Automotive

Automotive 2020

Clarity beyond the chaos

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Clarity beyond the chaos

By Sanjay Rishi, Benjamin Stanley and Kalman Gyimesi

The automotive ecosystem is in the midst of significant change, with increasing challenges in consumer demands, technology development, globalization, integration and collaboration. A new era is rapidly approaching in which the very definition of personal mobility will change. Multi-modal transportation will become increasingly common, and intelligent vehicles will cater to diverse consumer needs for information, environmental responsibility and safety. Automotive companies are racing to develop new business models to help them maintain responsible growth. In this dynamic new age, we believe, a focus on the development of compelling personal mobility solutions, retail transformation, global execution and extensive partnering will be the keys to success in 2020.

Introduction

Rarely has an industry confronted the magnitude of multi-dimensional change the automotive industry faces today. Credited for providing the foundation for economic transformation of the developed world a century ago, and well under way to bringing mobility and prosperity to the developing world today, the industry finds itself simultaneously coveted for the employment and investment it attracts and disparaged for its perceived lack of environmental responsibility.

As it races toward 2020, the industry must learn to effectively manage the global resources it has put in place, respond to increasing demands for environmental accountability and use the technology at its disposal to transform the way it develops products and goes to market.

Indeed, the underlying and surrounding ecosystem of the industry is in a state of flux. Automakers, along with their partners, must respond to the changing dynamics of how automobiles will be manufactured, purchased, distributed and serviced. Consumers are becoming more empowered and sophisticated. Their wants and needs are evolving at an exponential pace. Basic transportation will no longer suffice, as consumers look to a comprehensive mobility experience.

Enlightened consumers will expect their vehicles to provide information, entertainment, safety and convenience. They will demand economy, environmental responsibility and sustainability. To meet these demands, vehicles will become more intelligent, offer "greener" operation and be customizable to greater "self expression" by buyers. As worldwide oil prices continue to surge, alternative powertrains will dominate new production.

Even the notion of "buying" as we know it today is expected to change. The concept of personal mobility will prompt consumers to purchase "transportation services" in place of personal vehicles for multiple uses.

The worldwide labor force will change and, by 2020, become radically different in terms of age, location and the way people work. Cultural awareness, diversity and adaptation will be the norm. This global workforce, with a geographically dispersed footprint for manufacturing and product development, will sustain and support the industry in 2020. The current investments in globalization will be established and a global infrastructure will essentially be in place. Evolving economies and markets will fuel new products, services and business models. The challenge faced by automakers will no longer be to globalize the industry, but will instead center on effective global integration and execution.

Collaboration throughout the automotive value net will be a necessity for those intent upon succeeding. Automakers will need to develop alliances and partnerships aggressively, both within and beyond the traditional boundaries of the industry. Today, divergent viewpoints among various industry segments threaten critical collaborative factors such as adoption of common standards, information management and data ownership. These differences provide a threat and will, if not addressed, retard progress.

The impact of external forces on the industry will continue to be significant, but the leading influencers will be radically different from those that affect the industry today. Technology will continue to develop at breakneck speed and will accelerate innovation in the vehicle, touching everything from performance to enhancements in safety and convenience. Sustainability, already an issue, will migrate to near the top of the list for the automotive value net. Unparalleled investments will make tremendous inroads for fuel efficiency, but unbridled and oft-impractical consumer and regulatory expectations will stay ahead of possible achievement, which may lead to disillusionment.

Consumers will also become increasingly watchful and wary about how companies perform outside the manufacturing and distribution processes. Corporate social responsibility will become markedly more important to the consumer and will become an imperative by which automotive enterprises will be evaluated.

Ultimately, executives we interviewed felt that to be well positioned for the market of 2020, automotive companies must anticipate beyond the expected: a new competitive landscape, rapidly evolving technologies, a departure from the traditional ecosystem, fresh attitudes about mobility and, above all, a very different consumer.

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Clarity beyond the chaos

Change abounds

The automotive industry is no stranger to change. New product ideas, *avant garde* styling and innovative solutions to increase performance have defined the industry. Regulatory mandates, including those for safety, fuel efficiency and emission standards, continue to pose challenges. But little of its past has prepared the industry for the wholesale changes that will sweep through its ranks in the next 10 to 12 years.

"In the next 10 years, we will experience more change than in the 50 years before."
– European automotive OEM executive

This is both exhilarating and troublesome news for many executives we interviewed. It is exhilarating for the opportunity that the changing dynamics will present to new market entrants and long-time leaders, troublesome for the sheer magnitude of this change and the necessary organizational responses.

Fascinating discoveries unravel as we identify how industry priorities shift and new dimensions of differentiation emerge.

Industry priorities shift

Technological progress – the development of products and services that perform better, last longer, offer more convenience, safety, entertainment and economy – will continue to lead the list of industry priorities in 2020.

Beyond that, however, industry leaders see a major shift (see Figure 1). Sustainability is already an issue of importance and is likely to remain so for an indefinite time. It will drive investments, product categories, and performance and convenience packaging decisions well into the next decades.

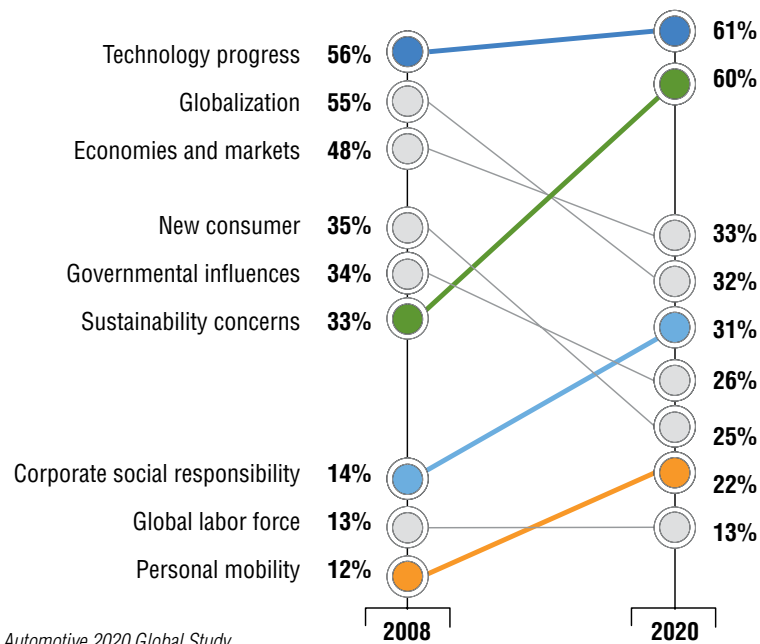**The IBM Automotive 2020 Global Study methodology**

To determine the needs and anticipated industry response to this changing ecosystem, IBM recently conducted interviews with 125 executives in 15 countries from a broad representation of automotive OEMs, suppliers and influential third parties:

- Our interviews were global and comprehensive, covering 85 percent of the top auto companies worldwide based on revenue, including all of the top 10.
- 69 percent of the interviews were with traditional participants in the industry (OEMs and suppliers).
- Other interviews were completed with:
  - Industry associations
  - Government economic development groups
  - Specialty companies outside the traditional industry
  - Academic institutions
  - Other organizations that provide a viewpoint on the future of the automotive industry.

