

The Emerging Autonomous Vehicle Ecosystem

Who will be the stakeholders and how they can win?

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WHITE PAPER

AS THE AUTONOMOUS MARKET GROWS EXPONENTIALLY IN THE CURRENT SCENARIO, OVER THE NEXT FEW YEARS, NUMEROUS BUSINESS OPPORTUNITIES IS EXPECTED TO EMERGE FOR VARIOUS COMPANIES ACROSS THE NEW ECOSYSTEM. COMPANIES, BOTH ESTABLISHED AS WELL AS NEW IN THE AUTOMOTIVE MARKET, ARE EXPECTED TO HAVE THE ABILITY TO EXPAND THEIR BUSINESSES ACROSS NEW VERTICALS, AS VARIOUS SECTORS SUCH AS ENERGY, INFRASTRUCTURE, FINANCE, AND TECHNOLOGY, AMONG OTHERS, WILL ALSO BE INVOLVED IN THE NEW AUTONOMOUS VEHICLE ECOSYSTEM. BUT HOW WILL COMPANIES IDENTIFY WHICH NEW BUSINESS OPPORTUNITIES CAN ARISE FOR THEM?

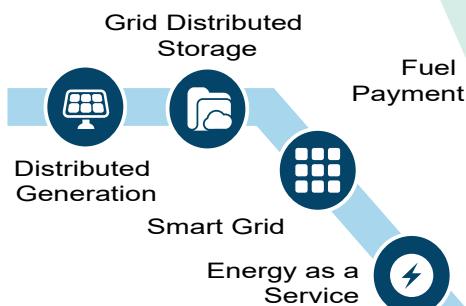
The emergence of the new-age automotive industry with the onset of connected, autonomous, shared, and electric vehicles, is expected accelerate the growth of the sector, which has been moving at a slow year-on-year growth rate due to a gradually decreasing rate of car sales. As companies attempt to expand their businesses across these new ancillary services for autonomous vehicles, new players with innovative business models will also emerge. In this report, BIS Research analyzes new business models that are possibly going to emerge and how OEMs and suppliers will be able to win in this new ecosystem.

BUSINESS VERTICALS

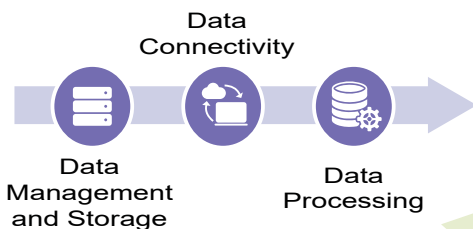
EV INFRASTRUCTURE



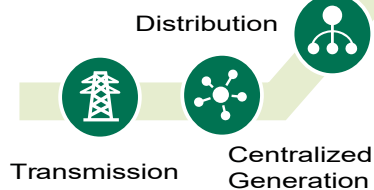
DECENTRALIZED ENERGY



DATA



ENERGY



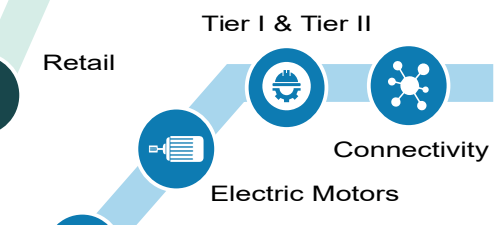
FINANCE & FLEET



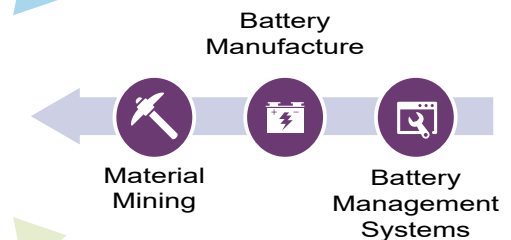
EXPERIENCE



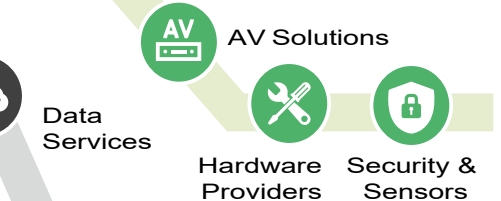
ELECTRIC VEHICLES



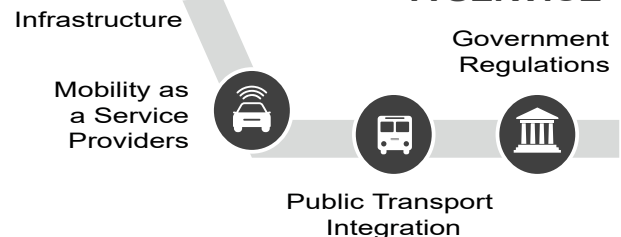
BATTERY



AUTONOMOUS VEHICLES



MOBILITY AS A SERVICE



CUSTOMER OR A FLEET

WHO WILL BE THE NEW PLAYERS?

