



# Planning for multiple futures

Disruptive times call for new capabilities. Scenario planning is an essential tool for developing agile business strategies that can adapt quickly to a range of alternative futures and speed decision making

By Tate Nurkin, IHS Aerospace, Defense & Security

**A**ny company intent on maintaining a competitive advantage in today's business environments must plan for multiple futures in order to ensure resilience and mitigate the growing risks of difficult-to-anticipate disruption. Current planning processes built around predictive forecasts of the probable will not be sufficient. Companies need to augment their forecasts with methods that stress proactively incorporating – rather than eliminating – uncertainty. Businesses that resist innovative thinking and processes will find themselves caught flat footed by fast-moving shifts.

There are many sources of business disruption but three stand out:

- **New unconventional actors.** In less than six years, Uber has disintermediated the taxi industry worldwide. Two years ago, ISIS further destabilized the Middle East by establishing a caliphate and emerging as a global terrorist threat. The rapid rise of far-right political parties in Europe is threatening the stability of the EU.
- **New technologies and new applications of existing technologies.** Internet of Things is a bit of both, combining existing digital technologies with data analytics to transform business processes and industries. The intersection of next-generation materials and advanced manufacturing techniques – for example, 3D and 4D printing – have the potential to create game-changing new capabilities and business models for nearly every major industry.
- **New existential threats.** Climate change is expected to raise sea levels, which will displace populations in low-lying areas and potentially lead to mass migrations and conflicts. The threat of the use of nuclear weapons – either deliberate or otherwise – has re-emerged and is amplified by diffusion of new technologies as well as increased geopolitical competition and instability.

The ability to respond rapidly to multidimensional disruptions is critical to driving business success. Indeed, the rate of change in today's connected and complex world can occur faster than many conventional decision-making processes are equipped to manage.

Forecasting has long been the primary tool for identifying “known factors” to predict the future and set strategy. However, forecasts are typically based on historical trends and assumptions that are less likely to be valid for understanding the future during periods of disruption.

Consider forecasting future energy demand. Since 1990 the share of fossil fuels in total global energy consumption has held remarkably steady, at around 80 percent. The future, however, will not follow historical trends. The confluence of new technologies, geopolitical realities, market dynamics, and regulations – such as the 2016 Paris Climate Agreement – ensure the path forward for energy companies will be fraught with challenges. However, for some savvy and adaptable companies, it could also mean opportunities.



A survey of 77 large European companies found that formal “strategic foresight” efforts add value through (1) an enhanced capacity to perceive change, (2) an enhanced capacity to interpret and respond to change, (3) influence on other actors, and (4) an enhanced capacity for organizational learning.

“Living in the Futures”  
by Angela Wilkinson  
and Roland Kupers,  
Harvard Business Review,  
May 2013

Likewise, in the automotive industry, the connected car, autonomous driving and new patterns of urban mobility are creating existential market and competitive uncertainties for some automakers.

### **New tools for strategic resilience**

Regardless of industry, the need for resiliency in an era of disruption is driving companies to embrace scenario planning and make it an integral part of their strategic planning processes. By expanding the range of possible futures considered – from probable outcomes to less likely but plausible ones – companies can systematically develop an understanding of how to make their business strategies more resilient.

Long used by national security organizations to inform competitive strategies and anticipate threats, scenario planning allows management to test deeply held assumptions about their business and understand the various pathways along which the future may unfold, and how they should act or react to remain competitive. Scenario planning complements – but not replaces – traditional analysis, expertise and trend monitoring, and offers a nuanced view of possible future worlds.

To stress test scenarios, companies typically use “strategy” or “tabletop” gaming, also known as war gaming in the military where the methodology originated. Gaming asks stakeholders to “play out” over hours or days specific scenarios that in the real world may unfold over a span of months or years. They are especially useful in understanding the interactions between and implications of a given company’s strategy and the behaviors and decisions of customers and competitors.

One of the most important outputs of any well-executed scenario planning exercise is the identification of signposts, or indicators, that one scenario or category of scenarios is more or less likely to come to pass. When signpost identification is matched with scenario-specific hedging strategies, organizations can move to enhance resilience before the disruptions emerge and markets shift, rather than after the fact.

## Elements of successful scenario planning

While scenario planning and gaming take different forms and seek to achieve different objectives, they both stress collaboration and teamwork to improve decision making by challenging assumptions and expanding the scope of alternative outcomes that the company should consider.

To get the most out of strategy gaming, organizations need to establish ground rules that create an environment free of risk or repercussions for novel thinking, encourage free exchange of ideas and opinions, and foster creativity, honesty and trust among participants. Three recommendations for successful gaming outcomes are:

- 1. Senior management's support to "question everything".** Participants should be given free rein to challenge long-held organizational assumptions, practices and processes. In many cases, legacy thinking inhibits companies from making necessary changes in response to disruptive competitive threats.
- 2. Multidisciplinary teams of experts.** Comprehensive analysis of future scenarios should involve a diversity of expertise and perspective from across the company and from external third parties.
- 3. Hire a facilitator.** Successful games require active – and objective – facilitation that includes moderating team and plenary discussions, and driving the teams to explore new environments.

Scenario planning and gaming are powerful tools for evaluating the complexity of new competitive threats in ways traditional tools cannot. Incorporating scenario planning into the formal strategic planning process provides a more nuanced understanding of possible futures that can reveal new opportunities and set the stage for driving competitive advantage.

Tate Nurkin is managing director, Consulting and Thought Leadership, IHS Aerospace, Defense and Security.

