Electronics-ization in Automotive

Reinventing the Industry Model To Boost Profitable Innovation

By Marc Girardot and Michael Schwarz

The Leafs, Volts, and Teslas on the road today clearly signal that the automotive industry has taken the “electric-car U-turn.” Regardless of whether the names relate to Mother Nature or the history of electricity, most automobile manufacturers have invested significant resources in the development of these new electric models. And, indeed, a disruption in automotive technology is sorely needed to tackle the 15 percent of global carbon emissions for which automobiles are responsible.

From electric vehicles to regenerative braking to ultra-lightweight architectures, multiple innovative solutions exist to achieve the ambitious goal of halving emissions by 2035.[1] Given the complexity of today's cars, the relative immaturity of battery technology, and the other challenges currently faced by automakers, achieving success will require exploration of many innovation avenues. It will come at a very high cost on top of many other expensive initiatives.

In the years to come, these industry-wide efforts will demand considerable financial backing from lukewarm investors, already scarred by the bankruptcies of General Motors and Chrysler, on the one hand; and from hesitant governments with their own financial misfortunes, on the other. In a recent study of 10 years of industry data, the Cisco® Internet Business Solutions Group (IBSG) found the overall financial performance of the automotive industry to be well below levels required by the high risk it poses to investors.[2]

Cisco IBSG believes the automobile industry is at an inflection point. In many ways, the auto industry is converging toward high tech, another innovation-based industry. This phenomenon, which we call "electronics-ization," carries a number of threats for traditional automakers, but also creates multiple opportunities for the auto industry beyond pure technology plays.

In the following pages, we make the point that the automotive industry needs to reinvent itself to become more like the technology industry, which has a more efficient industry structure, a razor-sharp value chain focus, leading-edge electronics expertise, and substantial self-generated cash to fund disruptive innovation.

Cisco Internet Business Solutions Group (IBSG)

What Is Electronics-ization?

Recently, Google's self-driving car received a driver's license from the state of Nevada (see Figure 1).[3] This brow-raising oddity is an example of electronics-ization—an automotive industry phenomenon whereby:

- Electronics and ICT are radically transforming the car as a product and an experience.
- The automobile industry no longer solely operates in the mechanical world. More and more, it is becoming part of the ICT and electronics worlds.
- High-tech players can seriously disrupt, either directly or indirectly, the automotive landscape as we know it today.

Obviously, informed skeptics may say that electronics started infiltrating cars thirty-some years ago. Indeed, today's automobiles are more silicon than steel—if not in weight, then certainly in cost.[4] For the most part, however, auto manufacturers have entrusted innovation to outside players. For auto-specific novelties such as engine management systems or radar-enabled cruise control, innovation often depends on companies like Bosch and DENSO.

Figure 1. Google's Self-Driving Car Earns a Driver's License in Nevada.

Source: Google, 2012

In domains like the Internet and communications, traditional high-tech players such as Microsoft and Qualcomm contribute most of the innovation. Consequently, the engineering ranks of car manufacturers are still predominantly composed of mechanical and electrical engineers rather than software and electronics engineers. And, even though more than 75 percent of automobile innovation stems from electronics, car manufacturers have not yet fully embraced electronics.[5]

Even so, almost every car company has acknowledged that future success lies in creating vehicles that are differentiated by electronics and software, rather than just by design and branding. Numerous initiatives, such as BMW's ConnectedDrive, exemplify this industry-wide vision.[6]

The most significant opportunity of electronics-ization lies in reinventing the car industry structure.

While these are valuable steps to transform the auto experience, we believe the most significant opportunity for electronics-ization will come more from a reinvented industry structure than from technology. As more and more electronics are incorporated into cars, automobile executives should ask:

"Shouldn't we also look to high tech for inspiration in terms of business structure and enjoy the same business benefits?"