The advent of autonomous vehicles will bring a change in how the automotive marketplace works. It will not only be the playing field of major OEMs and distributor partners who will have a stake in the market but new and emerging players of different sectors will too form a role into shape the new autonomous vehicle market.

1. Manufacturing of vehicles will not be limited to only the traditional OEMs, as technology companies will enter the marketplace as a major player.

Major tech firms are manufacturing and producing vehicles of their own, initially for a commercial mobility option and later also for personal usage. The other tech firms will act as technology providers at a supplier level for both software and hardware, through collaborations with the vehicle manufacturers. The level of collaboration will also have different impact, such as one tech company can provide the software in exchange for a large payout and share in the business, while others can provide the software for free to OEMs in exchange for access to their vehicle's user data, to be used later in analytics and marketing purposes. Many OEMs have also started actively developing their own software and technical capability, as a way to compete rather than co-operate with other tech companies.

2. Vehicle OEMs will play a crucial role in the arrival and production rate of autonomous vehicles.

Their strategic approaches will be important on how soon autonomous vehicles will replace traditional car models. Major OEMs will take an incremental approach towards autonomous vehicles, introducing vehicle of Level 2, then Level 3, and onwards. Some OEMs with technological partnerships can also target to launch Level 5 fully autonomous vehicles directly. The timing of launches may vary but implying Nash equilibrium, eventually every OEM will enter into manufacturing autonomous vehicle of some level.

3. The crucial cog in the wheel will be the Mobility-as-a-Service providers, who will act as an end-service integrator and mobility provider to the customers.

These companies will provide mobility in various forms, either shared or personal, and will be crucial for an intelligent transportation system, where a commuter can avail a ride anywhere, at any time, and according to the person's travel plans.

4. Mobility and related services providers will play a major role in the market.

The rise of autonomous vehicles will also facilitate the ease of using various services for a passenger. A person can do various things such as, enjoy a movie, shop online, work and have a tele-conference, among others, all while sitting in their self-driving vehicles without the need to focus on driving. These ancillary services give rise to a new business model, where companies can partner with mobility providers and deliver their services to the customers in the form of a bundled package. Companies will provide these monthly or custom price-plans similar to that of the current telecom and television network companies.

5. To facilitate all this, an important aspect which will also evolve along with autonomous vehicles will be the vehicle insurance, auto-financing and banking companies.

Traditionally, these services have been a major source of revenue for auto dealerships and insurance companies, but with self-driving vehicles and Mobility-as-a-Service, these aspects are bound to change. Earlier, insurance was bought individually and was based on a premium-based payment. Autonomous vehicles will lead to safer roads and fewer accidents, which will lead to less revenue from premiums, and hence the insurance companies will also have to change their business models to adapt. Insurers may introduce new coverage models for risks that will come with the rise of autonomous vehicles such as cyber security risk, software, and hardware malfunctioning risk, road infrastructure risk, and operational risks related to maintaining a fleet of robo-taxis, among

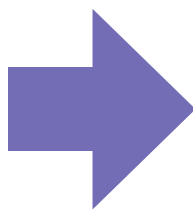
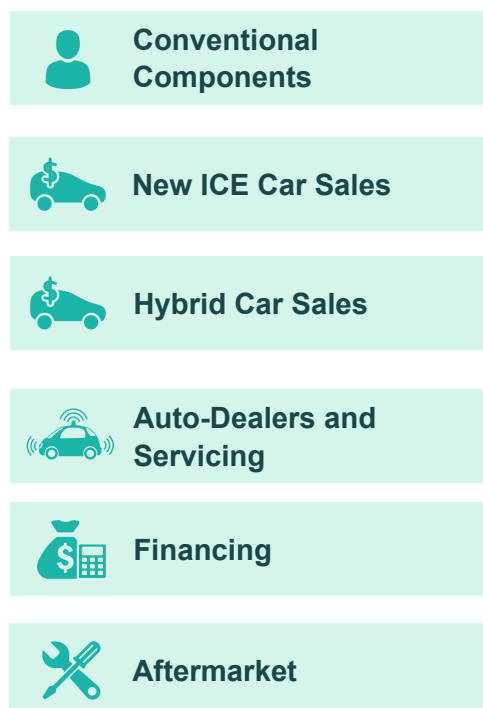
others. Auto financing is another aspect which will drastically change with autonomous vehicles. Banks and financing companies would have to find new models which will be able to provide financing programs on a pre-approved credit sharing and leasing model for private vehicles and also have financing programs for fleet operators and related services. Both the aspects, insurance and financing would have to be flexible, quick, and easy to obtain for the consumers.

