KPMG

Islands of autonomy

How autonomous vehicles will emerge in cities around the world

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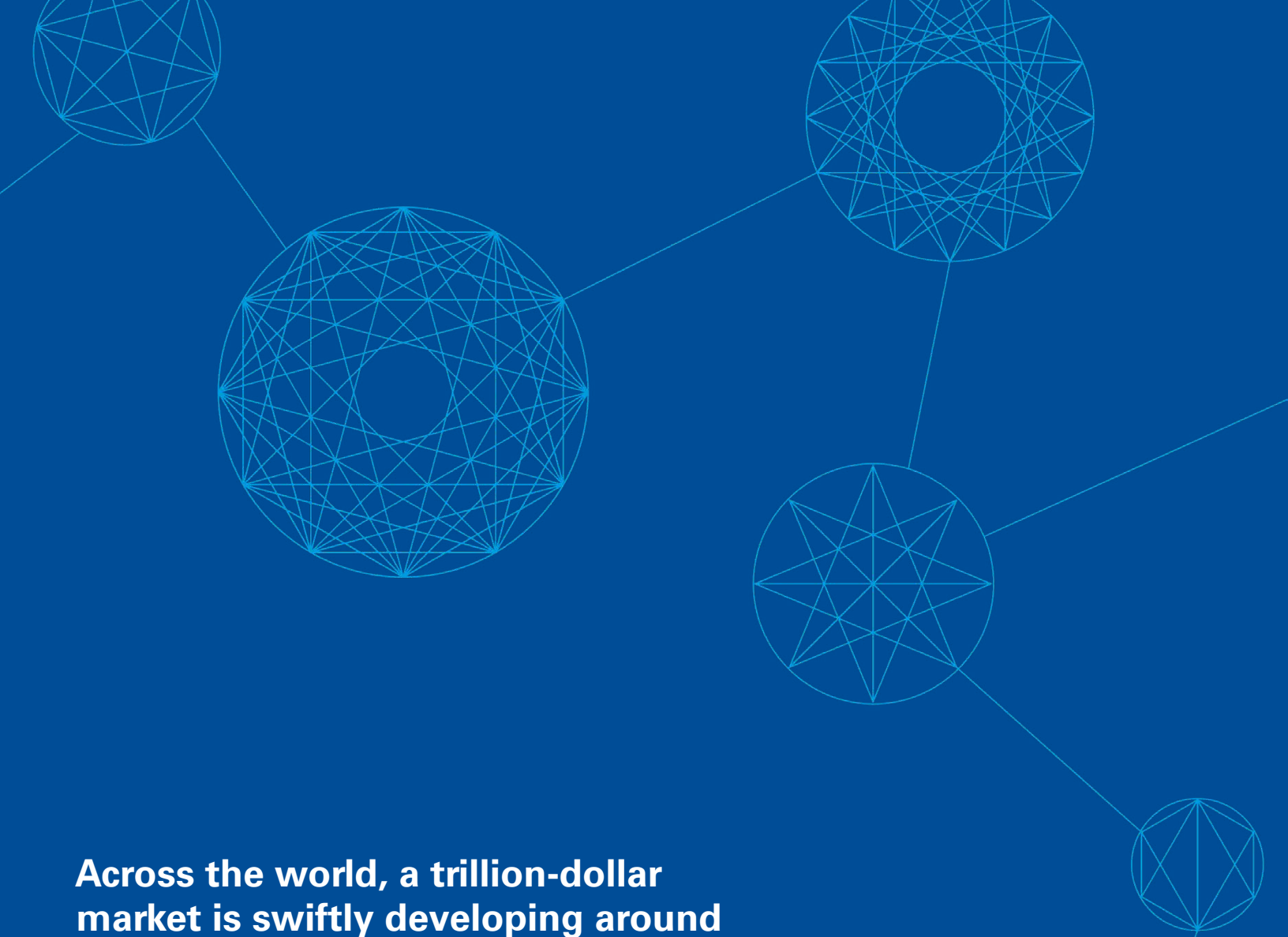


Across the world, a trillion-dollar market is swiftly developing around a new and disruptive transportation mode: driverless vehicles coupled with mobility services. But the embrace—the adoption of this new transportation mode—will not be immediate and everywhere. Instead it will arrive metro market by metro market in what we call "islands of autonomy." To win in this marketplace of the future requires a new way of thinking. Meeting customer needs will demand complex new analyses of local travel requirements based on trips and missions.

Contents

A message from Gary Silberg

Over the past five years, our white papers have charted the exhilarating changes the transportation industry is now undergoing.

In 2012, we predicted the rise of driverless cars as the next revolution. In 2013, we described how consumers might react to this revolution, and a year later we explored the fundamental improvements to consumers' lives that driverless cars and mobility would bring. In consecutive papers beginning in 2015, we identified how these changes were quickly transforming the auto industry. First came the idea of "**The clockspeed dilemma**" to describe the multiple clockspeeds that industry players must now operate to accommodate both traditional manufacturing and technology-based innovations. Then, last year, we highlighted one of the fastest and most important clockspeed driving technologies, artificial intelligence/deep learning, which creates extraordinary value through its ability to analyze data from the on-road experiences of the entire fleet. Deep learning enables continual upgrading of the performance of cars, accelerates the development of driverless vehicles, and furthers the rise of mobility services at the expense of car ownership.

We are swiftly arriving at something magical, a new and disruptive transportation mode: driverless vehicles coupled with mobility services. We think consumers will want this. We think it will be fantastic for them. We think it will be transformative in the same way the smartphone and personal computer have been. Consumers embraced them so completely that they never looked back; flip phones and typewriters were all but gone from their thoughts. We think consumers will likewise flock to this new transportation mode, changing forever their relationship to cars and transportation.

But the embrace—the adoption of this new transportation mode—won't roll out the same way as it did for cell phones and computers, instantly across the country and world. Instead, carmakers will have to think of its adoption as coming place by place, location by location—what we call **islands of autonomy**. These islands are cities but not only cities. They are cities across the world that fit certain demographic criteria, but they

are also bounded concentrations of populations in places that range from college towns to cities-within-cities, and they include cities that push beyond their boundaries until they merge into other communities.

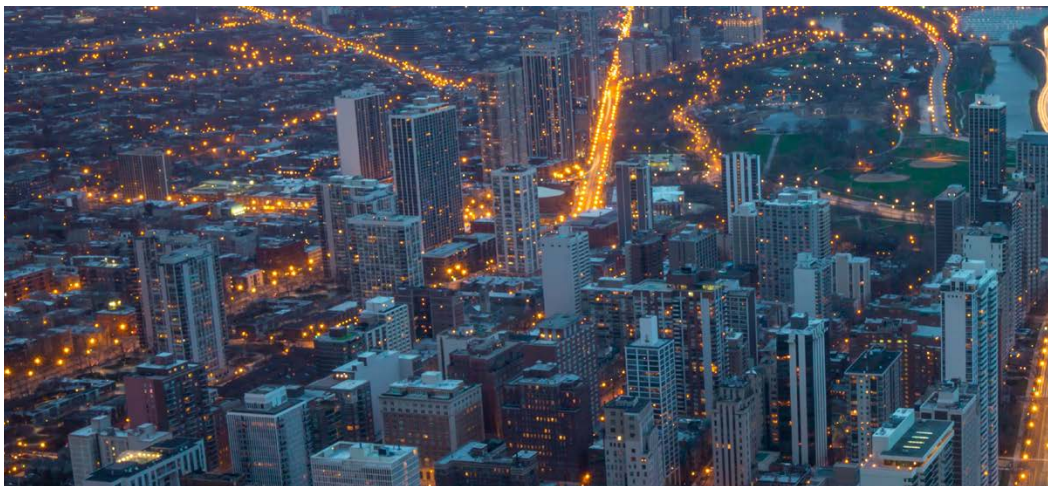
We believe these islands will be first to experience this transformation due to a number of factors. First, mobility service providers will require network density afforded by cities in order to affordably meet customer demands for 2–3 minute response times, which appears to be a tipping point. Second, early autonomous cars will operate most effectively in geofenced city centers, where they can make the frequent observations of the driving environment they will need to gather data and improve performance.

