

Automotive Industry Future

10 Themes that will make a significant impact on the industry

MarketLine Case Study

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1. Overview

1.1. Catalyst

The need to lower the auto industry's environmental impact is driving the sector's ESG considerations. It's mainly focused on reducing emissions through more efficient engines and the introduction of more EV options. In Europe, manufacturers face fines if the average CO2 emissions of their vehicle pool exceeds 95g/km, adjusted for vehicle weight. In 2020, OEM pools avoided fines thanks to higher-than-expected EV sales driven by more market choice and incentive schemes, along with phase-in credits that applied only in 2020 worth 3g/km for each pool. These credits do not apply in 2021 and, with some EV incentive schemes ending, OEMs may find it harder to meet 2021's pool CO2 targets without incurring fines.

1.2. Summary

Automakers previously only had a few ways to continue earning money from customers once they had sold a car – usually aftersales and servicing packages. However, the advent of on-board infotainment and connected vehicle technologies has opened new avenues for automakers to monetize their products. Expect this to increasingly take the form of subscription services – software-based functions made available to users for a monthly fee – enabling the OEM to earn profit throughout the lifetime of the vehicle and even between multiple owners. GlobalData forecasts show that global infotainment revenue is expected to increase from \$29.7 billion in 2021 to \$49.6 billion in 2030 – a CAGR of 5.9%.

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Smaller AV competitors will be taken over by larger ones, leaving only the most established firms on the scale of Waymo or Cruise in the sector. Transport as a Service (TaaS) is the most significant driver of demand for AVs and is driving strategic partnerships – Alibaba is funding AutoX, while FedEx, Aurora, and PACCAR will launch AV trucks in 2023. Waymo is developing autonomous cargo vans and robotaxis with Stellantis and Volvo. By 2025, Level 4 robotaxis will be launched across many urban areas, led by the likes of Didi Chuxing, Uber, Lyft, and tech giants Apple, Amazon and Baidu.

Electric vehicles (EVs) as a proportion of new light vehicle production will rise from 5.3% in 2021 to 11.3% in 2025. The shift towards EVs has been driven by legislative changes to meet ESG targets, but momentum is beginning to shift to being demand-led too. In the short term, the lithium shortage will have little impact on large players with a more vertically integrated supply chain, such as Tesla and Toyota. By 2025, the first solid-state -powered EVs will arrive, likely costing much more than regular Li-ion versions. By 2030, solid-state batteries will be introduced to mass-market EVs.

2021 was a wake-up call for the auto industry, highlighting significant weaknesses in its semiconductor supply. In response, new partnerships emerged, including Ford's agreement with GlobalFoundries, aiming to boost US chip supplies and enhance R&D efforts in ADAS, battery management, and networking. In December, BMW signed an agreement with INOVA and GlobalFoundries for microchips for its ISELED embedded interior LED lighting technology, which the OEM codeveloped, and will see first deployment in the BMW iX. We expect more deals as auto OEMs aim to address short-term semiconductor shortages with upstream partners, while also addressing long-term product development needs

China's Impact in Automotive: China is arguably the most important market, spawning a new generation of manufacturer

Published: September 2021

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2. ESG- Credit changes for 2021 could lead to fines for some OEMs in 2021

The need to lower the auto industry's environmental impact is driving the sector's ESG considerations. It's mainly focused on reducing emissions through more efficient engines and the introduction of more EV options. In Europe, manufacturers face fines if the average CO2 emissions of their vehicle pool exceeds 95g/km, adjusted for vehicle weight. In 2020, OEM pools avoided fines thanks to higher-than-expected EV sales driven by more market choice and incentive schemes, along with phase-in credits that applied only in 2020 worth 3g/km for each pool. These credits do not apply in 2021 and, with some EV incentive schemes ending, OEMs may find it harder to meet 2021's pool CO2 targets without incurring fines.

2.1. Electrification targets will give way to lifecycle analysis and battery scrutiny

With EV targets in place and future bans for combustion engines, there is a refocusing of attention on EV lifecycle sustainability. Combustion vehicles mainly produce emissions during their 'use' phase as they burn fossil fuels. EVs generate almost no direct emissions in use, with the overall use figure determined by how much renewable energy is used when charging. Analyzing EV production cycles can help understand their impact. Both the mining of materials for batteries and motors, and their manufacturing processes bring ESG risks, such as the overconsumption of natural resources, high energy use in production, human rights violations in mines, and the uncertain fate of spent batteries.