Need for Greater Flexibility and Financial Performance

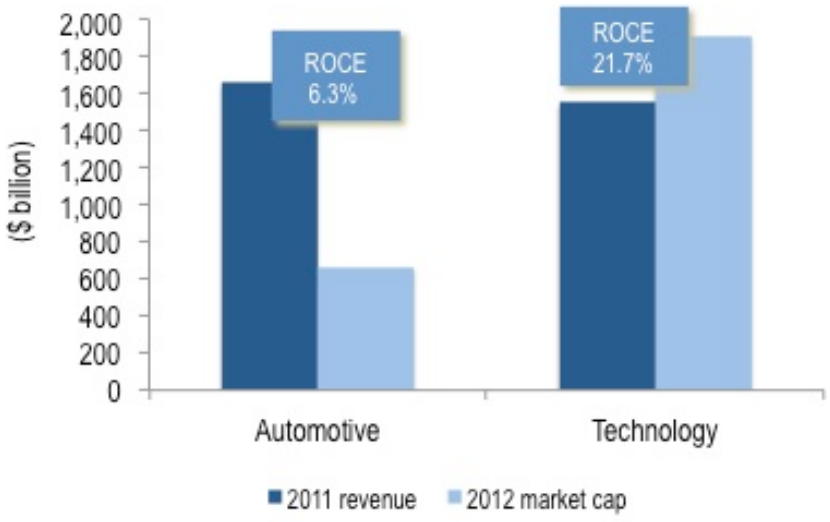
Generally speaking, over the past 20 years, automotive company profitability has been significantly out of line with the inherent risks and financial returns required by investors. And with $1.6 trillion in capital employed by just the top 50 auto companies, the industry is indeed very capital intensive.[7] Given the challenges ahead, the large amount of capital required to achieve the industry's goals shows no sign of abating.

Interestingly, our work shows that the auto and high-tech industries:

- Utilize approximately the same amount of capital
- Have similar revenues: between $1.5 trillion and $1.6 trillion
- Have very different market values. In 2012, the top 50 auto companies' combined market value was approximately $0.7 trillion, when the top 50 high-tech companies were valued at $1.9 trillion—almost three times as much (see Figure 2).[8]

Indeed, industry statistics reveal that over the past decade, the rate of return on capital employed (ROCE) for the high-tech industry—21.7 percent—was three times higher than that of the auto industry (6.3 percent).[9]

Figure 2. Comparison of the Top-50 Automotive and High-Tech Companies.



Sources: Thompson Data, 2012; Cisco IBSG, 2012

Additionally, as recent events such as the Japanese tsunami and the European debt crisis have reminded us, the automotive industry lacks the required flexibility and extra capacity to rapidly adjust to ever-changing market conditions. Across the world, the Great Recession caused nearly every major car manufacturer to suffer the financial equivalent of a "heart attack," requiring more than a year of resuscitation in the form of government programs like Cash for Clunkers, direct and indirect loans, shareholder takeovers, and debt write-offs through the bankruptcy process.

Though such systemic shakedowns can naturally be attributed to the forcefulness of these crises, Cisco IBSG believes these are actually more symptomatic of the inherited structural flaws that exist within the auto industry.

Over the past two decades, the auto industry has been actively transforming and reinventing itself by establishing new alliances, outsourcing to tier-one suppliers, expanding globally, developing new car platform strategies, embracing lean principles, adding diversity to its product lineups, speeding product development cycles, and reducing carbon dioxide emissions. To its credit, the industry has been relatively successful at implementing these changes.[10]

Even so, despite fundamental market changes such as globalization, enhanced quality, and fragmentation of traditional customer segments, the industry hasn't fundamentally changed the way it is structured. Apart from more concentration (notably in the supply base), the auto industry is organized basically the same way it was a century ago—vertically integrated around large manufacturers.

One hundred years ago, vertical integration was a necessary evil for the likes of Henry Ford, since automobile technologies still needed to be invented, supply chains needed to be developed and secured, manufacturing techniques needed to be designed, and quality was still a Holy Grail. Simply put, automobile manufacturers had no choice but to control as much of the value chain as possible—sometimes going as far as owning fleets of ships, as well as steel mills and even ostrich farms.[11]

Vertical Integration No Longer Justified

Today the original justification for vertical integration no longer exists. By and large, current car technologies and global supply chains are mature and trustworthy. And, across all mainstream carmakers, quality has improved greatly and, overall, is under control. Nevertheless, automotive executives have never fully challenged the status quo of the industry's structure, nor have they broken away from vertical integration.

> Almost every OEM has, more or less, the same business strategy.

On the contrary, they have invested a considerable amount of time and resources chasing scale for the sake of scale itself. This is understandable, as scale was a driver of success in the past. And, on one hand, the political and social pressures to maintain and to protect an industry that represents up to 10 percent of gross domestic product (GDP) in some countries are difficult to resist. On the other hand, the industry's achievements, heritage, and cultural legacy are truly humbling even for the brightest executives, making it difficult to change the status quo.

