PitchBook

EMERGING TECH RESEARCH

Mobility Tech

1Q 2019

Report preview

The full report is available through the PitchBook Platform.

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Contact

Asad Hussain
Analyst, Emerging Technology
asad.hussain@pitchbook.com
206.480.1378

Research
analystresearch@pitchbook.com

Mobility Market Map

REPORT PREVIEW

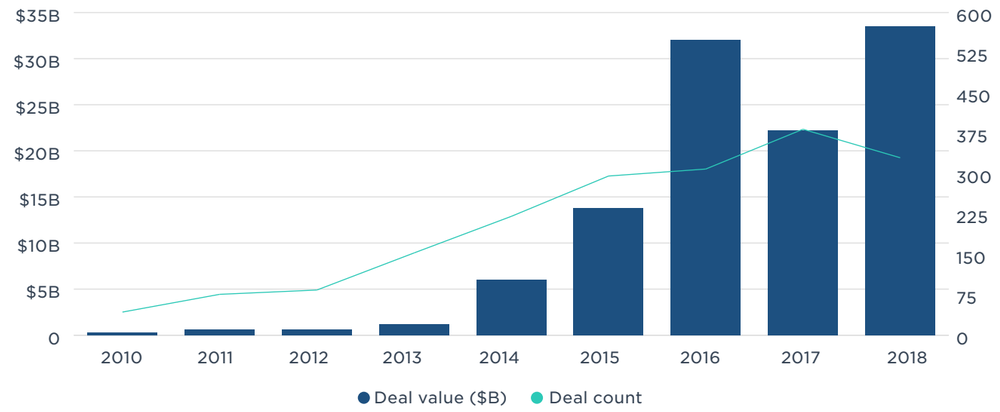
Overview

We define Mobility-tech as the intersection of transportation and technology. As the world has become increasingly connected, demand for differentiated mobility solutions is higher than ever, creating a fundamental challenge to match demand with supply. Ridesharing startups like Uber and Lyft have revolutionized and disrupted traditional means of transportation, and self-driving startups like Zoox and TuSimple are poised to usher in a new age of autonomy. We believe strong venture funding activity has been key in driving the thematic shifts taking place in this industry and note that in 2018, venture investors deployed approximately $33.5 billion across 330 deals into this vertical.

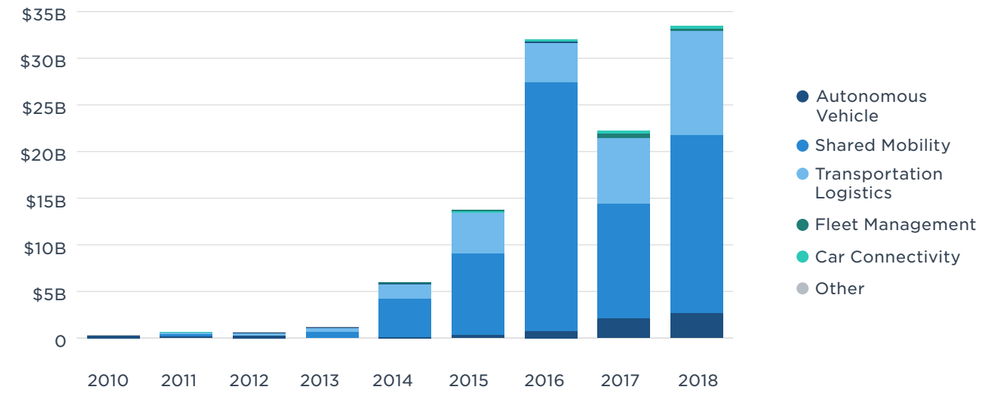
This presentation provides an overview of the technologies being applied by venture-backed mobility startups. Market segments were determined by similarities in use-cases, and further categorized into specific sub-segments. While we acknowledge that some startups could belong in multiple segments or sub-segments, we have placed them within the categories that match our understanding of the primary use-case.

