Morgan Lewis

WORKING WITH, OR OPERATING, A TECH STARTUP IN THE AUTOMOTIVE AND MOBILITY SECTORS

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Morgan Lewis Automotive Hour Webinar Series

Series of automotive industry focused webinars led by members of the Morgan Lewis global automotive team. The 10-part 2020 program is designed to provide a comprehensive overview on a variety of topics related to clients in the automotive industry. Upcoming sessions:

AUGUST 5 | Electric Vehicles and Their Energy Impact

SEPTEMBER 23 | Autonomous Vehicles Regulation and State Developments

NOVEMBER 11 | Environmental Developments and Challenges in the Automotive Space

DECEMBER 9 | Capitalizing on Emerging Technology in the Automotive and Mobility Space

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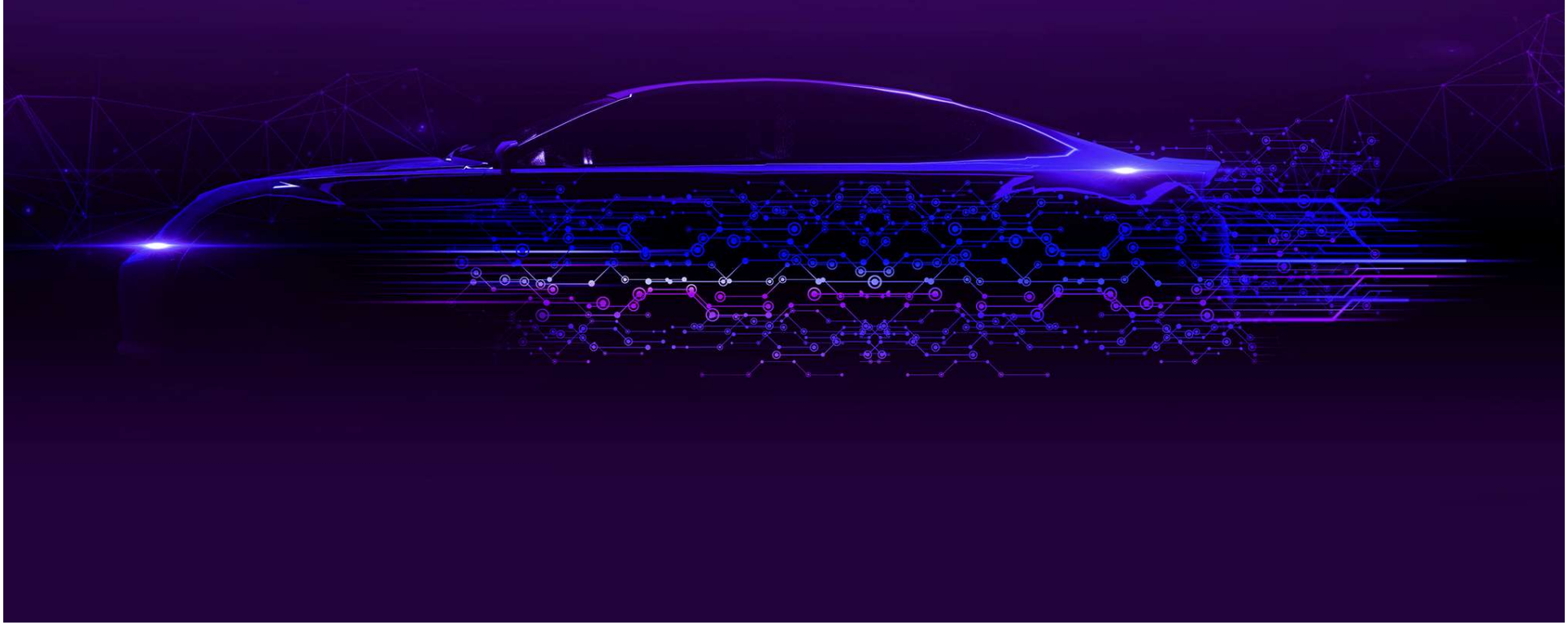
INTRODUCTIONS



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SECTION 02

OVERVIEW OF MAJOR NEW INNOVATIONS IN AUTOMOTIVE AND MOBILITY SECTORS

CASE: Connected, Autonomous, Shared, Electrified

Trends

Connected Cars

Autonomous Driving

Shared / Smart Mobility

Electrified Vehicles

Technology Clusters

- Autonomous-vehicle (AV) sensors and advanced driver-assistance systems (ADAS) components
- AV software and mapping
- Back end/cybersecurity
- Batteries
- Connectivity/infotainment
- Electric vehicles and charging
- E-hailing
- Human-machine interface and voice recognition
- Semiconductors
- Telematics and intelligent traffic

Source: "*Start me up: Where mobility investments are going*," McKinsey & Company. April 2019

Icons provided by Flaticon

DATA and the CONNECTED CAR

Version 1.0

Today's connected technologies are making transportation safer and more convenient. Many new features are enabled by the collection and processing of data. Cars are becoming part of a trusted mobile ecosystem that ensures data flows between a network of carmakers, vendors and others to support individuals' safety, logistics, infotainment, and security needs. This visual represents devices that may be employed in today's connected cars; no single vehicle will have all of these features, but most new vehicles have some. Much connected car data is protected by technical controls, laws, self-regulatory commitments, privacy policies, and other emerging mechanisms or controls.

Produced by FUTURE OF PRIVACY FORUM
FPF.ORG

DATA RECEIVERS

A growing number of entities receive and transmit data through the connected vehicle ecosystem

OTHER CAR (V2V)

TRAFFIC LIGHT (V2I) & LICENSE PLATE READER

CAR MAKER

THIRD PARTIES

TOLL BOOTH

EMERGENCY SERVICES

SATELLITE

WIRELESS CONNECTIVITY

- CELLULAR
- NON-CELLULAR
  - BLUETOOTH
  - WIFI
  - DSRC RADIO
  - SATELLITE/GPS
  - SHORT RANGE RADIO
  - SHORT RANGE RADAR

CAN-BUS: internal communication bridge between Electronic Control Units

TELEMATICS CONTROL UNIT (TCU): interconnects CAN Bus and external systems

AUTONOMOUS VEHICLE IMAGING AND SCANNING: LIDAR, radar, ultrasonic sensors, or exterior cameras

DSRC RADIO: vehicle to vehicle and vehicle to infrastructure communication

License Plate

TIRE PRESSURE SENSORS: short range radio, goes to radio receiver

EVENT DATA RECORDER: black box with accident data

CRASH DATA RETRIEVAL UNIT: extracts EDR data

THIRD PARTY MONITORING DEVICE: OBD-II or external device communicates with fleet operator

RFID VEHICLE TAG: enables short-range tracking

ELECTRONIC TOLL COLLECTION SYSTEM: transponder sends ID via radio

CABIN MONITORING SYSTEM: e.g. monitors eye movement to measure attention

VEHICLE SERVICES: Links to, e.g., roadside assistance and preventative maintenance reminders

GPS UNIT: uses satellite to inform location, navigation

VIN NUMBER: long-used unique vehicle identifier

OBD-II PLUGIN: pulls data from port, or generates own location or movement data

OBD-II PORT: interface to driving and operational data

TOUCH SENSORS: detects driver fatigue through grip, pulse

SIM CARD: connectivity point for transmitting onboard information

WIFI NETWORK: enables in-car internet access

INFOTAINMENT SYSTEM: access entertainment and navigation apps

USB PLUG-IN: connects via USB port for power or data transfer

PHONE- PROJECTING SOFTWARE: mirrors apps from smartphone

SMART PHONE: connects to car via Bluetooth, WI-FI or USB

KEY FOB: supports keyless entry

TYPES OF DATA

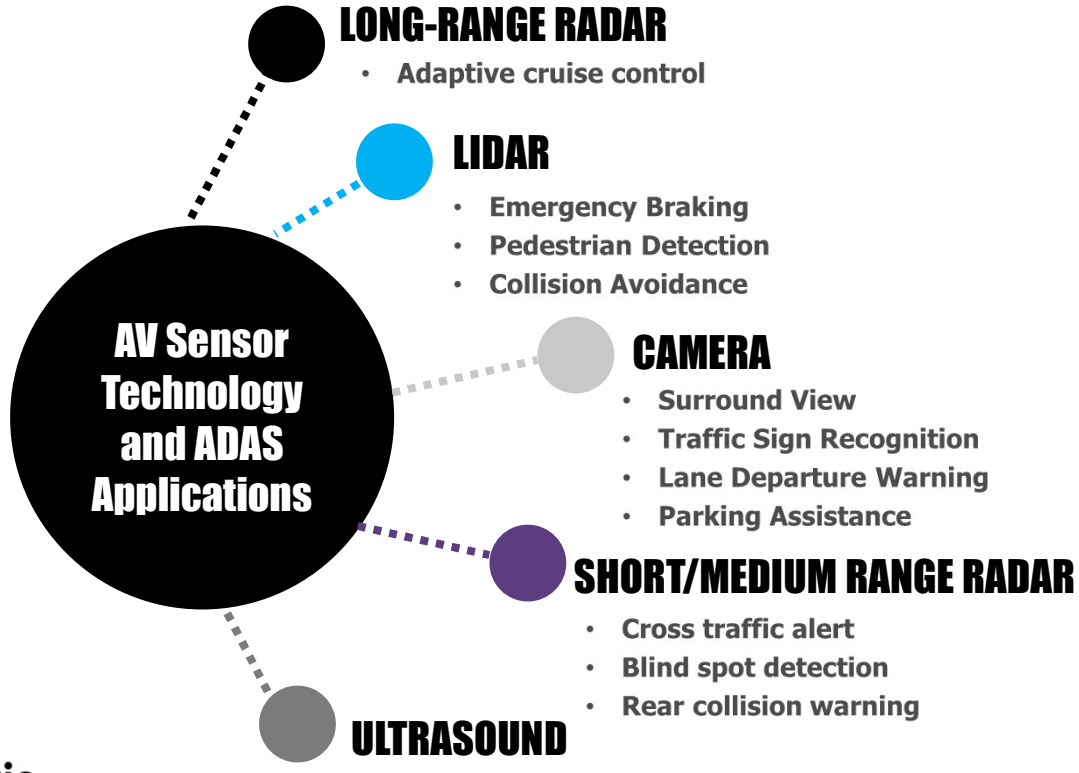
VEHICLE & SAFETY functioning of vehicle, including maintenance status, mileage, and operations

DRIVER driver physical characteristics or how a person drives a vehicle: i.e. speed, seat belt use, braking habits