Emerging nations, such as Brazil, Russia, India and China, accounted for 27 percent of the interviews. The synthesis of this rich repository of individual views, consolidated in this paper, provides clarity beyond the chaos dominant in the industry today.

FIGURE 1.
Anticipated change in external forces impacting the industry, 2008-2020.

	2008	2020
Technology progress	56%	61%
Globalization	55%	60%
Economies and markets	48%	
New consumer	35%	33%
Governmental influences	34%	32%
Sustainability concerns	33%	31%
		26%
		25%
Corporate social responsibility	14%	22%
Global labor force	13%	13%
Personal mobility	12%	

Source: IBM Automotive 2020 Global Study.

Overall, the anticipated shift in priorities reflects a move away from historic factors that have preoccupied the industry, globalization and governmental influences amongst them. Corporate social responsibility will take on additional importance and impact organizational strategy in as yet unforeseen ways.

> Globalization, among the industry's significant issues today, drops down significantly in priorities. Markets will indeed continue to emerge, but the strategy, processes, operational roadmaps and experience necessary to serve them will be largely established. Far from today's reality of learning, experimentation, and creation, the automotive enterprise of 2020 will apply this knowledge effectively and rapidly.
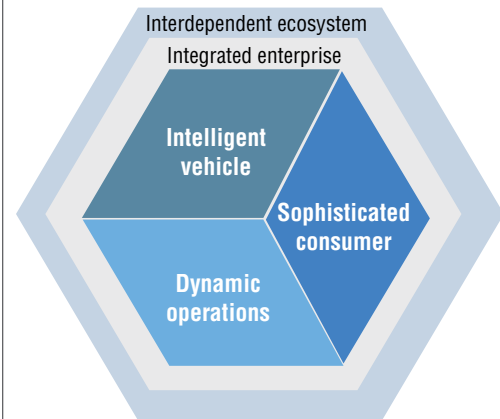
Five dimensions of differentiation
In response to this shift in industry priorities by 2020, differentiation and, therefore, success will manifest itself through five key dimensions (see Figure 2).

1. Sophisticated consumer
Automotive consumers of 2020 will be highly informed, demanding, impatient and environmentally conscious. They will compel a new, radically different ownership experience.

With more information at their disposal, enhanced traceability and transparency throughout the value chain, consumers will have more comparative shopping power than ever before.

FIGURE 2.
The five dimensions of differentiation.

Interdependent ecosystem
Integrated enterprise

Intelligent vehicle

Sophisticated consumer

Dynamic operations

Source: IBM Global Business Services.

These new, sophisticated consumers will prompt the automotive ecosystem to respond to their needs and demands by:

• Redefining mobility as we now know it

• Developing new and alternative finance mechanisms with the potential to generate innovative business models

• Creating new methods to connect with and retain consumers.

"The industry has become more consumer driven . . . The consumer will be dictating the terms."
– Indian automotive OEM executive

Mobility redefined
As consumers become even more selective and demanding in their quest for satisfaction, they are changing the way they move about. By 2020, consumers will have rede-fined personal mobility. Vehicles today are purchased based on financial constraints or to satisfy *"maximum"* needs (i.e., buying a pick-up truck to fulfill an occasional need to transport loads).

> The new definition of mobility will be represented with an innovative ownership profile – one in which the purchase or lease of a vehicle provides access to a diverse "garage" of vehicles.

The consumer of 2020 is more likely to be interested in flexible access to different types of transportation. Primary ownership profiles are likely to shift to the small luxury segment in line with "median needs" (primary daily needs). Bundled in the price would be scalable access to additional vehicles. Lifestyle changes will allow access to luxury or larger vehicles during weekends, as an example, while a small, efficient vehicle will suffice for daily commuting needs. This model would impact the aggregate production profile for vehicle segments.

The other part of this equation is the integration of multiple modes of transportation. The emergence of "mega cities" and the growth in public and alternative transportation options will be a key influencer to changing lifestyles. This will necessitate the creation of a seamless mobility experience between automobiles and these alternatives. The industry will need to respond with ownership models and technology to integrate these options.

In some geographies, there is an alarming change in the century-long love affair with the automobile.

Passion for automobiles is on the decline, somewhat driven by environmental concerns, but also due to changing lifestyles. While newly affluent populations in emerging markets aspire for their first experiences with the automobile, established customer bases may weaken.

"Personal mobility is attitude flexibility."

– European automotive association executive

Financing evolved

It is evident that the "garage" approach will impact vehicle financing models. Offerings will include predefined access to a broader selection of vehicles included in the monthly payments. Enhanced services (dealer or third-party based) would make it a more attractive cost and convenience alternative to the current rental model.

The advent of alternative powertrains – in particular the anticipated growth of battery technology – will also require new finance mechanisms. The cost of batteries, unless compensated via these innovative mechanisms, will be a significant barrier to rapid penetration across all segments. Executives we interviewed estimate battery cost to be as high as 10-15 percent of the total cost of vehicles in certain segments, significantly higher than current internal combustion engine configurations.

While this need will likely spawn a multitude of innovative solutions, our interviews revealed one particular scenario of promise:
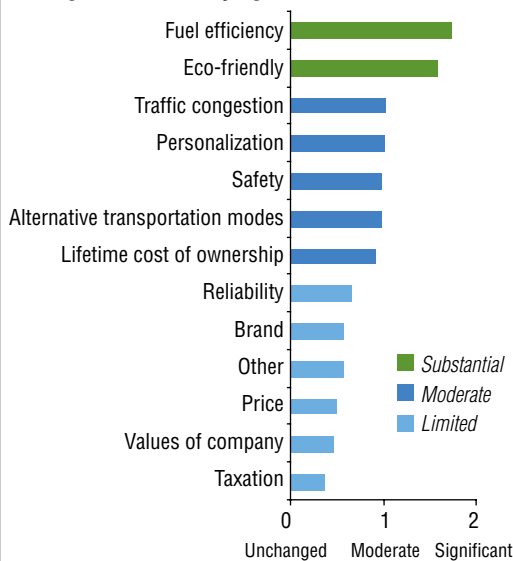
Usable battery (lithium-ion) life for automotive applications is estimated at about 10 years. Interestingly, this battery will have an even longer life for non-automotive applications, such as its energy storage potential for power grids. The average vehicle in the developed world is financed for 3-5 years and the emerging world is expected to follow suit. The opportunity to split the vehicle from the battery for purchase/lease/finance purposes is a real option. Discreet amortization schedules for the two would make battery technology affordable and help increase proliferation of hybrid and electric powertrains by neutralizing the premium that is currently charged.

Retention transformed

Perhaps the most significant change facing the industry will be a shift in consumer buying criteria that goes beyond – and, in fact, is unrelated to – vehicle performance (see Figure 3). The increased emphasis on environmental, safety, personalization, traffic congestion and alternative transportation will have a major impact on how and what people choose for their mobility needs. Traditional criteria such as price, reliability and brand will have much less an impact in the decision process of the future consumer.

Automotive dealerships may have the most to gain or lose by how they communicate their value. New retail models will emerge. Vehicles, conceivably, could be sold directly to the consumer, outside today's brick-and-mortar outlets. In certain markets, like the United States, dealers enjoy regulatory protection. Emerging markets are not likely to adopt these restrictive practices.

