وزارت علوم، تحقیقات و فناوری
دانشگاه خاتم

کنفرانس ملی تحول دیجیتالی

انجمن مدیریت ایران

# سومین کنفرانس ملی تحول دیجیتالی با رویکرد فرهنگ انسان محور

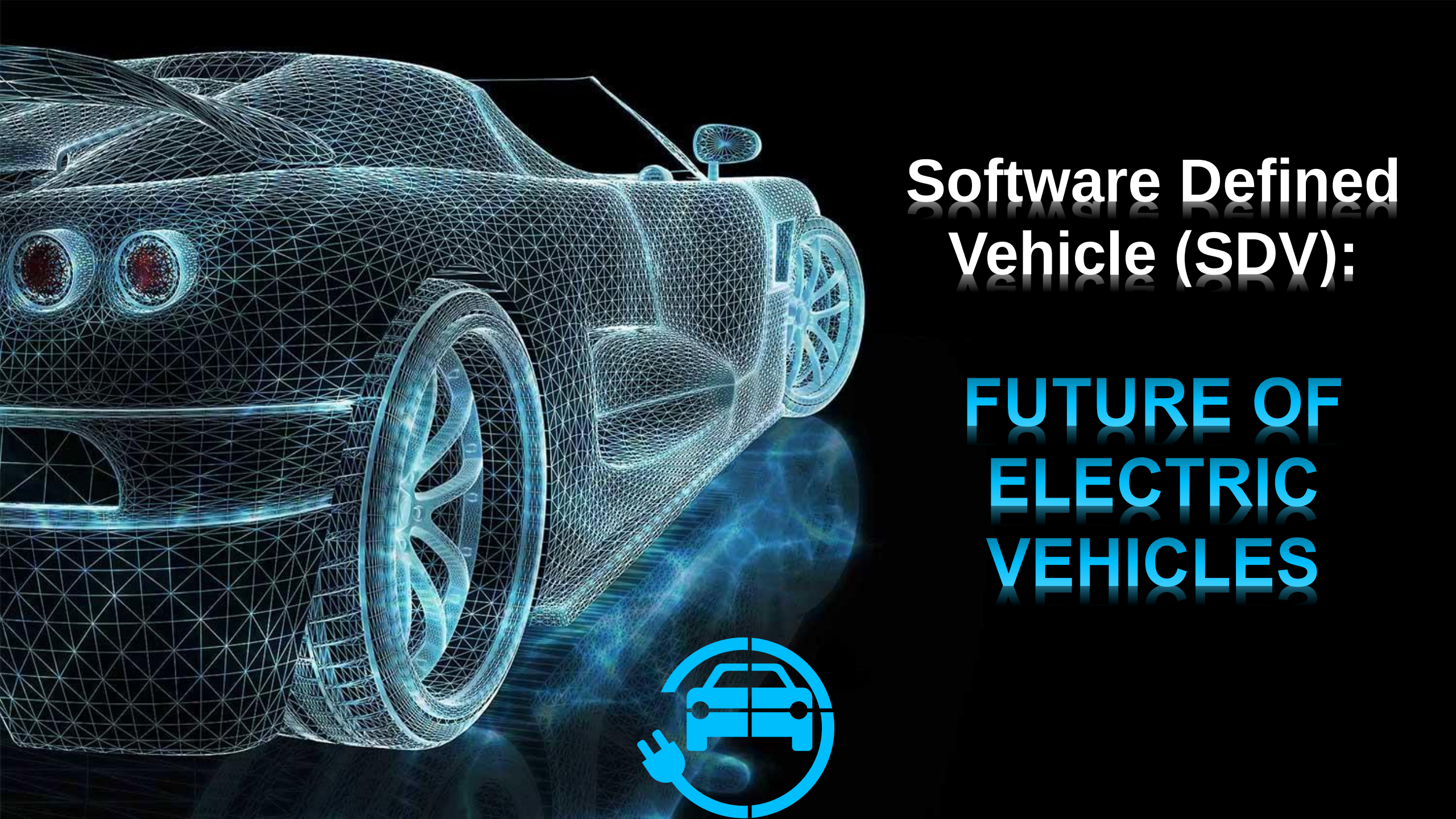
تهران، دانشگاه خاتم – ۱۲ و ۱۳ تیرماه ۱۴۰۳