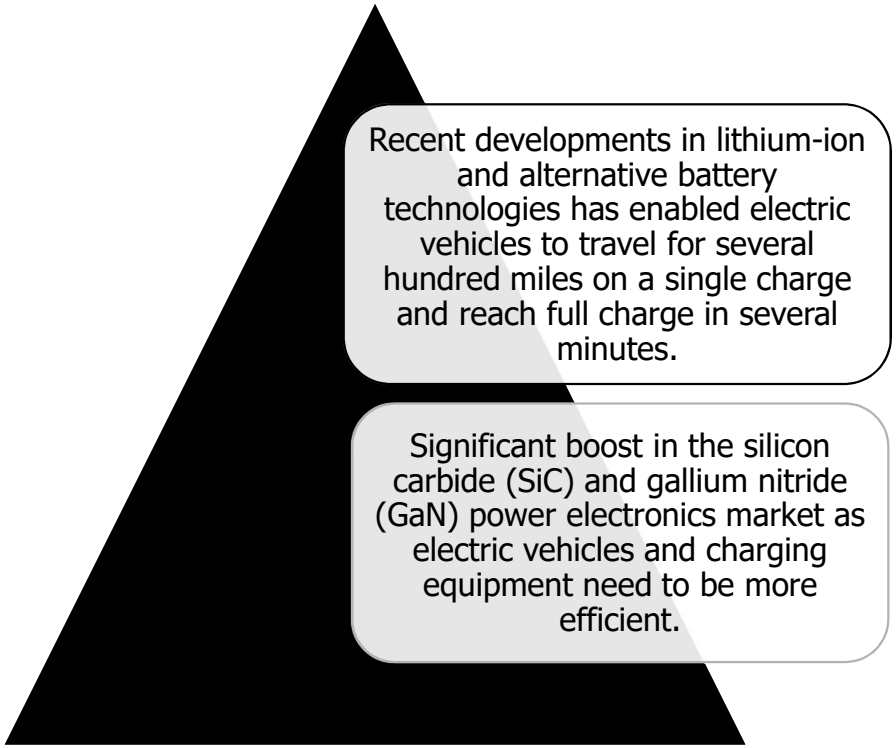
LOCATION precise geographic location of a vehicle

ACCOUNT personal accounts established by vehicle owner

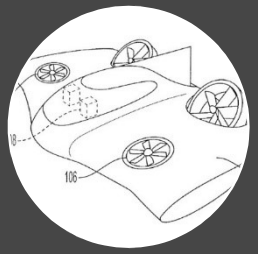
Sensors and Advanced Driver Assistance Systems (ADAS) for Autonomous Vehicles



Battery Technology and Power Electronics for Electronic Vehicles



Air Mobility Vehicles and Drones



Advancements in drone and autonomous vehicle technology have accelerated the urban air mobility market for passenger travel and freight/package transportation.

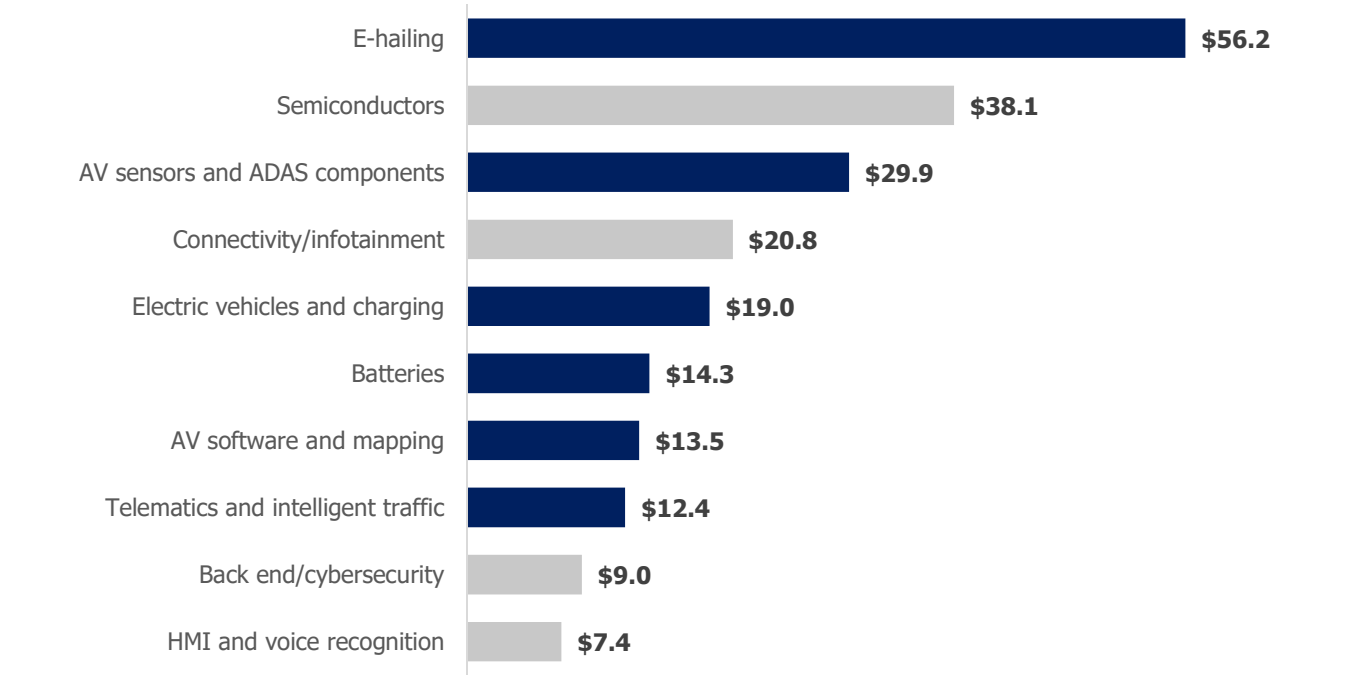
According to a 2019 Morgan Stanley Research Study, the autonomous urban aircraft market may be worth $1.5 trillion by 2040.

SECTION 03

TECHNOLOGY STARTUPS IN AUTOMOTIVE AND MOBILITY: TOP 5 SECTORS

Market Overview - Investment Activity

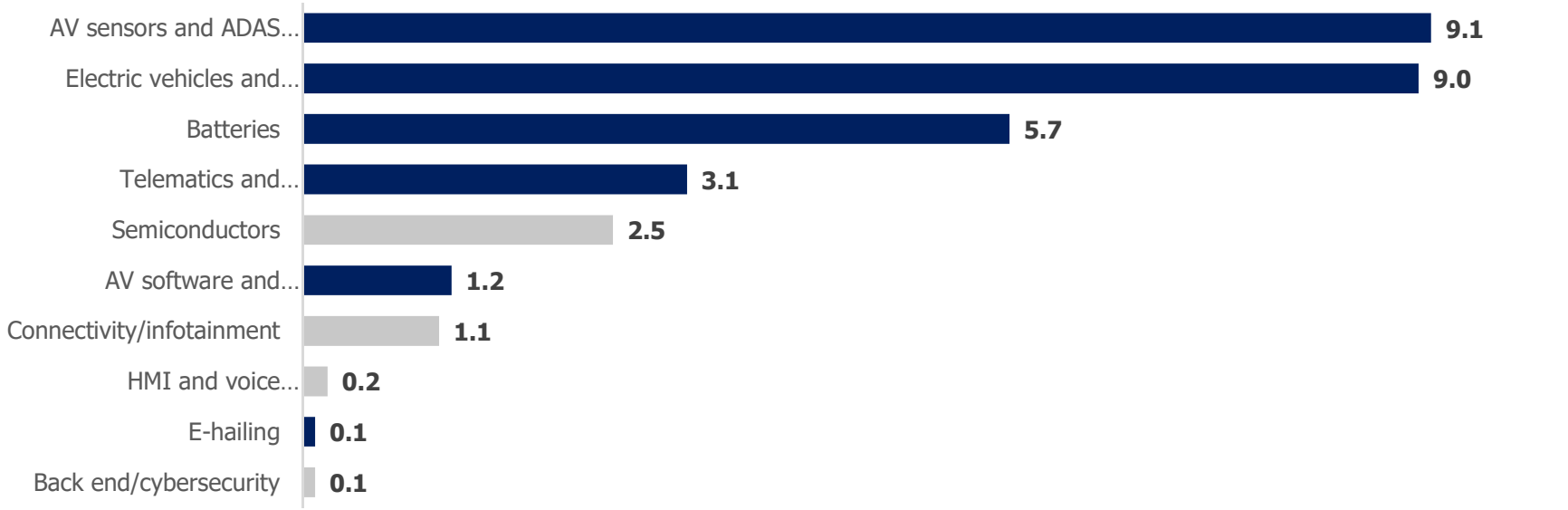
Total disclosed investment since 2010 by cluster [in $B]



Source: "*Start me up: Where mobility investments are going*," McKinsey & Company. April 2019

Market Overview - Innovation Activity

Total number of patents since 2010 [in thousands]



Source: "*Start me up: Where mobility investments are going*," McKinsey & Company. April 2019

Sensors and ADAS for Autonomous Vehicles

In June 2019, Renault-Nissan announced that they entered into a partnership with **Waymo** for the development of self-driving systems for vehicles that will carry both passengers and haul packages.

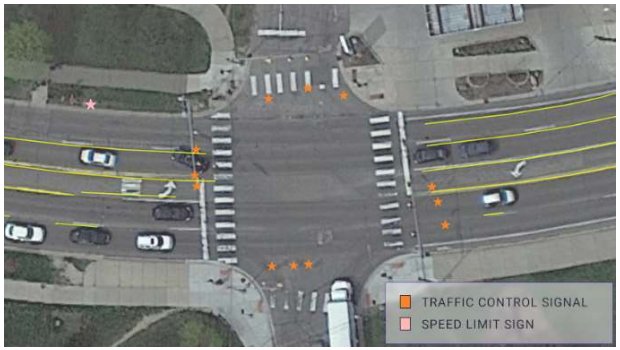
In November 2019, Denso partnered with **Metawave Corporation**, a startup focused on radar sensors, to accelerate the development of smart radar systems for autonomous cars. According to Metawave, its SPEKTRA radar platform can detect and classify pedestrians over 200 meters away, and supplies a suite of other advanced automated safety features.

In June 2020, Amazon acquired **Zoox**, a self-driving startup, for more than $1.2 billion. Zoox is developing a full end-to-end autonomous vehicle software stack with a sensor suite including multiple cameras, lidar, radar, and proprietary sensors.