Status Quo Leads to "Me-Too" Strategies

In our view, the cost to maintain the status quo of vertical integration is overwhelming and poses a threat to the very industry it is meant to sustain. Indeed, this obsolete model inhibits the development of truly differentiated strategies, wastes resources by encouraging redundant efforts, and depletes the monetary resources required to invest in innovation.

Today, for instance, almost every original equipment manufacturer (OEM) has more or less the same business strategy:

- Create and manage a balanced global footprint (for now, more BRIC, less Europe)
- Benefit from economies of scale through mergers, alliances, and platforms
- Find the best mix of electric / hybrid initiatives and ICE / weight-optimization efforts
- Expand the product lineup to capture lower- or higher-end market niches
- Improve quality and streamline operations using lean manufacturing methodologies

When a majority of mass-market carmakers simultaneously undertakes the same strategy, it is only natural that they have difficulty differentiating themselves and are stretched financially. Simultaneous multi-billion dollar investments—such as building a greenfield manufacturing plant in China, developing a high-performance electric vehicle, or halving CO2 emissions—place heavy demands on a company's cash and talent resources.

And when the going gets tough, the challenge becomes even more acute and threatening. The current financial challenges at The Peugeot Citroën Group are a perfect example of funding too many large initiatives without having the necessary self-generated cash to sustain ongoing operations.[12]

Emulating the High-Tech Industry

Cisco IBSG believes the auto industry can truly benefit by emulating the way high-tech companies are structured. Specifically, we think automakers can improve cash utilization, increase flexibility, boost profitability and accelerate innovation.

In many ways, the automobile and high-tech industries are very different. We are well aware that the automobile industry has some unique traits, notably that safety and quality are crucial, that it's a highly regulated industry, and that a lot of the industry is still influenced by government, by founding-family values, and by emotions tied to historical legacies.

There are also many similarities. Both industries have transformed the world (and are still transforming it today). Both employ millions of people globally, drive economic growth, spend tens of billions of dollars in R&D every year, and are founded on rigorous innovation. Moreover, the line between the automobile and high-tech industries is blurring. As evidence, cars and trucks are now one of the most popular attractions at the Consumer Electronics Show (CES), the world's largest electronics event, held each year in Las Vegas.

Although it is much younger than the auto industry, the high-tech industry has had to adapt much earlier because of a faster pace and new disruptive technologies. Short Darwinian cycles caused many companies to go bankrupt and many others, spurred on by the competitive edge of start-ups, to restructure, focus, and innovate.

Five Main Differences

As a consequence, the structure of the high-tech sector is more adaptive and differs from that of the automobile sector in five main ways. For the most part, high-tech companies (1) are not vertically integrated and are more selectively positioned with regard to value chains; (2) have fewer competitors in each market niche; (3) orchestrate and widely adopt industry standards; (4) mutualize through partnerships and co-opetition; and (5) focus resources and specialize in areas where they can make a difference for customers.

1. Not Vertically Integrated

As highlighted earlier, it made sense to control the value chain during the early days of the automobile industry. Today, automakers do not design or manufacture everything themselves. Still, as demonstrated by the auto industry's low ROCE ratio, Cisco IBSG believes the scope of car company value chains is still much too wide and too far-reaching.

By letting go of discrete parts of their value chains—possibly going as far as letting go of car manufacturing or even marketing cars altogether—auto companies could focus their resources on developing core strengths based on their particular context (e.g., footprint, skill set, brand) and on where their customers see most value. In areas where value-add is debatable, companies would rely on partnerships with other players who have a distinctive advantage to share and capitalize upon.

Benefits: Investments are more focused. Auto companies have differentiating assets and distinctive strategies.

2. Fewer Players

In high tech, large players, such as Microsoft, Apple, and Cisco, contribute in multiple domains in a selective manner with limited overlap. Contrary to what can be seen in the automotive space, big high-tech players do not systematically compete in the same areas. Hence, in any sizable market, high-tech competition will include only three to five players, compared with more than 15 players in the auto industry.

As demonstrated by Apple and Samsung, this industry equilibrium leaves sufficient space for fierce competition on one hand, while still permitting to share enough value to accelerate, fund, and pay back heavy investments for innovation, on the other.

Benefits: Greater profits, enhanced financial capacity, and re-energized innovation.

3. Mutualization

By "mutualization," we mean a model whereby different competing companies, through the service provisioning of another player, a joint venture, or even a competitor, can share the investment burden and its corresponding risks.