FIGURE 3.
Change in vehicle buying criteria 2008-2020.

Criteria	
Fuel efficiency	
Eco-friendly	
Traffic congestion	
Personalization	
Safety	
Alternative transportation modes	
Lifetime cost of ownership	
Reliability	
Brand	
Other	
Price	
Values of company	
Taxation	

■ Substantial
■ Moderate
■ Limited

0   1   2
Unchanged   Moderate   Significant

Source: IBM Automotive 2020 Global Study.

Regardless of the regulatory environments, the traditional value definition for dealerships is expected to decline significantly. Erosion of long-established regulatory protections over time is a likely reality, as consumers become intolerant of inflexibility.

Dealerships, especially large dealer groups, have begun to recognize this threat. Prosperity will be reserved for those that focus on customer intimacy and robust relationship management supported by intense information management, a wide range of personalization offerings and new heights of service. Technologies, including telematics and remote prognostics, will allow dealerships to provide a "sense and respond" approach to building customer loyalty.

Irrespective of which scenario eventually plays out, it is clear that dealers are *now* at a crossroads. They should look to develop and implement programs and services that will re-establish and maintain their value to the consumer.

2. The intelligent vehicle

Innovation drives the automotive industry today, prompting automakers to differentiate products and services by increasing performance, reliability, economy and options. The vehicles of the near future will be "intelligent." Electronics will bring new capabilities to every part of the vehicle. New technologies will provide for greater assistance in navigation, enhanced driver information about the vehicle, its environment and vehicle connectivity. Consumers, with a plethora of electronic devices that inform them, entertain them and keep them safe, will find themselves enjoying the overall experience of their vehicles. Connectivity and lifestyle trends will change the way cars are used. This "experience" will be a key differentiator in attracting consumers, especially in the areas of driver assistance, safety and service.
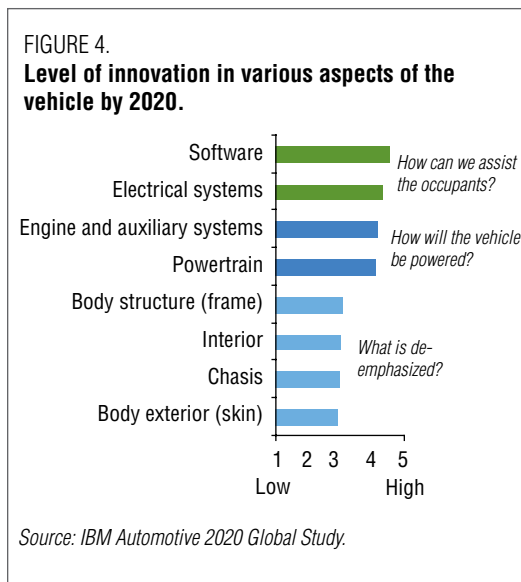
Glimpses of technologies that will shape the vehicle of 2020 are becoming visible today. Telematics is coming of age. Active safety technologies that sense and respond to driving behaviors and road conditions are becoming common in mid- to upper-tier vehicles in the developed world. Entertainment choices and navigation have seen rapid adoption in recent years. And powertrain innovations are making their way out of engineering workstations and into vehicles around the world.

The extension of this vision for the vehicle of the not-so-distant future reveals an autonomous vehicle smart enough to sense its surroundings and navigate through traffic safely and efficiently, all the while allowing its occupants the luxury of personalized comfort and convenience. Ultimately, this vehicle would represent a seamless transition from life within the vehicle to life outside it.

Can we expect significant progress by 2020 towards this vision? Absolutely! Is this vision achievable in its entirety by 2020? Probably not.

The vehicle of 2020 will be characterized by several significant developments that, although implemented in incremental steps over the next 12 years, will make it remarkably different from today. A fierce focus on innovation across the broad automotive landscape will be concentrated on software, electrical systems, electronics, engine and auxiliary systems, and powertrain (see Figure 4).

FIGURE 4.
Level of innovation in various aspects of the vehicle by 2020.

Source: IBM Automotive 2020 Global Study.

The resulting vehicles will be characterized by the following:

The *green* vehicle
Executives we interviewed project an unambiguous picture of the vehicle powertrain by 2020. Alternative power will see continued innovation for years beyond 2020.

Battery technology will be ubiquitous. Lithium-ion technology holds the most promise and will see considerable investment and growth.

Micro, mild and full hybridization is undergoing extensive development today. All new vehicles in 2020 will have some level of hybridization.

- Micro hybrids with stop-start capability and regenerative braking hold the potential to make sizeable contributions to carbon emission reduction and lower fossil fuel consumption. Current projections include estimates of up to 10 percent reduction in carbon emissions and fuel savings of up to 13 percent under certain driving conditions.[1]

- Mild hybrids, designed to provide extra power as needed but incapable of propelling the vehicle alone, are gaining attention, with several OEMs announcing agreements to collaborate and develop this technology.

- Full hybrids, not unlike some vehicles available today (powered exclusively by the electric motor under certain operating conditions) will continue to see extensive development. Alternative financing models will fuel the affordability of this technology for consumers.

Hydrogen fuel-cell vehicles will remain a viable alternative, but even optimistic projections put only a small fraction of vehicle production migrating to this technology (less than 1 percent of vehicles in the United States, according to a study by the U.S. National Research Council).[2]

"Energy storage is in the heart of the next generation of efforts for fuel economy."

– U.S. specialty company executive

Our respondents were uniformly skeptical on this front. But success for this still-emerging technology will depend on generating, transporting, storing and distributing fuel efficiently. This will be no small task for an element with the properties of hydrogen. The added challenge of building an entirely new infrastructure may be cost prohibitive, at least by 2020.

Ethanol must undergo rapid evolution for global application and proliferation. Food-based ethanol is clearly not a viable alternative and there is already a chorus of vocal dissent across all population spectrums because of the obvious conflict. Next generation ethanol, cellulosic and waste based, has the potential to see widespread acceptance. Infrastructure readiness costs for higher ethanol content fuels remain a sizeable hurdle. Provision of next generation low-ethanol content fuel utilizing the current distribution infrastructure is feasible and holds promise.

The all-electric, plug-in battery-powered vehicle will be a reality by 2020. A range of 100 miles is already within reach, enough to satisfy needs of large population sections. OEMs are investing sizeable resources to making these a reality.