The islands of autonomy will have enormous consequences for the planning of cities and transportation systems, from how to construct highways to where and how much parking will be needed.

For carmakers and others in the transportation and mobility industries, the consequences of the islands are also enormous. The current market, which has existed for decades, will no longer be recognizable. In its place will be a market driven by product, service, and investment decisions according to the requirements of consumers on these islands.

Islands of autonomy identify the segmentation of the market for autonomous vehicles and mobility as a service (AV-MaaS). Knowing how and where these islands develop will make all the difference in understanding how consumer behavior will soon change in them, how vehicle ownership will change, and where and how mobility services will grow. It will be essential for where and how those in the auto industry will find value.

The ramifications are incredible. They predict that consumers will have far more choices in transportation. They



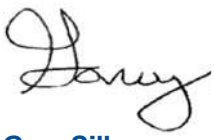
can push a button and their driverless car will appear, or push another button and a mobility service will arrive. The vehicle that appears before them will accommodate their need to go to the office, go to the grocery store, spend a night on the town, or take that ski trip.

Those greater options translate into different consumer buying behavior—less of a need to own, which signals a far more rapid decline in auto sales than original equipment manufacturers (OEMs) expect. That is especially true with "standard" vehicles in the A, B, and C segments. We calculate a massive decline in personally owned sedans in the United States as a result of these islands, **dropping from 5.4 million units sold today to just 2.1 million units by 2030.**

This astonishing decline will lead to greater overcapacity in supply and further disruption of the market than OEMs have anticipated. In this fantastically competitive market, some carmakers and major auto players may struggle to stay in business. Public markets are aligning with these perceptions. Think of the shockingly low valuations of global behemoths and the shockingly high valuations of those on the vanguard of change.

Not all is lost, however. A trillion-dollar market will soon arise around mobility and selling miles. The key to understanding the decline and the opportunities are the islands of autonomy.

In the following paper, we will identify the kinds of islands that result from our exciting and creative research. That research describes different kinds of islands, the specialized mix of vehicles each of these various islands require, and a precipitous decline in sedan sales. The market for vehicles will never look the same, but the possibilities for those in the industry are huge if they see the future and respond well.



Gary Silberg
Partner and National Automotive Leader

Executive summary

The new transportation market

The transportation market is about to change from a national or regional one to 150-plus island markets—metropolitan areas with their own distinct consumer demands. The change will be profound.

The analytics of the new customer demand

No two island markets are exactly the same. To understand and compete in them, you will need depth in research and analyses that you have never done before.

Economic models must change

Get ready to rethink your product, service, and investment decisions. The market is no longer simply about GDP per capita and a family of four, including two kids and a dog. Instead it is about trip origin and destination, duration, miles, occupancy, mission, and velocity on each island.

Focus on the trip mission

There is no one-size-fits-all vehicle for the island markets. In fact, each island will need a unique mix of vehicles to meet consumer needs—a pod for short city trips, a mobile office for longer commutes on and off the highway, delivery vehicles for the increased demand in transporting goods, and more.

Massive decline in sedan sales

The islands will transform the car market, most heavily impacting the sedan class. Self-driving vehicles and mobility services provide options that will reduce consumer desire to own cars, particularly sedans. Pushing a button for mobility services competes with the utility of sedans and both give consumers the freedom to buy the car they really want to own or utilize mobility by the trip.
Look for the islands to produce still further decline in personally owned sedan sales. We estimate a precipitous decline—from 5.4 million units sold in the U.S. today to just 2.1 million units by 2030, impacting the equivalent of more than 10 assembly plants and forcing many current players to exit this vehicle class.

You cannot do it all

Pick the islands in which you will compete carefully. Profit pools are shifting. You cannot be all things to all island markets.

CHAPTER 1

What are the islands of autonomy?

In the United States, there are 169 communities of 300,000 persons or more—in Census Bureau terms, Combined Statistical Areas (CSAs) that are cities with distinct metropolitan centers economically and socially linked to surrounding areas. Each of these CSAs fit the demographics of an island of autonomy—high density of riders and frequent vehicle observation of the streets.

Considered globally, there are 987 cities of 500,000 or more people.[1] These communities are not only cities but towns that have concentrated populations, such as university towns—Madison, Wisconsin, for example. These are the islands to which we refer, each of them presenting unique markets for automakers and the mobility industry.

Competing in the United States means suddenly facing potential markets in as many as 150-plus islands. How can you win in those circumstances? What are the analyses to make? Where can you find scale across these uniquely local markets?

By 2030, the United Nations expects there to be more than 50 cities globally with a population greater than 10 million.[1]

Understanding the island markets: Chicago, Atlanta, and Los Angeles-San Diego

To answer these questions, we have researched three quite different cities in the United States as examples: Chicago, Atlanta, and the greater Los Angeles-San Diego metropolitan area. From these three cities, we can begin to explain how to think strategically about the island markets.

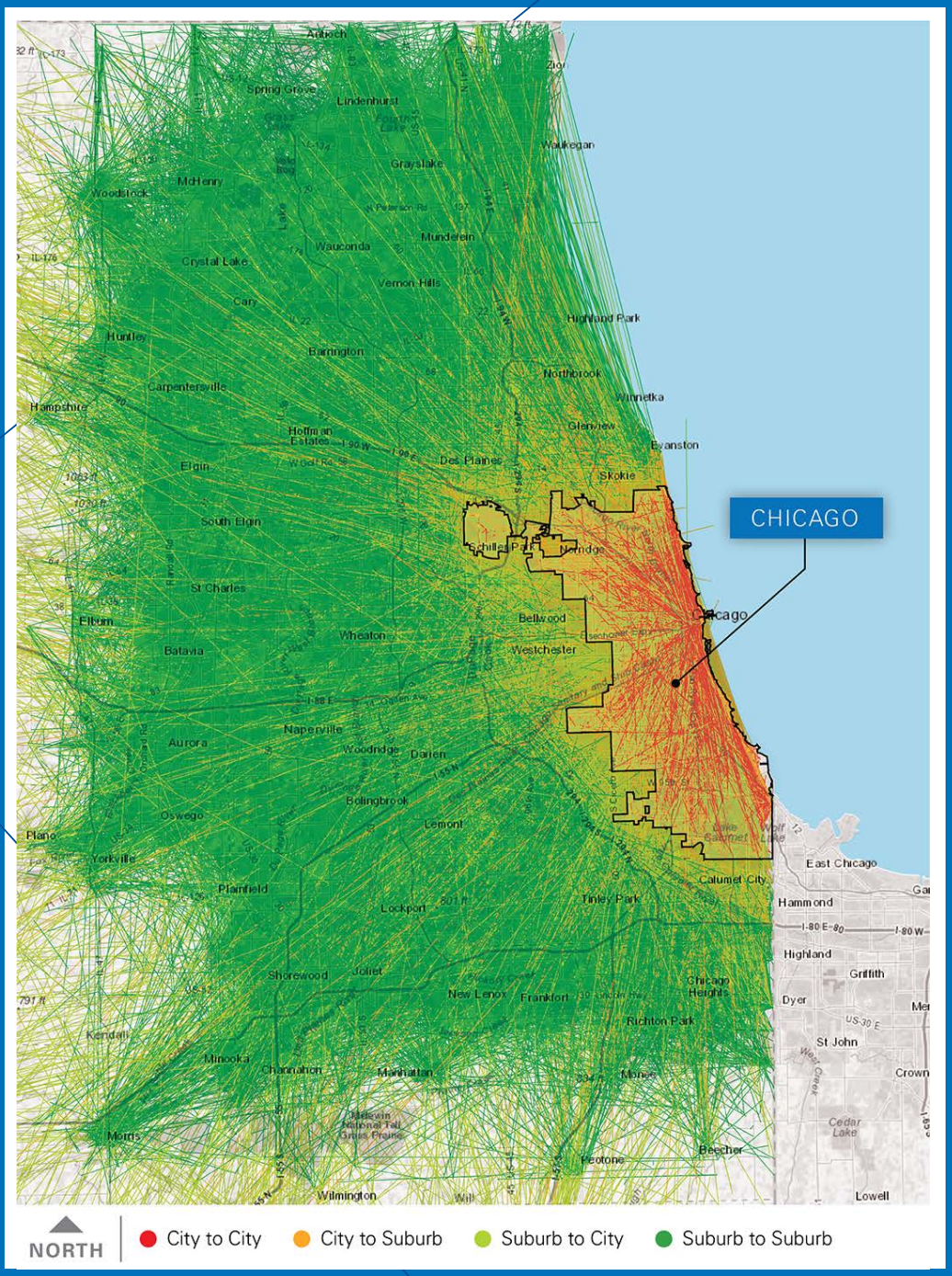
The research on these three cities deserves explanation because it is astonishing for what it reveals. Using geographic information systems (GIS), we analyzed anonymized cell phone ping data that identified, with extraordinary accuracy, the location and time of travel for individual trips within each of these three cities.[2] For Chicago alone, we analyzed the unique movement of more than 180,000 individual travelers. We then compared that analysis with the findings from travel surveys.