Sensors and ADAS for Autonomous Vehicles (continued)

Toyota Research Institute-Advanced Development, Inc. (TRI-AD) has reported high definition (HD) map building for surface roads with relative accuracy of less than 50 centimeters.

TRI-AD collaboration with Maxar, NTT DATA, CARMERA, TomTom and HERE.



Source: https://global.toyota/en/newsroom/corporate/31898884.html#

Sensors and ADAS for Autonomous Vehicles (continued)

Nuro, an autonomous package delivery startup, received a permit in April 2020 to test its driverless, battery-powered vans in parts of Santa Clara and San Mateo counties in the Bay Area.

Source: https://www.starship.xyz/business/

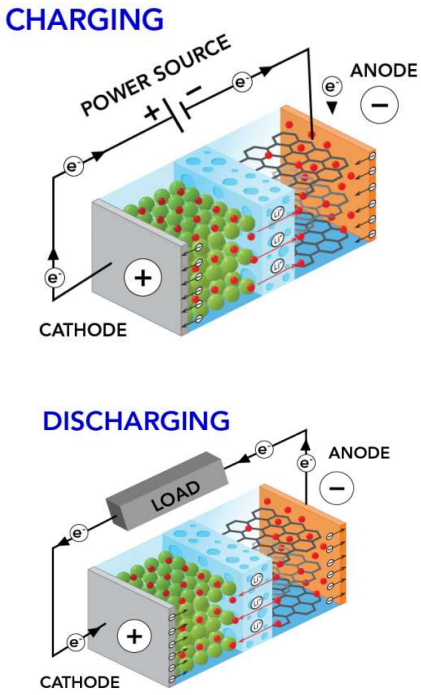
Source: https://nuro.ai/product

Starship Technologies is developing advanced delivery robots that can carry items within a 4-mile radius. Parcels, groceries and food are directly delivered from stores, at the time that the customer requests via a mobile app

Batteries and Fuel Cells

New battery chemistries are being developed to sustain EV growth rates.

Typical EV batteries rely on lithium-ion technology.



Source: https://letstalkscience.ca/educational-resources/stem-in-context/how-does-a-lithium-ion-battery-work

Batteries and Fuel Cells (continued)

- **Tesla** is reportedly developing batteries using cathodes made from lithium *iron* phosphate. This new battery design is meant to have higher charge and discharge rates and longer lifetimes than conventional lithium-ion cells.
  - Lithium iron batteries are also reportedly free of cobalt, which is expensive and has been mined using unethical practices.

- In 2019, Tesla acquired **Maxwell Technologies**, a company designing ultracapacitors to boost a battery's fast charge and discharge performance.

Batteries and Fuel Cells (continued)

Echion Technologies
a startup based in Cambridge, England, has reported development of a new anode for high-capacity lithium batteries that could charge in just 6 minutes using a proprietary “mixed niobium oxide” anode.

Sila Nanotechnologies
a battery startup, has reported development of an alternative type of lithium-ion battery that uses silicon (in the anode) to achieve three times better performance than current lithium-ion batteries. Sila Nano has received investments from Daimler and BMW.

Graphenano
has reported development of a battery that relies on graphene. The company says the batteries can be charged to full in just a few minutes and can charge and discharge 33 times faster than lithium-ion batteries.

IBM Research’s Battery Lab
has reported development of battery materials that can be extracted from seawater. The materials provide potential advantages over lithium-ion battery materials by reducing flammability and improving battery safety.

AC Biode
a Japanese startup, has reportedly developed a stand-alone Alternating Current battery. According to the company, AC batteries are more efficient and are up to 30% more compact than DC batteries for EVs. AC Biode is a finalist at the 2020 Japan-US Innovation Program at Stanford.

Batteries and Fuel Cells (continued)

- Fuel cell electric vehicles (FCEVs) combine **hydrogen** stored in a tank with oxygen from the air to produce electricity, with water vapor as the by-product.
- Scientists at Northwestern University have reportedly developed "bath sponge" storage system for storing hydrogen and other gases at much lower (and safer) pressures.
- **Toyota Motor Corporation** is exploring the feasibility of hydrogen fuel cell technology in semi-trailer trucks. In March 2020, Toyota Motor Corporation and Hino Motors, Ltd. agreed to jointly develop a heavy-duty fuel cell truck.

Source: https://global.toyota/en/newsroom/corporate/32024083.html

Batteries and Fuel Cells (continued)

- On June 25, 2020, California adopted the Advanced Clean Trucks (ACT). This is the world's first zero-emission commercial truck requirement.
- Requires truck makers to sell an increasing number of clean, zero-emission trucks in California in place of diesel and gasoline. Beginning in 2024, manufacturers must increase their zero-emission truck sales to between 30-50 percent by 2030 and 40-75 percent by 2035.
- Requires California Air Resources Board to determine how to transition California's truck fleet to 100 percent zero-emission vehicles by 2045 with earlier targets for market segments such as drayage trucks, first- and last-mile delivery, garbage trucks, local buses, and utility and government vehicles.

Semiconductors and Power Electronics for Electronic Vehicles

- Market for new semiconductor films, such as silicon carbide (SiC) and gallium nitride (GaN), booming as electric cars and charging equipment need to be more efficient.
  - SiC and GaN are called "Wide Bandgap Semiconductors" (WBG), due to the energy needed to blow up the electrons of these materials from the valence band to the conduction band.
- Electric vehicles rely on high power electronics for routing, control, and conversion of electrical power. Power electronics includes motors, motor drive inverters, and on-board chargers.
- Power electronics utilizing SiC and GaN films, as opposed to standard silicon, allow for potential operation of power devices at high voltages and especially at high temperatures. The improved heat management makes it possible to lower the operating temperature of the device and improve the overall efficiency of the system.
- Using SiC and GaN films also allows car component manufacturers to shrink the size of the power electronics SiC substrates permit the use of thinner base structures.
- University of Tokyo joint development with Mitsubishi Electric Corporation to enhance the reliability of SiC semiconductor devices.
- Cree, Inc. announced investment up to $1 billion in the expansion of its SiC capacity with the development of a 200mm SiC fabrication facility and a materials mega factory at its headquarters in Durham, N.C.

Electric Vehicles

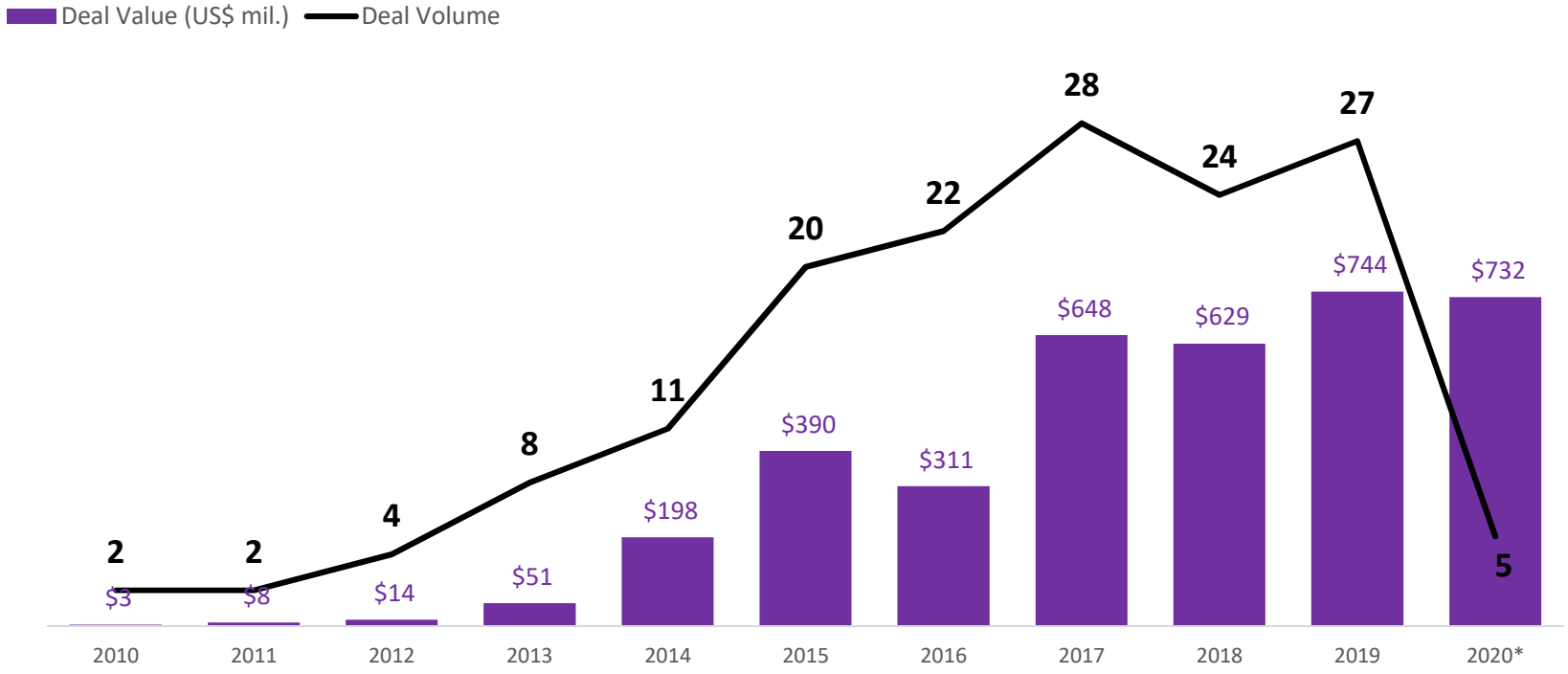
Source: https://voltacharging.com/

- **Volta Charging** partners with businesses to install EV chargers in high-traffic areas such as shopping centers, and partners with brands to sponsor free charging for all EV drivers.

- **Freewire Technologies** offers turnkey power solutions for EVs, including its Mobile Mobi EV Charger.

Source: https://freewiretech.com/products/mobi-ev/

Urban Air Mobility VC Deal Activity
(2010 – Q1 2020)



Source: PitchBook Database – Angel, Seed, Early Stage, and Late Stage Financings

Air Mobility Vehicles and Drones

Jan. 16, 2020

Toyota and Joby Aviation are Flying to New Heights Together

Bell and Hyundai Soar Into the Air Taxi Race

At CES, the helicopter maker and the global manufacturing giant unveil their concepts for flying urban mobility.