An analysis of the anticipated progress towards green reveals interesting projections (see Figure 5). We looked at progress in fossil fuel, carbon emissions and recyclability.
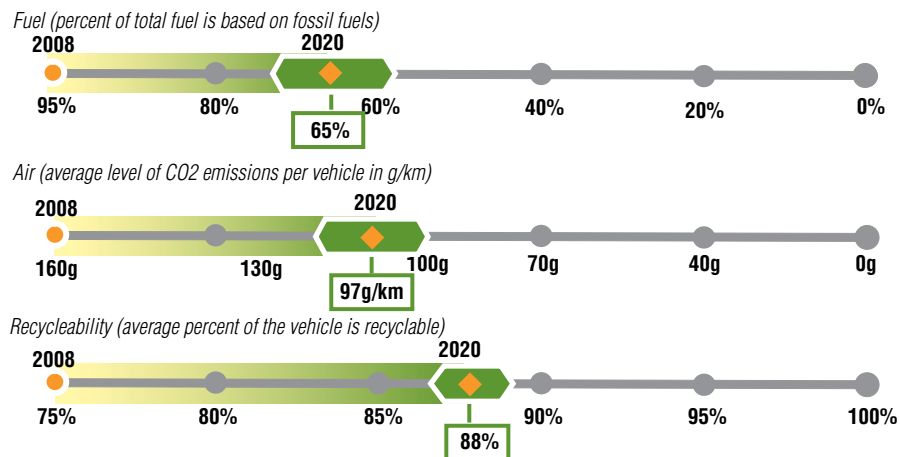
It is evident that the substantial investments made will start to pay dividends. The global portfolio of new vehicle production will show noteworthy advancement. Our study reveals that traditional fossil fuel-based vehicles are anticipated to make up 65 percent of new vehicle production, average levels of CO_2 emissions are expected to reach 97 g/km and vehicle recyclability is estimated to be at 88 percent.

Overly optimistic expectations, regulatory pressures and often impractical hopes will not cease to affect the industry. These can lead to disappointment and undue government intervention. Worse, these regulatory constraints could become the new battleground between economies trying to attract the industry versus those perceived as penalizing growth. A careful balance must be achieved between the possible and probable across all geographies, both emerging and developed.

The concept of total carbon footprint is increasingly the focus and will drive key decisions between now and 2020. Sustainability will be defined and broadly understood as a reflection of total carbon used in manufacturing and distributing across the entire value chain. This will pose some challenging choices. Satisfying consumer demand for electric power in certain geographies, as an example, is a high-carbon proposition (power generation based on coal).

The connected vehicle
will allow automated
response to developing
traffic situations and
will provide increased
safety, driver assistance
and enhanced service.

FIGURE 5.

Executive ratings of the global portfolio of new vehicle production in 2020 with regard to producing environmentally friendly vehicles.

Fuel (percent of total fuel is based on fossil fuels)

2008		2020				
95%	80%	60%	40%	20%		0%

65%

Air (average level of CO2 emissions per vehicle in g/km)

2008		2020				
160g	130g	100g	70g	40g		0g

97g/km

Recycleability (average percent of the vehicle is recyclable)

2008			2020			
75%	80%	85%	90%	95%		100%

88%

Source: IBM Automotive 2020 Global Study.

The *connected* vehicle:

> The vehicle of 2020 will be a communications wonder. As another node on the Internet, it will connect with other vehicles (V2V connectivity), the transportation infrastructure (V2I) and to homes, businesses and other sources (V2x).

Sensing capabilities, software and wireless communications will enable the vehicle to detect road conditions, recognize other vehicles and pedestrians near its space and sense environmental changes. The vehicle will then have the capability to either self correct or communicate information back to the driver.

Connectivity will allow vehicles to respond to developing traffic situations, find alternate routes and anticipate impending collisions. Telematics will enable the vehicle to diagnose operating problems and self heal. Built-in speech recognition capabilities will result in more voice commands by the driver and fewer manual processes. Overall, the connected

vehicle will enhance the driving experience in three specific areas: safety, driver assistance and service.

Safety – Creating safer driving conditions will be the predominant contribution of the connected vehicle. Connectivity will give the driver access to extensive information about congestion, accidents, road conditions, work zones, weather changes and hazards. It will enable vehicles to communicate with others in proximity, warning of such things as unsafe lane encroachment or impending collision. Connectivity will also allow sensors in the infrastructure to regulate traffic according to conditions. Emergency vehicles may command the infrastructure to stop or move all traffic in its path; cars may be stopped or moved to avoid an intersection violation. Technologies, such as regenerative braking, will be leveraged beyond their core intent to relay congestion patterns to other vehicles and enable active responses.

Driver assistance – Personalization will be a defining trait of the connected vehicle. It will provide age-focused assistance for drivers and will offer help according to personal driving habits and driving maturity. Consumers can expect their vehicles to offer limited self-driving capabilities, such as autonomous parking, depending upon rate of adoption and regional regulatory acceptance. The connected vehicle will be able to optimize routes based on fuel economy, realtime changes in traffic conditions and minimal tolling. The vehicle will become an extension of lifestyles, with entertainment solutions (streaming audio, video and communications) that allow seamless transition between mobility, office and home. Consumers will have drive-through convenience, with remote ordering and payments. A multitude of service offerings will grow from vehicle connectivity.

Service – The connected vehicle will be able to use realtime remote diagnostics and prognostics to assess operating conditions and affect some degree of self-repair. Software and other service patches to electronic systems will be automatically delivered to the vehicle, keeping it updated with little consumer involvement. Warranty information will be communicated as appropriate. OEMs and dealers will be able to offer more comprehensive customer relations management by maintaining, with consumer agreement, vehicle usage data and consumer preference profiles. Service alerts, scheduling and notifications will be offered based on operating behavior information transmitted from the vehicle.

Applications well under development today and projected to be pervasive in all new vehicles by 2020

Safety

- Intersection control violations
- Lane/road departure
- Road surface and pavement conditions
- 360/distance vision
- Active suspension and stability control.

Driver assistance

- Dynamic route guidance and navigation
- Motorist information on incidents, special events, weather and work zones
- Data downloads (entertainment, media, home network, personal preferences)
- Recovery of stolen vehicles
- Electronic payments including toll, drive-through, parking, road pricing.

Service

- Remote vehicle diagnostics
- Remote vehicle prognostics and self healing
- Transfer of vehicle data based on warranty
- Customer relations management including vehicle use profiles and dealer use data
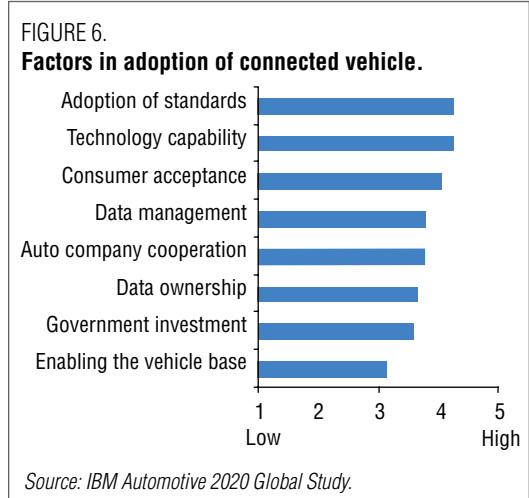- Driving-based behavior service/scheduling/alerts/notification.

Sources: Automotive 2020 Global Study; 2008 CAR Delphi Survey of the Telematics Industry.

By 2020, all new vehicles will have connectivity features. The extent to which these capabilities will be both utilized and effective, however, will depend upon several issues, including adoption of industrywide standards, technology capability and consumer acceptance (see Figure 6).

Executives interviewed agreed that the greatest barrier is the creation of global standards. Companies throughout the value net, including external players such as government and telecommunications companies, will need to work together to establish a common platform that enables vehicles and components from different manufacturers and geographic locations to communicate seamlessly.

Secondly, technology development, particularly in the area of sensors, must continue. However, because relatively less collaboration is necessary in this arena, it is likely to be the easier capability to enable.