We believe this research offers a unique and powerful way to project from consumers using transportation today—whether in personal vehicles or via mass transit—to their travel on these islands once AV-MaaS arrives. Our findings describe a form of ridership and trip segmentation, which begins with our having identified the locations of the trips (trip environment), the start and end times of each trip (trip duration), trip miles (PDT),[3] and trip occupancy.

[1]The World's Cities in 2016" (United Nations)
[2]Safegraph
[3]PDT = passenger distance traveled

Chicago

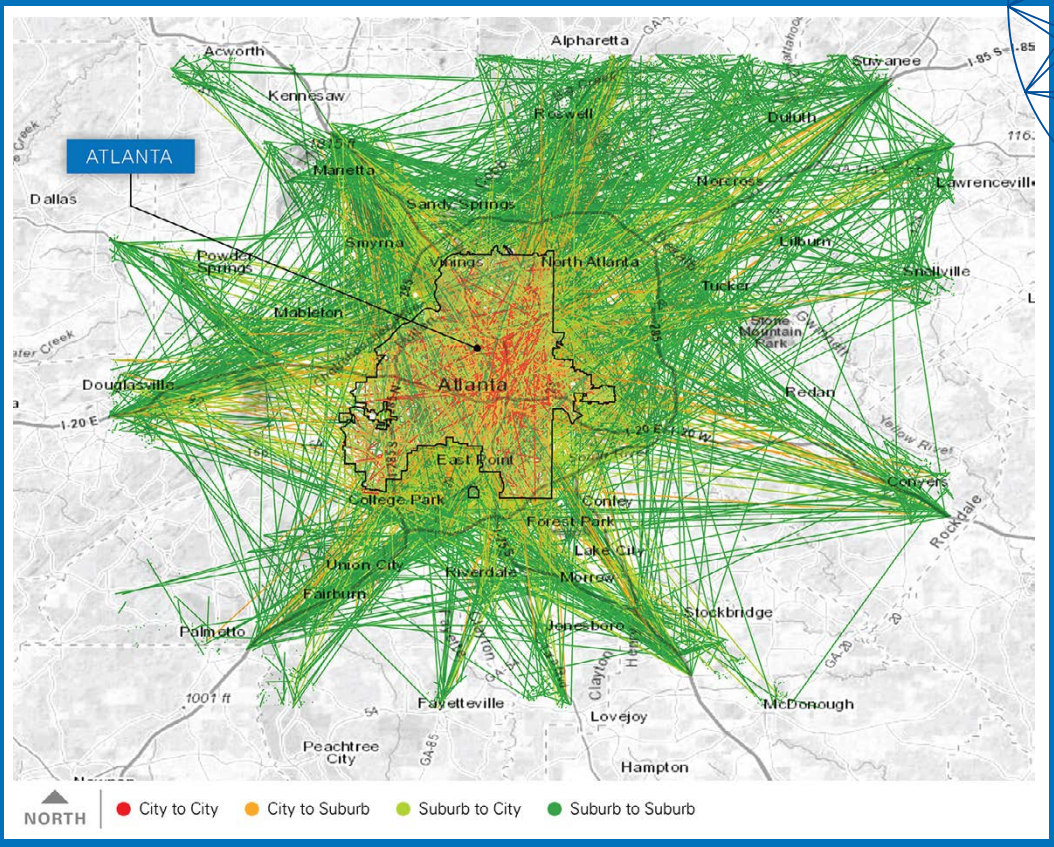
"A half-sun"



Source: KPMG analysis of SafeGraph cell phone location data

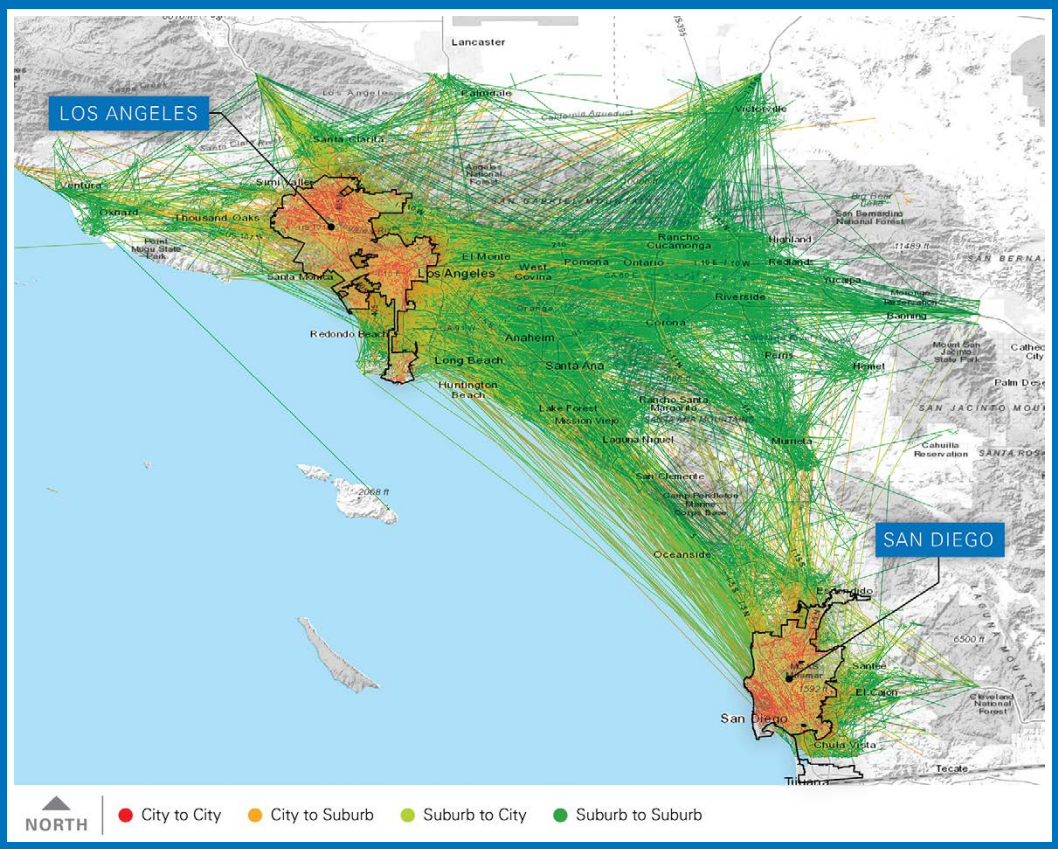
Atlanta

"A star"