Uber and Hyundai team up to put flying taxis in the sky

By Matt McFarland, CNN Business

Updated 5:40 PM ET, Tue January 7, 2020

SECTION 04

KEY LEGAL ISSUES FOR AUTOMOTIVE STARTUPS

Key Employees and Trade Secrets

Increasing trade secret litigation

- Significant expansion of corporate entities in Silicon Valley
- Litigation is fueled by employees rapidly moving to new companies

More trade secret litigation as employees change companies

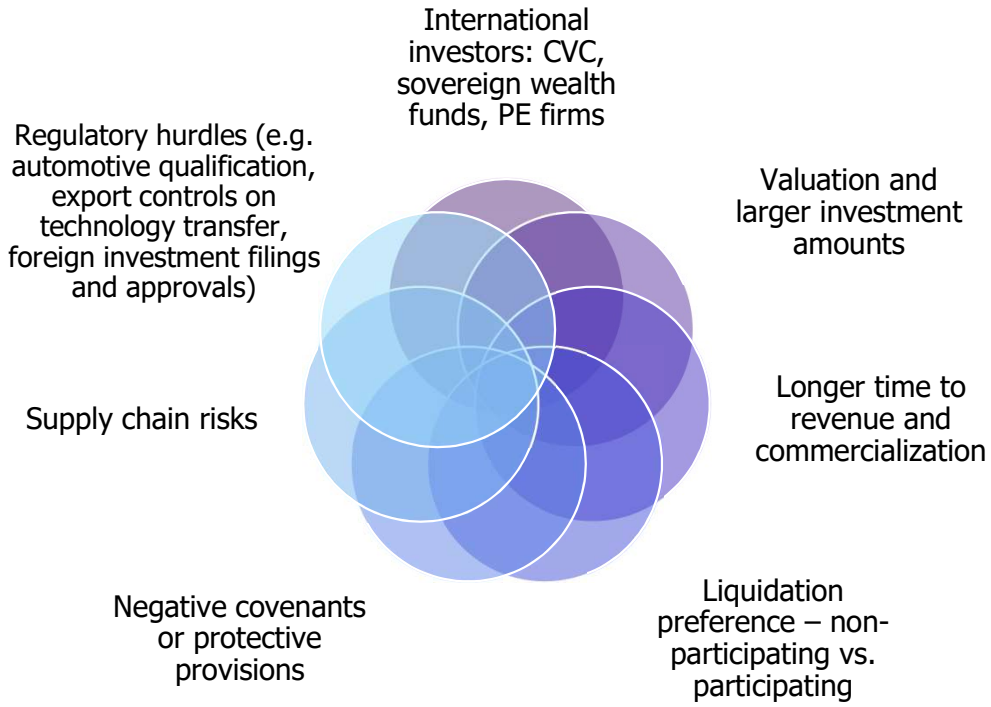
- *Waymo v. Uber*
- *Tesla v. Zoox*
- *Faraday & Future Inc. v. Evelozcity, Inc.*, 2:18-cv-00737 (C.D. Cal.)
  - Electric vehicle startup Faraday & Future sued rival Evelozcity Inc. for trade secret misappropriation in California, claiming its former CFO solicited employees to leave and join his new company, encouraging them to copy and steal Faraday's intellectual property on their way out. Settled Dec. 2018

Key Employees and Trade Secrets (continued)

- Important to have a trade secret policy **before** key employees exit:
  - Identify proprietary information and those employees with access
  - Implement a detailed confidentiality/trade secret protection policy
  - Implement appropriate security measures limiting access
  - Enforce compliance

- Have a **well-established exit protocol** for key employees:
  - Establish an Exit Team that includes an IT representative
  - Immediately restrict access and set a date certain for return of computer equipment
  - ***Pre***-Exit interview to discuss confidentiality expectations and means to retrieve personal electronic information from computer equipment
  - Obtain signed acknowledgement that applicable protocols have been followed

Investments in Automotive Startups



Non-Participating Liquidation Preference

In the event of any voluntary or involuntary liquidation, dissolution or winding up of the Company, the holders of shares of Series A Preferred Stock then outstanding shall be entitled to be paid out of the assets of the Company available for distribution to its stockholders, and in the event of a Deemed Liquidation Event (as defined below), the holders of shares of Series A Preferred Stock then outstanding shall be entitled to be paid out of the consideration payable to stockholders in such Deemed Liquidation Event or out of the Available Proceeds , before any payment shall be made to the holders of Common Stock by reason of their ownership thereof, an amount per share equal to the greater of (i) [__ times] the Series A Original Issue Price, plus any dividends declared but unpaid thereon, or (ii) such amount per share as would have been payable had all shares of Series A Preferred Stock been converted into Common Stock pursuant to Section ___ immediately prior to such liquidation, dissolution, winding up or Deemed Liquidation Event (the amount payable pursuant to this sentence is hereinafter referred to as the "Series A Liquidation Amount").

Non-Participating Liquidation Preference (continued)

If upon any such liquidation, dissolution or winding up of the Company or Deemed Liquidation Event, the assets of the Company available for distribution to its stockholders shall be insufficient to pay the holders of shares of Series A Preferred Stock the full amount to which they shall be entitled under this Section ___, the holders of shares of Series A Preferred Stock shall share ratably in any distribution of the assets available for distribution in proportion to the respective amounts which would otherwise be payable in respect of the shares held by them upon such distribution if all amounts payable on or with respect to such shares were paid in full.

In the event of any voluntary or involuntary liquidation, dissolution or winding up of the Company, after the payment in full of all Series A Liquidation Amounts required to be paid to the holders of shares of Series A Preferred Stock, the remaining assets of the Company available for distribution to its stockholders or, in the case of a Deemed Liquidation Event, the consideration not payable to the holders of shares of Series A Preferred Stock pursuant to Section ___ or the remaining Available Proceeds, as the case may be, shall be distributed among the holders of shares of Common Stock, pro rata based on the number of shares held by each such holder.

Non-Participating Liquidation Preference: Example

greater of either (i) [___] times the Series A Original Issue Price, plus any dividends declared but unpaid thereon, or

(ii) such amount per share as would have been payable had all shares of Series A Preferred Stock been converted into Common Stock.

Example: Series A Preferred Stock financing round = $1,000,000

Series A Preferred Stock ownership ratio = 30%

If the purchase price upon an M&A exit is at $20,000,000, more advantageous for the Series A Preferred Stock investor to receive $6,000,000 ($20,000,000 x 30%)

Fully Participating Liquidation Preference

In the event of any voluntary or involuntary liquidation, dissolution or winding up of the Company, the holders of shares of Series A Preferred Stock then outstanding shall be entitled to be paid out of the assets of the Company available for distribution to its stockholders or, in the case of a Deemed Liquidation Event (as defined below), out of the consideration payable to stockholders in such Deemed Liquidation Event or the Available Proceeds, before any payment shall be made to the holders of Common Stock by reason of their ownership thereof, an amount per share equal to [___ times] the Series A Original Issue Price, plus any dividends declared but unpaid thereon.

If upon any such liquidation, dissolution or winding up of the Company or Deemed Liquidation Event, the assets of the Company available for distribution to its stockholders shall be insufficient to pay the holders of shares of Series A Preferred Stock the full amount to which they shall be entitled under this Section ___, the holders of shares of Series A Preferred Stock shall share ratably in any distribution of the assets available for distribution in proportion to the respective amounts which would otherwise be payable in respect of the shares held by them upon such distribution if all amounts payable on or with respect to such shares were paid in full.

Fully Participating Liquidation Preference (continued)

In the event of any voluntary or involuntary liquidation, dissolution or winding up of the Company, after the payment in full of all Series A Liquidation Amounts required to be paid to the holders of shares of Series A Preferred Stock the remaining assets of the Company available for distribution to its stockholders or, in the case of a Deemed Liquidation Event, the consideration not payable to the holders of shares of Series A Preferred Stock pursuant to Section ___ or the remaining Available Proceeds, as the case may be, shall be distributed among the holders of the shares of Series A Preferred Stock and Common Stock, pro rata based on the number of shares held by each such holder, treating for this purpose all such securities as if they had been converted to Common Stock pursuant to the terms of this Amended and Restated Certificate of Incorporation immediately prior to such liquidation, dissolution or winding up of the Company. The aggregate amount which a holder of a share of Series A Preferred Stock is entitled to receive under Sections ___ and ___ is hereinafter referred to as the "Series A Liquidation Amount."

Deemed Liquidation

Each of the following events shall be considered a "Deemed Liquidation Event" unless the holders of at least [___%] of the outstanding shares of Series A Preferred Stock (the "Requisite Holders") elect otherwise by written notice sent to the Company at least [__] days prior to the effective date of any such event:

(a) a merger or consolidation in which the Company is a constituent party, except any such merger or consolidation involving the Company in which the shares of capital stock of the Company outstanding immediately prior to such merger or consolidation continue to represent, or are converted into or exchanged for shares of capital stock that represent, immediately following such merger or consolidation, at least a [majority], by voting power, of the capital stock of the surviving or resulting corporation; or

(b) the sale, lease, transfer, exclusive license or other disposition, in a single transaction or series of related transactions, by the Company of all or substantially all the assets of the Company (including, without limitation, [_____] [*insert important assets such as intellectual property*]*).*

California Law Restrictions

- The Company shall use the consideration received by the Company for such Deemed Liquidation (net of any retained liabilities associated with the assets sold or technology licensed, as determined in good faith by the Board of Directors of the Company), together with any other assets of the Company available for distribution to its stockholders, all to the extent permitted by Delaware law governing distributions to stockholders (the "Available Proceeds").
- Under California law, no distributions to shareholders are permitted unless either (i) retained earnings immediately prior to the distribution equals or exceeds the sum of the total amount of proposed distribution and cumulative dividends in arrears on shares having preference over the shares to which the applicable dividend is being made, or (ii) immediately after the distribution, the value of the corporation's assets would equal or exceed the sum of its liabilities plus the amount that would be needed if the corporation were to be dissolved at the time of the dividend to satisfy preferential rights, including accrued but unpaid dividends, of other shareholders upon dissolution that are superior to the rights of the shareholders receiving the dividend
- Under California law, the preferential rights portion of the above can be excluded in the Articles of Incorporation, in which case dividends can be paid out of either retained earnings (as long as the dividend amount equals or exceeds the dividend amount) and net assets (i.e. corporation's assets equal or exceed its liabilities).
- If California Corporations Code Section 2115 (long arm statute) applies, even Delaware corporations become subject to these California law requirements.