6. An important part of the eco-system would be the sensor and component providers for the autonomous vehicles.

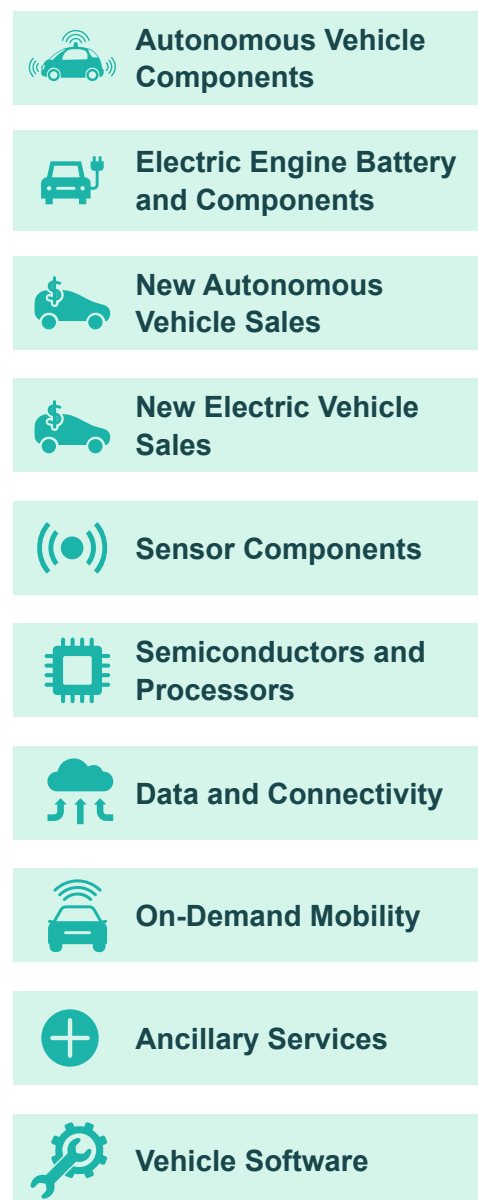
The self-driving vehicles would require a lot of different variants of sensors such as LiDARs, RADARs, ultrasonic sensors, image sensors, among others, along with many different subcomponents such as semiconductors, chips, actuators, V2X components, among others. Partnerships or collaborations with these companies will be crucial for vehicle manufacturers to reduce the costs of the vehicles. A significant revenue will also arise for these companies from aftermarket and servicing businesses. Many OEMs and technology giants have already started to acquire such component companies or are producing their own components. The market for these components will grow significantly and will be an important stakeholder for the autonomous vehicle ecosystem as the cost of manufacturing the self-driving vehicles will decrease with cheaper sensor and subcomponent costs and calibration and retrofitting costs, among others.

PROFIT POOL SHIFT

Traditional Profit Pools



New Profit Pools

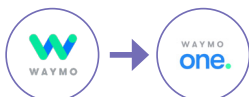


The profit pools will shift in the mobility industry as it continues to grow. OEMs and Suppliers need to change their strategies to win in the new automotive.

KEY STRATEGIES BY OEMs AND SUPPLIERS

New products and Services

Google's Waymo released Waymo One Services



Nvidia launched its Nvidia Xavier automotive driving processing chip



Business Expansions

Velodyne LiDAR

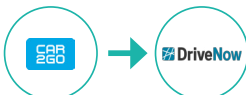
Velodyne LiDAR opens new factory to manufacture over a million units per year

tu simple

TuSimple expands to build world's largest self-driving truck fleet

Mergers and Acquisitions

Daimler's Car2Go merged with BMW's DriveNow to compete with Uber in Europe



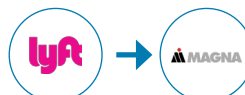
Motherson Group acquired Reydel Automotive for \$201 million