2.2. More integrated supply chains to limit ESG risks

For an automaker or supplier seeking to limit its exposure to ESG risk, bringing a larger proportion of its supply chain 'in house' can reduce the potential for issues thanks the ability to deploy consistent oversight across the chain. Already, BMW has signed a lithium supply agreement in 2021 with Livent to take advantage of its sustainable extraction method and will then supply that lithium to its cell manufacturing partners. Elsewhere, Renault has agreement with Vulcan Energy for lithium supply that claims to save up to 700kg of CO2 per battery pack.

2.3. Novel approaches will be employed to reduce environmental impacts

As the auto industry transitions to EV production, it will use novel techniques to minimize the environmental impact. In the search for battery materials including nickel, cobalt and manganese, Canadian startup The Metals Company claims to have located resource-rich 'polymetallic nodules' on the sea floor that can be extracted with far less environmental damage and waste than regular mining. Novel solutions can also be used in EV manufacturing processes, including the use of microfactories as proposed by UK-based commercial EV startup Arrival. These smaller, simpler facilities suit the modular design of EVs, where different models use mostly the same architectural platform. Their benefits include local job creation and economic stimulation, along with a smaller physical footprint which causes less environmental impact.

3. Connected Vehicles- Auto players will be eyeing new income from subscription services

Automakers previously only had a few ways to continue earning money from customers once they had sold a car – usually aftersales and servicing packages. However, the advent of on-board infotainment and connected vehicle technologies has opened new avenues for automakers to monetize their products. Expect this to increasingly take the form of subscription services – software-based functions made available to users for a monthly fee – enabling the OEM to earn profit throughout the lifetime of the vehicle and even between multiple owners. GlobalData forecasts show that global infotainment revenue is expected to increase from \$29.7 billion in 2021 to \$49.6 billion in 2030 – a CAGR of 5.9%.

3.1. The first in-vehicle subscriptions will focus on autonomous driving functions

Many new vehicles now feature level 2 autonomous systems that can control speed and steering in certain areas with human oversight. These systems are costly because they rely on dozens of sensors feeding data to advanced chipsets that run software that takes years to develop. Tesla's range-topping Full Self-Driving system costs \$10,000 outright, but customers now have the option of accessing the system for a monthly fee – \$99 for users with Enhanced Autopilot and \$199 for those with standard Autopilot. Similar moves are being made by EV pickup truck and SUV maker Rivian, which expects to earn around \$10,000 from each of its vehicles over a 10-year period from autonomous subscriptions.

3.2. Strong growth expected in telematics services for commercial vehicles

On-board telematics services are expected to be another valuable profit source for the industry. GlobalData forecasts show that revenue from the telematics market will grow from \$17.1 billion in 2021 to \$49.7 billion in 2030 – equating to a CAGR of 12.6% – with most revenue generated by the commercial vehicle sector. As ever, securing market share will be vital to success in this theme, so we expect industry consolidation within the fragmented telematics market. Established players such as Mix, Geotab and OnStar must push to compete with new entrants into the market.

3.3. Automakers to push for more vertical integration of software stack

Automakers are looking to connected vehicle tech to differentiate their on-board experience from their rivals. In July 2021, Volkswagen created Cariad, a subsidiary to centralize its software efforts that were previously scattered among 15 separate companies. Cariad will build 'vw.os', the company's new operating system that will be deployed across its entire lineup by 2025, bringing VW's share of in-house auto software development up to 60%. Stellantis has announced a similar strategy, with three unified software stacks to be used across its range – STLA SmartCockpit for infotainment functions, STLA AutoDrive for autonomous driving and STLA Brain to underpin all systems in the vehicle.

4. Autonomous Vehicles- AV partnerships are developing autonomous trucks and taxis

Smaller AV competitors will be taken over by larger ones, leaving only the most established firms on the scale of Waymo or Cruise in the sector. Transport as a Service (TaaS) is the most significant driver of demand for AVs and is driving strategic partnerships – Alibaba is funding AutoX, while FedEx, Aurora, and PACCAR will launch AV trucks in 2023. Waymo is developing autonomous cargo vans and robotaxis with Stellantis and Volvo. By 2025, Level 4 robotaxis will be launched across many urban areas, led by the likes of Didi Chuxing, Uber, Lyft, and tech giants Apple, Amazon and Baidu.