Negative Covenants (Protective Provisions)

As long as the Investor owns or controls majority of [the target company] (the "Company"), the Company shall not (either directly or by amendment, merger, consolidation or otherwise), without the prior written approval or affirmative vote of [the Investor] [the holders of at least 75% of the then issued and outstanding shares of all capital stock of the Company], given in writing or by vote at a meeting as required under applicable law:

(i) sell, transfer or dispose of all or substantially all of the property and assets of the Company, or sell, lease, license or dispose of any of its property or assets, whether tangible or intangible, including, without limitation, any intellectual property rights or accounts receivables of the Company;

(ii) form any corporation, partnership, company or other organization or entity of which the Company is a general partner or the Company directly or indirectly owns or controls at least a majority of the interests having by their terms ordinary voting power to elect a majority of the board of directors or other persons performing similar functions;

(iii) acquire or agree to acquire by merging or consolidating with, or by purchasing or acquiring any assets or equity interest of, or any other manner, any business or any corporation, partnership, company or other organization or entity or any division thereof, or otherwise acquire or agree to acquire any assets that are material, individually or in the aggregate, to the Company's business;

(iv) form any partnerships, joint ventures or similar arrangement with another party;

(v) change, modify or terminate the business conducted by the Company;

Negative Covenants (Protective Provisions) (continued)

(vii) issue, authorize or grant any equity interests (or any securities exercisable or exchangeable for, or convertible into, equity interests) of the Company, including any initial public offering, option grants or otherwise;

(viii) increase or decrease the authorized number of shares or equity interests of the Company or authorize any changes in the capital structure of the Company;

(ix) cause, suffer or permit to be incurred any indebtedness for borrowed money or the deferred price of property or services or other obligations for bonds, letters of credit and similar arrangements or instruments or obligations evidenced by notes, bonds, debentures or similar arrangements or instruments, guarantee any such indebtedness, obligations, arrangements or instruments, or grant any security interests, liens, mortgages or any other encumbrances on any of the property or assets of the Company;

(x) purchase, acquire, lease, sublease, sell or otherwise grant any rights or interests whatsoever in any of the real estate, including land, buildings and fixtures, owned by the Company;

(xi) enter into any transaction, make any payment to, or enter into any agreements or arrangements with any person that is a director, officer, employee, consultant, service provider, shareholder, representative or agent of the Company (other than for compensation for employment or services and except for this Agreement);

Negative Covenants (Protective Provisions) (continued)

(xii) grant compensation to any person, including employees, consultants or any other service providers, in excess of $150,000 per year;

(xiii) hire or fire any member of the Company's management or materially change the role of any such member of the Company's management;

(xiv) increase or decrease the number of directors on any board of directors or any other governing body of the Company;

(xv) liquidate, dissolve or wind up the business and affairs of the Company, or consent to any such liquidation, dissolution or winding up;

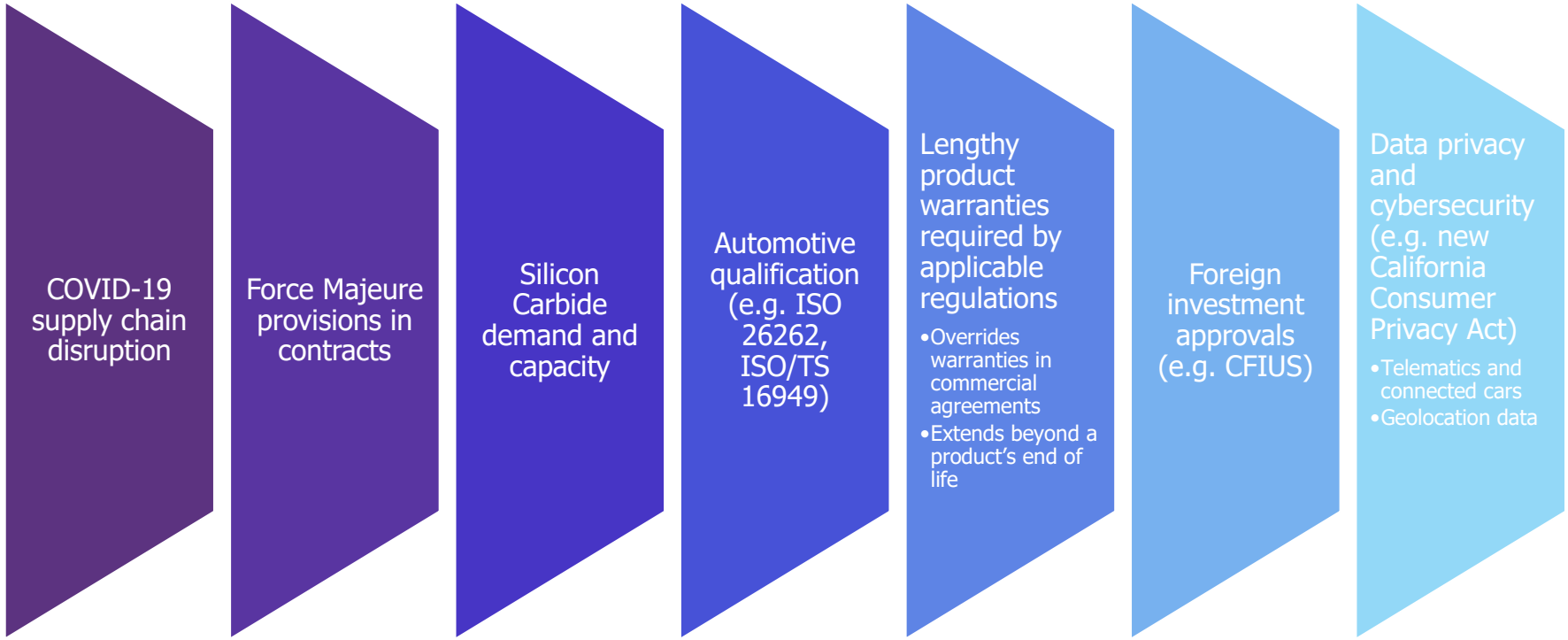
(xvi) amend, alter or repeal any provision of the governing documents such as articles of incorporation or bylaws of the Company;

(xvii) cause suffer or permit to be made any expenditures by the Company that are not in the annual capital and/or operating budget approved hereby;

(xviii) initiate, settle or withdraw any legal action or proceedings to which the Company is a party;

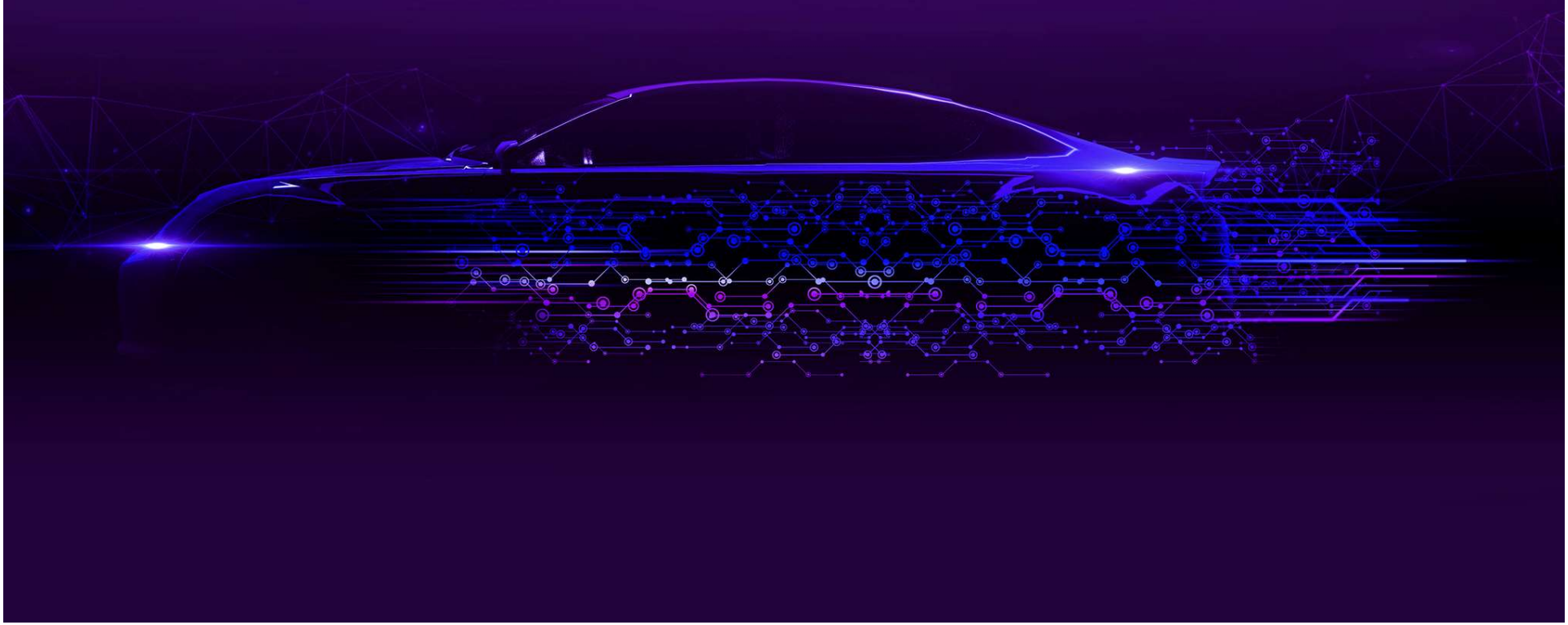
(xix) agree or offer to take any of the actions described above.

