GEARING UP FOR THE METAVERSE

How immersive technologies will reshape the automotive industry

THE HIGHWAY TO CREATION:
METAVERSE AND WEB3

The metaverse will inevitably impact every aspect of the automotive industry.

In the history of technology, truly groundbreaking developments become household names. For the last decade, people have been using 'Google' as a verb, asking whether or not there is an app, and saying 'post' when they mean publish online. Blockchain technology led to the most famous acronym in a generation: NFT or Non-fungible Token. Now, combined with Virtual Reality (VR) units, the same technology has created two more increasingly popular neologisms: metaverse and web3. Only those living under a rock for the past few years would not have heard these terms. But they will, soon, because the reverberations of disruptive

tech touch all aspects of life. The automotive industry is no different.

This report examines the many ways the automotive industry is set to be transformed by these two highly anticipated innovations.

The metaverse will inevitably impact every aspect of the industry. But this report will look at the impacts felt along the value chain and application fields. Additionally, it is worth exploring the many strategic opportunities expected to arise for key players and OEMs worldwide.

METAVERSE

Since the end of 2021, it has been almost impossible not to come across "the metaverse," a coinage used to describe a virtual space based on 3D models that enable us to be present in an immersive virtual experience.

Alexandre Embry, Global Head of Immersive Technologies & Metaverse from Capgemini describes it this way:

"The Metaverse is an open network of decentralized 3D virtual and hybrid spaces, a persistent place that is parallel to the physical world, with an aim to combine online digital and real-life experiences with the sense of presence, independent of place, time or device. The Metaverse enables more emotional connections with consumers, boosts creativity - giving ownership to individuals and communities - reinvents the employee experience and collaboration, and fuels transparent and more efficient supply chain, manufacturing and engineering processes."

While the metaverse as a concept is still hard to grasp, the technologies used to build it are not. Looking at a simplified technology stack, we see that software and hardware are the underlying enablers of the "application layer" depicted as the metaverse. What is different to the current state of infrastructure is that there is a core belief that the metaverse will be built on Web3.

> *Web3 is one of the key enablers for the metaverse.*

WEB3

Web3 is defined as the next generation of the internet, built on distributed technology and a token-based economy. Recollecting the early days of the internet and its functionalities, it becomes evident that it was not built to transfer digital goods and values. It was more of a read-only system offering access to HTML documents via a browser. Web2 created a participatory form of the internet, where users could create and distribute content in mostly centralized platforms. Still, content generation and content ownership were not connected. This is about to change. The promise of Web3 is to eradicate this design flaw by decentralizing platforms and attaching ownership to creation, thus democratizing the internet and its data.

With Web3 being one of the key enablers for the metaverse, one can say that immersive technologies and Distributed Ledger Technologies (DLT) are the key foundational layers of the metaverse. From an immersive point of view, virtual reality (VR), augmented reality (AR), mixed reality (MR), and technologies like mid-air haptics and volumetric scans will enhance experiences in the metaverse in ways not yet imaginable. Meanwhile, DLT-based topics, such as Non-fungible Tokens NFTs, Decentralized Finance DeFi, and Digital Autonomous Organizations DAOs will reshape the financial ecosystem as we know it today.

[1] Wave emitters that let users manipulate virtual objects in the air without wearing
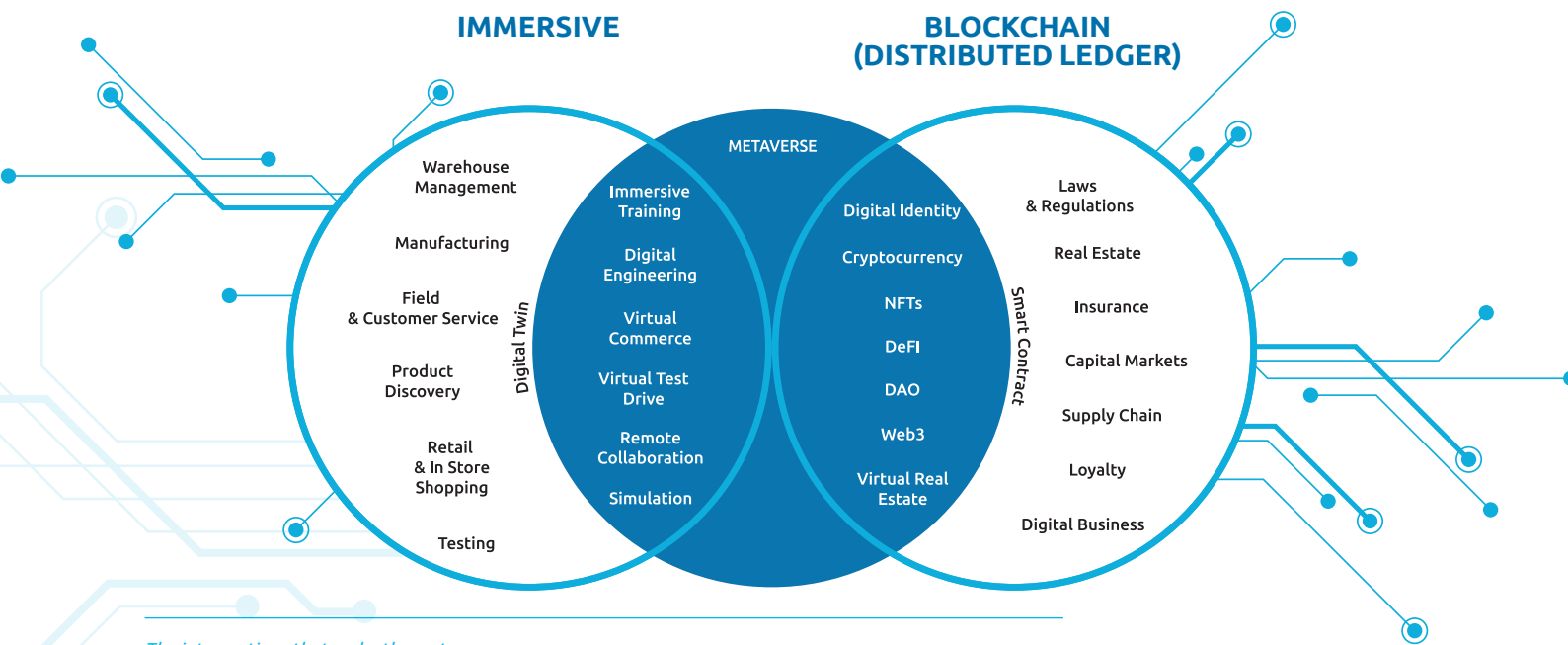
THE AUTOMOTIVE INDUSTRY CAN TAP INTO THIS POTENTIAL