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## FURTHER READING ON SCENARIO PLANNING FROM IHS MARKIT

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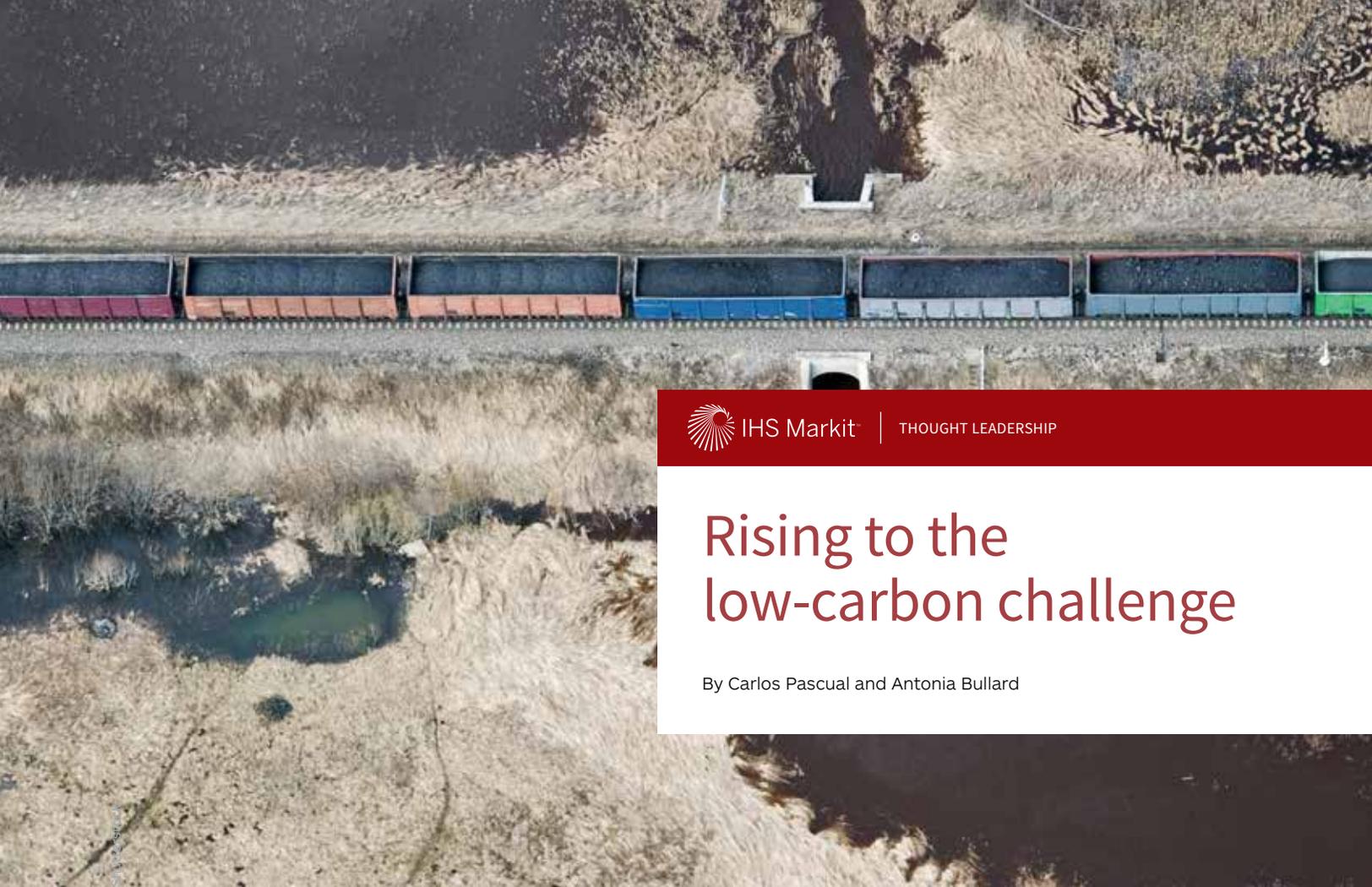
[Rising to the low carbon challenge.](#) The agreement from the UN Climate Change Conference in Paris aims to move the world toward a sustainable global economy. However, the path forward will not be smooth... **PAGE 5-8**

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### THE IHS MARKIT ADVANTAGE FOR DELIVERING STRATEGIC FORESIGHT

The [IHS Strategic Assessments and Futures Studies \(SAFS\)](#) Centre is uniquely positioned to leverage best-in-class methodologies for the design and execution of scenario planning, war gaming, red teaming and competitive assessments to deliver insightful – and often unconventional – analysis of key strategic and operational issues facing senior decision makers in government and industry. To support client engagements, the centre draws on world-class subject matter experts from across IHS Markit in the fields of aerospace & defense, automotive, chemicals, economics & country risk, energy, maritime and technology. Learn more about other solutions from [IHS Aerospace, Defense & Security](#).



## Rising to the low-carbon challenge

By Carlos Pascual and Antonia Bullard

**T**he United Nations Climate Change Conference in Paris last December created an unprecedented global mandate to arrest climate change.

Whether it succeeds will depend both on commercial realities and on the public policies that will determine how quickly and at to what scale low-carbon energy systems can compete with traditional energy sources.

Every year since 1995 the United Nations has held a conference seeking an international agreement to reduce greenhouse gas emissions. Prior conferences stalled, in large part because developed and developing countries advocated quite different approaches. This time, in Paris, all members of the UN Framework Convention on Climate Change – countries rich and poor – agreed to reduce emissions.

Already some 185 countries have signed on to emission-reduction pledges called “Nationally Determined Contributions” (NDCs). The NDCs submitted so far will not meet the Paris Agreement’s stated goal of limiting temperature increases to “well below” 2 degrees

Celsius. But the nations unanimously agreed to meet every five years to revise their pledges. Rather than seeking perfection, the parties in Paris chose to get emissions reductions going on a national basis and then build on the momentum.

Reaching the goals agreed to in Paris requires solving a conundrum. On the one hand, delivering economic and human development to a global population growing by 2 billion through 2050 will require using more energy. Today, 80% of that energy is supplied by fossil fuels. On the other hand, climate models generally forecast that if the world continues to rely predominantly on fossil fuels to produce energy, delivering more energy to a growing world will have unacceptable implications for global living conditions. To solve this problem, future systems to produce and use energy will need to be decoupled from GHG emissions.

The Paris Agreement provides a mandate and framework for reducing these emissions, but it does not tell us how to actually achieve the target

reductions. For the world to meet the ambitious goals set in Paris, five key strategic challenges must be surmounted: (1) managing policy risk, (2) figuring out how to price carbon, (3) deciding the role of natural gas, (4) providing sources of base-load power to support intermittent renewables, and (5) closing the gap between the cost of renewables and that of traditional energy sources.