4.1. Regulatory environment for AVs likely to become stricter in the US

The cost and difficulty of developing 'eyes-off' level 3 and up AVs means automakers are likely to focus more on level 2 systems that offer a clearer return on investment. These systems require constant oversight from human drivers, somewhat exonerating the OEM of liability in the event of an accident. In the US, the previous Trump administration took a hands-off approach to encouraging safety regulation of AVs. Following the election of President Biden, the NHTSA has been given new leadership and has opened an investigation into Tesla's Autopilot system following several crashes involving emergency vehicles. This could see new regulations imposed in the US limiting the deployment of level 2 autonomous systems, making it harder for automakers to test new technologies without gaining regulatory approval.

4.2. Level 3 AV deployment has begun but will remain extremely limited

Level 3 AVs – those that control the vehicle's speed and steering in geofenced areas without the oversight of the driver – are expected to be deployed far slower than level 2 and below, and level 4 and above systems. This is because level 3 sits at an awkward point where the system's complexity is so high that the cost makes it less tempting for deployment across mass-market vehicles – not least due to the liability the OEM may have to accept if it crashes in AV mode. Plus, it lacks the utility of level 4 and above systems that are more applicable to robotaxi fleets. Nevertheless, Honda became the first OEM to take the plunge in March 2021, gaining approval to sell a small number of level-3-equipped Legend luxury sedans exclusively for the Japanese market. Daimler won approval from German authorities to begin selling level3-equipped versions of the S-Class and EQS in Germany from 2022, while BMW and Stellantis are jointly targeting 2024.

4.3. Solid-state LiDAR deployment to accelerate

LiDAR uses laser beams to sense distances. Its all-weather operation means it's considered by many to be safety-critical for AVs. Bulky spinning LiDAR units that see in 360-degrees have been used on AV test vehicles but are too costly for mass deployment. Solid-state LiDARs that have no moving parts arrived in 2020 with Velodyne, Luminar and Robosense launching production models – these only scan in one direction but are much cheaper and easier to build into a vehicle.

5. Shared Mobility- Ride hailing companies will add new dimensions to their suite of offerings

While 2021 witnessed a gradual recovery in number of rides and revenue per ride, ride hailing companies continued to struggle with squeezed profits from the segment. Uber's number of rides in Q3 2021 grew by 39% when compared to Q3 2020 but the company suffered a net loss of \$2.4 billion during the period. Further, external factors such as consumer fears over risk of transmission, prevalent work from home culture and regulatory obligations in the US and China continue to impact the operations. As a result, ride hailing companies have added new dimensions to their business models. Uber acquired an on-demand alcohol marketplace in North America and added critical delivery services to its portfolio. Lyft expanded into vehicle maintenance with Lyft Auto Care, Ola and Gojek entered into manufacturing of electric two-wheelers with strategic acquisition and partnership, respectively. Ola launched Ola Cars platform for buying, selling and financing vehicles. A GlobalData survey indicates 46% of respondents remains pessimistic on recovery of shared mobility services to pre-COVID levels in 2022. The omicron COVID variant adds to uncertainty over the pace of recovery in 2022 leading to more ride hailing companies restructuring, divesting or diversifying their core business.

5.1. Regulatory approval for commercialization of Level 4 robotaxis to accelerate

Autonomous vehicles are gaining regulatory approvals across the world's key urban areas for commercial use. Shared mobility is the most significant driver for AVs and is the epicenter of the megatrend. Waymo already has regulatory approvals. It introduced a ride hailing fleet with its Level 4 vehicles and offers 20K to 40K rides a quarter in the US. In China, after AutoX which received approval in January 2021, Baidu and Pony.ai have also won approval to run commercial driverless ride hailing services in Beijing with fleet of not more than 100 level 4 AVs. Germany is also set to legalize the commercial use of Level 4 AVs as taxis by 2022. Approvals are also on the cards in Japan for 2022. Teraki GmbH and Mobileye aim to launch robotaxi services in Germany in 2022. WeRide, the Level 4 AV company along with partners GAC Group and mobility platform ONTIME also aims to get commercial approval for robotaxi service in China in 2022.