By leveraging immersive technologies and DLT (e.g., blockchain), applications and use cases across industries can be transformed and extended from offline and centralized applications to decentralized playing fields

(e.g., NFT, DeFi, DAO) and immersive experiences and working environments (e.g., immersive trainings, remote collaboration). In the midst of virtualized and decentralized applications, we also recognize central playing fields and the enormous potential at two borders: real and virtual worlds (e.g., Digital Twin) and centralized and decentralized authority (e.g., Smart Contracts).

The transformative power of immersive technologies is also set to shape the automotive industry in potentially fundamental ways, including such emerging use cases as digital engineering, simulation, testing, monitoring, operations, virtual training, virtual commerce, and digital identity.

IMMERSIVE   BLOCKCHAIN (DISTRIBUTED LEDGER)

METAVERSE

Warehouse Management

Immersive Training

Digital Engineering

Manufacturing

Virtual Commerce

Field & Customer Service

Virtual Test Drive

Product Discovery

Remote Collaboration

Retail & In Store Shopping

Simulation

Testing

Digital Twin

Digital Identity

Cryptocurrency

NFTs

DeFI

DAO

Web3

Virtual Real Estate

Smart Contract

Laws & Regulations

Real Estate

Insurance

Capital Markets

Supply Chain

Loyalty

Digital Business

The intersections that make the metaverse

To get a granular view of the metaverse in automotive, this point of view explores the metaverse within the automotive industry and outlines the transformative power of technology and its implications for business. Additionally, we discuss the potential upstream and downstream impacts on the industry and its value chain.

Upstream activities include those related to an organization's Engineering Research and Development (ER&D), procurement, supply chain, and operations while downstream refers to post-manufacturing activities, such as sales, marketing, mobility services, and customer experience.

Finally, we conclude this paper with a chapter showcasing and analyzing initially identified use cases and use case clusters and derived strategic fields of opportunity for players in the space.

UPSTREAM   DOWNSTREAM

| ER&D | Procurement | Supply Chain | Production | Sales | Aftersales/ Digital Business | Mobility |
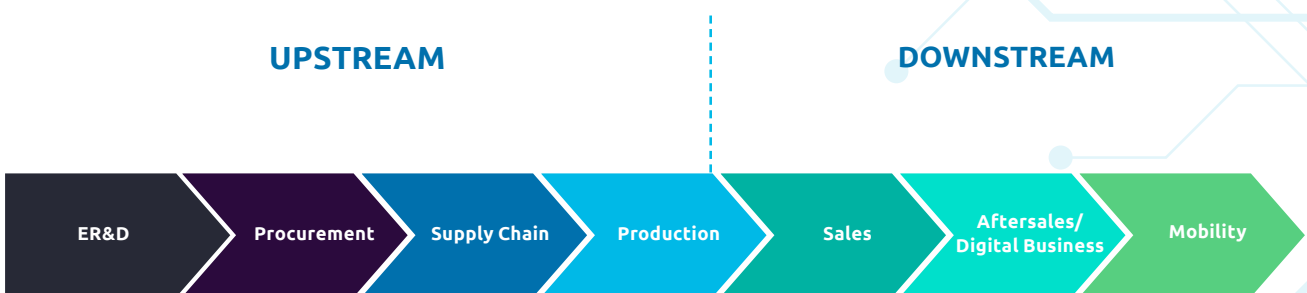
THE AUTOMOTIVE VALUE CHAIN: **UPSTREAM**

The upstream metaverse-related value chain can be broken down into three applications: design, production, and performance. Most of these applications are enabled by mixed reality and blockchain technology. To explore the applications in more detail, it is essential to first understand blockchain technology and mixed reality.

For the automotive industry, the integration of blockchain technology and MR with the metaverse will give rise to many applications. Increased collaboration opportunities, both within organizations and with external communities, will lead to an outpouring of ideas during the design phase. The metaverse gives us the realm to virtually create and experience fictitious environments and scenarios, expanding creative boundaries. Furthermore, being able to build and test designs under different behavioral, structural, and climatic conditions in a virtual setting leads to significant cost and safety related benefits (e.g., less real-world hazards). The expected economies of scale are significant. Additionally, virtual testing has the potential to reduce costs and save time during the production phase. For example, a factory's digital twin can be assessed and optimized virtually. Only final changes will then be implemented in the real world with minimal downtime.