## عنوان ارائه :

# Software Defined Vehicle (SDV): FUTURE OF ELECTRIC VEHICLES

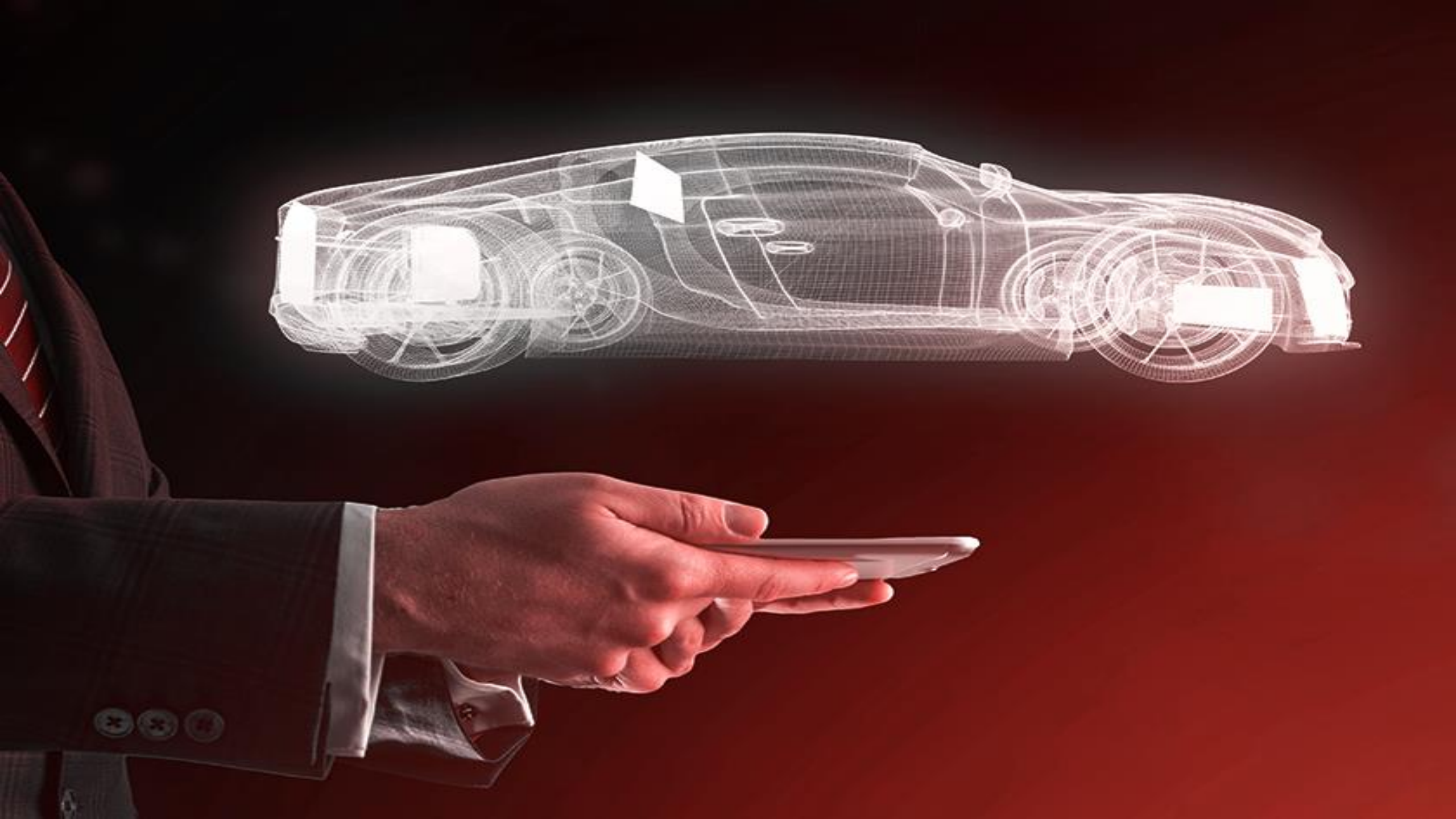

ارائه کننده :