First among these is managing policy risk. The NDCs presented in Paris are not binding under international law. With each nation setting its own NDCs, there are few common methodologies and no agreement on such key issues as carbon tariffs. With current economics still favoring fossil fuels, changing patterns of energy use will require national laws, regulations, and other incentives to become reality. This will require political will, social support and effective enforcement at a time when many countries face challenging macroeconomic conditions. And at a time when energy companies are subject to exceptional strategic stress from falling commodity prices, they now face additional risks from new, varied and potentially fast-changing climate policies. The planning challenge for national governments and energy companies is far greater than before if they are to achieve cost-effective and commercially sustainable paths to reducing emissions.

Second, nations will need to price carbon effectively if they want to use markets to incentivize emission reductions. Carbon pricing figures prominently in the Paris Agreement; indeed, one-quarter of NDCs make reference to emissions trading. But while carbon pricing has broad support in principle, the carbon-pricing and emissions-trading regimes implemented so far have had limited effectiveness, owing to political reluctance to impose meaningful prices. While details remain to be worked out, the Paris Agreement supports the development of an international market in GHG credits by recognizing that countries may use “internationally transferred mitigation outcomes” to achieve their NDCs – that is, one country can pay for the emission reductions achieved in another country and get credit. An increasing number of jurisdictions are likely to adopt carbon taxes and emissions trading, and more companies will prepare for a carbon-constrained future by incorporating shadow carbon pricing in their planning and investment decisions. But moving from national carbon-pricing schemes and corporate practices that price carbon internally to an efficient global market that delivers clear and effective

signals to optimize investment decisions across countries and companies will be a controversial and time-consuming undertaking.

Third, nations and energy developers need to reach a clearer agreement on the potentially transitional role of natural gas. Shifting primary energy supply from oil and coal to natural gas (currently around 20% of global primary energy) reduces GHG emissions since, per unit of energy, using gas generates about half as much carbon dioxide emissions as coal and three-quarters as much as oil. Thus, switching from coal-fired power generation to gas-fired power generation, for example, can be a pragmatic and relatively low-cost carbon dioxide abatement option. But concerns about locking in hydrocarbon energy and the methane emissions associated with natural gas could create a bias toward policies that favor zero-emissions renewables and limit incentives for conversion to natural gas.

Fourth, decarbonization of energy creates opportunities for renewables in the electricity sector. Not surprisingly, over 80% of NDCs make reference to clean energy. The IHS base case scenario (“Rivalry”) forecasts that the share of global power generated from renewables (primarily solar and wind) will rise from 7% currently to 15% in 2030. But for countries to deliver on their NDCs, renewables would have to grow much faster, as envisioned in the IHS “Autonomy” scenario (for more information, see “Energy Evolution or Revolution? A Question of Perspective” below). Depending on location, today’s wind and solar typically dispatch power just 25–35% of the time, so an investment in 1,000 MW of capacity delivers just 250–350 MW of power. Growing the share of renewable power may therefore require providing supplemental base-load fossil fuel power. Nations will need to take a systemic rather than ideological approach to optimize renewables while also using other fuel sources for reliability.

Fifth, meeting the low-carbon challenge will require that low-emission alternatives compete on cost with fossil fuels in the power generation and transport sectors. In Southeast Asia, for example, the use of coal in the fuel mix is projected to grow from 15% in 2013 to 29% in 2030 unless commercial incentives change massively. Financing terms can make a difference for renewables, where up-front capital investment accounts for most of the costs, while the wind and sun are free inputs after initial construction has been

completed. Here there is space for public and private sector energy companies to work with each other and with governments and investors.

In Paris, political leaders signaled an end to business as usual in the energy system. But they also need a robust energy sector to deliver the healthy low-carbon economy the world needs. That will not go forward without development of rational priorities, sensible

transition paths, effective policies and incentives and substantial advances in technology. These are the practical market considerations that will determine whether nations can deliver on what was promised at the Paris accord.

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## Energy evolution or revolution? A question of perspective

By James Burkhard and Richard Vidal

**W**ill the future of energy be evolutionary or revolutionary? The agreement reached at the UN Climate Change Conference last December in Paris represented an effort to move toward a less carbon-intensive economy (see side bar). But reducing the use of fossil fuels requires enduring change. Since 1990 the share of fossil fuels in total global energy consumption has held remarkably steady at around 80%. The future, however, will not necessarily follow historical trends. Nor will the path be a smooth one.

A number of known factors, such as demographics, existing infrastructure and current policies, prices and costs will shape the future of energy. But there will also be unknown or unpredictable factors that alter the energy picture. Given the difficulty of predicting the future, are we fated to rely on gut instinct or extrapolation when it comes to investment and policy choices?

When developments occur that surprise us, it is because our assumptions turned out to be wrong or because the key drivers of the future were missed or hidden. Yet the consequences can be severe, as the events of recent years demonstrate.

The use of scenarios to consider different futures provides a way to challenge conventional wisdom; to test company doctrine and baseline thinking and to ask fundamental, sometimes uncomfortable, questions about the future. Scenarios provide a framework for turning uncertainty into a decision-making tool.

The IHS Global Energy Scenarios provide three distinct views of the future of energy to 2040 (see figure on next page). Many factors shape these outlooks; among the most important will be generational change, environmental measures and advances in technology.

### The impact of generational change

Population data and age group breakdowns are well understood. However, generational change is not just numerical, it implies the emergence of different perspectives and values. Historically, there have been times when a particular generation has had a great impact on society and markets. The revolutions of 1848 are a famous political example; the 1960s is a cultural one.

People born between the early 1980s and the early 2000s, known as millennials, have different views and priorities than their parents and grandparents. Millennials tend to be more comfortable with technology and social media. They have grown up with environmental issues discussed at home, online and in schools. Many have grown up in societies where rising environmental and safety standards are taken for granted. As more millennials become decision makers, their impact will grow in the world and in energy. Many find freedom and an open road in social media, not behind the wheel of a car.