Mutualization can be very profitable by sharing high investment costs, notably when the outcome is uncertain. For example, OEMs with plans to expand to Russia could have imagined a model where manufacturing plants were mutualized instead of building multiple, independent new plants. Mutualization can also be beneficial in scenarios such as outsourcing (e.g. logistics), on the condition that talent, resources, and investments are shared across several partners. Obviously, a much higher degree of standardization would be indispensable for firms to truly benefit from mutualization.

By entrusting parts of the value chain to a mutualizer, companies could benefit from reduced need for capital along with the best-in-class operations of a specialist. Companies would also mutualize and diversify risk, as the operation would no longer be dependent on just one or two product success, but rather upon a diverse portfolio.

Benefits: Improved utilization (plant, infrastructure, etc.), reduced capital requirements, and reduced risk.

4. Standardization

Obviously, for this effective restructuring to happen, more interdependencies will need to be created (along with a lot more trust) throughout the industry. Bridges between complementary companies will need to be created, shifted, and redeployed seamlessly. And for this intricate organizational puzzle to evolve and survive, industry-wide standardization will be key not only for components and platforms, but also for the system itself.

Today, some degree standardization is already happening within most automotive groups; but tomorrow, we believe this standardization will need to be industry-wide, just as in IT, where Lenovo and Apple computers share numerous standard components, technologies, and architectures.

Benefits: Lower costs, flexible partnerships, and faster adaptation to changes in the marketplace.

5. Specialization

To continue differentiating and creating distinctive value, the flip side of standardization will be varying degrees of specialization in products or services in areas chosen to create distinctive value.

As resources are freed up by value-chain "cherry picking" and mutualization, companies will be able to select specific areas where they will specialize, investing both their best talent and top dollars in spaces that will provide true differentiation and high payback potential.

Specialization won't necessarily mean big-bet investments. Indeed, specialization can happen at more anecdotal and strategic levels. A good high-tech example is Apple's patented aluminum carving technique. Even a few years after it was first used, this approach still gives Apple a distinctive anecdotal advantage over competing casings.

Obviously, with strategic specialization, one can envision much more disruptive plays such as Apple's iOS platform, which completely reshaped not only the world of cell phones, but also the music industry.

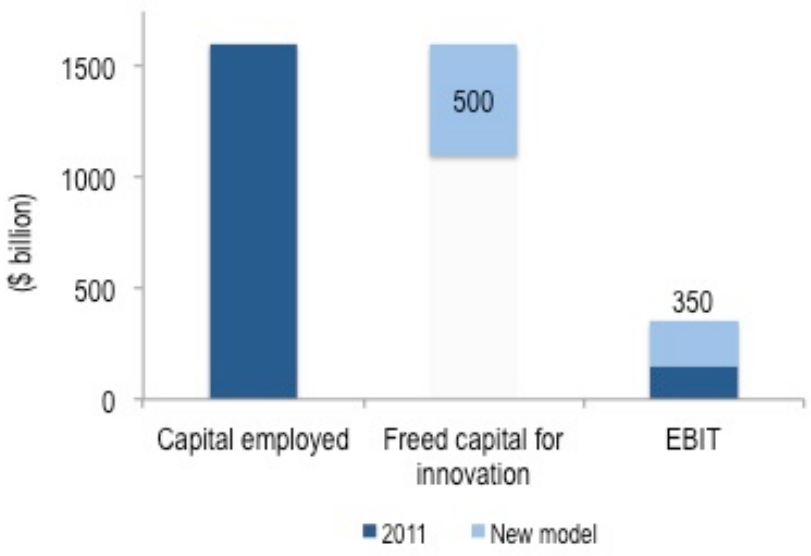
Benefits: Accelerated innovation, differentiation, and improved pricing power.

Racing Toward Tremendous Benefits

By adopting more of a high-tech approach, the automotive industry could avoid seeding too many undifferentiating opportunities with limited payback, and adopt a more precise and focused self-sustaining approach centered on innovation.

Companies would retrench from some areas. More mutualization would occur across the industry. And standardization would be prevalent. A significant amount of investment cash would be freed up. Our preliminary estimate is that as much as 30 percent of capital employed, or approximately $500 billion, could be progressively freed up and reinvested in innovation (see Figure 3).

Figure 3. Benefits from Adopting a High-Tech Business Model in Automotive.