Los Angeles-San Diego

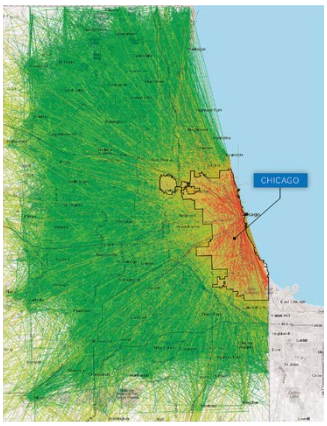
"A binary star megaregion"



Source: KPMG analysis of SafeGraph cell phone location data

Chicago

"A half-sun"

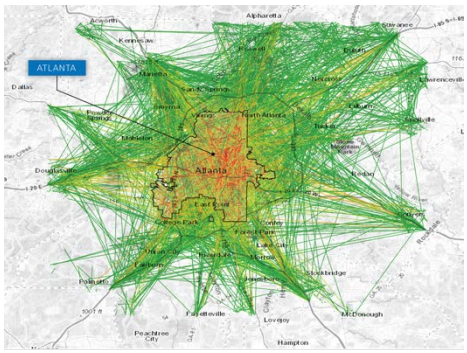


Relative to Atlanta and Los Angeles-San Diego, Chicago has a larger share of intracity travel and a larger percentage of trips that are 15 minutes or less, which correlates with those intracity trips. From a separate analysis we did of anonymized cell phone ping data, Chicago also has a significant number of trips from suburb to suburb specifically during commuting hours. In terms of occupancy, the vast majority of Chicago trips—76 percent—involve 1–2 people, but a significant percentage of travel, 11 percent, is from large occupancy trips, which represents public transportation.

Together, these findings reflect two essential characteristics of Chicago. First, it shows the shorter-duration travel of many people who live in the city and work near where they live—as is typical of dense urban centers. Second, the large number of commuting trips between suburbs reflects the ring of businesses located there and identifies Chicago as "suburban dense." From the anonymized cell phone ping data we analyzed, Chicago's overall travel pattern, the dense suburban and intracity movement, makes the city appear like a half-sun around Lake Michigan—with a little imagination and page rotation required to see it. At the center of that half-sun is downtown Chicago itself.

Atlanta

"A star"

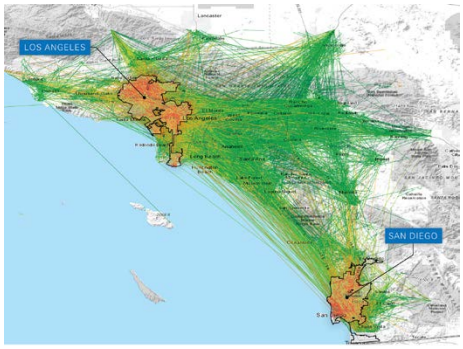


Atlanta shows the greatest proportion of trip miles traveled from suburb to suburb—from Alpharetta to Marietta, for example. It also has the greatest number of trips from suburb to city and city to suburb during commuting hours, double that of Chicago and Los Angeles-San Diego. Atlanta trips tend to be somewhat longer in duration than in Chicago. There are fewer short trips of 15 minutes or less and more medium-length ones between 15 and 90 minutes; very long trips of 90 minutes or more account for 10 percent of all trips—double the percentage of Chicago.

Together these findings suggest Atlanta is a city where movement between its suburbs is a significant part of travel outside of work hours, and commuting travel between city and suburb is highly significant. These findings reflect Atlanta as a city with large employers in its downtown, one where it is less common for people to live in the city center and where the mass transit system does not move many of the commuters between suburb and city. From the anonymized cell phone ping data we analyzed, the commutes between suburb and city in Atlanta give its travel pattern a distinctive star shape.

LA-San Diego

"A binary star megaregion"

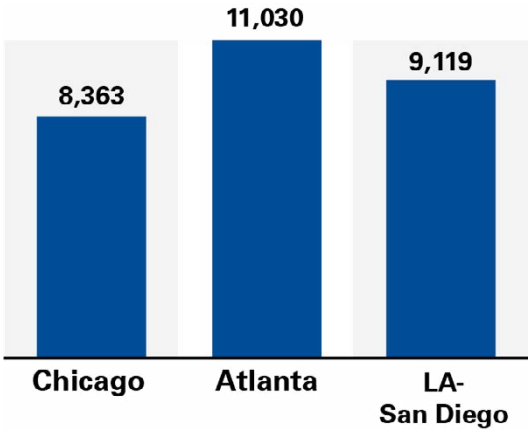


Los Angeles-San Diego describes yet another kind of island. Very long duration commutes—those of 90 minutes or more—are far more prevalent than in Chicago or Atlanta, amounting to 20 percent of trips. And yet those longer duration trips are not necessarily further, often just slower, as is reflected in the low number of trip miles traveled per capita. Travel in Los Angeles-San Diego also has a small number of trips taken via public transportation and a significant number of trips with 3–6 occupants.

Together, these findings reflect a megaregion with considerable congestion: Travelers move short distances in relatively long duration trips; they often use high-occupancy vehicle lanes and do not utilize mass transportation as much. These findings identify the decentralized nature of the megaregion, one that includes two large cities and numerous smaller cities between which people move and work. The travel pattern of the megaregion appears like binary stars, the larger star extending from Los Angeles toward the smaller one in San Diego, as if the two cities were going to merge.

Trip environment, trip miles, trip occupancy, and trip duration

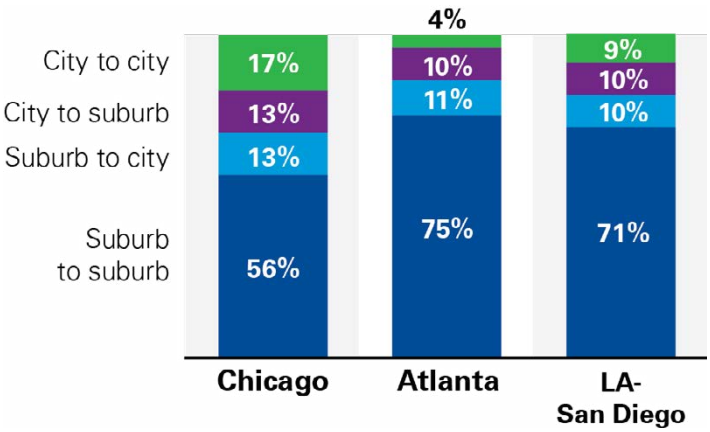
Trip miles (PDT) per capita



— Chicago residents on average travel the fewest miles on an annual basis, almost 25 percent less than residents of Atlanta.

— LA-San Diego residents fall right in the middle of Chicago and Atlanta.

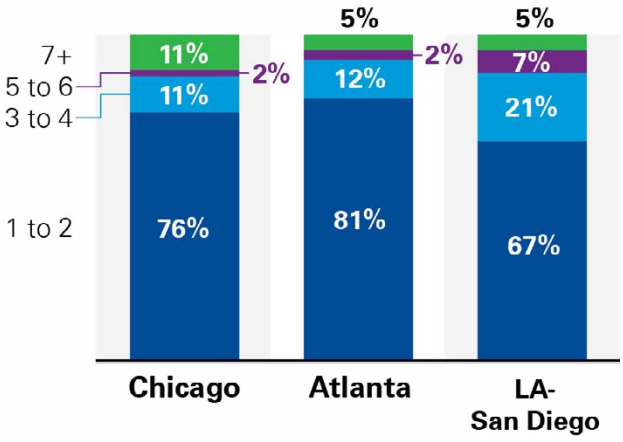
Trip miles (PDT) split by trip environment



— Suburb-to-suburb trips are the dominant segment, but there are significant differences in mix between cities.