FIGURE 6.
Factors in adoption of connected vehicle.

| Adoption of standards |
| Technology capability |
| Consumer acceptance |
| Data management |
| Auto company cooperation |
| Data ownership |
| Government investment |
| Enabling the vehicle base |

1   2   3   4   5
Low   High

Source: IBM Automotive 2020 Global Study.

The final key will be the rate of consumer adoption. In an environment of steadily increasing prices, cost will be a significant factor for the consumer in determining the level of connectivity that will be accepted. Drivers are likely to have reservations about how much control they are willing to turn over to the vehicle in crisis situations. Privacy issues, such as the degree to which consumers are willing to share personal information, will also be a concern.

The benefits of full connectivity will not be realized until an advanced degree of conversion is available for legacy vehicles or there is a greater turnover to post-2020 machines. We anticipate aftermarket products will be available to give older automobiles basic connectivity capabilities.

The most significant differences in vehicle connectivity by geographic region in 2020 are likely to occur in areas that require government investment. Developed nations, particularly Japan, Germany and the United States are expected to be the leaders in both innovating and establishing the required infrastructure. Other countries actively engaged in promoting connectivity include Korea, China and Sweden.

3. Dynamic operations
Emerging as a winner in 2020 will require an innovation-led approach to multiple factors, including growth strategies, the workforce, redefinition of "core" businesses and proactive flexibility.

Strategies for growth

Multiple avenues are available to achieve the growth expected for the industry. As current trends indicate, executives identified accelerating growth in emerging markets as the leading catalyst by 2020.

Our study, however, did show some regional disparities. Those interviewed in emerging markets put a greater emphasis on new business models and the development of service-based offerings.

We further compared various growth strategies and the factors involved in the adoption of connected vehicles. While there are broad areas of alignment, there are also several areas where disparate opinions were clear. OEMs consistently rated activities that required broader industry cooperation lower than suppliers. Figure 7 shows that OEMs have a more independent orientation toward these development initiatives, while suppliers were more inclined toward a partnership approach.

> Suppliers are looking for greater leadership from OEMs, especially around industrywide collaborative initiatives, in order to realize the industry's growth potential. As software and electronics in the vehicle grow rapidly, the industry, led by the OEMs, must collaborate on the architecture and define clear expectations to suppliers of requirements, performance, interfaces, testing and functionality.
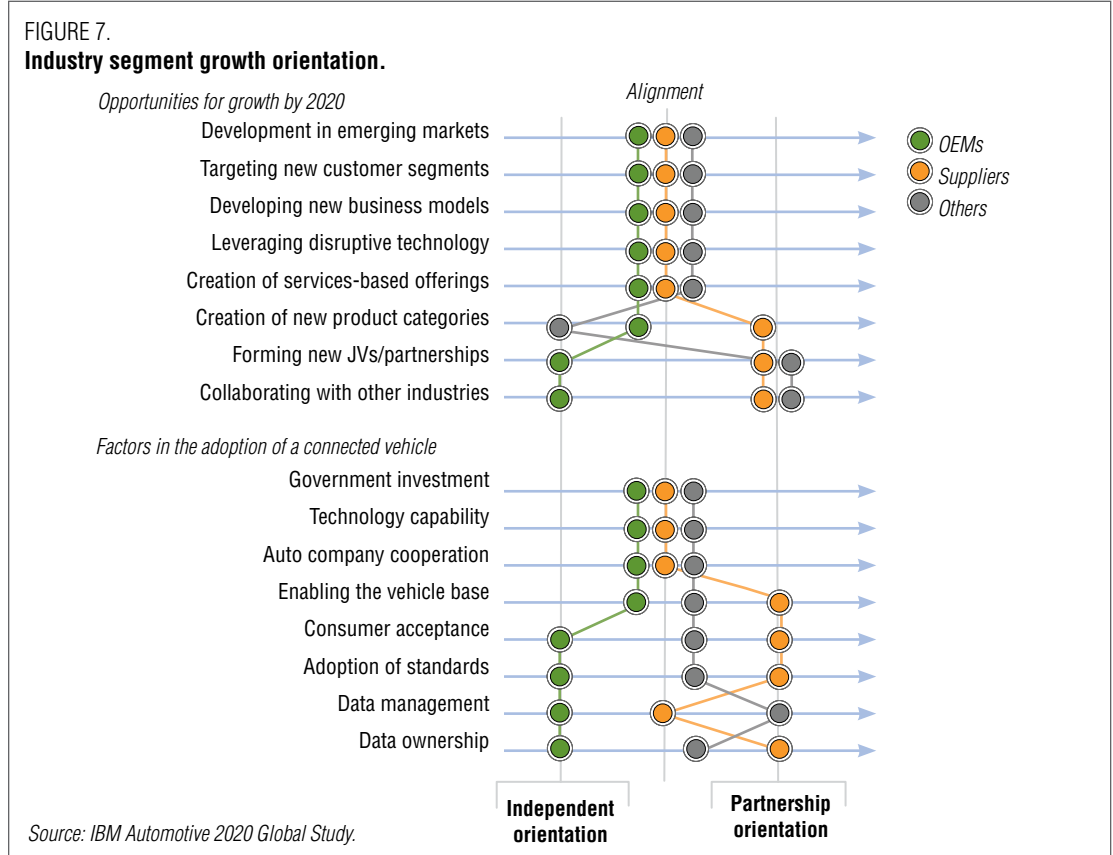
FIGURE 7.
Industry segment growth orientation.

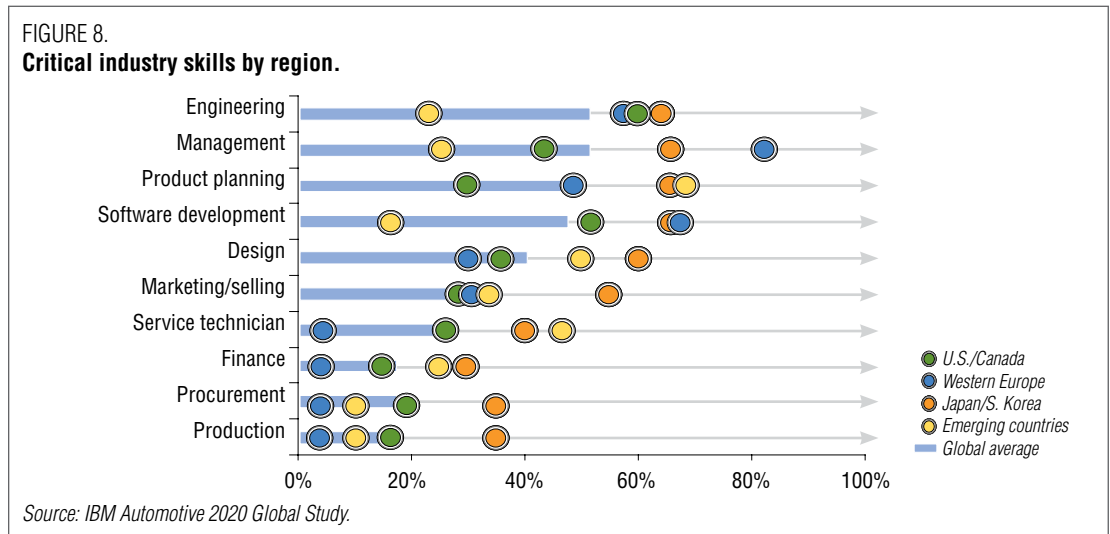Source: IBM Automotive 2020 Global Study.