REPORT PREVIEW

MOBILITY VC DEAL FLOW



MOBILITY VC DEAL FLOW BY SEGMENT



VC Investing in Mobility

REPORT PREVIEW

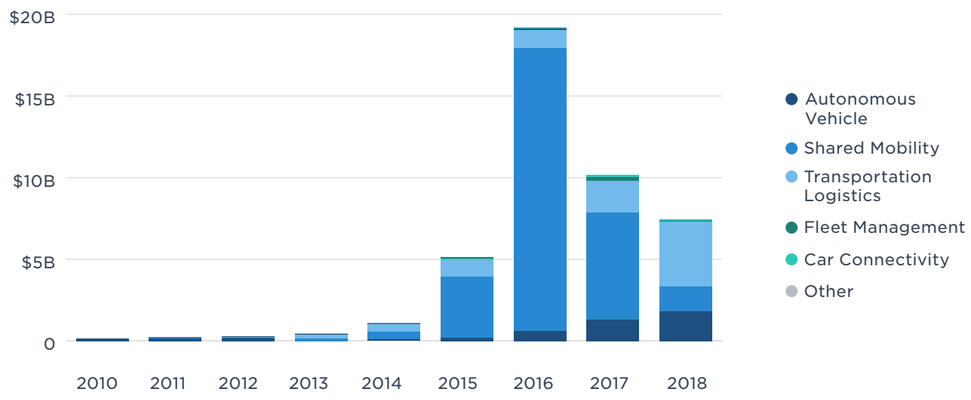
Dominance of shared mobility

Attracted by the fast growth and disruptive nature of ridesharing, carsharing, and micro-mobility startups, investors have deployed more venture dollars to shared mobility than any other segment within mobility. This dominance transcends company age, as shared mobility investing is prominent across both early stage as well as later stage venture deals.

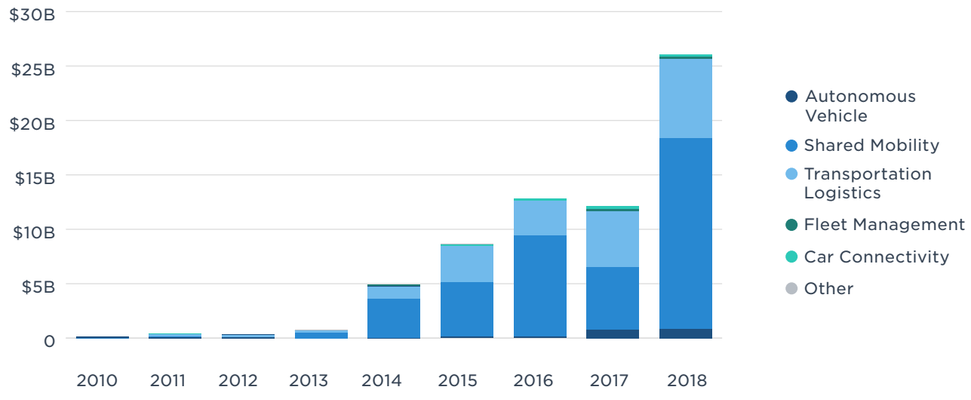
Later stage deals taking share

Over the past three years, early stage deals in the mobility space have moderated, while later stage deals have seen an upward trend. This reversal likely reflects the maturation of the shared mobility industry, as these companies find their footing and become more established, gaining market penetration, generating strong revenue growth, and laying the groundwork for future profitability.

EARLY STAGE VC INVESTED



LATER STAGE VC INVESTED



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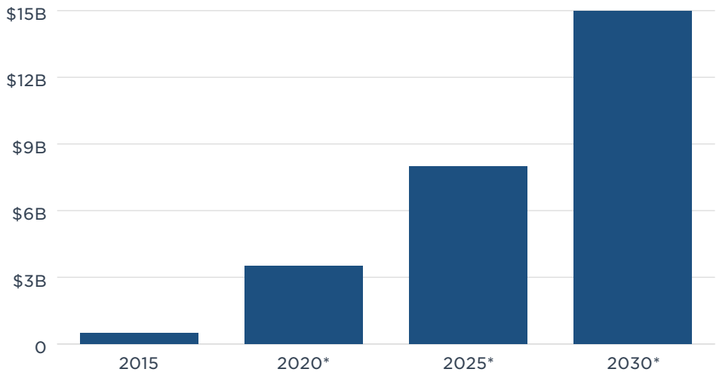
REPORT PREVIEW

SEGMENT DEEP DIVE

Autonomous Vehicles Software

AUTONOMOUS VEHICLES SOFTWARE

MARKET SIZE



Source: Roland Berger, internal PitchBook estimates
Represents global autonomous vehicle software revenue (sales of internal autonomous vehicle software).

BUSINESS MODEL

Autonomous vehicle software companies provide software and solutions enabling vehicle autonomy. Some focus on aspects of autonomy such as localization, mapping, perception, and simulation, while others focus on building full-stack autonomous solutions.

Companies in this space monetize by licensing software to automakers and automotive suppliers. In the future, full-stack providers could monetize by operating cost-effective ridesharing/delivery platforms or through direct vehicle sales.