5.2. Micromobility to offset demand gap from other services

Micromobility covers 'last-mile' solutions that account for shorter journeys using E-scooters or E-bikes. These vehicles fill the gap left when users cease the use of private vehicles for short journeys. Being an eco-friendly and socially distanced transport, they will continue to see growth in the near-term. A favorable worldwide regulatory environment and a hoped for easing in COVID-19 restrictions in 2022 will be key drivers. As with EVs, the rise of electrified micromobility options is aided by greater availability of affordable lithium-ion batteries, electric motors and power electronics. With these ingredients, manufacturers can churn out enormous numbers of these devices to sate the growing demand in urban areas.

6. Electric Vehicles- Annual EV production will exceed 10 million units by 2025

Electric vehicles (EVs) as a proportion of new light vehicle production will rise from 5.3% in 2021 to 11.3% in 2025. The shift towards EVs has been driven by legislative changes to meet ESG targets, but momentum is beginning to shift to being demand-led too. In the short term, the lithium shortage will have little impact on large players with a more vertically integrated supply chain, such as Tesla and Toyota. By 2025, the first solid-state -powered EVs will arrive, likely costing much more than regular Li-ion versions. By 2030, solid-state batteries will be introduced to mass-market EVs.

6.1. China's EV fleet will be 60% of the world's total by 2030

Though Europe's EV fleet grew at a faster rate than China's in 2020, China will continue to dominate the EV landscape. In 2020, 48% of all EVs on the road could be found in China, more than the combined US and Europe figure. Chinese automakers are less disadvantaged by the lithium shortage as they have access to most raw materials needed to build batteries. The Chinese government has extended its sales tax exemption on EVs to the end of 2022 to support its net zero target year of 2060. It has also extended its subsidies for domestically built EVs to the end of 2022, with Tesla hence losing market share in China to BYD. EVs will contribute to 25% of China's new car sales by 2025.

6.2. Legacy automakers have now electrified, and pose a big threat to EV startups

Over the last decade, EV startups spearheaded by Tesla amassed a large lead over traditional OEMs in the EV space. As Tesla's sales and valuation rose dramatically, the gulf between it and the legacy automakers seemed vast. Their inflexible manufacturing networks suffered from overcapacity, while the Californian startup was racing to ramp up pure-EV production to meet soaring demand. However, after some multi-billion-dollar investments, legacy OEMs are ready to deploy EVs at scale. Notable examples include the Ford F-150 Lightning pickup – an EV version of North America's most popular vehicle – or Volkswagen's expanding ID range. This means the advantage enjoyed by startup EV companies has mostly evaporated, while legacy OEMs' vast manufacturing experience is likely to begin paying off.

6.3. Increased scrutiny over EV startups eager to go public via SPAC deals

In the race to launch new vehicles and secure manufacturing and supply networks, some EV startups sought to list themselves publicly to take advantage of ready investor cash. Some opted to list via special-purpose acquisition companies (SPACs), shielding them from some of the investor scrutiny involved in a traditional IPO. However, a number now find themselves the subject of investigations by regulators following accusations of overstating their technical capabilities or falsifying pre-orders. Lucid, Nikola and Lordstown Motors are all currently subject to SEC investigations, indicating that the regulatory environment for funding in the EV space may become more stringent in the future.

7. EV Batteries– New giga factories will drive dramatic increases in lithium-ion production capacity

Ambitious electrification strategies will see demand for lithium-ion battery cells skyrocket. Battery producers around the world are committing to multi-billion-dollar expansion strategies, opening new 'gigafactories' to supply cells to automakers. GlobalData figures show that worldwide production capacity for Li-ion cells stood at 622.6GWh in 2021 – assuming an average pack size of 60kWh, that's enough to power around 10.4 million electric vehicles. For 2022, this figure is set to nearly double to 1,140GWh – enough for 19 million 60kWh EVs. With greater production capacity come larger economies of scale, which could push the price of Li-ion cells down to the magic \$100 per kWh mark.