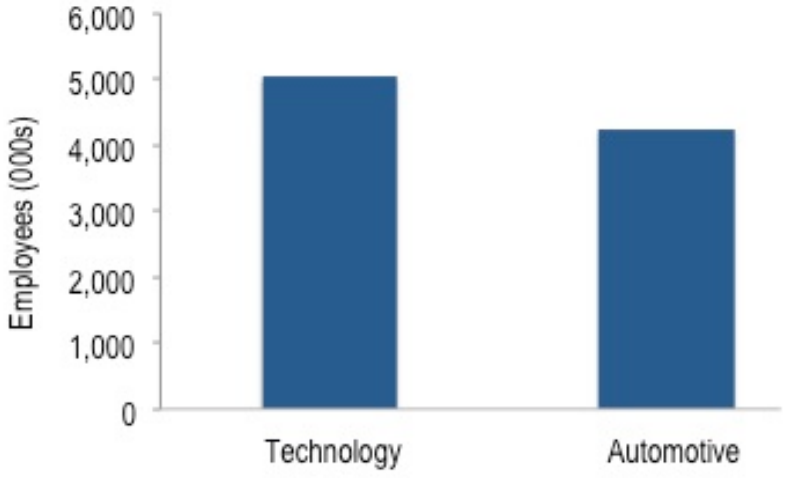
Sources: Thompson Data, 2003-2012; Cisco IBSG, 2012

With a rationalized use of resources, a much faster and dynamic innovation engine, and a greater capacity to capture pricing premiums, the automotive industry could well match high tech's 22 percent ROCE benchmark in the next two decades.

By adopting more of the high-tech model, the auto industry will gain in visibility and in the regularity of its financial numbers. Possibly, it will more than double its profitability, reaching the combined earnings before interest and taxes (EBIT) for the top 50 auto companies of $350 billion (from $150 billion today).

Counterintuitively, with 5 million employees, the top 50 high-tech companies actually employ more people than the top 50 automotive companies, which employ 4.2 million people (see Figure 4).[13] So, even though such a transformation would necessarily mean significant changes to the workforce, it could actually result in more and better-paid employees in the end, not fewer.

Figure 4. Top 50 Companies Employment Comparison (Technology Versus Automotive).



Sources: Thompson Data, 2012; Cisco IBSG, 2012

Making Inroads

It is true that many automobile companies have already implemented initiatives based on the principles used by high-tech companies. For instance, BMW has gone a long way by outsourcing the production of its MINI Countryman to Magna Steyr, a car manufacturer located in Graz, Austria (see Figure 5). In another striking example, a few years back, Toyota and Peugeot Citroën mutualized their Kolin plant in the Czech Republic. While many such initiatives have been undertaken across the industry, to date, these have mostly been one-off tests or limited in scope or time.

There are a number of reasons auto companies haven't been more aggressive in adopting a high-tech approach to structuring and running their businesses:

- Auto companies have been busy adapting to a fast-paced market by expanding globally, becoming lean, reducing time-to-market, and extending product lineups.
- The high-tech industry model is relatively new. Until recently, most automotive leaders constructed their visions and strategies by benchmarking other automakers, such as Toyota.
- In the automotive industry, recognized leadership qualities were traditionally and normally directed at maintaining, securing, and progressively optimizing the system in place, and not at challenging its foundation.
- Finally, given the high stakes and the radical transformation needed, governments and labor unions have been resistant to change.

To achieve the full benefits of moving to a high-tech business model, automakers need to go beyond one-off trials and progressively redefine the scope of areas in which they engage to extract more value per invested resource.

Figure 5. BMW Implements High-Tech Principles for Its MINI Brand.

High-tech principles	High-tech principles implemented by BMW for its MINI brand
Not vertically integrated	• Outsources part of its manufacturing to Magna Steyr (MINI Countryman) • Orchestrates engineering through multiple partners
Fewer players	• Created entirely new car segment—small premium • Leads its own market; limited competition
Mutualization	• Partnered with Peugeot Citroën for diesel engines • Originally teamed with Toyota for gasoline engines (sourced from BMW today) • Majority of dealer back offices and operations shared with BMW
Standardization	• Next-generation MINI will be based on a new car architecture; will be standardized across the MINI and entry-level BMWs
Specialization	• 100-person team focuses on brand management / overall network orchestration • Highly specialized in offering superior personalization and customization • Early emphasis on customer community building and "socially networked" car • Go-to-market strategy is MINI-specific for customer-facing activities

Sources: BMW, 2012; Cisco IBSG, 2012

Turbo-Charged Competition

Given the typical passion for automobiles displayed by high-tech engineers, we believe that a select number of high-tech companies with deep pockets (e.g., Google, Apple, Intel) might be interested in tackling the challenge of disrupting the automotive industry the way Apple did with the music industry, or possibly with a different twist.