— Chicago has highest share of city-to-city trips, while Atlanta has the highest share of suburb-to-suburb trips; LA-San Diego falls in the middle.

Trip miles (PDT) split by trip occupancy

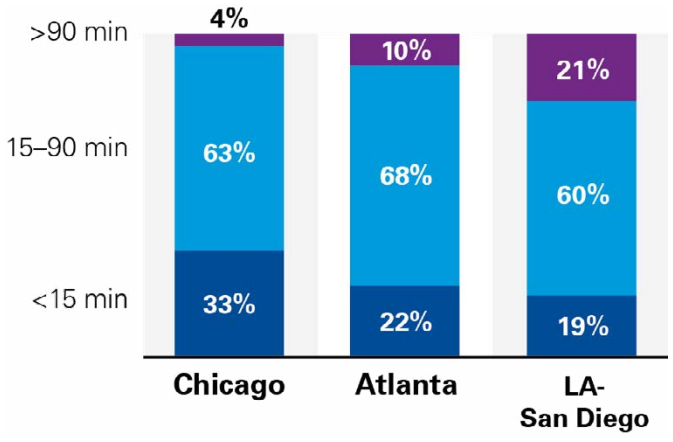


— One-to-two-occupant trips account for the majority of PDT in all cities.

— Mix by trip occupancy is also relatively similar between Chicago and Atlanta; slightly higher share in 7-plus can be explained by higher use of public transport.

— LA-San Diego has a larger share of three-to-six-occupant trips, potentially due to higher instances of carpooling (use of HOV lanes).

Trip miles (PDT) split by trip duration



— Trips between 15–90 minutes are the dominant segment.

— Chicago has highest share of short duration trips, which can be explained by larger share of city-to-city trips.

— However, LA-San Diego has lowest share of short duration trips and highest share of long duration trips, potentially due to congestion problems in the area.

Sources: Chicago Metropolitan Agency for Planning – Travel Tracker Survey (2007–2008)
Atlanta Regional Commission – Regional Travel Survey (2011–2012)
California Department of Transportation – California Household Travel Survey (2010–2012)

What these findings begin to reveal about the island markets

Chicago, Atlanta, and Los Angeles-San Diego. A half-sun, a star, and a binary star megaregion. One city with a distinct tendency toward intracity travel and intrasuburb commuting; a second with disproportionate numbers of miles in suburb to suburb travel and disproportionate numbers of commuting trips between suburb and city; and a third with fewer-mile, longer-duration trips.

The differences in travel in these cities suggest more than the differences among these islands. They suggest the different segmentation within each island market according to trip environment, miles, duration, and occupancy. Understanding that trip segmentation is a first step toward finding value in the islands. A second step appears as we consider the conclusions we can draw from our study of the islands.

CHAPTER 2

What are the implications for the transportation market?

As we researched further on the islands, we repeatedly considered the implications for each island's market. There may be many islands appearing all at once, and many that will look different from each other. How then does a carmaker determine the selection of vehicles and service offerings that allow it to achieve economies of scale? How will a carmaker assess this in a market that no longer can be understood in terms of GDP per capita and family size, as was historically the case? Our research leads us to two key takeaways for answering these questions.

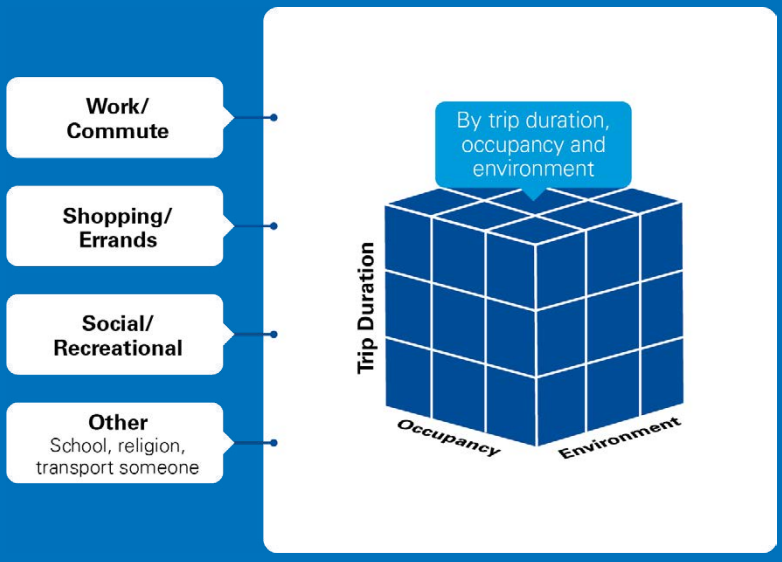
Takeaway one

Winning OEMs will be those that find product scale within billions of individual trips across hundreds of islands.

We quickly came to this conclusion once we analyzed trip mission alongside the other characteristics of trip environment, occupancy, miles, duration, and implicitly, velocity. We had hypothesized each trip mission would have its own vehicle—the same vehicle for all islands. Our findings, however, reveal the vehicle satisfying that trip mission will vary considerably across the islands.

The perfect AV-MaaS fleet will be the result of travel patterns on each island—patterns that may change daily and even hourly. No single car fits for each trip mission across all islands. What's more, no single mix of vehicles fits for all the island markets. Each island will require a different mix of vehicles and services to match supply with demand. Scaling up for production will require a complex analysis of the islands from billions of trips travelers will take.

Segmenting travel behavior by mission



Note: This analysis illustrates the complexity of trip segmentation by mission, but a full analysis would examine luxury trips too.

Mission-specific mixes of vehicles according to the island

To identify those mixes of vehicles, you must analyze the data of trips according to the four factors that were identified early—trip occupancy, environment, duration, miles, and (implicitly) velocity—but for each kind of trip mission.

For a simple illustration using three of those factors, we divided missions into work/commute, shopping/errands, social/recreational and a collection of less frequent, common missions. (We also investigated premium travel, but for the purposes of our paper, sketching the nature and importance of these islands, we restricted

our focus to considering each kind of mission according to those four factors and velocity.)

If you were to look only at the distribution of missions, it would seem the same mix of vehicles fits every island. Each mission holds approximately the same proportion of trips for the islands analyzed. But if you look more closely, you will see differently: the automobile necessary to fulfill a particular mission varies according to the island.

In Chicago, for example, the work mission is heavily intracity, so it requires a larger share of vehicles optimized for shorter-duration trips in a densely populated area, likely a vehicle that maneuvers well and that one can exit from and enter easily, such as a pod. In Atlanta, that work mission will likely involve less intracity travel but a greater share of longer trips in miles at higher velocity between the suburb and city, requiring a quicker vehicle that is safer at higher speeds and has room for work, such as an office on wheels. In Los Angeles-San Diego, that work mission might need a greater share of vehicles appropriate for 90-minute-plus trips—vehicles capable of being an office but spacious and comfortable, perhaps with reclining seats and even an entertainment system.

And yet the vehicle mix for each island is likely to be still more complex. Chicago, for example, has more than one significant environment for work missions, not simply intracity but also suburb to suburb commutes of shorter duration. The Chicago work mission will therefore require not simply a pod but a vehicle that is highway-safe. Each city will require that kind of granular analysis of each kind of mission, until an OEM flexes and finds the appropriate, customized mix of vehicles for an individual island.