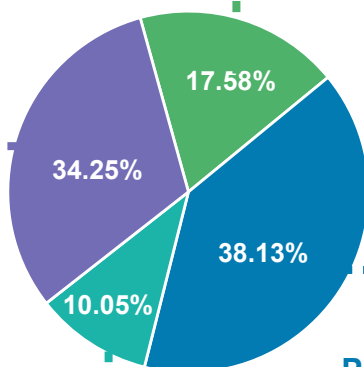
Partnerships, Collaborations, and Joint Ventures



Toyota extends its collaboration with Uber by investing \$500 million in its self-driving car programme



Magna partnered with Lyft to build self-driving vehicles by investing \$200 million



BIS Research tracked 430+ key developments of 50+ prominent OEMs and component suppliers in the industry over the past two years (2017 and 2018), to view the way companies are making strategic business decisions in the connected, autonomous, and shared vehicle space. Categorizing these strategies into four main aspects namely, partnerships, collaborations, and joint ventures; business expansions; mergers and acquisitions; and new product launches.

We found a majority of strategies were focused on partnerships, collaborations, and joint ventures, followed by new product launches due to increased R&D by companies. We have shown some examples of such developments, both from OEMs and suppliers in the above figure. The increased amount of such developments by automotive companies show that there is an increasing competition towards getting a prominent market share by all stakeholders in the new autonomous vehicle ecosystem.

HOW WILL OEMs WIN?

RECOMMENDATIONS FOR COMPANIES

There is a general perception that with the arrival of self-driving vehicles, traditional OEMs will suffer a huge loss, mainly due to a decrease in vehicle sales and the cannibalization of the market from new players who will indulge in shared mobility services. As these companies will begin to dominate the vehicle market as everyone would prefer vehicle-on-demand and shared robo-taxis, car ownership will virtually be over and so will the operations of many traditional OEMs. Despite these perceptions, this may not be the case, at least in the foreseeable future. There are many factors which indicate that it will not be a unilateral market in the future, dominated by only mobility service providers, but a mixed habitat of personal, shared, and public vehicles co-existing. There are several unique factors which can lead to people buying personal cars in the future.

Firstly, the new autonomous vehicle industry will not be the same as today's vehicle industry. The emphasis will be more on selling the latest and better technology and features than just a car body. Autonomous vehicles will be made using electric engines, which may be cheaper to manufacture and maintain than the traditional internal combustion engines and will have a more affordable lifetime cost. The chassis and other parts will also become cheaper due to the usage of lighter and lower-cost materials, as autonomous vehicles will be programmed to have almost no road-accidents. Also, the need for

vehicle parts like steering wheels and foot pedals may become obsolete, as no human intervention would be needed, and the vehicles will be redesigned to fit people comfortably. A major part of the cost for the vehicle may be induced from the technology associated with vehicles, along with the customization of technology and features for its customers. This cost too will be reduced due to factors such as mass scale of production, decreasing rates of semiconductors and other hardware components, and open source availability of data and technology, among others.

Secondly, self-driving vehicles will lead to a renewed sense of usage for cars than what we know of now. As consumers will be able to do much more than just travel in their personal vehicles, people may use these cars as a personal traveling-office, or as a small shop-on-wheels for small businesses. People can work, rest, play, enjoy content streaming, or even use the cars as a traveling home or storage. New vehicles types will lead to new usage for vehicles.

Lastly, socio-economic factors will come for the sales of personal vehicles. There are many groups such as families with children and elderly, people living in rural or remote areas away from cities, people having to travel a lot who would require instant accessibility to a vehicle, or people who would not like to lose their ability to drive and move at their will, among others, would be the ones who would prefer a personal vehicle

rather than using a shared mode of travel. The new autonomous vehicles will be software-heavy and their price/performance ratio will track to Moore's Law. These vehicles would need regular Over-the-Air upgrades. As new features along with new designs are released, there will be an appeal for owning the latest models, and consumers will drive the need for more customized vehicle with diverse functionalities.

These factors will ensure the continued sales of personal autonomous vehicles, but OEMs would need to change its strategies to win in this new ecosystem. There needs to be certain strategical changes in the approach for these companies to thrive with autonomous vehicles.

OEMs would need to understand customer demand and product trends related to offering of Level 3 autonomous vehicles and higher. The first-mover advantage will be crucial for any company, and gaining customer confidence in their product will be key to winning a substantial portion of the market share, as many people are still wary of using self-driving vehicles.