Beyond production, the metaverse can provide value to the supply chain through shared compliance information and the existence of one trusted network of suppliers. This will make it possible for materials and transformed parts to be tracked electronically by all stakeholders in a transparent manner. Moreover, it will lead to the successful local identification of any processing errors. Consequently, companies will see an increase in efficiency, transparency, and traceability. This implementation of blockchain technology is only possible when integrating automation that can identify various materials. Blockchain technologies enable supply chains to be more secure because the origin and authenticity of products are known, proven, and shared.

The digital twin concept facilitates the optimization of the production chain. Creating a virtual replica of the factory will make it possible to simulate the manufacturing of multiple vehicles across multiple assembly lines, testing which is the most efficient. This optimization of internal factory paths will allow for more efficient and cost-effective A/B testing. For example, in collaboration with NVIDIA, BMW offers us a use case for the digital twin. BMW is able to offer digital management of its factory by making use of augmented reality, mixed reality, robotics, and AI. This experience reflects the potential of a bridge between reality and digital. Thanks to this technology, learning will also be more fluid, immersive, and compelling. Being able to dissect an engine piece-by-piece in the metaverse will lead to better operational understanding and more realistic performance tests, since we will be able to analyze how elements interact. But that's not all.

A/B testing in the metaverse and mixed reality will increase manufacturing performance, creativity, and savings. These improvements will be extended by the collection of data, which will lead to better vehicle performance, safety, and comfort. The application of the metaverse in the upstream segment of the value chain is a snapshot of just how much the technology can transform industries.

In the future, the industrial metaverse could eventually be leveraged to support some remote operations as well, providing the feelings for workers to be on the real site from everywhere. Thanks to advanced 3D real-time visualization, combined with IoT, AI, natural interfaces, and robotics, we might be able to deliver recurring field operations from office or home, even collaborating with other on-site or remote peers with co-presence feelings. Imagine how powerful it could be in critical environments; improving workers' safety, reducing physical on-site presence, hence enabling more efficient manufacturing processes.

THE AUTOMOTIVE VALUE CHAIN: **DOWNSTREAM**

NFTs will test the market's appetite and initiate collaboration between car manufacturers and the community.

NFTs have incredible power in the metaverse, linking the virtual and the real world. In the automotive industry, this link offers just as many applications downstream as it does upstream. Immersive tech linked to NFT technology will enable us to generate value in general user experience, branding, sales, aftersales, digital business, and mobility services. Just like in the upstream, many of these applications are linked to the use of the metaverse as a purely digital and mixed reality element.

Before we dive deeper, let's recall two definitions of NFT. Dipanjan Das, Priyanka Bose, Nicola Ruaro, Christopher Kruegel, and Giovanni Vigna from the University of California, Santa Barbara state that:

"In the cryptocurrency world, an NFT is the equivalent of a conventional proof-of-purchase, such as a paper invoice or an electronic receipt. Among other things, what makes NFTs attractive are verifiability and trustless transfer. Verifiability means that sales are recorded as blockchain transactions, making ownership tracking possible.

"In addition, the NFT concept allows for the trading of digital assets between two mutually distrusting parties, as both the crypto payment and the asset transfer happen atomically in a single transaction."

Next, it is important to look at the applications linked to DLTs. But we first need to create an overview of Ethereum (a specific DLT), which shows extended technological capabilities compared to other DLTs and further use cases than comparable technologies. Ethereum makes it possible to run "smart contracts," autonomous programs that automatically execute actions validated beforehand by stakeholders.

The metaverse is its own digital gateway. Given the creative trend of NFTs, an immediate automotive application is collections on platforms like OpenSea, which are based on iconic, classical, or motorsport vehicles from diverse car manufacturers. Metaverse communities should also consider NFTs promoting new concept cars or models. Fractionalized assets are a special form of collectible NFTs. They break a single asset (e.g., a car collectible) into many smaller pieces, allowing customers to own single or multiple pieces of the overall asset.

These NFTs will test the market's appetite and initiate collaboration between car manufacturers and the community.

Virtual tokens serve as a broader application: the creation of digital value. At present, this is difficult to quantify; however, if expectations hold true, the potential could prove to be remarkable. It will enable brands to strengthen their position by initiating an affiliate link with a community in need (e.g., one unable to buy a vehicle in the real world). In this way, it bridges the gap between the virtual and the real.

Applications that capitalize on this intersection seem to be unlimited, especially in the creative sphere. It's surprising how quickly some of these applications have hit the market. For example, it is already possible for customers to access a virtual showroom that can create vehicles for the real world. In the future, OEMs may have their own immersive metaverse, "private worlds,"[2] serving as the marketplace where their customers can configure, create, try, feel, and order before receiving a vehicle in real life. This service could also be personalized to suit each customer's VIP status and NFTs stockpile.

Customers will be able to simultaneously own a vehicle in both the virtual and real world. Their vehicle in the real world will be accompanied by its own NFT, which will authenticate its origin. Satoshi One and Arianee have already implemented this practice, giving their customers the ability to certify their purchased shoes with NFTs. Customers can also acquire NFT options for their vehicle, leading to additional features, better customization, or even pre-series cars. In summary, this technology is expected to improve transparency and security while creating optimized and personalized user journeys.

Despite many requests to operate and reassure the transfer of funds during vehicle purchase, attempted fraud remains a significant concern. The digitization of banking identities through the blockchain enables tamper-proof and secure authentication and transactions. Reselling a car via the metaverse could be one way to overcome this challenge. OEMs or salespersons would sell the car with an NFT attesting to its provenance. This virtual inventory, authenticated and inviolable, would result in resale transparency. The 3D modelling of a vehicle in the metaverse would provide parties with defaults and an after-sale purchase in better condition.