### One-way-street: Environmental measures

Since the modern environmental movement took shape in the 1960s, measures to reduce pollution have typically traveled on a one-way-

**What does the future hold?**  
**Defining characteristics of IHS Long-Term Energy Scenarios to 2040**

**RIVALRY**



**Most intense competition in history among energy sources for market share, which fuels evolutionary change in energy mix and demand**

- Energy rivalry driven by four factors: price differentials, environmental concerns, technology improvements, and energy security
- Gas and electricity loosen oil's grip on transport demand; renewables compete increasingly with gas, coal, and nuclear in power generation

**AUTONOMY**



**Transition to an energy mix away from fossil fuels at a faster pace than many thought possible**

- Market, technology, and social forces decentralize the global energy system
- Generational change and urbanization pressures alter energy demand dynamics—demand for coal and oil falls
- Breakthrough in electricity storage and solar photovoltaics (PV)
- Widespread development of unconventional oil and gas

**VERTIGO**



**World economy like weather on a mountaintop—sunny and pleasant one moment, then engulfed in fog and rocked by hurricane-force winds the next**

- Recurring economic and financial tremors fuel instability that undermines confidence and exacerbates risk aversion
- Volatile economic growth creates mismatches between demand and supply
- Conservative capital investment spending slows move to less carbon-intensive economy

Source: IHS Energy © 2016 IHS: 50218-1

street. Lead will not be put back into gasoline. Regulations to reduce noxious emissions from power generation are often strengthened over time, not reversed.

Historically, movement toward tighter environmental rules has been concentrated in North America, Europe and Japan. But this is changing. As incomes grow in emerging markets, these populations develop a growing willingness and means to address environmental concerns.

In 2014, Chinese Premier Li Keqiang said that the time had come to “declare war” on pollution. Environmental issues have also become more important in India, where air pollution levels in Delhi recently led to vehicle restrictions. Climate change was the top global threat cited in a recent Pew Research Center survey of Chinese and East Indians, beating out economic instability and terrorism.

Views across Asia, Africa and the Middle East are of great importance to the energy industry because the

vast majority of future demand growth – up to 85 – will occur there.

**The unyielding march of technology**

Technological innovations do not respect market cycles or borders. The great revival of U.S. oil production was a principal catalyst behind the 2014-15 oil price collapse. It took root during the recession of 2008-09 and deployed technologies that were already around.

Among renewables, the capital cost of solar photovoltaic (PV) panels is 70% less today than in 2006, and the cost of lithium-ion batteries is down 50% since 2010. Of course, further declines in costs are not preordained, and integrating new technologies into existing energy systems is far from a cost free endeavor. But if costs for green (low or no carbon) energy technology continue to fall, it will influence a growing swath of consumers.

But oil and gas markets have also moved from fear of too little supply to too much – resulting

in downward pressure on prices; and lower prices tend to support consumption unless outweighed by other factors.

We return to the question of whether the future of energy is evolutionary or revolutionary. The energy mix – absolute shares of demand by source of energy – will not change quickly because of the vast amount of existing fossil-fuel infrastructure and availability of fossil fuels. But lower costs for renewable energy combined with climate change and pollution concerns increase the likelihood of lowering the share of fossil fuels over the next several decades. The composition of energy demand growth could be revolutionary, even if change in the shares of consumption by energy source is evolutionary.

James Burkhard is vice president and chief of research for global oil markets and energy scenarios, and Richard Vidal is director of the global energy scenarios service – both of IHS Energy.

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Planning for the energy future after the 2015 UN Paris climate deal requires the ability to anticipate a range of outcomes. [The IHS Global Energy Scenarios](#) service helps organizations factor the unknown into major business decisions by positing three distinct international energy outlooks to 2030. Test the biases and assumptions behind your strategies to both increase your company's resilience and take advantage of emerging opportunities. Learn more about other solutions from [IHS Energy](#).

# New China internet law signals more trouble for U.S. technology firms – and future global internet governance

By Dale Ford, IHS Technology

**A** new law in China that will tighten internet controls could create formidable headaches for U.S. technology firms in an already difficult environment, as well as altering the landscape for how they do business there in subtle but significant ways.

China has long enforced various constraints on internet use within the country: censoring online information, especially in times of political turmoil; manipulating search mechanisms to prevent sensitive material from emerging; and even blocking sites completely. But formally encoding internet restrictions into a national edict imposes an entirely different order of scrutiny on U.S. and other foreign firms, compared to mere local-government or low-level compliance. Moreover, controlling the flow of online information will be China's Cyberspace Administration – a governing body at the country's highest levels of management – indicating the seriousness of the new law.

While the new law affects all foreign technology entities, U.S. firms are subject to closer probing by

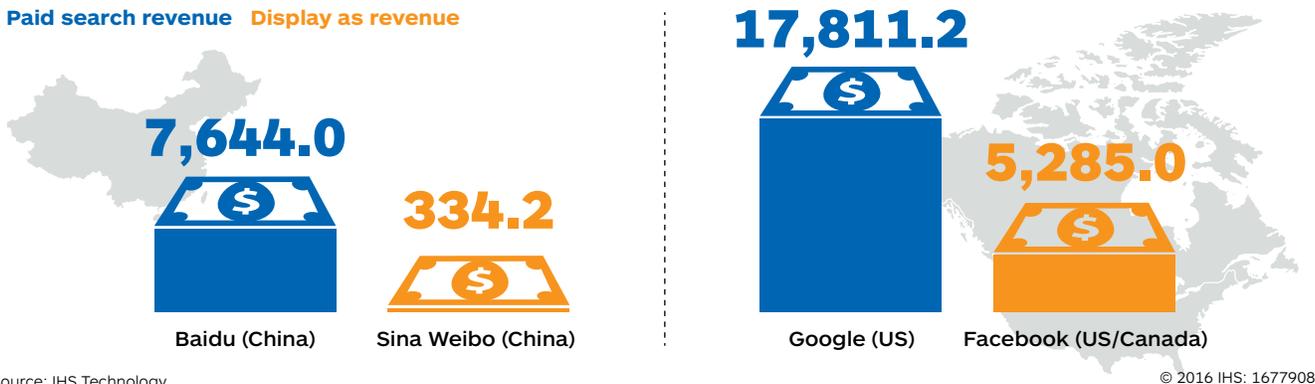
Chinese officials when doing business in the country and the new law is not likely to let up on such scrutiny. The U.S. and China have clashed on many cyberspace-related issues – including Washington's charges of alleged Chinese hacking and cybertheft of U.S. assets – fueling acrimony between the two powers.