Partnerships with players across the ecosystem would be crucial for maintaining a steady supply chain and a streamlined research and development initiative across various technologies, which will help companies to have the edge over its competitors and provide better features at lower costs for its consumers.

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3 4

OEMs need to focus on other revenue streams from this new car ecosystem, such as software maintenance, parking, Transportation-as-a-Service, comfort and content option's customization, among others. There needs to be a restructuring of the OEMs dealerships to help with these new models of income, which will act as hubs for services and logistics for the new autonomous vehicles.

Customers need to see the benefit in adopting autonomous vehicles, in terms of safety, cost, and facilities. Once the adoption starts and an aftermarket is also established, Economics of scale will ensure that the vehicles are available at a cheaper rate to a much larger target group of customers for the OEMs. For this, OEMs would need to prove autonomous vehicle's viability by feasibility studies and BTL advertising for these vehicles.

HOW WILL COMPONENT SUPPLIERS WIN?

RECOMMENDATIONS FOR COMPANIES

Suppliers in the autonomous ecosystem have a great chance to increase their revenues and defining themselves as a market leader. The focus point for suppliers should be to identify their opportunities and make developments according to different markets.

Suppliers will operate with OEMs, technology hardware providers, MaaS providers, and in the aftermarket. They need to expand their products to provide cost-effective components and services to suit all different segments. Suppliers need to outlive others in terms of system integration, assembly-line retrofitting, sensor calibration, and a robust SCM, to win the market, as OEMs would prefer entire systems delivered to them rather than getting different subcomponents from multiple channels to reduce the cost of the vehicles.

Suppliers need to innovate regularly, to keep bringing new and competitively priced tech into the market and provide a tough competition to other suppliers. Also, there needs to be a diverse product strategy, to cater to different component needs for any segment. It would be important for the suppliers to produce their component systems at low cost and high-volume scale to ensure a good market share, as suppliers, especially from the APAC region will be huge disruptors.

Suppliers need to aggressively form partnerships, mergers, or attract investments for their companies. This will benefit them in multiple ways, as they will be able to get more R&D funds, get more experienced people and resources for their projects, get more data and technological tools for their systems, and participate in autonomous vehicles trials to get a good understanding of their product's quality and the component market.

Suppliers would have to win over the confidence of the customers to ensure a steady and quick market growth. There has been a shift in the technologies related to sensors such as LiDARs, where consumers have moved from mechanical state LiDARs to new types of solid-state LiDARs, due to their increased performance and lower cost. Similar technological innovations are needed for other products to gain public acceptance.

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CONCLUSION

STAKEHOLDERS SUCH AS VEHICLE MANUFACTURERS, COMPONENT SUPPLIERS, TECHNOLOGY PROVIDERS, AND MOBILITY SERVICE PROVIDERS ARE EXPECTED TO EMERGE AS KEY PLAYERS IN THE NEW ECOSYSTEM. STRATEGIES SUCH AS PARTNERSHIPS, COLLABORATIONS, AND JOINT VENTURES WOULD BE CRUCIAL FOR COMPANIES TO GROW IN DIFFERENT VERTICALS. INVESTMENT FIRMS WILL ALSO HAVE A PROMINENT ROLE IN DECIDING WHO WILL BE THE MARKET LEADERS, AS HIGHER RATE OF INVESTMENTS WILL LEAD TO RAPID RISE IN RESEARCH AND DEVELOPMENT ACTIVITIES ALONG WITH BUSINESS EXPANSIONS.

Companies need to focus on devising strategies to capture the shifting profit pools, as new autonomous vehicles would create new profit pools. Some OEMs and major technology companies have already begun to invest in, partner with, and acquire companies which are focusing on mobility to increase their existing capabilities. The need for better safety, ease of travel, and affordable transportation can lead to a widespread public acceptance of new products and services from the automotive industry. In the next whitepaper, the last mile connectivity, a key aspect of these services from the automotive companies will be covered. The current and future modes of last mile connectivity, along with its challenges and recommendations for companies would be examined. OEMs and suppliers are expected to gain a large the market share for the new autonomous vehicle industry, provided they make their strategies more innovative, with short-, mid-, and long-term goals in mind, as is mentioned in this whitepaper. The evolution of the automotive industry will be guided by how self-driving vehicles and Mobility-as-a-Service becomes more popular with the consumers, and what type of strategies and initiatives would be taken by stakeholders.



WHITEPAPER

The Emerging Autonomous Vehicle Ecosystem

Who will be the stakeholders and how they can win?

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