Examples of vehicle types based on trip characteristics

Pod

- Shorter-duration trips
- Maneuvers well
- Easy to exit and enter

Office on wheels

- Higher velocity
- Safe on highway
- Room for work

Living room on wheels

- Spacious and comfortable
- Reclining seats
- Entertainment system

In some cases, fewer trips

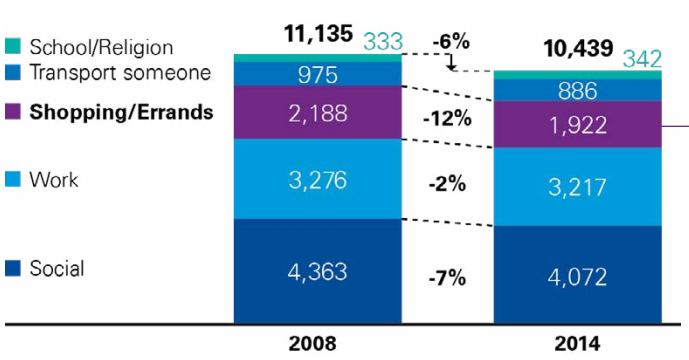
As mobility rises, the personal ownership of vehicles will be affected and so will the mix of vehicles OEMs must provide. As evidence of that effect, consider the shopping mission. In London, the number of trips and miles consumers have driven in their own vehicles to shop has notably dropped as affordable home delivery has become available.

U.K. PDT per capita trend

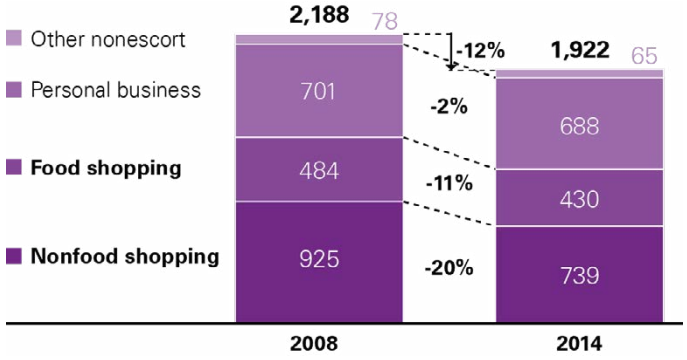
U.K. PDT per capita declined 6 percent from 2008 to 2014, largely driven by shopping/errand-related missions.

Within shopping/errands, the decline has been concentrated in grocery and hard goods delivery.

Annual PDT per capita by mission – 2008–14 (km)



Annual PDT per capita by shopping/errands – 2008–14



Takeaway two

Autonomy and mobility may accelerate the demise of the personally owned sedan.

The U.S. auto industry is already experiencing a decline in sedan sales offset by increases in SUV sales. We expect the arrival of AV-MaaS in the islands to precipitously accelerate that decline.

In *I see, I think, I drive, (I learn).*, we predicted that MaaS will depress car sales. Now comes our research on the islands. It leads us to believe the arrival of autonomy and mobility services will further lower the demand for car sales but sedans in particular—well beyond any decline OEMs have anticipated. **We estimate a potential decline of 3 million sedan units sold per year to individuals in the United States alone—from 5.4 million units sold today to just 2.1 million units by 2030.**

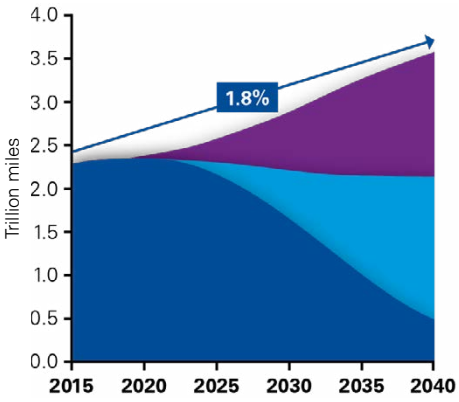
There are two principal reasons for this impact. In islands with dense urban areas, consumers will have ready access to mobility services, which will depress car sales. A disproportionate percentage of vehicles in these environments are sedans—currently as high as 52 percent.

Consumers in suburban portions of islands will also contribute to this decline in sedan sales. As driverless vehicles appear in the market, consumers in the suburbs will purchase them but reduce the number of cars they own, with sedans the likely victim of that reduction. Families with multiple cars will consolidate because a driverless vehicle does not need to sit parked and unused where the driver left it; it can do double or triple service. They will likely keep their larger vehicles for shopping and family travel, when they require comfort and space. The sedan will be the first car to go.

The effect of an unanticipated, dramatic decline in sedan sales would be to create significant excess capacity in the value chain, an oversupply that would be felt acutely not only by OEMs but by suppliers, channels, dealers, and distributors, such as a car-carrying trucks and ships.

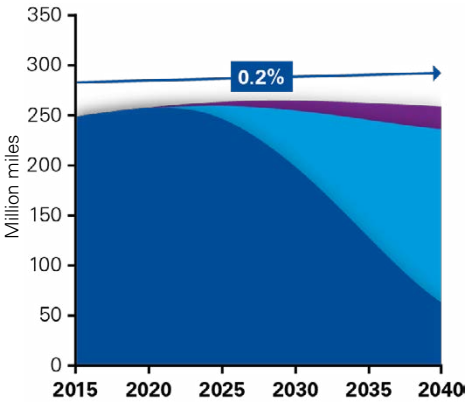
At these volumes, we would expect the current 10 OEMs serving the U.S. market with more than 800,000 sedans per year to contract to only 3 or 4.

Passenger vehicle VDT



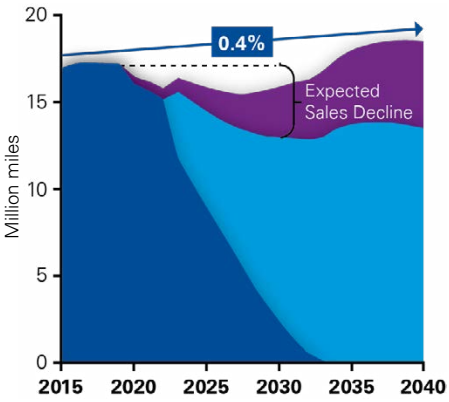
Vehicle distance traveled (VDT) grows more rapidly than passenger distance traveled (PDT), due to a drop in average occupancy per vehicle.

Passenger vehicle car parc



Growth in the car parc declines as AV-MaaS vehicles eliminate the need for a portion of personally owned vehicles.

New passenger vehicle sales



Nonautonomous vehicle sales fall, but are replaced by autonomous personal and MaaS vehicles.

Source: KPMG analysis
Note: Passenger vehicle VDT analysis excludes non-MaaS commercial POV

● Personally owned vehicle (POV) ● AV-POV ● AV MaaS

The rise of AV-MaaS primarily impacts two groups, with long-term industry trends also impacting vehicle mix.