A direct implication of the new Chinese internet law is that every U.S. tech firm doing business in China will be affected. Even though many lament the new statute as adding another layer of burden on operating in the country, not complying with China's demands – and the risk being left out altogether – is unthinkable. China's market is simply too big to ignore and U.S. tech companies banned for perceived offenses against Beijing – Google, Facebook and Twitter, for example – have forfeited billions of dollars in potential revenue.

Baidu, a Chinese search company that can be said to be Google's equivalent in China, reported paid search revenue in 2014 of CNY48.5 billion (US\$7.6 billion). Sina Weibo, a popular microblogging site in China, described as something of a Twitter-Facebook hybrid,

Comparison of major internet company reviews, China vs. U.S., 2014 (US\$ millions)

Paid search revenue    Display as revenue



Source: IHS Technology

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posted display ad revenue of CNY2.1 billion, or US\$334 million, for the same time period.

Of concern, too, is a particular clause in the draft law about “safeguarding critical information infrastructure”. What this means is not yet clear, but it puts on notice any U.S. tech firm providing information technology hardware, software and services. It could mean that new conditions make compliance with the law more difficult for U.S. players – for instance, unpalatable terms such as turning over customer data or sharing valuable intellectual property with Chinese counterparts.

Firms unable or unwilling to stomach the stipulations could either exit the field or be exiled from participation, enabling Chinese companies to step in to fill the vacuum.

A look at some figures highlights China’s enormous size and pull in technology markets. For instance, China accounts for 21-22% of global revenue for microcontrollers – tiny computers on an integrated circuit used in practically all modern devices featuring automated control mechanisms, present in equipment ranging from automobile engine control systems to office machines and implantable medical devices. In industrial electronics for semiconductors, such as memory integrated circuits, optical chips in light-emitting-diodes and sensors and actuators, China’s share stands at 15-16%.

A not-so-obvious effect of the new internet law would be to shut out U.S. and other foreign companies from the booming online shopping business in China. Just as Amazon has upended the commercial model and consumer experience for shopping in the U.S., Chinese firms are also innovating on their home front, creating

their own “must-shop” events. One example, the 1111 event held every November 11 encouraging single men and women to buy for themselves, has become known as a sort of “Christmas in China” day.

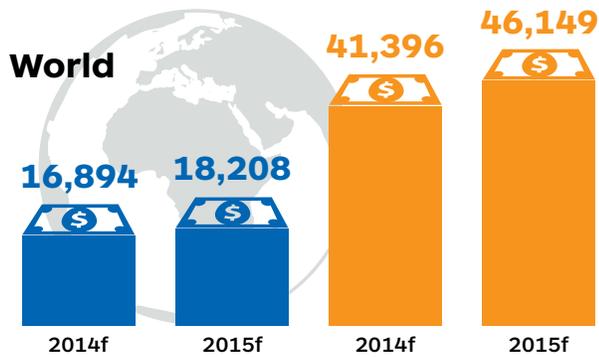
With China able to shift huge amounts of merchandise to its billion-and-a-quarter population and with the internet itself able to facilitate promotions of all sorts, regardless of seasonality, U.S. firms unable to take part risk losing out in this financial bonanza and becoming altogether irrelevant in light of diminished influence and power.

**Winners and losers**

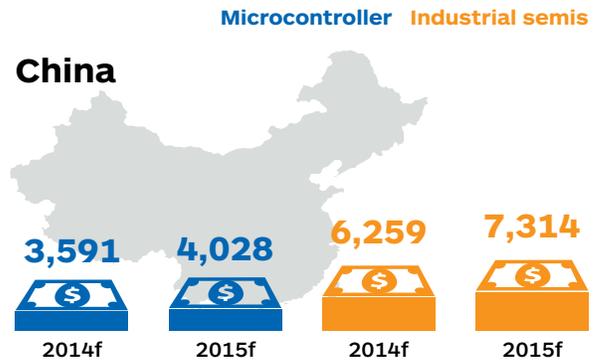
U.S. tech firms had certainly been working to protect their own business interests in China, even before the new law was proposed. IBM, Qualcomm, Intel, HP and Dell, for instance, have formed partnerships with Chinese domestic companies, hoping that local ties will improve their prospects for doing business in the world’s second-largest economy. Dell plans to invest US\$125 billion in China over the next five years to revive its faltering business in the country. Intel committed as much as US\$1.5 billion in September 2015 for a 20% stake in Tsinghua Unigroup, the owner of Spreadtrum Communications and RDA Microelectronics – two Chinese chipmakers with ties to the Beijing government. The new law is likely to ratchet up the pace of U.S. partnerships with Chinese entities while accelerating localized operations for U.S. players.

For other foreign players besides the U.S., the law’s impact will likely be more muted. Similar to what U.S. firms are doing, foreign tech players have also been partnering up with Chinese firms – French telecoms colossus Alcatel-Lucent with Shanghai Bell; and Finland-based giant Nokia with China Huaxin.

China vs. world revenue for microcontroller and industrial electronics markets (US\$ millions)



Source: IHS Technology



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The difference, however, is that the foreign (non-U.S.) players have already established Chinese companies and are expanding their presence even more. For instance, Ericsson (China) Co. Ltd – established in 1994 as a subsidiary of Ericsson of Sweden – acquired Chinese IT services provider Sunrise Technology in May 2015. Meanwhile, Nokia’s agreement with China Huaxin will enable it to merge Nokia China with Alcatel-Lucent Shanghai Bell to create a new joint venture: Nokia Shanghai Bell, with Nokia holding 50% +1 share. Perhaps more important, China’s attention isn’t riveted on European and other non-U.S. actors to the same degree, which could enable them to emerge relatively untouched in the wake of the new law.