A crucial part of vehicle ownership is vehicular insurance. This industry is already investing in blockchain technology, particularly the smart-contract application, which enables automated reimbursement operations. Depending on one's contract, insurers can consider billing by the kilometer, adapting to one's environment and driving style. The personalization of the contract is done automatically by using the insurer's smart-contract and real-time information uploaded from the vehicle. This means vehicles have never been more transparent, accurate, and above all, inviolable.

And that's not all. Vehicle insurance can also intervene in unforeseen and emergency situations. For example, BMWs and Mercedes vehicles can call for assistance following a severe collision.

It is already possible for customers to access a virtual showroom that can create vehicles for the real world.

[2] Have your own metaverse or use a secure and proprietary space in a global metaverse.
[3] BMW Intelligent emergency call
[4] BMW Intelligent emergency call

Gearing up for the Metaverse

Smart contracts could activate following an accident, based on an unbiased, automatic, transparent, and tamper-proof analysis of the accident's circumstances (identified by vehicle data). An immediate refund would be carried out following interpretation of the data. While this application is not yet possible due to a high risk of fraud, it could save time for victims and the insurance company in the future.

In short, these use cases show that DLTs can eliminate the intermediary and directly connect demand with supply.

The potential of blockchain technology in the metaverse for consumer services, customer journey, and direct purchases is significant and yet to be discovered fully. Some manufacturers have already taken the plunge and fostered collaborations with tech companies. Let's look at use cases already available on the market.
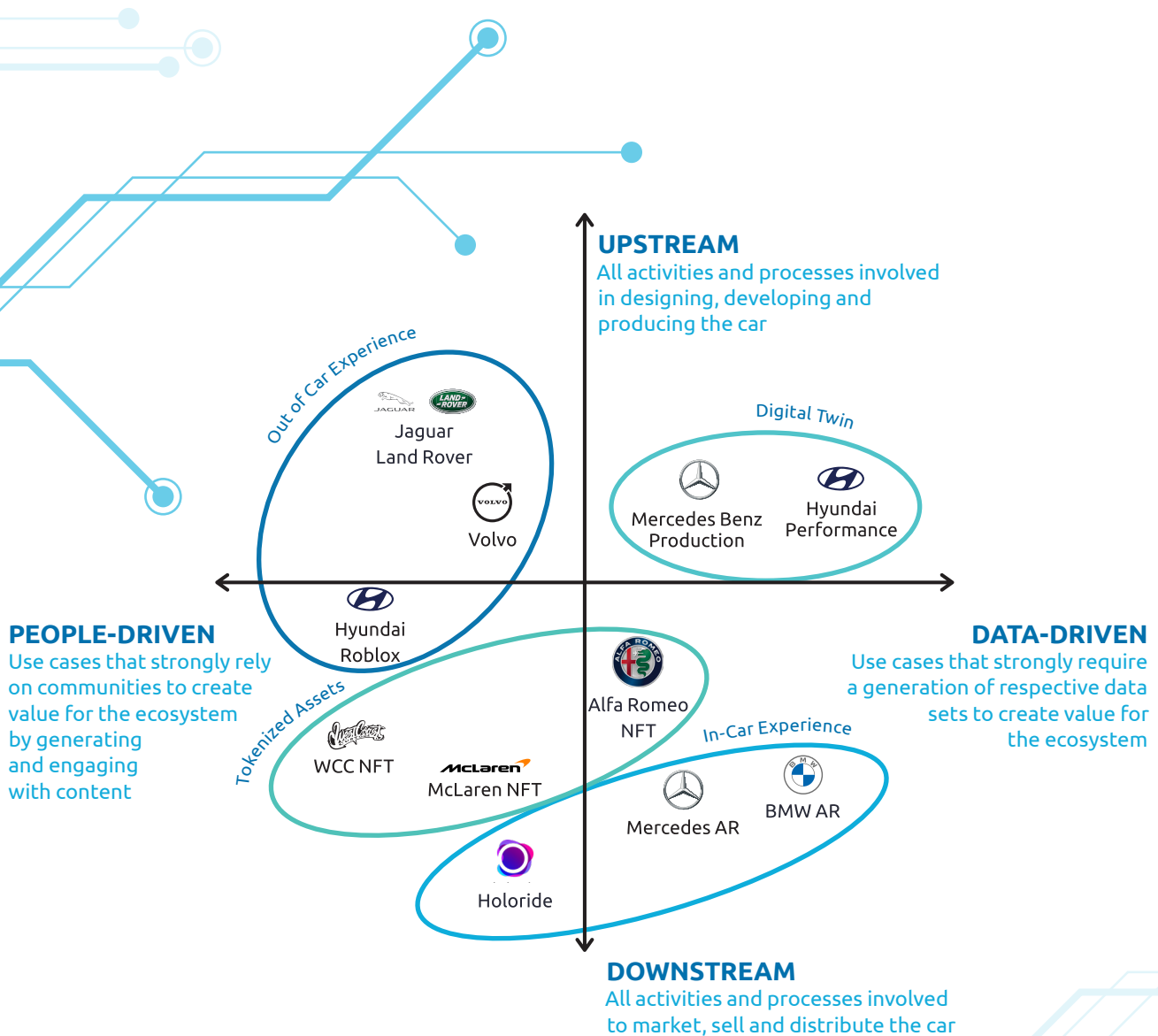
APPLICATION FIELDS

It becomes apparent that use cases around metaverses, Web 3.0, and DLTs already have a first impact on the entire automotive value chain. Across emerging up- and downstream playing fields, we identified an additional dimension becoming prevalent in the segmentation of metaverse applications and use cases: people-driven versus data-driven.