With the proliferation of electronics and software within the vehicle, OEMs will need to elevate current levels of integration and software lifecycle management.

The multiplex workforce

By 2020, investments currently underway in globalization will be largely established. The challenge will be to execute in this expansive environment, leading to the need for a *multiplex workforce*. As with a "multiplexor" in electronics, the multiplex workforce enables the diverse skills and culture that are a byproduct of globalization and unites them into common goals and direction. This new workforce will have important new attributes, such as the ability to work across diverse cultures and will likely be conversant in multiple languages. The new global worker will also be effective working virtually.

Traditional organizational models will be transformed. Corporate functions currently housed in, or close to, company headquarters will see geographic distribution. Leadership models will become further matrixed.

The skills required for this new workforce tilt heavily toward the intelligent vehicle of the future. As Figure 8 shows, the highest rated skills for 2020 focus around engineering, management, product planning and software development. The industry will need to bring all of these skills into play. Skills in finance, procurement and production were underrated by executives, but will have important roles in effective global execution.

FIGURE 8.
Critical industry skills by region.

Legend:
- U.S./Canada
- Western Europe
- Japan/S. Korea
- Emerging countries
- Global average

Source: IBM Automotive 2020 Global Study.

"If you look at manufacturing, anybody who chases cheap labor doesn't win."

– U.S. automotive supplier executive

> As this workforce will be more mobile and diverse, employees will have less interest in tying themselves to a singular career and will put greater value on job flexibility and balance with non-work activities. They will also make greater demands on an inclusive and collaborative work environment.

Those auto companies that are financial outperformers consistently rated workplace capabilities, such as fostering a culture that supports learning, knowledge transfer to inexperienced workers and attracting employees to the industry, higher than the their underperforming peers.

An additional key to enabling the multiplex workforce to reach its potential will be the building up and global rotation of leadership talent, with an emphasis on attracting quality executives from outside of the industry. Building leadership talent was the highest rated capability challenge (see Figure 9). Nearly 50 percent of those we interviewed gave "building leadership talent" the highest possible rating. As the workforce turns over, this new leadership must guard against allowing entrenched culture to become a disabler. Priority skills that will need to be recruited and developed will vary according to region, availability and market skills.

In addition to innovating growth strategies and effectively managing the multiplex workforce, market dynamics will prompt automotive companies to *redefine the core* of their businesses. As new business models emerge among the various industries that will collaborate with auto companies, new definitions of what is core will apply. For example, requirements for increased product innova-

FIGURE 9.
Primary capability challenges facing the industry between now and 2020.

Source: IBM Automotive 2020 Global Study.

tion will spur suppliers to develop greater core competencies in energy, materials and electronics. And the mandates of marketing, selling and after-sales innovation will lead OEMs to develop greater core competencies more tightly linked to product innovation and consumer strategy. OEMs will also need to be resource integrators across the automotive value net.

"By 2020, the traditional OEM will be the vehicle integrators, product innovators, customization centers and vehicle brand owners"
– Executive, automotive OEM

Proactive flexibility

Finally, *proactive flexibility* in operations and processes will be necessary to keep up with rapidly evolving consumer needs and the demands of working with interdependent ecosystems. This flexibility will require the ability to anticipate market changes and continually adjust critical "footprints" to respond.

Product development footprint

> With engineering skills continuing to be available in abundance within countries such as China and India, the redefinition of the product development footprint is a foregone conclusion.

However, to assume that all product development will happen in these emerging markets is an overstatement. Consumer proximity and development needs in a "follow the sun" model will provide continuity of product engineering in development markets. Transformation will be evident through the following:

- Core product development will happen in both mature and emerging markets. Industry executives believe that, in addition to available talent, the unique combination of excitement, entrepreneurship and innovative skills in developing economies will allow for homogeneous distribution of these activities.

- Application development will also be distributed and not limited to today's model that splits core development to developed markets and application development to emerging markets.

- Innovation will be distributed among multiple global R&D centers to leverage expertise.

Manufacturing footprint

> The fear of automotive manufacturing moving exclusively to emerging economies is vastly overstated.

We believe this model is not sustainable, and executives interviewed provided strong corroboration on this point.

The complexion of "domestic" (in developed countries) manufacturing will undergo change; ownership profiles will not be a carryover of those from the past. Non-domestic OEMs will continue to invest in plants in developed economies. Leading global OEMs will have established their near-optimum presence in emerging geographies. Readily visible signs of a new 2020 manufacturing footprint will include:

- Automated, flex manufacturing plants that will allow for greater flexibility in building vehicles based on local and global demand.

- Broader footprints that will be established as new markets emerge.

- Manufacturing plants that will not be constrained by the quantity of labor, but will be heavily reliant on the quality of skills.

Skill-based footprint

> The available skill base will not only include those of the enterprise, but also those that are sharable among collaborating companies and industries.

Optimizing the distribution of the workforce will be an ongoing focus of OEMs and suppliers alike.

- Emerging markets will continue to produce highly skilled workers that auto companies will leverage.

- Lack of attraction to the industry in developed markets and work requirements of next generation workers will cause greater turnover and a skills shortage.

4. The integrated enterprise

The pursuit of the sophisticated consumer, development of intelligent vehicles and the transformation to dynamic operations will be wrapped in a new integrated enterprise that breaks from the past and is appealing to new talent the industry is seeking to attract. Auto companies will forge a new identity. The image of the industry, enterprise and individual brands will be defined in a widely critical, global marketplace.

Automotive companies must strive to build and extend social responsibility initiatives that transform the image of the industry. These concerns will increasingly drive consumer expectations and have the potential for far-reaching impact:

- *Brand image* – Enterprises no longer explicitly own their brands. In addition to its own efforts, a company's brand is defined by others, including, consumers, competitors and special interest groups. The Internet has enabled more than 100,000 new citizen groups around social and political issues since 1990.[3]

- *Industry attractiveness* –The need to attract employees to work in the automotive industry received mixed ratings in our interviews, implying an under appreciation for this challenge. New global locations lack the history that traditional automotive cities have enjoyed to enable automatic talent recruitment.

- *Company culture* – Executives in all developed geographies are concerned about the difficulty of changing long-established culture. Employees that are favorable about their company's CSR are also more positive about senior management integrity, the company's sense of direction and its marketplace competitiveness.

"When we compare 2020 with the present, we cannot think about the growth of the automobile enterprise without also paying attention to the safeguarding of the world environment."

– Japanese academic institution representative

Interdependent ecosystem

Consumers, regulatory and environmental requirements compel the auto industry to extend outside the borders of its own ecosystem to tap into the innovation and resources of others.

Winning in the marketplace starts with the ability to work with other industry ecosystems to identify innovative solutions quickly (see Figure 10). The relentless push to work with other industries will bring differentiating mobility solutions to consumers. Some of these innovations will include:

- Collaboration with the consumer electronics industry for in-vehicle electronics and software, as well as development of the battery
- Collaboration with the energy/ utilities industry for alternative fuel and energy sources

- Partnerships with the telecommunications industry for connected vehicle communication technology
- Cooperation with the financial services industry to develop new financing models and automated payment of parking, tolls and other services
- Association with government for infrastructure improvements to enable the connected vehicle and regulatory requirements for fuel economy, environmental issues and incentives to drive the conversion to cleaner technologies.