Group 1: Dense urban / urban / suburban car owners

Description and rationale
Residents of more densely populated areas who typically own a car but do not use it often and are looking to save on parking costs by using AV-MaaS instead of owning a vehicle

Car models owned
Typically sedans

Ownership impact
More owners get rid of their vehicles in more densely populated areas

Group 2: Urban/suburban households with two or more cars

Description and rationale
Suburban residents and families who have a second or third vehicle for rare occasions, but would be willing to give it up once AV-MaaS becomes a reliable and cheap option

Car models owned
Typically 1 sedan and 1 or more SUVs/vans

Ownership impact
Car buyers purchase fewer sedans in favor of SUVs and other large cars

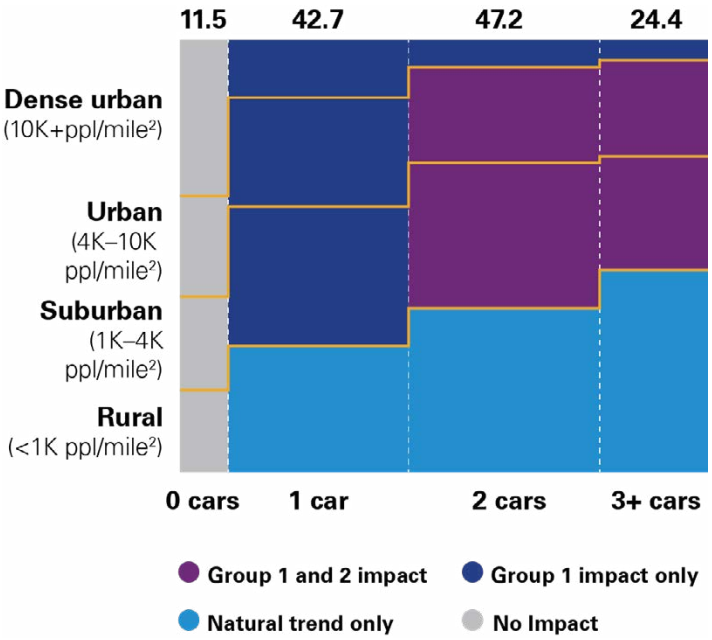
Natural trend of declining sedan sales

Description and rationale
General trend in consumers purchasing fewer sedans and more large vehicles, driven by low gas prices and desire for safer vehicles

Car models owned
All

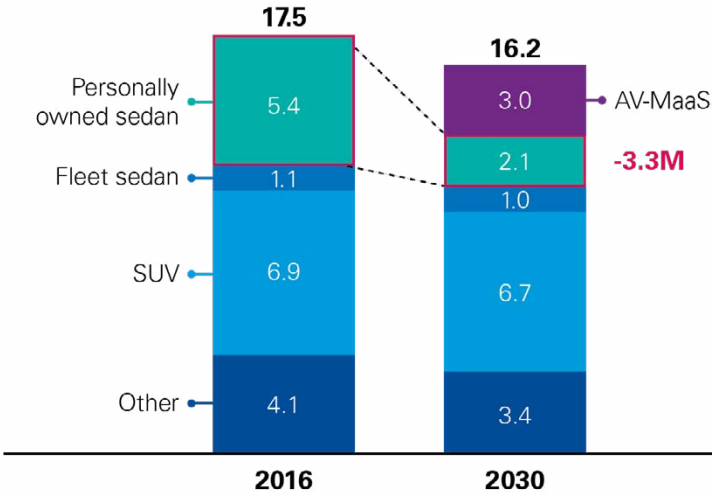
Ownership impact
Households get rid of sedans, keeping larger SUVs and vans for special family events

2016 households by geography and car ownership (millions)



Together, these effects could reduce personally owned sedan sales by more than 3 million units

2016 versus 2030 annual vehicle sales (million units)



Note: Analysis does not evaluate mix of fleet (including AV-MaaS) vehicle types and excludes impact on current fleet sales.

The implications of these takeaways

These takeaways imply that an industry player can make money in mobility and/or vehicle manufacturing, but the market it faces is going to be entirely different.

The AV-MaaS market on the islands will not be one-size-fits-all.

Human movement and the interrelationship of public transit, commercial transportation, personally owned transportation, and shared mobility services will create different mixes and volumes of vehicles and services required.

Demand on the islands is driven at the individual mission/trip level.

Demand on the islands, segmentation of consumers, and definition of vehicle platforms and vehicle mix must be done at the individual mission/trip level.

Forecasting demand for mobility services requires new-to-the-world capabilities.

Forecasting demand at the country-level will not work without fully understanding each of the major cities and their megaregions and then agglomerating demand for urban, suburban, and rural areas. This must expand beyond simple Transportation Network Company demand to include public transportation, private transportation, and all modes of human movement to accurately capture volumes for personal and commercial vehicles.

Keep in mind, PDT/VDT will continue to soar as autonomy enters the market.

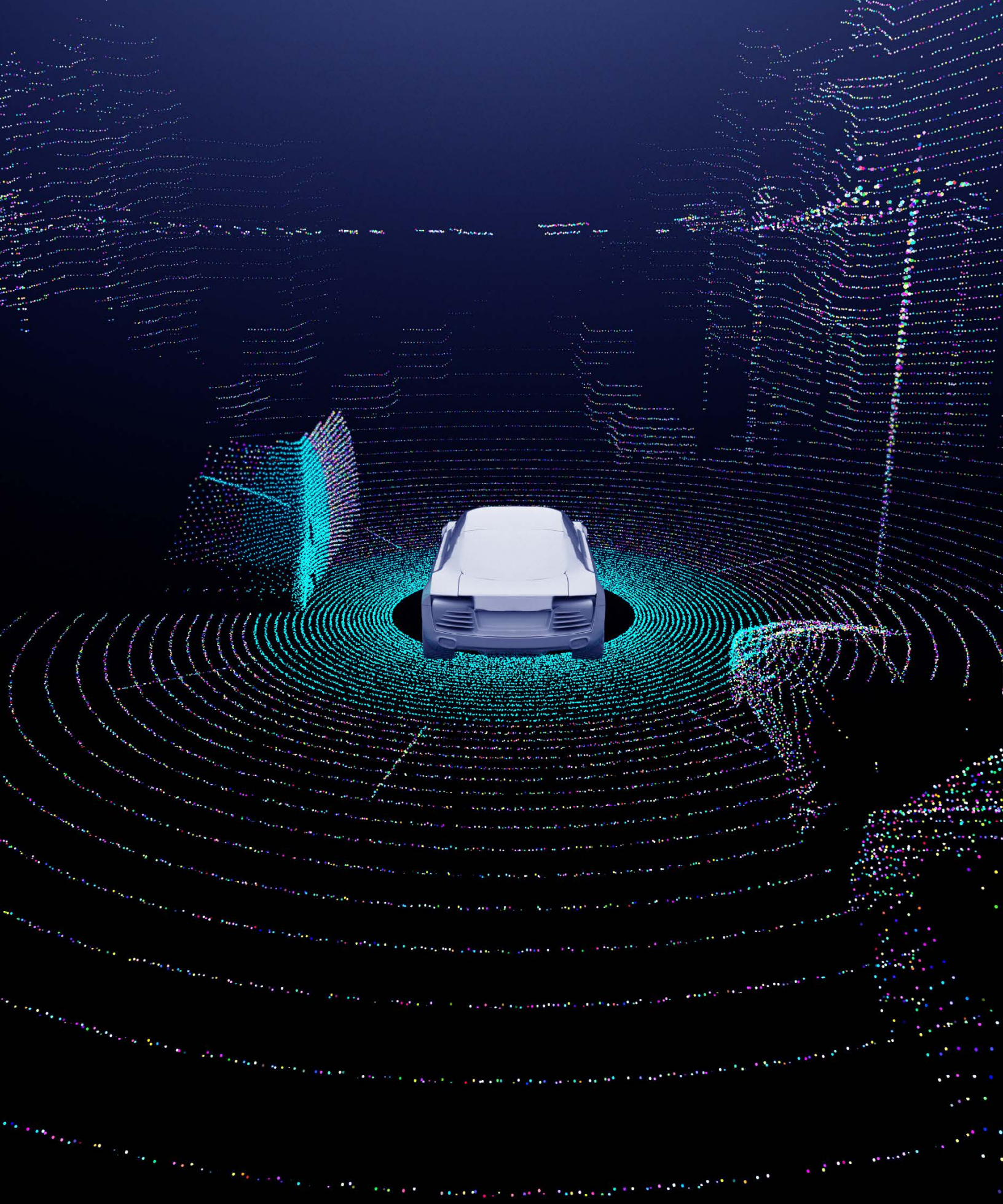
We continue to hold that personal mobility, particularly of seniors and younger age groups, will increase and that the injection of autonomous services and mobility will continue to cause vehicle miles traveled to soar.