دکتر منوچهر منطقی، دکتر فاطمه هاشم



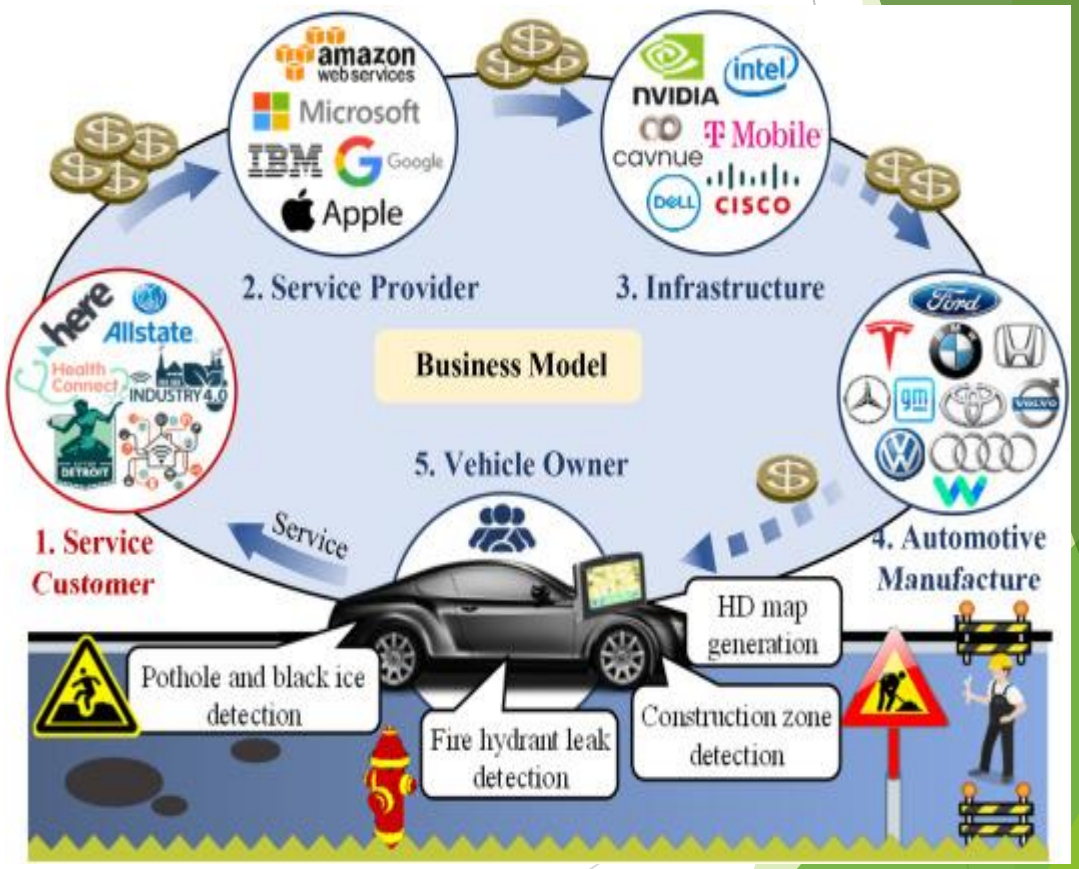
# Software Defined Vehicle (SDV):

# FUTURE OF ELECTRIC VEHICLES



# Enabling the New Ecosystem, Partnerships for Tomorrow

- **Leading automakers, technology majors and engineering companies are united in recognizing the scale and complexity of challenges within the SDV and EV domains.**