7.1. Tesla's new 4680 cell format will either succeed or fail

Tesla revealed its new 4680-format cylindrical lithium-ion cell in September 2020 – named for its 46mm diameter and 80mm height. The new larger-format battery means fewer cells are needed to build each pack, reducing production time and cost. Plus, each individual 4680 stores five times as much energy and outputs six times as much power as the older 2170 format – leading to a claimed 16% extra range at a pack level compared to Tesla's existing cell technology. Tesla linked the 4680 to many of its new vehicle projects including the Cybertruck pickup, the Semi truck and the cancelled Plaid+ super-sedan, but production delays mean the company isn't planning on rolling out the new cell until 2022.

7.2. Battery swapping infrastructure will grow but remain small

EV battery swapping sees drivers pull up to an automated station where, in just a few minutes, a robotic system removes their spent battery pack and reinstalls a fully charged one. It solves range anxiety and can improve battery service life thanks to the fact swap stations can charge packs more gently. However, it calls for compromises in vehicle design to incorporate the swapping mechanism, and swapping stations incur higher infrastructure costs than charging points. Nevertheless, in December 2021, NIO – a leading battery-swapping EV maker – opened its 700th swap station in China. This indicates that in high-density urban areas, where plug-in charging is not readily accessible, could be an idea worth revisiting despite the earlier failure of Israeli start-up BetterPlace.

7.3. Solid-state cells will begin testing but be slow to appear in production

EVs Solid-state batteries promise more energy and power density, lower production costs, and better safety. While solidstate developments are progressing, we don't expect these next-gen cells to appear in EVs until around 2024/2025, tallying with timelines proposed by VW, BMW and Toyota. Nevertheless, solid-state test cells are expected to make their way into OEM hands in 2022 – among them, Ford and BMW are due to receive cells through their investment in Solid Power. Elsewhere, NIO plans to fit a 150kWh solid-state pack to its models by the end of 2022.

8. COVID-19- Outlook for 2022

COVID-19 piled unprecedented financial and organizational pressure on the auto industry at a time when it was already straining to respond to emerging CASE megatrends. 2020 saw sharp declines in auto sales and production, and the recovery through 2021 has been hampered by supply chain issues. These are exacerbated by the current semiconductor shortage impacting the supply of many electronic auto components, causing production delays across the industry. This lack of momentum should continue into H1 2022 but, with OEM build back mounting, improved supply should see sales pick up in H2. Nevertheless, the H1 stall will see total 2022 sales hit just 84.1m – about the same we would have expected for 2021 before the chip crisis. Markets remain inverted at present because levels are led by production. While there is currently decent demand, macroeconomic storm clouds are gathering, and the omicron variant brings more uncertainty. Pressures from rising energy costs and inflationary sources are mounting, potentially dampening demand before supply is realigned. On the flip side, fiscal stimulus is still abundant and personal mobility needs are high.

8.1. With omicron unknown, chips still the heaviest weight on auto industry recovery

While the chip shortage originated before COVID-19 stemming from limited raw material supplies, the pandemic dramatically accelerated the issue. Auto demand fell sharply in 2020, leading OEMs to cancel orders with chip makers, who then pivoted to other sectors such as personal electronics where demand remained high. This included prioritizing orders of the latest 5nm chipsets, while automakers usually rely on older processes with larger nanometer increments. With chip manufacturing still far below the levels needed to return to business-as-usual auto production, it will remain the largest brake on auto sales growth throughout 2022. In response, automakers will continue to ration their existing supplies according to the model lines that generate the best margins – production of pickups, large cars and SUVs will see a relatively small impact, while compact cars, small cars and MPVs will see a larger dent in their numbers.

8.2. Omicron variant is latest risk to stability

As COVID-19 infections continue to rise and fall around the world, the virus has mutated into several different variants. With each newly discovered variant, the risk increases that one could emerge as more contagious and/or more resistant to current coronavirus vaccines, bringing with it a new wave of infections, lockdowns and general disruption. At the end of November, a new variant dubbed Omicron was announced by South Africa, although it had likely already been circulating in a few countries for a while. There are concerns that Omicron could be more transmissible than previous variants, and be more resistant to vaccines, which could impact the automotive industry through disrupted supply chains, forced production closures and slowing sales if lockdown orders are reintroduced.