- People-driven: Use cases and applications with a strong focus on the community aspect, creating value for the respective ecosystem by providing engaging content for the user or customer

- Data-driven: Use cases and applications that focus on the generation and usage of data as the primary source of value in the respective ecosystem

Following people-driven versus data-driven and downstream versus upstream applications, use cases spread across all dimensions, already covering a broad array of playing fields.

In the below graphic, you can find four highlighted application clusters that are leading the discussion and developments around metaverse use cases in the automotive industry at the moment.

UPSTREAM
All activities and processes involved in designing, developing and producing the car

Out of Car Experience

Digital Twin

Jaguar Land Rover

Volvo

Mercedes Benz Production

Hyundai Performance

PEOPLE-DRIVEN
Use cases that strongly rely on communities to create value for the ecosystem by generating and engaging with content

Hyundai Roblox

Tokenized Assets

Alfa Romeo NFT

WCC NFT

McLaren NFT

In-Car Experience

Mercedes AR

BMW AR

DATA-DRIVEN
Use cases that strongly require a generation of respective data sets to create value for the ecosystem

Holoride

DOWNSTREAM
All activities and processes involved to market, sell and distribute the car

Four core dimensions for use cases based on application fields

DIGITAL TWIN

Since the metaverse is the convergence of the real and virtual worlds, it requires digitalized copies of everything tangible. These copies are commonly known as digital twins, which replicate processes, products, and services virtually. Fueled by a consistent flow of real-world functional and behavioral data, VR, AR, and AI, digital twins can add value to operations in a variety of ways. In the following section, we identify three use cases covering the possible major applications of digital twin technology.

DIGITAL TWIN CASE STUDIES

Design: Jaguar Land Rover

The metaverse has changed the traditional approach of 'first building and then iterating' to designing, testing, and iterating prototypes virtually. Offering a more virtual-based design process, teams can collaborate from anywhere and experiment more freely, providing several advantages. As a result of avoiding physical prototypes, the design process is faster and cheaper. For example, by eradicating the construction of terracotta prototypes and their following iterations, OEMs will reduce the costs generated by the acquisition of materials and the time needed to manufacture prototypes at scale. At the same time, the increase in the quality of the textures and the realism of the designs in metaverses 3D representations will allow for more adaptable renderings. Less constrained by the supply of materials and the cost of A/B testing at scale, this technology should encourage creativity and lead to better collaboration between teams without geographical limits. This approach even makes it possible to involve the brand community in the development of a new model.

Metaverse technology, which is based on a significant pillar of the social network, will enable automobile manufacturers to involve their communities much more. These future virtual, hypothetical models can be tried, examined, touched, and modified by everyone, making the user experience more inclusive. However, OEMs can also incorporate various access and participation rights, depending on the level of involvement with the brand, the number of vehicles purchased, and the acquisition of NFT VIP status. Similar to the One-of-One cars[5] at Ferrari or others, community members feel as though they are participating in the creation of their car.

Ushering in this new way of designing, Jaguar Land Rover offers a fresh take on vehicle creation.

They have been using virtual design and simulation to develop new vehicles in three-dimensional virtual reality at their state-of-the-art Virtual Reality Centre at the Gaydon Design and Engineering Complex.

Here, designers and engineers can visualize the entire car. Building each aspect of the vehicle in 3D, the designers and engineers work together to see how each element interacts, determining whether the vehicle is aesthetic and functional. The 3D production process also makes it possible to optimize material tests, production, and engine evaluation. Ultimately, this leads to the global visualization of optimized manufacturing in its entirety, including holistic cost optimization potential.

[5] One-of-one cars are vehicles developed solely for a customer based on an existing vehicle. (ex; SP38 based on a Ferrari 488 GTB).

Production: Mercedes-Benz

By simulating manufacturing processes or entire plants, the metaverse can help to validate and optimize the way cars are manufactured. Furthermore, OEMs can provide real-time and immersive training in three-dimensional virtual spaces.

This ability to adapt and optimize its production using the metaverse and immersive technologies will provide the visibility and anticipation of problems. In the same vein as optimizing the production process, the metaverse will increase the performance of quality control and problem solving with minimal downtime.

The immediacy and the collaborative aspect of the metaverse make it possible to envisage improved training, accessible in real-time to a global audience. The same can be said about the ability to optimize and automate production processes.

Mercedes-Benz has collaborated with Microsoft to make Hololens 2 augmented-reality (AR) headsets a part of its repair process. While wearing a Hololens 2 headset powered by Microsoft Dynamics 365 Remote Assist, a technician can receive live assistance from a remote specialist. The specialist can also share diagrams, pictures, and videos on the technician's heads-up display to guide them through the repair process. The camera on the headset provides the specialist with a detailed, real-time view of the issue.

Performance: Hyundai Motors

OEMs can capture the data from vehicles in operation and analyze it to provide actionable insights for informed decision-making. Being able to simulate endless environments and potential scenarios, OEMs can access real-time insights and predict the results of upscaling or downscaling situations today and in the future.

To improve the performance of the metaverse ecosystem, automakers will obtain a more precise, holistic, and coherent data set overall. This connected data set will enable enhanced performance testing, car safety, and ease of use.

Finally, one of the most encouraging applications is the capacity to execute dangerous scenarios in a virtual but realistic universe, without harming human workers or expensive robots.