Supply Chain, Regulatory and Other Legal Issues



SECTION 05

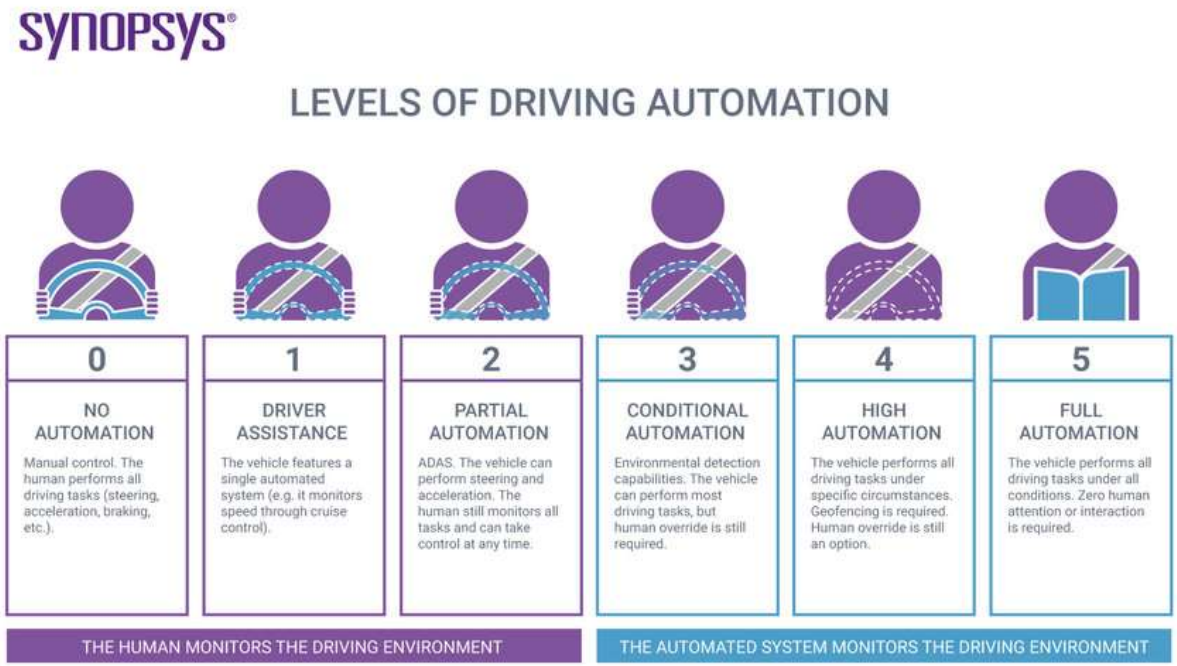
FOCUS ON JAPAN: CASE STUDIES



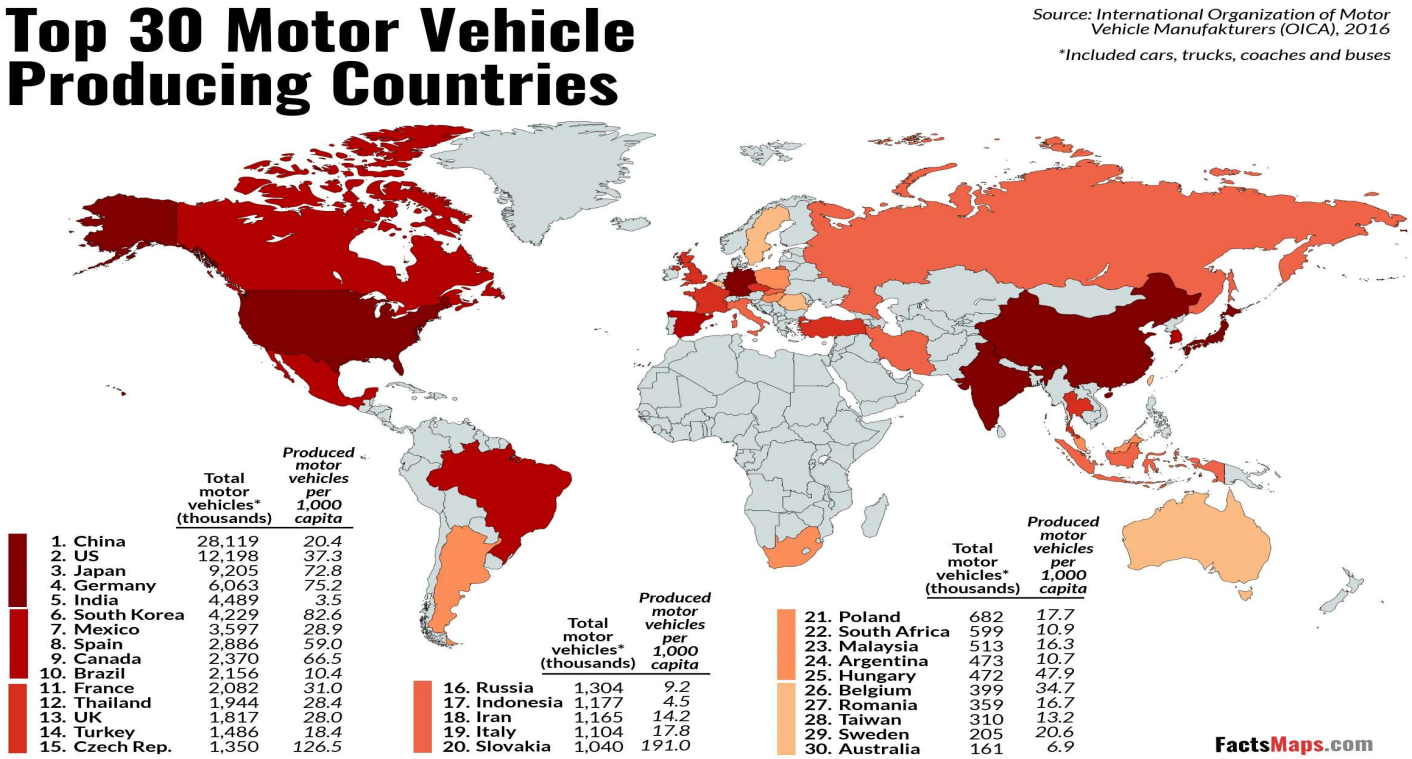
Japanese Automotive Industry

- One of the world's top 3 auto producing countries
- Automotive delivery and shipments (both domestic and exports) – 19% of the total value of Japan's manufacturing shipments and 41.2% of the value of the machinery industries' combined shipments
- Investment in automotive – capital investment and R&D expenditures increased 4.4% from 2016 to 2017, more than 20% of the value of overall investments of Japan's major manufacturing sectors
- Employment – automotive manufacturing employs 8.2% of the total Japanese population
- On-site production – Japanese automakers' overseas production totaled 19.97 million units in 2018, with increases in production in Asia and Africa
- Autonomous driving – Japanese government supporting autonomous driving; published system protocols for autonomous driving technologies (Level 3) in April 2018 for implementation in 2020

Japanese Automotive Industry (continued)



Japanese Automotive Industry (continued)



Japanese Automotive Industry (continued)

SHIPMENTS OF MAJOR MANUFACTURING SECTORS IN VALUE TERMS, 1970-2017

x 100 million yen

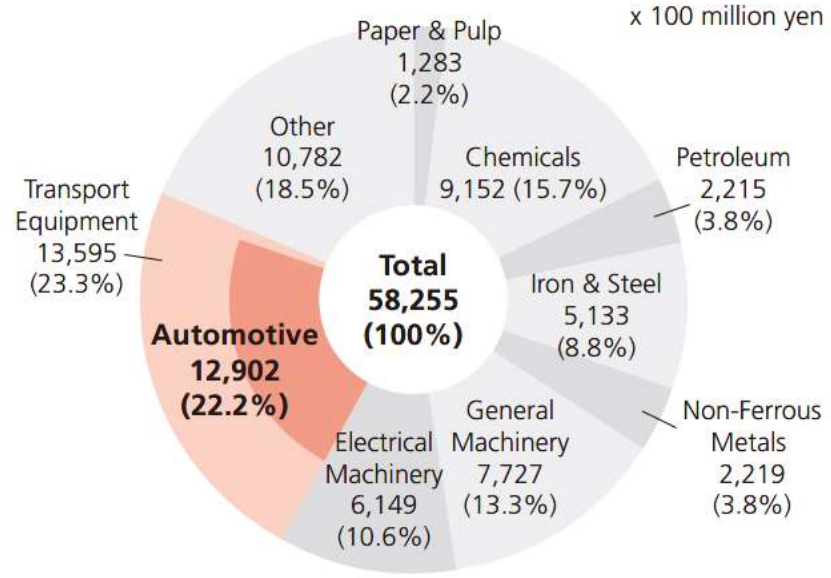
Year	Chemicals	Iron & Steel	Non-Ferrous Metals	Metal Products	Machinery Industries					Other	Total	Automotive Shipments	
					General Machinery	Electrical Machinery & Equipment	Transport Equipment		Subtotal			As % of Value of Machinery Shipments	As % of Total Value of Manufacturing Shipments
								Automotive					
1970	55,402	65,648	30,547	37,277	68,028	73,305	72,758	54,673	223,008	287,383	690,348	24.5	7.9
1975	104,381	113,063	39,087	65,731	106,112	108,213	147,935	105,241	379,551	589,807	1,274,329	27.7	8.3
1980	179,787	178,956	81,186	106,465	175,998	222,346	249,536	212,346	682,457	952,724	2,146,998	31.1	9.9
1985	205,524	177,543	63,836	130,944	241,904	408,422	361,793	276,927	1,055,932	1,063,240	2,653,206	26.2	10.4
1990	235,030	182,687	78,217	185,736	332,249	545,286	468,582	423,106	1,397,439	1,205,939	3,233,726	30.3	13.1
1995	233,625	140,727	64,964	176,465	298,844	548,309	442,145	395,613	1,330,364	1,155,277	3,060,356	29.7	12.9
2000	237,994	119,630	62,189	155,868	304,132	595,817	444,474	400,429	1,385,612	1,115,720	3,035,824	28.9	13.2
2005	250,271	168,964	67,116	140,159	312,108	495,083	539,999	489,548	1,385,037	988,717	2,962,417	35.3	16.5
2008	281,299	243,322	104,805	151,492	402,477	518,797	637,666	566,053	1,558,940	1,015,930	3,355,788	36.3	16.9
2009	242,757	159,884	69,400	124,267	289,320	400,593	471,866	404,915	1,161,779	894,503	2,652,590	34.9	15.3
2010	262,120	181,463	89,114	122,920	306,186	442,848	542,136	472,962	1,291,170	944,290	2,891,077	36.6	16.4
2011	263,512	186,656	90,225	121,277	322,495	403,789	505,870	439,592	1,232,154	955,863	2,849,688	35.7	15.4
2012	260,379	180,121	89,228	128,607	330,816	369,426	564,858	502,627	1,265,100	963,841	2,887,276	39.7	17.4
2013	274,092	179,053	88,059	130,606	320,911	368,283	582,032	519,710	1,271,226	977,885	2,920,921	40.9	17.8
2014	281,230	192,022	94,220	139,328	337,273	394,772	600,633	533,101	1,332,678	1,011,922	3,051,400	40.0	17.5
2015	286,222	178,420	96,795	143,057	359,715	408,060	646,539	570,524	1,414,314	1,012,477	3,131,285	40.3	18.2
2016	272,496	156,693	88,892	143,986	363,611	376,748	649,912	577,604	1,390,271	968,018	3,020,356	41.5	19.1
2017	287,242	176,867	97,620	151,989	392,279	398,955	682,635	606,999	1,473,869	1,004,080	3,191,667	41.2	19.0