The biggest beneficiaries of the new Chinese internet law will be Chinese domestic tech companies, as Beijing is wholeheartedly supporting a homegrown effort to dislodge foreign expertise from Chinese shores. Huawei Technologies and ZTE Corp., China’s

If governments impose geographic borders on the internet, then we lose the openness and interoperability that makes the internet different from television, radio, and other information and communication technologies.

[“Why the Global Battle for Control of the Internet Can’t Be Won,”](#)

Fast Company, May 9, 2014

two biggest telecom equipment vendors, already rank among the world’s top-five mobile infrastructure vendors in terms of revenue, with a combined share in 2015 of 35% of the world’s total. No U.S. firms are in this list, and the new law is not going to help U.S. players break new ground.

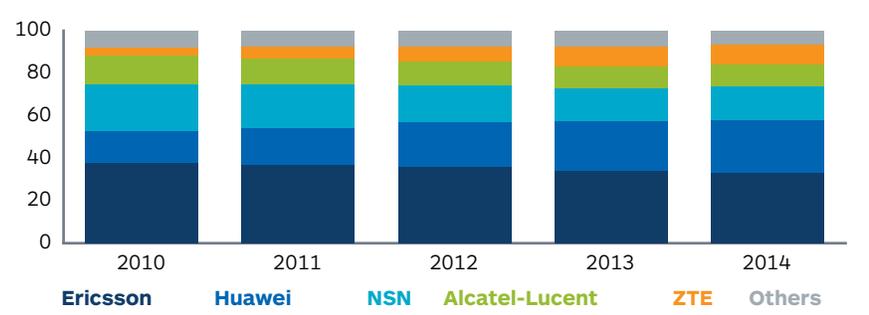
By IHS estimates, California-based Cisco Systems may be missing out on as much as US\$2.0 billion every year in China’s telecom market for hardware, software and services, which was worth US\$30.4 billion in 2014. For routers and switches alone, Cisco generated nearly US\$410 million last year in China – third after Huawei’s US\$1.7 billion and ZTE’s US\$855 million – an indication of just how much it stands to lose moving forward.

Cisco fell into disfavor following Edward Snowden’s revelations that the company’s equipment was being used by the U.S. National Security Agency for spying on other governments, including China’s. Cisco’s fall, in turn, has driven China’s mobile services providers – China Mobile, China Unicom and China Telecom – to team up with home companies Huawei and ZTE. The lack of an American presence will also benefit Alcatel-Lucent, which has strong intellectual property of its own.

**A larger question, globally speaking**

While Chinese hegemony over the country’s internet use is ostensibly the aim of the new decree, the ramifications go much further and touch upon the very essence of the global internet. The U.S., long the acknowledged leader in the digital realm, has always argued for an open internet where freedom of expression reigns. With this new law, China has put forth its own contrarian vision: that a country has the right to enforce

Market share of mobile infrastructure vendors by revenue, 2010-14



Source: IHS Technology

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internet control within its boundaries; deem what can be seen by its citizens on the web; censor content if necessary; and force foreign companies to comply with local laws.

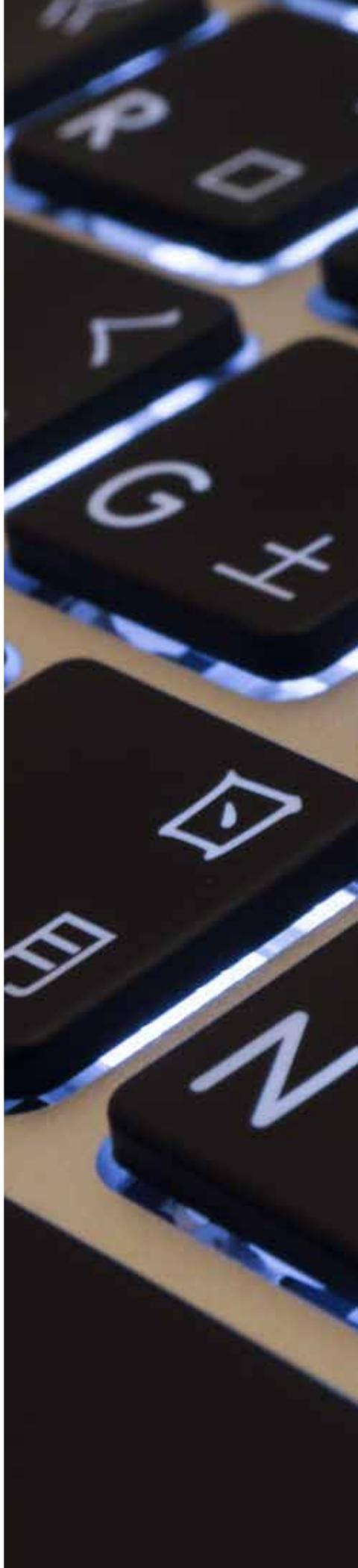
If adopted as written, the new law could entirely reframe the terms of this contentious debate. In particular, other countries sharing this nonconformist internet-with-borders idea might well wish to follow China’s example, in effect seriously testing the currently accepted U.S.-led world order of an unrestricted, unregulated internet. By extension, the appeal to so-called “internet sovereignty” could be used to justify state control over online speech, data protection, privacy rights, access to information and even license to operate.

This new law could be the uneasy herald of a potentially tectonic change – one that not only shapes future U.S. response within technology in China, but also throws into play the much bigger question of internet governance between two world powers of diametrically opposing visions.

Dale Ford is vice president and chief analyst, IHS Technology. Contributors included Stephane Teral, senior principal analyst; Michael Howard, senior research director; and Daniel Knapp, director-advertising – all with IHS Technology.

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# The connected car: Industry evolution or transformation?

By Alastair Hayfield, IHS Markit

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**T**he connected car represents one of the greatest transformational forces in the automotive industry, while simultaneously being one of the greatest unknowns.