Before mass producing vehicles, Hyundai employed virtual reality solutions in designing and testing new cars. This was done to save time and costs in the development process. This is the first time the company has used VR to build a prototype of a new model and evaluate it before the pilot stage. When the virtual development process is fully introduced to the entire R&D process, the carmaker can improve design quality and efficiency with VR technology, reducing vehicle development time by 20% and annual development cost by 15%.

Optimizing the production process through the massive use of AR, VR, AI, and immersive technologies via the metaverse will reduce material costs, design time, and construction time. This will allow for better anticipation of problems and more efficient resolution, saving money. The large-scale deployment of these collaborative and innovative technologies requires a significant investment, one that appears promising in light of emerging trend.

OUT-OF-CAR EXPERIENCE

Out-of-car experiences are viewed as augmented and virtual experiences that are not directly connected to the car itself but enable collaboration, community building, and user engagement. These experiences can vary in their nature, depending on upstream use cases with a focus on collaboration of design, or downstream use cases where fan and driver communities engage with brands or actively contribute by generating content. Those use cases with a people-centric focus rely on network effects and critical masses to generate relevant value for the company or brand. The following use cases provide an overview of some of the companies now exploring this area.

OUT-OF-CAR EXPERIENCE CASE STUDIES

Hyundai and ROBLOX

Hyundai Mobility Adventure is a virtual experience built into the famous game, Roblox, to showcase future mobility lifestyles in the metaverse. In this shared virtual space, users interact with one another with the help of avatars (digital characters representing the participating players). These avatars make it possible to collectively meet, communicate, and experience Hyundai Motors' mobility offerings. Operating on a metaverse platform, Hyundai gives participants the freedom to customize their avatars and have imaginative experiences.

With this use case, Hyundai is not only experimenting with playful ways to foster product discovery, but also attract young people (67% of Roblox players are 16 years old and younger) and familiarize them with Hyundai Motor products, technologies, brands, and future solutions. Due to this novel combination of both use case and target groups, we can see that the boundaries between sales and employer branding can merge in an innovative way.

Volvo and Unity

Unity and Volvo's open-source digital models of car designs facilitate visualizations and an interactive environment in XR. The first template features a 3D model of a Volvo XC40 Recharge, as well as a digital environment. While users cannot edit the CAD model itself, they can use the template to explore unity features related to lighting, color, and other visual manipulations.

This use case is particularly interesting because it leverages XR to develop and make 3D models and emulators more accessible. Furthermore, users can play with distinctive styles and features in a more immersive manner, making them feel part of the design process. Through this enhanced engagement with vehicles, visual appeal could draw potential customers to the brand, leading to an increased order conversion rate.

In general, the out-of-car experience can enable two potential revenue drivers: experience-based services and loyalty for drivers and fans. While the revenue from experience-based services will be generated rather directly (e.g., in Roblox, users pay for the games with a proprietary currency called Robux), all loyalty-strengthening activities need to be seen as a concerted approach to increasing revenue through connection with the brand. This leads to augmented sales of services and cars through an enhanced, immersive user experience.

IN-CAR EXPERIENCE

In-car experience is the second part of the challenge for future metaverse ecosystems. Here, several lines of thought are being considered. Perhaps the most popular is augmented reality, specifically the projection of artifacts on the vehicle's glass surfaces. This options really will mix reality and the virtual world. As for the entertainment part of the metaverse, its design is already more immersive and advanced. The following use cases provide an overview of some of the companies now exploring this area.

IN-CAR EXPERIENCE CASE STUDIES

BMW with Basemark and Mercedes with AR

In collaboration with Basemark, BMW has announced that the iX now comes with the option to have augmented reality directly on the essential information display. This application uses all the car's sensors and is the result of the extensive development of high-performance GPU (graphics processing unit), AR, and VR. In the same way, Mercedes has announced an all-electric sedan for 2022, including a 142-centimetre display of a camera that has superimposed digital street signs and other graphics. AR street numbers will appear on the screen and then slowly fade as a pin floats over a graphical map and marks the destination on the real-time scene. Blue directional arrows mark the road ahead via an augmented reality navigation system and color head-up display. Both uses of AR demonstrate effective integration of infotainment in the vehicle ecosystem.

Using available but still unused technologies on a large scale facilitates the large-scale use of augmented reality content. We envision the democratization of technologies, the extension of services, and a vast field of possibilities mixing augmented reality and the metaverse in an experiment that transcends the limit of space.

Holoride

More than their practical application, AR and metaverse technologies open the door to new forms of recreation. Holoride has collaborated with HTC VIVE to deploy Extended Reality (ER) technology in the VIVE Flow, a compact and lightweight immersive glasses device. In VIVE FLOW, users can naturally navigate the virtual world with surprising freedom. Holoride's advanced cinema mode also delivers 2D content that individual users can privately enjoy on a virtual, motion-synchronized cinema screen. Audi

has signed a partnership with Holoride to take advantage of this remarkable technology, which may result in an immersive and complete user experience for premium sedan customers.

This immersion mixing virtuality, reality, entertainment, and utility will power plenty of future applications. Virtual immersion is the beginning of autonomous vehicles that take us to our destination safely, projecting every meter in virtual form, as we choose to continue our meetings, purchases, movies, social network activities, and even games.

Such applications have the potential to bring in a diverse range of revenue, from direct revenue with the purchase of immersive options and internal purchases in the metaverse to indirect revenue using the optimization of energy management, facilitated by AI and data on the interactions within the community.