If Steve Jobs had a passion for cars, Apple might have already disrupted the car industry!

In Silicon Valley, passionate, successful entrepreneurs backed by heavily funded venture capital firms are already sparking new automotive initiatives (e.g., Tesla) with top talent from the high-tech industry. These new firms will inevitably attract people with a high-tech philosophy and practices that made their entrepreneurial success possible. Like a foreign "virus" re-engineering DNA inside the human body, high-tech entrepreneurs will inevitably enter the automotive industry, and most probably will radically change its ways. In any case, the transformation process has already started with the technological convergence of automotive technologies and electronics.

Figure 6. A High-Tech Business Model Roadmap for Auto Executives.

Building blocks	Elements
Craft a new vision	• Define target customers and determine what they care about • "Cherry pick" submarkets, core focus areas (design, manufacturing), and specialization areas (engines, style, service provision) • Design out-tasking partnerships
Change corporate culture	• Foster an entrepreneurial culture based on trust, diversity, and partnering • Recruit more software and electronics engineers • Establish trust as a key cultural attribute
Redesign operations	• Transition noncore activities to a mutualizer or new service provider • Build flexible and secure IT systems • Invest in cross-industry standardization
Perfect communications	• Communicate “vision and commitment” to governments and unions rather than to “off-shoring” • Communicate the change in vision to financial stakeholders
Manage partnerships	• Create strong industry interdependencies to foster trust and collaboration despite co-opetition • Build partnerships with high-tech companies in relevant domains • Orchestrate industry-wide standardization bodies
Review product strategy	• Engineer a sustainable and flexible electronics platform with clear functional components and open interfaces • Map out distinctive customer care-abouts with corresponding specialization technologies • Choose product focus (self-driving car, iCar, electric vehicle, etc.); set innovation priorities to achieve goal

Source: Cisco IBSG, 2012

Moving Forward

The fact that automobiles are becoming more dependent on electronics doesn’t mean that company executives can just “cut and paste” the high-tech industry model into their businesses. Even if they could, they wouldn't want to, for several good reasons.

To its credit, the automotive industry has made considerable progress in the past 20 years, and it has already begun adopting several components of the high-tech business model through many ongoing initiatives. Like any significant business or industry transformation, this process will take time. However, catalysts from the high-tech world have already started to accelerate it all, and carmakers should be proactive or run the risk of being sidelined.

Inspired by electronics-ization, this vision of a reinvented industry structure holds serious promise for the automotive industry. It will, indeed, require bold leadership, a significant change in culture, and a renewed vision for the role of cars in the future.

Innovation is at the heart of electronics-ization and the journey ahead. If consumers want self-driving cars, ultra-light vehicles with limited environmental impact, and even cars that become energy-storing devices inside their homes, auto manufacturers will need to make the radical investments in technology and high-tech business models that will enable auto companies to become leaders in innovation and financial performance.

So buckle up, the future is right around the corner and we are headed there in a hurry.

For more information, please contact:

Marc Girardot
Managing Director, Global Automotive Lead
Cisco Internet Business Solutions Group
+33 6 19 98 49 41
mgirardo@cisco.com

Michael Schwarz
Director, European Automotive Lead
Cisco Internet Business Solutions Group
+49 175 43 000 65
michasch@cisco.com

Endnotes

1. Source: Global Fuel Economy Initiative, 2012, http://www.globalfueleconomy.org
2. Sources: Bankruptcy filings: Delphi, April 8, 2005; Chrysler, April 30, 2009; GM, June 1, 2009.
3. Source: "How to Get a Permit for Your Driverless Car," *Businessweek,* February 21, 2012.
4. Source: *Bosch Electronics Handbook,* 5th edition, 2007.
5. Source: NXP Semiconductors, November 2011.
6. Source: BMW, 2012, http://www.bmw.com/com/en/insights/technology/connecteddrive/2010/index.html
7. Sources: Thompson Data, 2012; Cisco IBSG, 2012.
8. Ibid.
9. Ibid.
10. Please look for the upcoming paper, "The Car as a Platform," Cisco IBSG, Marc Girardot and Michael Schwarz.
11. Ostrich feathers are sometimes used for their electrostatic properties to dust car bodies just before the painting process.
12. The diversification into specialized tier-one supplier, Faurecia, and logistics specialist, GEFCO, brought considerable value during the recent automobile crisis.
13. Excludes Foxconn's almost 1 million employees.

Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV Amsterdam,
The Netherlands

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco Website at **www.cisco.com/go/offices.**