This collaborative effort must also extend past just the individual companies and institutions to their consumers, communities and geographies in order to tap into ideas for innovation and identify marketplace wants and needs.

FIGURE 10.
Interdependent ecosystems.

Source: IBM Global Business Services.
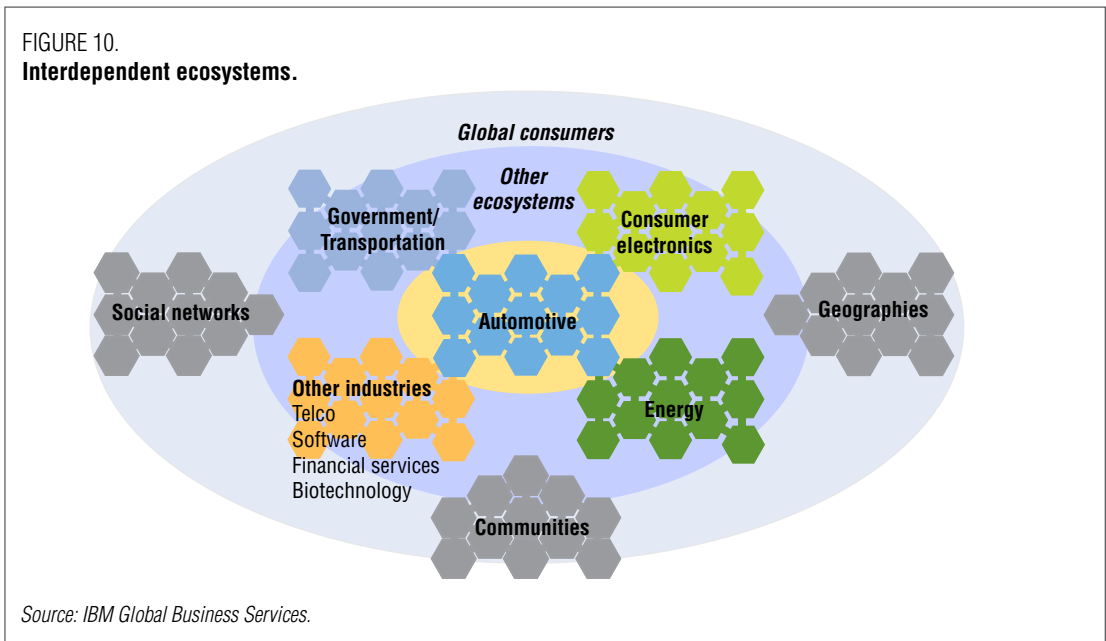
Today's "collision" of industries, in which proprietary technology is the norm, will need to be replaced by a new approach, much remains to be accomplished to make this a reality. The ability for the auto companies to work with a broader set of ecosystems was identified in our study as the largest shortcoming. As Figure 11 shows, there is will be a significant increase in importance by 2020 in the need to collaborate among ecosystems.

The collision (as opposed to collaboration) of industries within and surrounding the automotive ecosystem today is highlighted by a variety of issues that must be addressed:

- Relationships with governmental agencies are often adversarial.

- Other industries have varying product life-cycles, different rates of innovation and may have competing priorities

- The automotive industry must have both the ability and capability to tap into ideas and innovation from consumers of other related industries.

- Current difficulties in managing increased software requirements and information technology needs of the vehicle must be corrected.

- Processes must be in place to seamlessly engage and disengage with companies from other industries without putting all the risk on them. Working within itself, the automotive industry traditionally takes its time in creating new partnerships and work out collaboration requirements. This may not be suited for faster-paced partners from other industries

Examples of collaboration

Enhancing safety, service and navigation capabilities requires greater integration of standards and technologies. Standards allow technologies to be developed that can be reused by multiple auto manufacturers and regions. This requires cooperation among government (road infrastructure for intelligent traffic systems), telecommunications (wireless communication channels) for vehicle connectivity and auto makers (vehicle intelligence) for technology that can be developed by suppliers and shared among different vehicles and geographies.

Reducing the reliance on natural resources drives greater collaboration between competing industries. Green concerns are prompting the development of alternative power sources for vehicles, such as batteries and the increasing prevalence of diesel fuel. As a result, the automotive industry must collaborate with competing segments – consumer electronics for battery innovation, utilities for power and the energy industry for alternatives to fossil fuels – because the answer is unclear as to the power of choice for the future.
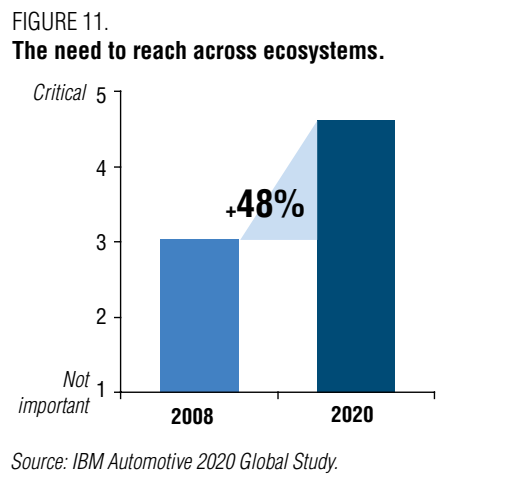
FIGURE 11.
The need to reach across ecosystems.

Source: IBM Automotive 2020 Global Study.

> The intersection between ecosystems that have varying product lifecycles, different rates of innovation and competing priorities will be fertile ground for new sub-industries to emerge and fill the gaps between industries by providing new, white-space services and solutions.

Examples of types of companies that may emerge include:

- Aggregation and synchronization of the personal "cyberself" to deliver personalized information, entertainment and preferences to the consumers regardless of what vehicle they're using

- Energy storage and brokerage to manage total energy usage between home and vehicle and provide metering services and credits for contributions to the energy grid

- Data analysis, disbursement and storage for the connected vehicle, including privacy rules and data security.

"The era when all work would be completed within the industry is over. Now we need to interface with several external entities to get work done."
– Japanese automotive OEM executive

With change storming across the breadth and depth of the industry, bringing clarity from the current chaos will require companies aspiring to take sweeping and speedy action.

Five imperatives will guide

Automotive executives must accurately, effectively and quickly assess the level of commitment required by their respective companies to succeed. With the pace of change accelerating, time could be running out.

The changes in the ecosystem outlined are not visions of a distant future. Most are well under way today and hold the promise of maturity.

Based on our interviews and other research, we have defined five imperatives we believe likely to separate the outperformers from the rest in the automotive world of 2020 (see Figure 12).

FIGURE 12.
Five imperatives.