TOKENIZED ASSETS

The NFT trend accompanies the new metaverse movement. As mentioned previously, NFTs are based on blockchain technology, bringing their own share of novelties and opportunities. Far from being just expensive-JPGs, NFTs are a programmable technology with smart contracting, all stored on an open ledger. They're both an asset and a tool. The NFTs we have seen in the market – for better or worse – are a reflection of the creator, not technology.

The following use cases serve as an overview of what car manufacturers have been able to offer so far by following the creative trend. It is important to keep in mind that NFT technology makes it possible to envisage many other economically attractive uses cases for the automotive market. For example, smart-contracts for insurance, privatized access to virtual showrooms, or share virtual and real vehicle options.

IN-CAR EXPERIENCE CASE STUDIES

McLaren Racing and Collectables

McLaren Racing announced the creation of the McLaren Racing Collective, a global community of collectors and fans served through an innovative digital platform. Here, fans can buy McLaren Racing digital collectables in non-fungible tokens. The forum will be McLaren Racing's primary location for fans and blockchain enthusiasts looking to engage with the brand, with the first drop featuring various digital components of the MCL35M 2021 Formula 1 race car, which originated from the McLaren Racing CAD system.

CarCoin and the NFT Fast Lane (e.g. West Coast Customs Concept Cars)

NFTs are available in the CarCoin community through a tiered membership program, "The CarCoin Fast Lane." Members have access to exclusive NFTs, including artwork by famed custom car designer Musa Tjahjono, collaborations with top crypto artists, and redeemable NFT experiences with A-List celebrity car enthusiasts. Plans include auctions of actual vehicles from classic episodes of "Inside West Coast Customs," starting with the life-size Nintendo Super Mario Kart featured in Season 2, Episode 7.

This is accompanied by new original creations like "The Rocket," which is a high-performance electric vehicle showcasing the inevitable fusion of the physical and digital worlds. One lucky Fast Lane member receives an NFT that unlocks a one-of-a-kind automobile designed by West Coast Customs.

Like any exclusive property, the dealerships will organize auctions. Barrett-Jackson will auction the first collectable car NFTs in Las Vegas. These sales will be followed by close monitoring of the NFT's performance, its use, and the proprietary license.

It isn't easy to see other applications with an overrepresentation of artistic NFT initiatives. However, NFT technologies make it possible to undertake other applications, including after-sales, insurance, vehicle options, and insight into the history of a vehicle.

Alfa Romeo & NFTs

Alfa Romeo has revealed that it will be using non-fungible tokens (NFT) to track and store maintenance records on the blockchain for its new Tonale SUV. The company says the car's NFT will be able to generate a certificate from records of its maintenance data, but only for service done by certified dealers. According to a release by the company, the Tonale NFT's blockchain ledger will record details about the car throughout its life cycle, including proof of proper maintenance. This way, owners of a Tonale can have digital certificates of regular car check-ups added to the blockchain, which could boost the car's eventual resale value.

ADDITIONAL CONSIDERATIONS

All use cases related to the use of NFTs reflect the desire and appetite of brands to explore this burgeoning market and expand their ecosystem. When analyzing the NFT trend, it is difficult to establish a price pattern. Indeed, most NFTs sell for less than $10,000, but some change hands for astronomical sums. The record stands at $69 million. However, the enthusiasm of collectors is limitless and should be able to

meet that of car collectors. It is important to remember NFT technology does not only apply to collectors and could therefore free the NFT ecosystem from speculative activity. At this stage, the NFT vision has not yet been developed on a large scale. However, with current technology, the following types of automotive NFT and their potential income are being explored: vehicle updates, different levels of rarity,

and pre-series releases. They would all be registered on the blockchain, making them more traceable and free of intermediaries. The revenue potential for NFTs is contingent upon their purchasing, revenue fees of up to 15% for creators, and additional income linked to the notoriety that the brand creates.
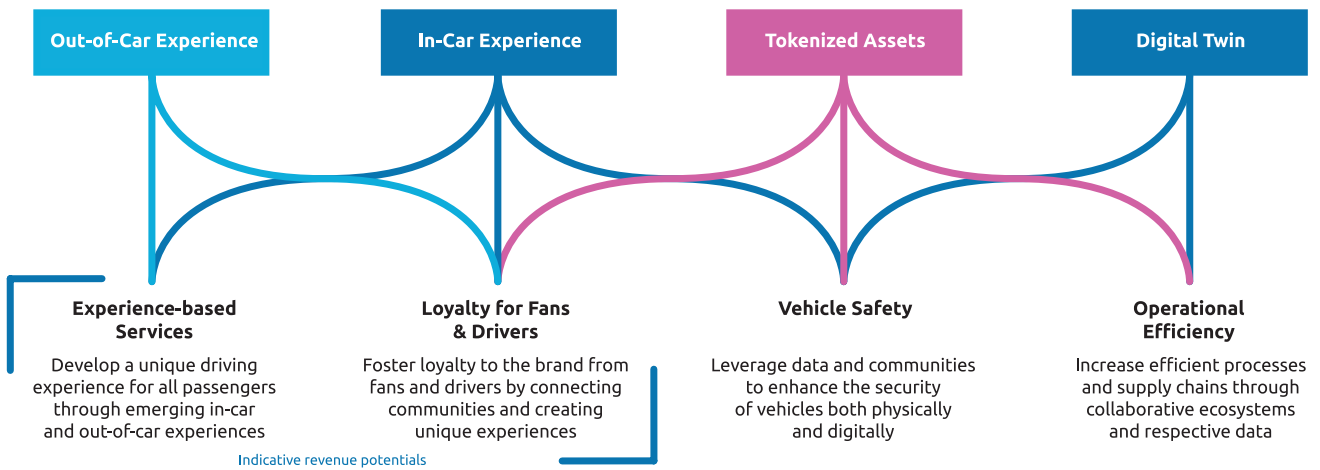
OUTLOOK AND KEY HYPOTHESES

Following our study on the potential of the automotive sector in the metaverse, we can put forward four strategic plays that are fueling automotive use cases moving forward: experience-based services, loyalty for fans and drivers, vehicle safety, and operational efficiency.