Mobility services will be a multitrillion-dollar market.

OEMs must assess how they will participate in the new value chain.

Autonomy and mobility will likely accelerate the demise of the personally owned sedan.

This is particularly true in urban areas, as car owners consolidate to fewer vehicles or increasingly use mobility services.



CHAPTER 3

How can KPMG help you seize the opportunities?

As islands of autonomy proliferate, and as consumer behavior around them changes, auto industry players must rethink the nature of their businesses to take advantage of their emergence. They must choose exactly where to compete (by each island), establish the kinds of services they will provide, and determine the precise mixes of vehicles they will produce. Our dedicated KPMG Automotive Strategy team can help you be successful in developing new capabilities to understand each island and moreover, provide an outside perspective on potential new products and specialized services with which you can compete.

We can help you to:

Methodically understand each island globally

Develop a national strategy that responds to the looming oversupply of vehicles

Determine the winning portfolio of products and services

Establish a global strategy that takes into account island evolution and maturity

Understanding the islands of autonomy is a complex problem with huge data and analytical needs. It requires strategically thinking through your options and will have huge implications for your business. There will be clear winners and losers.

KPMG welcomes the opportunity to help you navigate through this extraordinary time.

About the authors

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Thank you

We would like to thank KPMG colleagues Nehal Doshi, Dennis Latto, and Peter Moot, who contributed extensively to the research and analysis behind this paper, along with Tara Thompson for her design support. Lastly, we would like to thank our writer, Jim Mendelsohn, for his considerable contributions to the development of this paper.

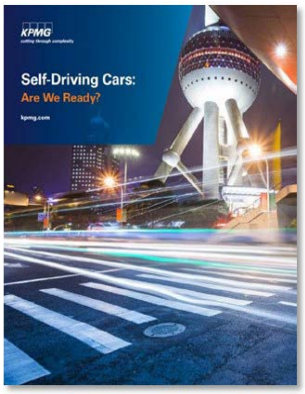
About KPMG

In case you missed them, you can download our previous papers related to the future of the automotive industry below.

Self-driving cars: The next revolution

August 2012

For the past hundred years, innovation within the automotive sector has brought major but mostly evolutionary technological advances. Now, the industry is on the cusp of revolutionary change with the advent of autonomous or "self-driving" vehicles. KPMG LLP and the Center for Automotive Research (CAR) joins forces in examining the forces of change, the current and emerging technologies, the path to bring these innovations to market, the likelihood that they will achieve wide adoption from consumers, and their potential impact on the automotive ecosystem.



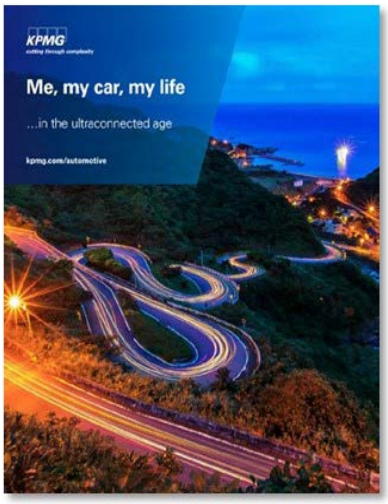
Self-driving cars: Are we ready?

October 2013

Gaze out at the automotive horizon and you can almost see a new era coming into focus—the age of self-driving cars. Ultimately, the shape of the automotive future will depend on consumers—their needs, preferences, fears—and their pocketbooks.

Will they trust these new vehicles? What will future car buyers care about? If we build self-driving cars, will they come? KPMG seeks to answer these questions through the lens of real consumers who provide us with their unique perspective on the self-driving market.

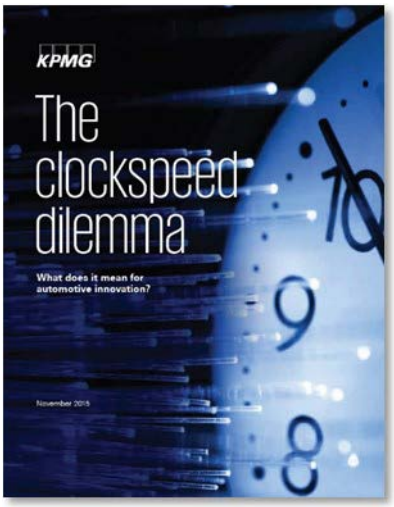
KPMG LLP's Automotive team understands the complexity currently flowing through the industry. We leverage our deep industry insight and our hands-on experience to help automotive companies shape a successful future while strengthening performance today. Using a cross-functional approach, KPMG's Automotive team helps empower the world's leading manufacturers, OEMs, and suppliers to achieve their goals. We put our breadth of experience and industry-specific knowledge to work for our clients, guiding them to make better decisions today to potentially create the greatest impact tomorrow.



Me, my car, my life in the ultraconnected age

November 2014

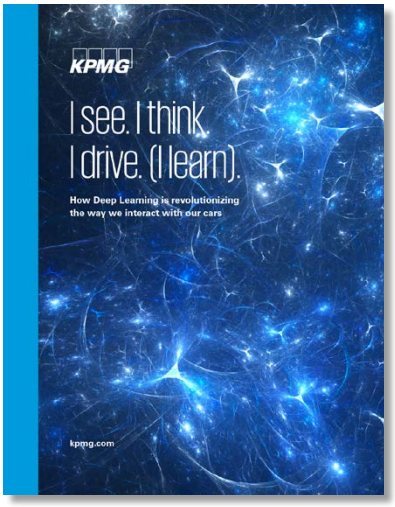
Not since the first automotive revolution has there been such stunning innovation in the industry. The convergence of consumer and automotive technologies and the rise of mobility services are transforming the automotive industry and the way we live our lives. How will the automotive industry adapt to this new world? How is technology reshaping the automotive ecosystem—and how will these industries work together? What will customers of the future expect from this collaboration—and be willing to pay for?



The clockspeed dilemma: What does it mean for automotive innovation?

November 2015

The convergence of consumer and automotive technologies, the rise of mobility services, and the development of autonomous vehicles are revolutionizing the automotive industry and the way we live our lives. There will be profound impacts on vehicle miles traveled, vehicle sales, car ownership models, energy demand, and infrastructure. KPMG examines how the automotive industry must innovate to thrive in this new and evolving ecosystem.



I see. I think. I drive. (I learn): How deep learning is revolutionizing the way we interact with our cars

November 2016

Deep learning, an advanced form of artificial intelligence and dynamic way of computerized decision making, is driving significant change for autonomous cars and for the automotive and transportation industry. Deep learning is a critical enabler of building a self-driving vehicle that can operate without human intervention. KPMG examines the direct impacts of deep learning and how it will revolutionize the nature of doing business for automakers.

Glossary

AV
Autonomous vehicle

CSA
Combined statistical area

GDP
Gross domestic product

GIS
Geographic information system

HOV
High occupancy vehicle

MaaS
Mobility-as-a-service

OEM
Original equipment manufacturer

PDT
Passenger distance traveled

POV
Personally owned vehicle

VDT
Vehicle distance traveled

Sponsored by the KPMG U.S. Manufacturing Institute's Automotive Center

The KPMG U.S. Manufacturing Institute's Automotive Center is an open forum where industry experts share knowledge, gain insights, and collaborate on timely and relevant issues facing the automotive and transportation market. KPMG recognizes that success in business is not a result of random inspiration, but rather of focused, strategic adaptations to ever changing conditions. And with the unprecedented amount of change happening in business today, KPMG inspires automotive organizations to confidently adapt, and empowers organizations to evolve rapidly and capture value in emerging opportunities.

For more information on the Automotive Center, please visit:
www.kpmg.com/us/automotive

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