Notes: 1. Shipments from all manufacturing operations with four or more employees are included in this data. 2. Compilation of data on production in value terms was discontinued in 1996 and replaced by data on shipments in value terms. 3. Figures in value terms include domestic consumption tax revenue from shipments. 4. "Electrical Machinery & Equipment" includes IT-related electronic parts and equipment as of 2002. 5. 2017 data includes preliminary figures. *Source* for statistical data on this page: Census of Manufactures, *Ministry of Economy, Trade and Industry*

Source: Japan Automobile Manufacturers Association, Inc.: *The Motor Industry of Japan 2019*

Japanese Automotive Industry (continued)

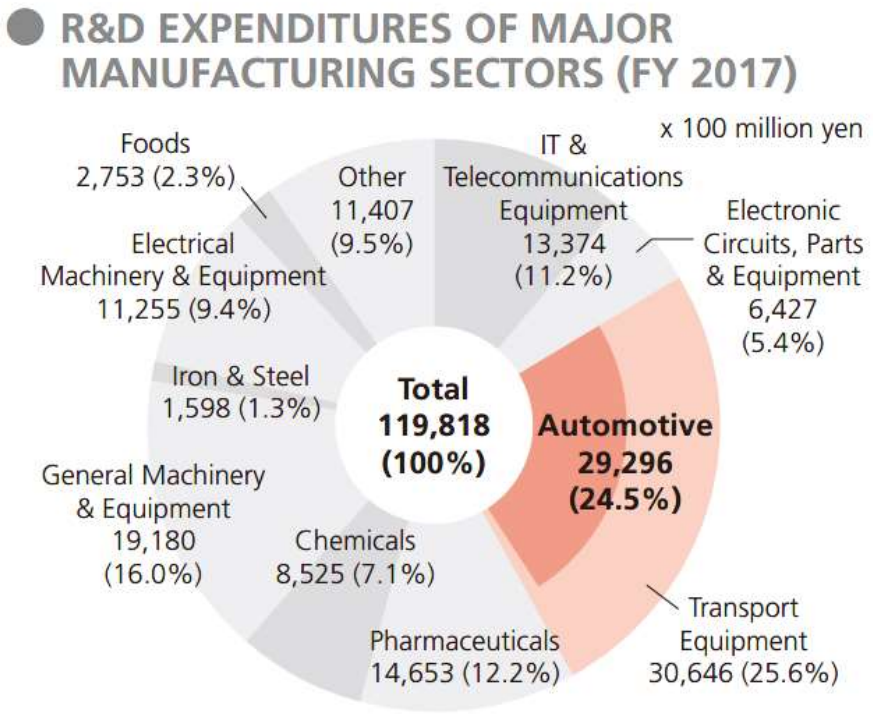
INVESTMENTS IN EQUIPMENT OF MAJOR MANUFACTURING SECTORS (FY 2017)



Note: Japan's fiscal year (FY) starts on April 1 and ends on March 31 of the following year.

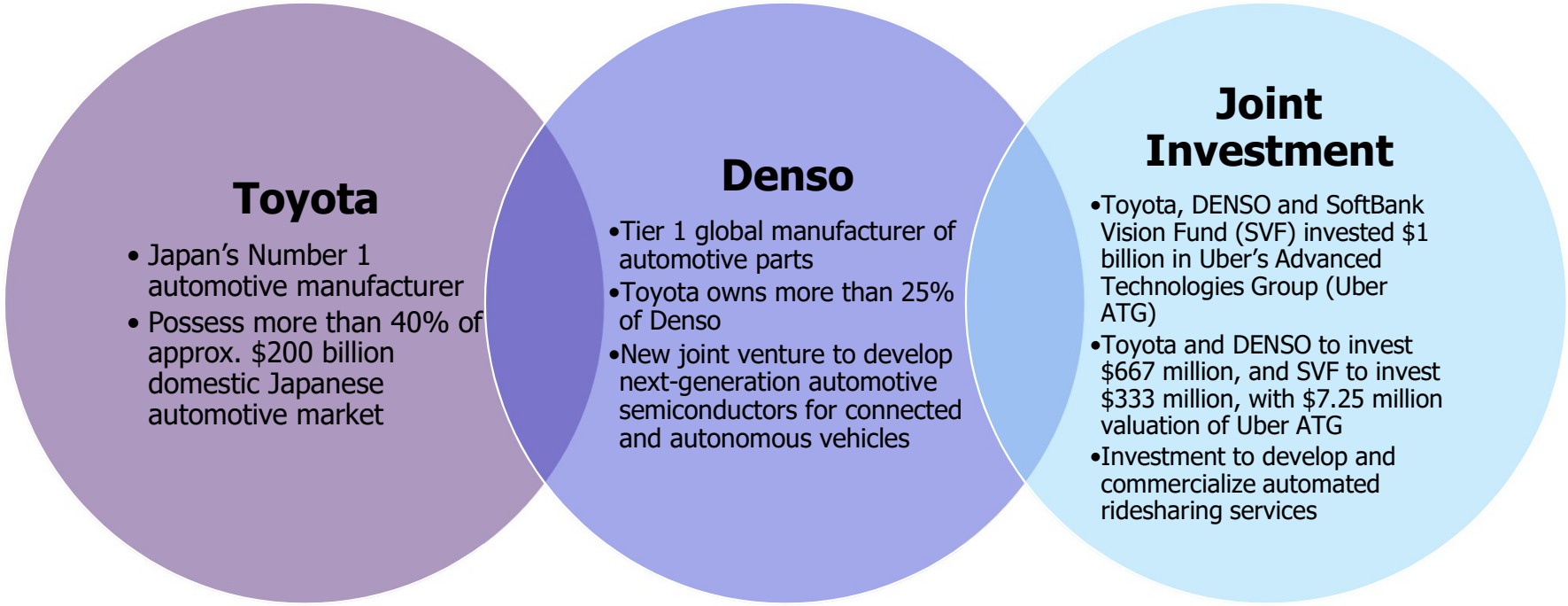
Source: Japan Automobile Manufacturers Association, Inc.: *The Motor Industry of Japan 2019*

Japanese Automotive Industry (continued)



Source: Japan Automobile Manufacturers Association, Inc.: *The Motor Industry of Japan 2019*

Toyota and DENSO Relationship



Hydrogen Fuel Cell Cars by Toyota

- Toyota's partnership with Chinese companies
  - United Fuel Cell System R&D, Toyota's joint venture with Beijing SinoHytec, Dongfeng Motor, Guangzhou Automobile Group, Beijing Automobile Group and China FAW Corp
  - Toyota will own 65% of the JV; initial investment approx. $46 million
  - China focused on hydrogen-powered vehicles a national priority
- Lithium-Ion Batteries v. Hydrogen Fuel Cells – benefits of hydrogen fuel cells
  - Lower cost, better fuel efficiency, durability – therefore, easier to scale
  - Produces less CO2 emissions over its lifetime (i.e. exhaust is hydrogen and oxygen, namely water)
- Market projection for hydrogen fuel cells

  Projected to reach market size of approx. $43 billion by 2026, growing at a CAGR of 66.9% from 2019 to 2026

DENSO TEN

- DENSO TEN
  - Toyota, DENSO and Fujitsu joint venture
  - Formerly called "Fujitsu-Ten" because Fujitsu had 55% ownership position
  - Fujitsu sold its shares to DENSO, and DENSO is now majority owner
  - Focus on auto safety technologies, including vehicle radar technology
  - DENSO focusing on artificial intelligence (AI) applications for cars, including advanced driving assistance systems
- DENSO/DENSO-TEN combination and expansion
  - DENSO to merge DENSO TEN Sales Limited and DENSO TEN Service Limited, subsidiaries of DENSO TEN, to form a new company, DENSO Solution Japan Corporation
  - DENSO's service business for trucks, buses, and leased vehicles integrated with DENSO TEN's service business for commercial vehicles, mainly taxis, to expand and strengthen the business in connected service business for fleet vehicles
  - DENSO's Connected Service Business Promotion Division incorporated into DENSO TEN

Sony Eager to Enter Automotive Space

- Sony's move into automotive
  - CES 2020 debut – revealed Vision-S prototype, battery-electric car with mirrorless DSLR and 33 sensors
  - Digital single-lens reflex camera (DSLR) – combines the optics and the mechanisms of a single-lens reflex camera with a digital imaging sensor
  - Mirrorless camera – no optical viewfinder, but image sensor exposed to light
  - Revolutionary in-car entertainment experience
- Other automotive technologies
  - Sony entering into lithium-ion battery agreements with automakers; manufacturing all li-ion cells in Japan
  - CMOS image sensor for automotive camera
  - Sensors for Advanced Driver Assistance Systems (ADAS)
  - Silicon-based vision sensors for self-driving

Representative Startups in Japan: ZMP

- "Robot of Everything" – autonomous driving through robotics technology
- ADAS (autonomous driving development platform) and sensor systems
- Japan already sells approx. 20,000 electric carts or "senior cars" per year for the elderly
- Already developed delivery robots, autonomous forklifts, and Japan's first fully autonomous single-seat electric vehicle, the Robocar Walk, approved for use on public roads
- Autonomous Taxi Service – world's first passenger-carrying autonomous taxi service on public roads in 2018; joint demonstration with Japanese taxi company, Hinomaru Kotsu
- Mobility as a Service – combination of an airport shuttle bus, autonomous taxi and Robocar Walk via smartphone app for travel from airports to central Tokyo
- Level 3 electric bus – joint venture with Marubeni; obtained government clearance and launched unmanned services in 2020 at Chubu airport. First commercial operation of level 3 technology at a Japanese airport.
- Level 3 towing tractors – experimental demonstration at Narita and Kansai airports in 2020
- RoboCar series – 1/10 the size of a passenger car for indoor use or single seat electric cars, minivans, SUVs, mini bus

Representative Startups in Japan: ZMP (continued)

Source: https://www.zmp.co.jp/en/

Representative Startups in Japan: TierIV

- Autoware – the world's first and largest open source software development and production for autonomous driving; the world's first "all-in-one" open-source software for autonomous driving technology based on the Robot Operating System (ROS1) and available under an Apache 2.0 license
- Contains modules for localization (3D maps plus Global Navigation Satellite System), detection (cameras and Lidar), prediction and planning (probabilistic robotics, using deep neural networks), and control (in conjunction with by-wire system)
- Deployed prototypes of self-driving vehicles across Japan as early as 2016
- Qualified to operate driverless intelligent vehicles on public roads in Japan in 2017 (see https://www.youtube.com/watch?v=5DaQBZvZwAI)
- Began test service with "Milee," a driverless intelligent vehicle, in March 2019
- Japanese government adopted Autoware as standard for autonomous driving safety benchmark in June 2019
- More recently in January 2020, entered into a strategic alliance with LG Electronics to develop a turnkey cloud service for simulation-based testing and verification of Autoware

