, a cost-effective breakthrough in battery technology has the potential to change the entire face of the industry.

## Growth and Change Remain In Overdrive

**The global auto industry could face far more change than stability over the next several years, at a pace it hasn't experienced since the first car rolled off the assembly line a century ago.** Rising vehicle sales in emerging markets are helping solidify these new players' position in the global auto market. To boost profits and market share in these areas, automakers will need to ramp up local production and design vehicles that meet new buyers' needs. The evolving industry faces many hurdles, including hefty capital investment and risk, significant environmental concerns, and strong competition for resources. Automakers' ability to successfully navigate these and other challenges could determine who comes out on top in tomorrow's global auto market.



“A cost-effective breakthrough in battery technology has the potential to change the entire face of the industry.”

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