These significant trends are interconnected, facilitating a complete network of innovation while bringing specific use cases to certain application fields in the sector. We can integrate them into the four pillars identified in this study: out-of-car experience, in-car experience, tokenized assets, and digital twins.

This interconnected matrix of innovation linked to the technologies highlighted gives us a glimpse of key drivers and future applications. As we see in the graph below, metaverse technologies have given rise to the following focus: the development of the best passenger and customer experience and an entirely optimized value chain.

Out-of-Car Experience	In-Car Experience	Tokenized Assets	Digital Twin

Experience-based Services

Develop a unique driving experience for all passengers through emerging in-car and out-of-car experiences

Loyalty for Fans & Drivers

Foster loyalty to the brand from fans and drivers by connecting communities and creating unique experiences

Vehicle Safety

Leverage data and communities to enhance the security of vehicles both physically and digitally

Operational Efficiency

Increase efficient processes and supply chains through collaborative ecosystems and respective data

Indicative revenue potentials

Four strategic plays that drive automotive use cases

OUTLOOK ACROSS FOUR CATEGORIES

Based on our research and the evaluation of the current state of the metaverse and its strategic directions, we can identify key hypotheses for the future development of uses cases for automotive industries in the metaverse. Moving forward, OEMs should focus on the following:

- Experience-based services and loyalty will be essential for direct and indirect revenue generation. Our analysis shows that use cases from that group show the strongest potential for product and solution innovation, which we directly associate with revenue potential.

- Community-based use cases currently dominate the customer-facing domain. Data-driven models currently lack respective infrastructures on Web 3. However, data-driven dialogue and exchange with the driver base show huge potential for after-sales interactions and retention.

- Hybrid cases will develop later, combining immersive and DLT technology. Looking ahead, the tech stack of DLT (NFT) will start slowly blending with the AR and VR tech stack, creating new application fields and opportunities for communities and data alike.

Metaverse and web3 are two of the most dynamic and innovative fields in the development of technology. However, in the automotive industry, many of these applications are still nascent. The industry is moving into a time of experimentation, exploring potential application fields, leveraging the technological developments around AR, VR, and DLT. Looking ahead, it will be crucial for OEMs and new players to steer their experimentation phase in the right dedicated application fields, analyzing the most efficient use cases from a financial, operational, and human perspective. All of this must be in line with each company's respective strategy.

CONCLUSION

The automotive industry has a strong presence in the metaverse, with numerous use cases and application fields already on offer and more taking shape. This brief overview shows how many different use-case types are distributed across the automotive value chain, either focusing on people and communities or on data. However, the general adoption of the use cases is still in a nascent stage. Still, some patterns are emerging, and they will soon be implemented at scale. Virtual experience, remote collaboration, and NFTs are key metaverse investments. This is because they largely focus on improving operations, increasing sales, and improving brand management. But to ensure long-term value to organizations and their customers, automotive companies should consider a thoughtful strategic entry into the metaverse. The following are some guiding principles:

DO

✅ develop a long-term strategy based on simple steps

✅ focus on the entire customer ecosystem

✅ consider open technology applications

✅ provide real value for your customers

✅ start small but with dedicated scope and the right people

✅ keep sustainability in mind across the entire value chain

DON'T

❌ take the metaverse experience as the expansion of a VR space

❌ think of the metaverse solely as an art marketplace for gamers and collectors

❌ underestimate the impact the metaverse will have on our society

❌ try to tackle all challenges and use cases at once

❌ miss out on data-based levers and potentials

❌ wait until the metaverse becomes mainstream - early players will develop a competitive advantage

It is worth remembering that these technologies will evolve and take up increasing amounts of space in our lives. "By 2026, 25% of people may spend at least one hour per day in the metaverse for work, shopping, education, social, and or entertainment," according to Gartner, Inc. Like the beginnings of the internet, music streaming, and data monetization, this new ecosystem will become a lucrative and unavoidable way of interacting with our future world. The transition will take time; metaverse integration is a long-term strategy that begins with simple steps into recognized aspects of the market, putting the end-user at the heart of the reflection. Car manufacturers must improve their customer experience when configuring, buying, and onboarding vehicles to create value in this emerging ecosystem.

New OEMs must position themselves to develop coherent strategies as the market evolves rapidly.

The first use case of the blockchain is its disintermediation on the market to sell products such as a car, credit, or detached pieces. This disintermediation aims to optimize the value chain by reducing transaction costs. The blockchain and metaverse ecosystem would simplify and secure the user's journey by offering them a complete and immersive journey.

The democratization of the metaverse goes hand-in-hand with the development of immersive technologies and the reduced volatility of existing cryptocurrencies. These essential conditions will facilitate large-scale integration and better use of innovative technologies and opportunities. The future of the metaverse is a one-time immersion in a purely digital universe and a more common immersion in a mixed-reality world. All the technologies and use cases we have described make it possible to understand the first bricks laid in the construction of this new world for the automotive industry. In this modern landscape, cutting edge technologies and business values are inseparable.

Verse yourself in use cases emerging in the automotive metaverse.

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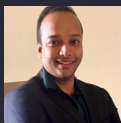
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