KPIS

- Total miles driven
- Simulated miles driven
- Average miles per intervention
- Total autonomous vehicle patents
- Autonomous fleet size

KEY PROVIDERS

Waymo, Zoox, Cruise, Tesla, Baidu, Pony.ai, drive.ai, Intel, Uber, Argo AI, Aurora, TuSimple, Nuro

KEY INVESTORS

PlugAndPlay, IDG Capital, NEA, Trucks, Qualcomm Ventures, Intel Capital, SVAngel, 晨兴资本 Morningside Venture Capital, NVIDIA, Y Combinator, Andreessen Horowitz, Foundry Group

NOTABLE DEALS

Mobileye

September 2017
$15.3B M&A
Acquired by:
Intel

Nuro

February 2019
$940M Series B
Investor:
SoftBank

INDUSTRY DRIVERS

- Consumer and enterprise-driven demand for more economic forms of transportation, logistics, and delivery
- Large potential market opportunity ripe for monetization
- Regulation concerning accidents, congestion, pollution, and other negative externalities associated with passenger vehicles

REPORT PREVIEW

SEGMENT DEEP DIVE

Autonomous Vehicles Hardware

Opportunities

Autonomous fleets to drive hardware demand: We believe a significant opportunity exists for autonomous vehicle hardware suppliers as autonomous vehicle fleets begin to scale. For a vehicle to operate autonomously, it must be able to sense its environment, process information, make decisions, communicate its intentions, and take control of the vehicle's inputs. Each of these processes requires the use of dedicated hardware solutions.

Visual perception technology is critical: Perhaps no emerging technology is so uniquely associated with autonomous vehicles as lidar, or light detection and ranging. Compared to other technologies, lidar has received the bulk of venture investment in the AV hardware space, surpassing investment in radar and cameras. Although lidar has some industrial applications, most venture capital investment in the last few years has gone to startups targeting the autonomous vehicle market, for which lidar technology is particularly well-suited. The technology works by sending out pulses of laser light that hit objects and reflect back to sensors on the vehicle. This measures depth more effectively than cameras and is used to create high-fidelity 3-D representations of the surrounding environment. Lidar pioneer Velodyne has developed a system that spins multiple laser beams to create a 360 degree view of the vehicle's surroundings. Other key companies innovating in the lidar space include Quanergy, Surestar, LeddarTech, Innoviz, Oryx, Aeye, Aeva, Robosense, Trilumina, Luminar, Innovusion, and Ouster.

Partnerships will be key to success: We expect partnerships with automakers and Tier-1 auto suppliers will be key success indicators. Recently, automotive supplier Veoneer announced a partnership with Velodyne to bring lidar to an unnamed automaker (possibly Ford[1]). Given product cycles of automobiles can extend well over 10 years, we believe companies that can secure a long-term partnership with a leading OEM will have significant competitive advantages. Automakers considering investing billions of dollars in autonomous vehicle hardware have strict requirements for the performance, reliability, and longevity of autonomous vehicle hardware, and companies meeting those requirements stand to succeed in the space.

Emergence of solid state or non-mechanical technology: A major issue with lidar is longevity. Automobiles are constantly subject to fluctuations in temperature, vibration, and weather conditions. The issue with lidar applications on the market today is that they involve mechanical movements and spinning lasers, generating a significant amount of wear and tear and necessitating servicing, replacements, and recalibrations. In a future of autonomous vehicles operating in a fleet, this is a significant added expense. Some emerging applications such as those made by Quanergy, attempt to solve this issue by creating solid state units with no moving parts. Non-mechanical lidar would significantly reduce manufacturing and upkeep costs, but this is hard to perfect, as evidenced by recent issues with Quanergy products reportedly failing to perform to spec[2]. Nevertheless, we view non-mechanical solutions as being a source of competitive advantage in the space.

1 *http://www.thedrive.com/tech/25986/velodyne-veoneer-deal-shows-lidar-is-getting-serious*
2 *https://www.theverge.com/2018/10/1/17915276/aeva-4d-lidar-technology-next-gen-self-driving-car-sensor-system*

The emergence of FMCW: Frequency-modulated continuous wave technology (FMCW) works by transmitting continuous waves with varied frequencies and is meant to address the deficiencies of traditional Lidar. These deficiencies primarily include risks to human eyesight and interference from other lidar beams (i.e., as would be coming from other autonomous vehicles). Other advantages of FMCW include its ability to see much further (200+ meters), and compute at a much lower level of latency compared to traditional Lidar. One startup leveraging this is Aeva, which was formed by two former Apple engineers. Aeva's product, dubbed 4d LIDAR, gauges velocity readings for moving vehicles[1]. Another startup, Blackmore Sensors and Analytics, has received investments from BMW and Toyota for an FMCW solution leveraging non-mechanical beamsteering. We believe GM's Cruise Automation, through its acquisition of Strobe, may also have access to this technology and could be one of the first to market. Finally, Insight Photonics has developed a long-range lidar sensor that is 10-100x more sensitive than traditional lidar. Insight Photonics' solution is also built directly on the semiconductor, which creates a cost advantage.