Interdependent ecosystem
Integrated enterprise

Simplify complexity
Advance mobility
Intelligent vehicle
Sophisticated consumer
Partner extensively
Transform retail
Dynamic operations
Execute globally

Source: IBM Global Business Services.
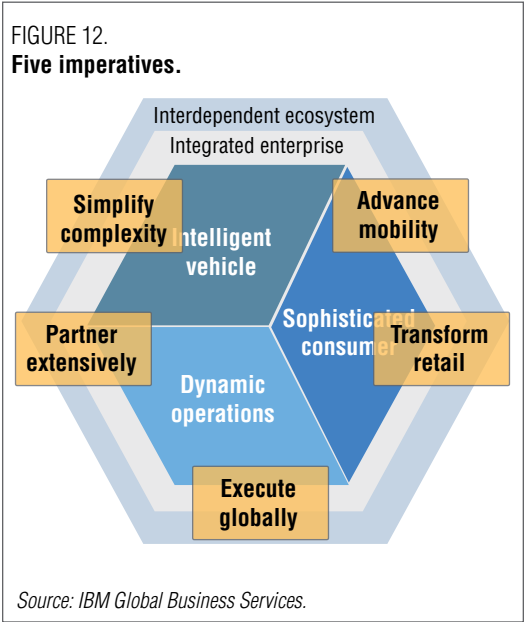
Advance mobility

The marketplace and macro-economic trends are aligning to transform the consumer's view of mobility. Fueled by the continued escalation of oil prices, a global shift to smaller vehicles is underway. Consumers also desire more mobility options than the limited finance models currently allow. The shift of the global population to "mega cities", increased traffic congestion and increased awareness of pollution are prompting consumers to demand more options.

As a result, auto companies must embrace new mobility models and use them as profit generators. They should:

- *Stake a claim in new ownership and usage models* – Major players are beginning to enter the market to establish subscription mobility. Automakers should look to explore partnership deals with them. They should examine their product profiles and assess which segments are more conducive to ownership and which are appropriate for a public fleet.

- *Develop cost of transportation options* – Consumers will need to understand the total cost of transportation, and automotive companies need to respond with innovative pricing models. Alternative financing strategies must be established, as well as methods for financing components of alternatively powered vehicles, such as batteries. Finally, automotive enterprises will need to engage with governments to find ways to incent consumers to switch to hybrid and/or alternatively powered vehicles.

- *Integrate other modes of transportation* – As vehicles are increasingly connected to navigation, automotive companies should establish a blueprint for integrated multi-modal mobility information and develop solutions such as a single search/optimization model of travel regardless of mode(s). Solutions such as developing a single search/optimization model of travel regardless of mode(s). Dynamic customization of transportation mode choices based on traffic, time of day, congestion patterns, etc., will need to be enabled by 2020.

Transform retail

The automotive industry should transform its retail model to adapt to the more sophisticated consumer. The consumer of 2020 is highly informed, aware, concerned and actively will tune in or out messages. The informed consumer will enter the sales cycle with more decisions predetermined and will be less reliant upon the dealer. Auto companies and dealers will need to:

- *Find new ways to connect with sophisticated consumers* – Dealers should work with OEMs to rethink and reestablish the basis of their relationship with consumers through integrated consumer analytics. They should harness the power of social networks to influence consumer buying behavior, work to personalize vehicles to establish service loyalty, brand affinity and the image of social responsibility.

- *Develop a new value propositions for dealerships* – Dealers should work to provide consumer knowledge beyond the OEM, such as educating consumers about safety and vehicle features. Innovations in the vehicle will allow dealers to develop new services and skill sets, such as dealer-installed and maintained personalization features.

Simplify complexity

The complexity of the vehicle will grow exponentially as future innovations enable it to become more intelligent and connected. Executives we interviewed estimate that 90 percent of future innovation will be based on electronics, most of which will be embedded

software, and a sizeable portion from companies outside the traditional automotive industry. A lack of common standards causes integration issues with external industry components, and integration management promises to multiply in complexity with growth in technology. To overcome these challenges, automakers should simplify the increased complexity in the vehicle to enable rapid technology adoption. The foundation to this simplification is common processes. The proliferation of processes within each company and across companies is crippling and will worsen in light of the exponential growth of electronics and software in the vehicle. Our recommendation is to:

- *Standardize and integrate* – OEMs must own the integration management process and architecture. Standardization is an imperative to allow for incorporation of traditional and non-traditional supplier innovation. Common specifications should be established for the intelligence being served to the vehicle – instead of the intelligence being resident in the vehicle. This should allow for both easier upgrades and simplify repair. Standardization and integration must go beyond the vehicle.

- *Modularize to modernize* – "Plug and play" capability will allow consumers to customize the vehicle based on their personal requirements. Modular design will provide greater flexibility to "swap out" energy and power components to allow for upgrades and technology improvements without having to buy a new vehicle. The rate of adoption for future V2x capabilities will be improved through the ability to install safety, service and driver assist modules in the existing vehicle population.

Partner extensively

The increasing cost of innovation is unsustainable for individual companies. We believe the successful company of 2020 will extend outside the industry for innovation and will work with others to solve common issues. To do so will require the industry to:

- *Extend the ecosystem* – Automotive companies should reevaluate what is core, both in the business and in the vehicle, and then find business partners that complement them. They will need to develop a common partnering platform to enable cross industry collaboration that includes rules, IP protection, risk and reward sharing and the ability to quickly engage/disengage. Further, they should look to leverage other industry forums, communities and consumers to widen their enterprise innovation networks. Together, the industry can be much larger than the sum of its individual parts.

- *Engage in collective partnering* – Automakers should consider extending the partnering concept to bring together a diverse group of companies (OEMs, suppliers, other industries) to focus on solving critical problems, such as vehicle energy consumption. The development of value sharing models can enable all participants to leverage innovations, while sharing in cost and risk.

Execute globally

Effective global execution requires harnessing the power of a workforce, throughout its geographically dispersed footprint, to bring innovation in products and services faster than ever before. Automotive companies that do this will improve both top and bottom lines, while effectively changing the image of the industry. The key drivers include:

- *Adapting to the multiplex workforce –* Automotive enterprises must have a comprehensive understanding of personnel, leadership and skill needs. The proper mix and depth of skills can be planned through wide-ranging workforce analytics. Information technology must be harnessed to simplify and enable both structured and unstructured workforce collaboration, manu-facturing and product development.

- *Balancing and flexing operations –* Companies should optimize their manufacturing footprints globally to strike a balance between cost and proximity. Optimization will be more complex with the inclusion of parameters such as reducing the carbon footprint and taxation, re-exam-ining mounting logistics costs through the value chain, volatile raw materials costs and the right skill mix. Core development innova-tion from emerging markets will need to be tapped into and workloads optimized by leveraging global skills and resources.

- *Harmonizing with local economies –* Automakers should go beyond development of products and services that reflect the desires and needs of local markets. Initiatives that contribute to the long-term social well-being of populations in all markets, and close cooperation with local governments and communities to enable prosperity, will be a key demonstration of corporate social responsibility.

The time is now

In just a dozen years, the automotive industry will be remarkably different from today – perhaps, even, unrecognizably so. Time is of the essence.

Global enterprises must build on strategies that:

- Respond to the redefined reality of personal mobility

- Connect with the sophisticated consumer of the next decade

- Harness the strength in standardization and commonality.

- Build new cohesive enterprise ecosystems

- Architect an optimal global presence and a unique socially responsible culture.

Organizations must act – aggressively, actively and with immediacy – to create clarity beyond the chaos within their respective worlds.

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