Representative Startups in Japan: TierIV (continued)

Source: https://tier4.jp/en/company/

Representative Startups in Japan: Cocoa Motors

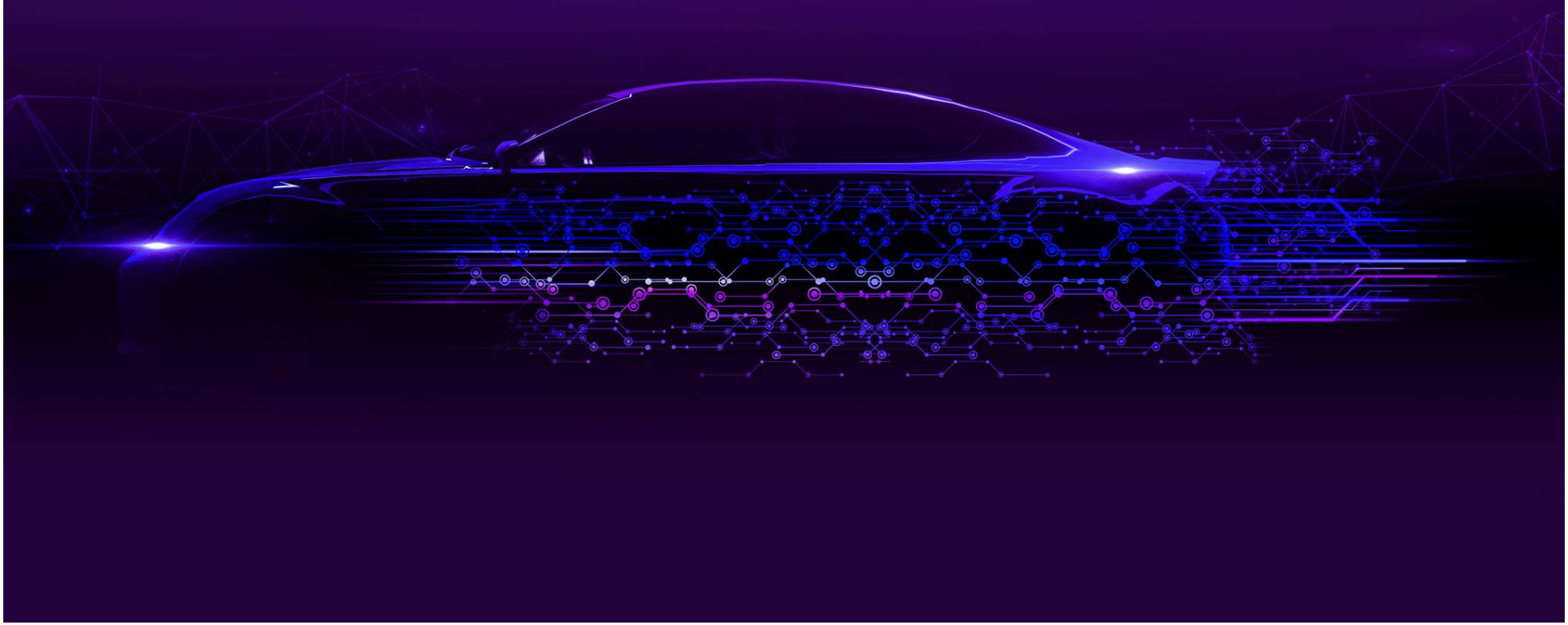
- WALKCAR – portable car to carry around; no parking required
- Size of a laptop PC (13 inches in length)
- Approx. 6 lbs. in weight
- Vehicle height is approx. 3 inches above the ground (about the width of a smartphone)
- Can be charged with household outlet 100-240 V 50/60 Hz
- Rechargeable battery: Lithium-ion (Li-ion), 68 Wh
- Maximum speed approx. 6 mph in normal mode and approx. 10 mph in sports mode
- Lightweight material made of carbon fiber and ultra duralumin

Representative Startups in Japan: Cocoa Motors (continued)

Source: https://www.cocoamotors.com/

SECTION 06

CONCLUDING REMARKS



Envision 2030

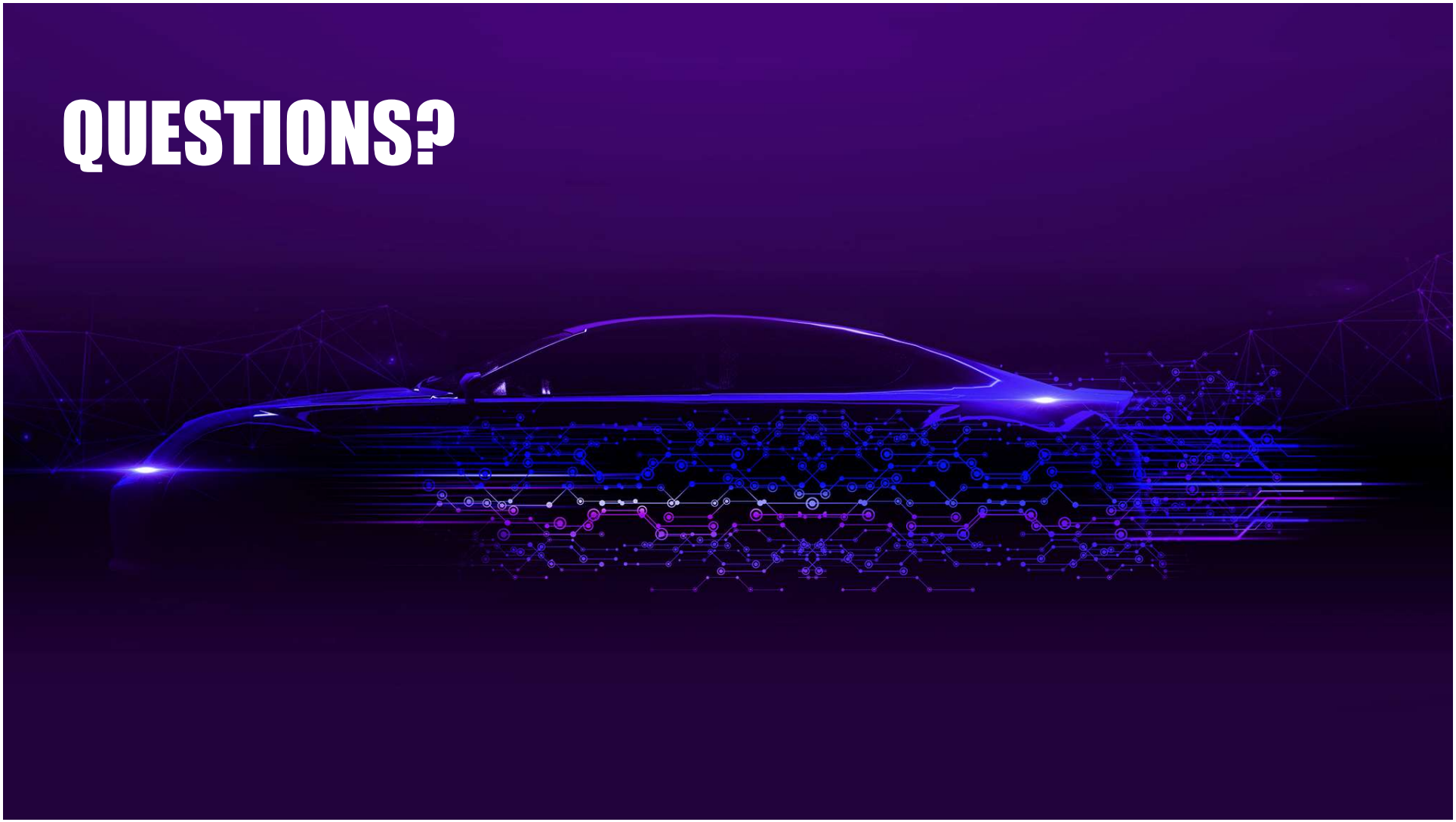
White House: 2021 R&D Budget Priorities

Policy Memorandum M-19-25
Office of Science & Technology Policy (August 30, 2019)

American Leadership in Industries of the Future

The Trump Administration continues to prioritize the technologies that power Industries of the Future (IotF) . . . Departments and agencies should support the development and deployment of advanced communications networks by prioritizing R&D consistent with the National Spectrum R&D Strategy. They should prioritize R&D to lower barriers to the deployment of surface, air, and marine autonomous vehicles with a focus on developing operating standards, integration approaches, traffic management systems, and defense/security operations. ***Departments and agencies should prioritize R&D that enables electric vertical-takeoff-and-landing*** *and civil supersonic aircraft, including for type certification, the creation of over-land supersonic flight noise standards, and low-sonic-boom aircraft research…..*

QUESTIONS?



Biography

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Nancy Yamaguchi advises technology companies across the world on cross-border mergers and acquisitions, strategic and venture capital investments, joint ventures, strategic alliances, and technology transactions. She also counsels clients, especially those in Asia, on US regulatory compliance related to technology investments and transfers. Her expertise includes latest US legislative developments regarding Hong Kong related economic sanctions.

Prior to Morgan Lewis, Nancy served as Chief Legal Officer of a semiconductor company based in California and Germany and also as Director of Mergers & Acquisitions for a public company headquartered in Silicon Valley. Nancy is admitted to practice law in California and Illinois, and is a registered foreign qualified lawyer in England and Wales.

Biography

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Jason E. Gettleman brings an electrical and computer engineering background to his services, which focus on patent procurement and patent litigation in the electrical and mechanical arts. Prior to attending law school, Jason was an associate design engineer with a major New York engineering consulting firm, where he designed copper and fiber telecommunications systems. As a design engineer, he worked on the Phoenix Project, the name given to the reconstruction of the Pentagon after the September 11, 2001, attacks.

Jason spent three years in the Morgan Lewis Tokyo office where he assisted Japanese clients with US intellectual property matters, including patent litigation support. He also counseled US companies on Japan-related IP matters. During his time in Tokyo, Jason frequently lectured Japanese clients on US intellectual property rights.

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Chair of the firm's emerging business and technology practice, Steven M. Cohen represents entrepreneurs, private equity investors, and venture capital funds. He advises clients in such industries as technology, life sciences, chemicals, consumer products, digital health, and fintech. Steve counsels mid-Atlantic region investors and emerging growth companies in a variety of business transaction including equity financing transactions, mergers and acquisitions (M&A), divestitures, initial public offerings (IPOs), joint ventures, and international strategic partnerships.

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