9. Strategic Partnerships- More agreements to secure critical semiconductor supplies and mitigate future risk

2021 was a wake-up call for the auto industry, highlighting significant weaknesses in its semiconductor supply. In response, new partnerships emerged, including Ford's agreement with GlobalFoundries, aiming to boost US chip supplies and enhance R&D efforts in ADAS, battery management, and networking. In December, BMW signed an agreement with INOVA and GlobalFoundries for microchips for its ISELED embedded interior LED lighting technology, which the OEM codeveloped, and will see first deployment in the BMW iX. We expect more deals as auto OEMs aim to address short-term semiconductor shortages with upstream partners, while also addressing long-term product development needs

9.1. Electrification will remain a key driver of strategic alliances

Many automakers have struck agreements with battery makers including CATL, LG, Panasonic, Samsung and SK, with more to follow in 2022. At the same time, OEMs are likely to vertically integrate more of their EV supply chains in the future. SK and Ford have jointly formed BlueOvalSK in North America, reflecting Ford's ambition to bring more of its battery cell supply in house. Elsewhere, VW is planning to undertake some cell production itself – initially agreeing to a JV facility with Northvolt in Germany, before deciding to buy out the Swedish company's share, bring the operation fully in-house. Daimler recently acquired a stake in cell manufacturer ACC – a JV between Stellantis and TotalEnergies.

9.2. More companies working together on software stacks for advanced applications

Spending on CASE megatrends came under scrutiny with the emergence of COVID-19, but there is still a feeling that they remain important, even if their timelines and weightings have changed. Software is an area where we are seeing more collaboration between automakers and suppliers. We also expect more OEM partnerships – the thinking being that players can co-develop complex software without compromising on brand differentiation. BMW, for example, is working with Stellantis on an ADAS software stack. We also expect to see suppliers, such as Foxconn and Hyundai Mobis, pursuing software stack opportunities as they accumulate more capabilities across different vehicle systems.

9.3. OEM shared mobility and AV tech collaborations to increase

2022 is likely to see shared mobility use accelerate as COVID's impact wanes and demand for urban delivery remains strong. Over time, more of that mobility will be facilitated by autonomous tech, driven by interest from OEMs and AV developers. Limited commercial robotaxi services are available in a handful of US cities, and Beijing has now awarded commercial robotaxi licenses to Baidu and Pony.ai. Mobileye plans to launch a pilot robotaxi service with Sixt and Moovit in Munich from 2022. Keep an eye on commercial vehicle applications, too. Waymo has partnered with Daimler to develop autonomous freight trucks, and is working with Stellantis to fit Waymo Driver to the Ram ProMaster van.

10. Cybersecurity- Cybersecurity spending by OEMs to accelerate with UNECE Regulation 155

The United Nations Economic Commission for Europe formally introduced Regulation 155 in January 2021. It obliges automakers to implement best practices to mitigate cybersecurity threats. This includes ensuring they have sufficient processes in place to promote cybersecurity, their vehicles are using appropriate cybersecurity architectures, and that they can demonstrate cybersecurity risk mitigation. Regulation 155 will form part of new vehicle type approval in Europe – except for models seeking approval before July 2024, where it is not possible to comply with the regulation. Regulation 155 is likely to increase R&D costs for automakers due to increased cybersecurity activities and costs.

10.1. Cybersecurity regulations will change as they adapt to new threats

In crafting Regulation 155, the UNECE has specified goal-driven targets, rather than specific methods to defend from cybersecurity threats. This is important because cybersecurity threats are constantly evolving as bad actors continue to develop new ways to break into systems. This means that auto companies need to be prepared for updated cybersecurity requirements further down the line as new threats emerge. The Society of Automotive Engineers (SAE) has developed the 21434 standard in collaboration with the ISO. ISO/SAE 21434 sets out a means for automakers to demonstrate compliance with Regulation 155, and a framework to present evidence to support a vehicle type approval application.

10.2. Cyberattacks on auto industry will increase in frequency and severity

The driving reason behind the increased focus on cybersecurity is due to the increased risk of cyberattack the auto industry faces as it introduces more connected, digital and electronic systems to new models. Ransomware attacks have already impacted Honda, VW, Peugeot and Kia across 2020 and 2021, with many other global OEMs suffering data breaches of their own. Most recently, Volvo Cars reported in early December 2021 that some of its digital R&D resources had been stolen in a cyberattack, although the loss was limited and did not affect customer data. The industry faces an increased risk of cyberattacks in the future, with ransomware and IP theft likely to accelerate.