The connected car serves as a communications hub that both transmits to and receives data and information from its surroundings. Connectivity makes autonomous driving possible and potentially offers enormous benefits to drivers, automotive industry participants and society in general. From better customer care, to lower insurance and warranty costs, to lower congestion and safer driving, connected cars create new opportunities for the automotive industry.

However, connected cars and autonomous driving create market uncertainties. How and by whom will connected cars and services be delivered? Will current automakers be able to navigate all the uncertainties and deliver connected cars and services in time to ward off the threat of new industry players?

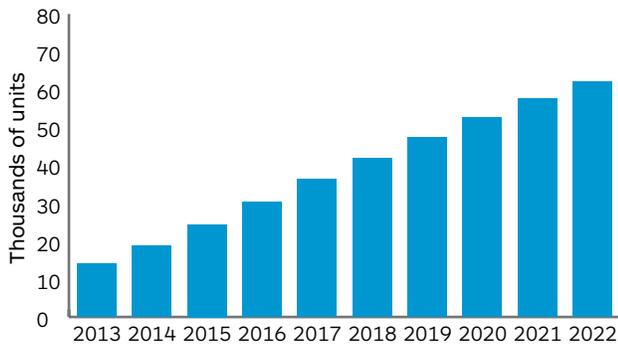
## **Right here, right now**

Connected cars are not a futurist's dream; you can get into one and drive it away today. In fact, almost all original equipment manufacturers (OEMs) offer connected services, with General Motors' OnStar service having a history dating back to 1995.

Indeed, the connected car opportunity is already large and growing rapidly. Worldwide sales of connected passenger vehicles are expected to grow to slightly more than 62 million units annually by 2022, rising at a compound annual growth rate (CAGR) of 16% from about 19 million in 2014, according to *IHS Automotive*. This means that by 2022, 61% of passenger vehicles sold will be connected in some way. Connected cars in the U.S. are expected to rise even higher, from 59% of vehicle sales in 2014 to over 97% in 2022.

But tension is building between the incumbent automotive players and a new wave of companies supplying the supporting software, components and infrastructure, particularly as new solutions

### Global connected vehicle sales forecast



Source: IHS

and business models emerge from outside the automotive industry.

In February of 2015, Mark Fields, president and CEO of Ford Motor Co., raised concerns that carmakers face the risk of becoming subordinate to the business models of other industries as new types of firms enter the auto trade.

“Guess what, they are looking at our industry, not taking anything for granted, they are questioning tradition and they are knocking down walls. I want to make sure Ford doesn’t end up like the handset business,” Fields was quoted as saying by Reuters.

Technology firms like Intel, Cisco, and HERE have announced multimillion-dollar investment funds for connected car technologies. Furthermore, Google with its Android Auto and Apple with its CarPlay are both making plays for the automotive market with driverless cars. It is clear that companies outside the traditional automotive market want to capture some market share in the emerging connected car market.

But is the automotive industry correct to be threatened by the emergence of new actors? Not necessarily. While there is a strong push from companies outside the automotive market to gain a foothold in the connected car market, it should be remembered that the automotive sector is a trillion-dollar industry with some of the largest companies globally and one of the most complex, globally integrated supply networks. Making cars in volume and delivering them to the customer is not a trivial matter. Carmakers have proven time and time again that they are adept at successfully delivering new vehicles and new technologies.

The automotive industry is also making its own investments in connected cars and mobility. Harman, a supplier of infotainment systems, recently spent nearly US\$1 billion on acquiring Symphony Teleca and Red Bend Software Inc.; two companies that will enable it to have a strong presence in connected services. HERE, the former mapping business of Nokia, was acquired for more than US\$3 billion by an automotive consortium of BMW, Daimler and Audi. More recently, Volkswagen invested US\$300 million in the Gett taxi app, and General Motors acquired Cruise Automation, an autonomous vehicle developer, and invested US\$500 million in Lyft.

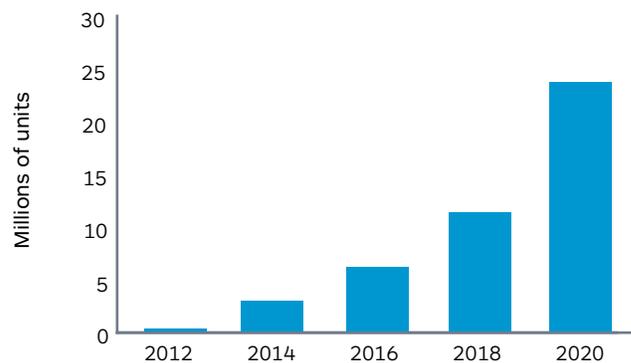
### Make sure you are connected

For strategic planners at automotive OEMs the current imperative is to develop a strategy to offer connected services or explore ways to enhance and protect their existing connected car solutions.

OEMs and suppliers that already offer connected solutions/technologies should be prepared to make “riskier” investments in emerging, leading-edge technology companies. This type of behavior is more common in the technology market, where companies have sizable cash reserves from high-profit-margin products or massive IPO valuations and can afford to make higher-risk investments in immature companies and products when balanced against a sizable payoff.

If automotive companies are also prepared to invest more opportunistically, they may be able to gain access to IP and solutions that offer them protection against emerging competitive threats.

### Global OTA-enabled vehicle sales forecast



Source: IHS

Automotive companies should also look to enhance the capabilities of their workforces and the skills of their dealerships to maximize the success of connected cars. Bringing on board experts in cloud and connected services, big data and digital content will help them establish a coherent connected product strategy. Training their dealer networks to sell connected cars and services will also be fundamental in building market demand, as connected car services will be sold in a different way from the more traditional automotive sales process.

### Over the air

One near-term connected car opportunity that automotive OEMs are seizing is the combined area of software over-the-air (SOTA) and firmware over-the-air (FOTA) updates. Total over-the-air (OTA)-enabled vehicle sales per year is expected to rise to 42.5 million in 2022, up from 3.9 million in 2014, according to *IHS Automotive*. FOTA/SOTA updates are already widely used in other technology sectors, including mobile phones, game consoles, PCs and tablets. Connected cars increase the dependence on electronic components and introduce a higher prevalence of software bugs that could require OEMs to service many vehicles under warranty or recall an entire vehicle lineup.