Integrated solutions will prevail: Many autonomous vehicles today use lidar in combination with other sensing technologies like cameras and radar. Through the use of sophisticated algorithms, autonomous vehicles combine lidar, camera, radar inputs with mapping, GPS positioning, and other perceptual data—a process known as sensor fusion. While sensor fusion works generally well, it is plagued by reliability issues, requisite sensor calibration, and reliance on custom software, all of which add to costs and reduce efficiency. As a result, several startups are focused on creating singular inexpensive devices that, by combining lidars with cameras, can read traffic signals and road signs and see at a very high resolution. Ouster's OS-1 system can produce images with the depth of lidar systems, but also the high resolution and data richness from a camera system. Aeva's lidar system is housed in a box containing additional sensors and cameras in one integrated solution. We see successful integration of multiple sensors such as lidar, radar, and cameras into packaged solutions to be a source of competitive advantage in the space.

1 *https://www.theverge.com/2018/10/1/17915276/aeva-4d-lidar-technology-next-gen-self-driving-car-sensor-system*

REPORT PREVIEW

SEGMENT DEEP DIVE

Shared Mobility

Outlook

Growth opportunity: We believe shared mobility companies have the potential to provide cost-effective and economically efficient transportation solutions that provide significant benefits to consumers. This has enabled a surge of adoption and billions of dollars in investment. We expect continued growth in this segment as shared mobility companies, fueled by investment in the space, continue to expand their scale and take market share from traditional car ownership and incumbent transportation providers.

Shift towards bundled solutions: We expect automakers, ridesharing companies and investors in the mobility space to increasingly pivot toward last-mile, micro-mobility and bundled mobility-as-a-service (MaaS) solutions, marking a secular shift away from pure-play ridesharing applications. In the long term, we believe incumbent ridesharing companies' strategy of pivoting towards MaaS could drive wider adoption. In the near term, we believe focus on untested markets could add downward pressure on margins and uncertainty for investors.

Major IPOs ahead pave the way for price rationalization: We expect Uber and Lyft to go public in 2019 (we note Lyft filed its S1 in early March), greatly expanding their base of capital. In the US, we anticipate the amount of promotions and price cutting to lessen as both companies face pressure from shareholders to price more rationally and demonstrate a clear path to profitability, rather than solely focusing on growth and market share gains.

Partnerships with automakers: We expect an uptick in partnerships between various ridesharing companies, autonomous vehicle providers, and automakers, such as the recently announced partnership between Uber and Toyota, in which Toyota agreed to supply Uber with minivans, and collaborate on self-driving technology. Owning and operating vehicles brings the entire supply chain into focus. This includes issues that impact manufacturing costs, such as tariffs, that aren't a concern for ridesharing companies.

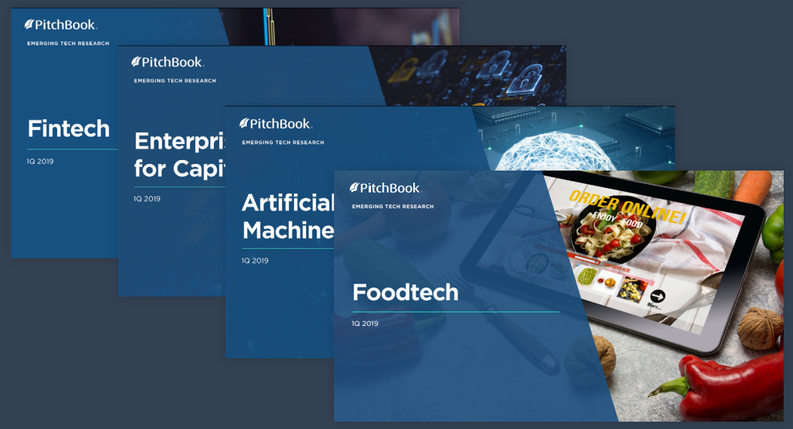
REPORT PREVIEW

About PitchBook Emerging Tech Research

Independent, objective and timely market intel

As the private markets continue to grow in complexity and competition, it's essential for investors to understand the industries, sectors and companies driving the asset class.

Our Emerging Tech Research provides detailed analysis of nascent tech sectors so you can better navigate the changing markets you operate in—and pursue new opportunities with confidence.



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