10.3. Increased patent activity and hiring patterns in automotive cybersecurity

The drive to improve the cybersecurity of vehicles and the wider automotive industry can be observed both through the statements of auto companies committing to defend their IP, but also through measures of patent activity and hiring patterns in the field. GlobalData figures show that cybersecurity-related patents granted from 2011 to 2020 increased at a CAGR of 20.3%, with more than 7,800 individual patents tracked in 2020. The same trends can be seen in hiring patterns tracked by GlobalData's Job Analytics service – we tracked 318 open cybersecurity jobs across the auto industry in Q3 2019, compared to 2,555 at the end of Q3 2021, equating to a more than 700% increase in just two years.

11. Internet of Things- Strong growth in IoT penetration across automotive applications

IoT finds its application in all stages of the automotive value chain. With the rapid growth of CASE megatrends and intelligent/smart manufacturing, the penetration will go deeper. GlobalData expects the global IoT market to generate \$1,077bn in revenue by 2024. Global IoT revenue for connected cars will reach \$42bn by 2024 and the CAGR between 2019 and 2024 will be 6.8%. Tangible devices such as sensors, gateways, actuators, and platform hubs connect and interact with each other over a wireless network. With a growing focus on connectedness by all OEMs, IoT applications in auto such as in-vehicle entertainment, telematics, autonomous features, safety and security will continue to grow.

11.1. Automotive factories will adopt extensive installations of IoT networks

IoT will play a significant role in improving the efficiency of the automotive value chain. IoT enables all parts of an assembly line to be connected to a central monitoring hub, reducing downtime and increasing process efficiency. Devices encompassed include automated guided vehicles, parts pickers, scanners, quality control stations and human-machine interfaces. Many stakeholders are already in the race, some recent examples are Nissan's Intelligent factory, Mercedes's Factory 56, Huawei's partnership with Neta for EV manufacturing, and GeicoTaikisha's IoT based painting equipment.

11.2. Intelligent edge will become mainstream and a primary accelerator for IoT

Edge computing – the remote processing of data before sending it to an IoT cloud will come to the fore and driven by the sheer increase in the amount of data being exchanged. Cloud-based systems don't have the latency required to respond quickly enough to the data signals. Edge in automotive could see autonomous vehicles parsing and analyzing some of the self-driving data they gather before sending it to a central system for big data analysis. Honda is working with Verizon to explore the role of 5G and mobile edge computing (MEC) in autonomous and connected uses cases. V2X requires onboard AI. By using 5G and MEC, AI capability is removed from the car, reducing the need for onboard AI.

11.3. 5G developments to make connectivity more effective, reliable and secure

Greater proliferation of 5G will enable more data-heavy connections between IoT devices and enable new services. Tech companies including 5G mobile solutions providers and key Tier 1 suppliers are expanding their presence in 5G connectivity solutions for automobiles. Samsung recently launched its latest automotive chip solutions for 5G connectivity, Lear Corp has announced that it will start the supply of 4G/5G telecommunication units to an EV maker by late 2022. Meanwhile, Ford and Volkswagen established in-plant private 5G networks to enhance vehicle production.

12. Appendix

12.1. Further reading

Automotive Manufacturing (2021) MarketLine Industry Profile

Global Automotive Industry: Severe impact from the coronavirus economic shutdown (2020) MarketLine CaseStudy

13. Ask the analyst

We hope that the data and analysis in this case study will help you make informed and imaginative business decisions. If you have any questions or further requirements, MarketLine's research team may be able to help you. The MarketLine Research team can be contacted at ReachUs@MarketLine.com.

14. About MarketLine

At MarketLine, we deliver accurate, up-to-date insights on over 100,000 companies, 3,500 industries, 215 countries, and 3,000 cities as well as the latest news and financial deal information from within your market and across the globe.

Established in 1997 when the Internet was in its infancy, we recognized the need for a convenient and reliable data service to help our clients understand local and global markets and the companies operating within them.

In today's information-rich world, sifting fact from fiction to pick out what's relevant and what's up to date has become the new 'holy grail' in business information provision.

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