*IHS Automotive* estimates the cost savings per OTA event without having to involve a dealer is in the US\$20-100 range. This means that remote software updates bring large cost savings to OEMs, in comparison to the existing manual approaches. Total worldwide OEM cost savings from OTA software update events is forecasted to grow from US\$2.7 billion in 2015 to over US\$35 billion in 2022.

Beyond FOTA/SOTA updates, there is a revenue opportunity in monetizing the transfer of content to and from the vehicle. Services and apps for connected vehicles will offer copious opportunities for future business growth. These uses include communications applications, information retrieval, transactions and shopping, and entertainment content. Automakers have successfully charged car buyers and owners for such services by using a variety of payment models.

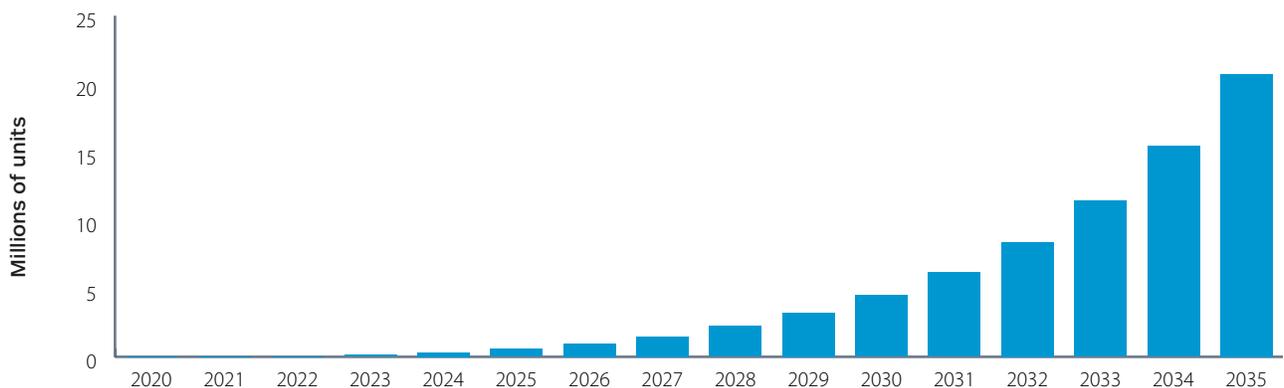
However, the success of the connected car business will not rely completely on consumers paying the bill. When consumers connect, they are also generating personal data that is valuable to many different third-party companies, including wireless carriers, insurance and traffic providers, and advertisers.

Payment from opt-in data is a compelling new business model for automotive. These third-party companies would be willing to subsidize the connectivity and content for consumers in exchange for valuable data generation. Because of this, automotive OEMs can generate revenue through collaboration with such third parties, rather than just selling services directly to consumers.

### Big money and big challenges in big data

There are many opportunities for using big data generated by connected cars. By 2020 there is expected to be a market generating approximately US\$14.5 billion in revenue from the data assets created by the automotive value chain. Value-added services or cost savings could be worth anywhere from US\$16 billion to US\$80 billion depending on scale and scope.

Global autonomous vehicle sales forecast



Source: IHS

“Hitherto, new cars – even quite modest ones – have tended to be bought as status symbols and expressions of personal style, but if consumers become more interested in what software and entertainment systems a car can run, rather than what it looks like, the industry’s whole business model may come apart.”

[“The Driverless, Car-Sharing Road Ahead,”](#)  
The Economist, January 9 2016

The challenge for the automotive market will be not to drown in the massive quantities of unstructured data generated by the connected car. According to *IHS Automotive*, global data collection from connected cars will be measured in hundreds of petabytes per year by 2020. This is an example of the classic “data rich, insight poor” scenario.

To be successful in the connected car space, automotive planners will need to integrate big data analytics into their long-term strategic planning. By being able to integrate and respond quickly to vast data sets, OEMs will, for example, be better able to respond to vehicle faults or drive more nuanced consumer behavior analysis, increasing loyalty and driving profitability in the long term.

### **Autonomy**

Each development in connected cars – telematics, FOTA/SOTA updates and data services – can be monetized, thus justifying the investment in hardware and support. While all these individual developments will have major impacts on automotive technology and business models, collectively they will lead to the biggest transformation yet to come: the rise of vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications and the advent of semi- and fully autonomous driving.

The advent of V2X and autonomous driving could lead to the greatest reallocation of value in the automotive

industry. *IHS Automotive* forecasts total worldwide annual sales of autonomous vehicles to rise from less than 600,000 in 2025 to nearly 21 million in 2035.

### **At your service**

In the era of connected cars, automobile manufacturers are beginning to shift their focus away from simply being builders of cars, and looking at ways to offer connected services, and, eventually, mobility as a service.

Where value is currently generated through the sale of hardware (the car), fuel, servicing and insurance, in the future value may be generated through a mobility service. If a car is autonomous and can be available on demand, why does a consumer need to own, fuel and service it? Value flows to those companies that provide the service and away from those who build the hardware.

In the short to medium term, there is scope for auto manufacturers to collaborate successfully with new players; after all, auto companies do not always have all the expertise necessary to create connected services.

In the longer term and as the value from connected cars increases, as well as beginning to flow toward a mobility service, the risk of disruption to the traditional automotive market increases.

Alastair Hayfield is senior manager for Automotive Technology, IHS Automotive.

### **THE IHS MARKIT ADVANTAGE FOR DRIVING SUPERIOR DECISIONS**

To understand the full range of challenges and opportunities presented by the connected car and other emerging innovations, IHS Markit offers five automotive technology portals, including the [Infotainment Portal](#).

Research up-and-coming technology solutions, plan for next-generation systems and inform your product planning with seven-year vehicle infotainment forecasts by technology, country and revenue. Find analysis of leading vehicle platforms by brand and model. Learn more about other solutions from [IHS Automotive](#).