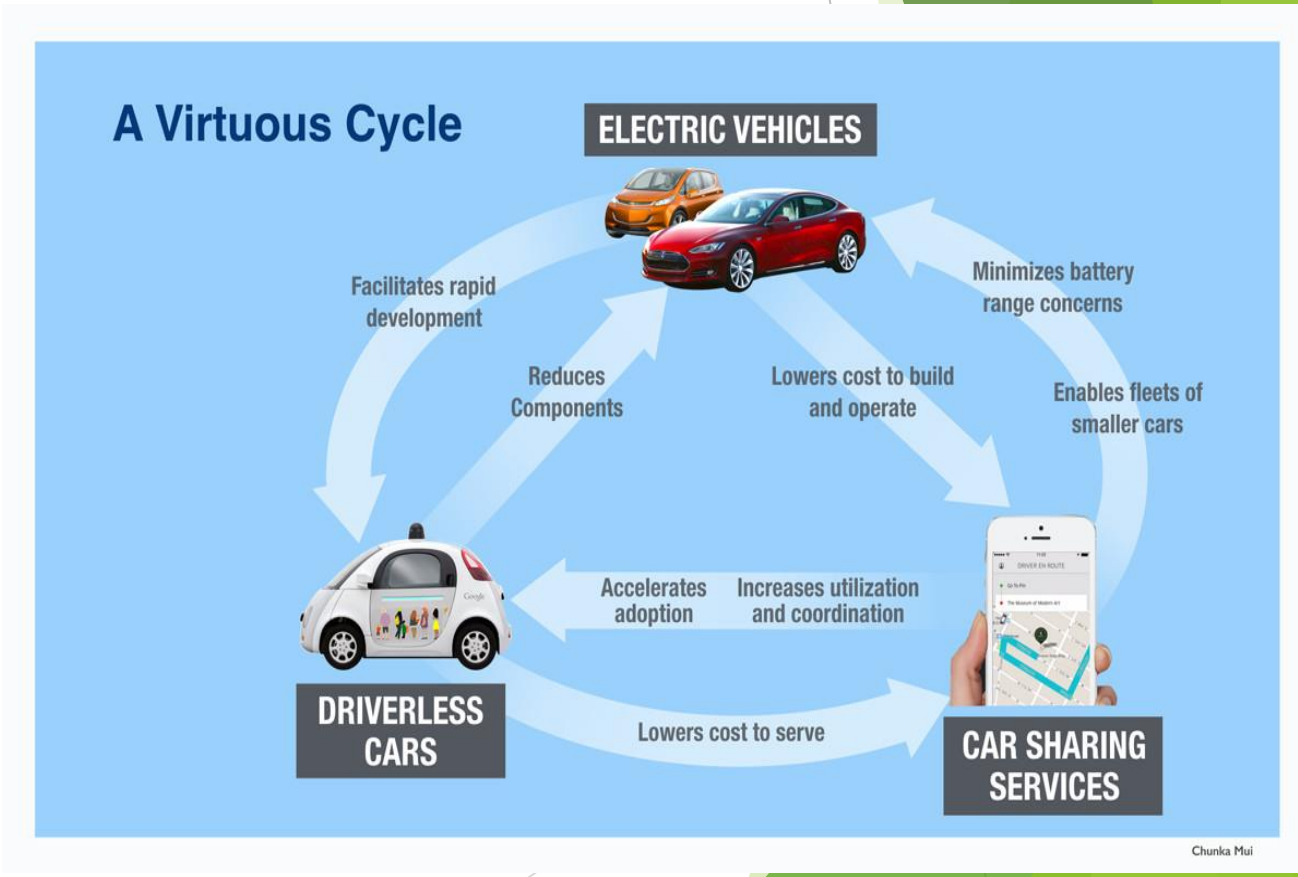


## Policy and Regulatory Frameworks Supporting Circular Economy


- **The support of public authorities is pivotal in shaping the new ecosystem for smart transportation. Governments worldwide are redefining their policies, funding automobile R&D, and streamlining regulatory frameworks for SDV-EV integration, especially after the recent COP rounds.**

# FUTURE OF ELECTRIC VEHICLES

- **The future will be defined by new and robust partnerships across the ecosystem. From smart road sensors and intelligent traffic management systems to true autonomous driving and wireless charging stations leveraging renewable energy grids, the potential is limitless!**



# Moving into the software-defined vehicle fast lane

- **Currently, the automotive industry is experiencing the biggest transformation in its history. While the focus was on the hardware, the new generation vehicle draws inspiration from one thing above all else: software.**
- **90% of automotive industry innovations are defined and operationalized by electric/electronic technologies.**

# What is Software Defined Vehicle?

- Software Driven Vehicle (SDV) is the key technology that enables vehicles to evolve and for a better driving experience throughout their lifetime:
- • Advanced navigation and connectivity,
- • Upgrade programs in real time,
- • Increasing safety and stability,

# The Software-defined Vehicle
# Our Definition:

- In a Software-defined Vehicle, functions are enabled by software. Decoupling software from hardware enables swift and continuous development & implementation of new functions and software updates throughout vehicle lifetime.

- The automobile, which until a few years ago was a self-contained system, has become part of a much more complex software centric ecosystem the IoT.

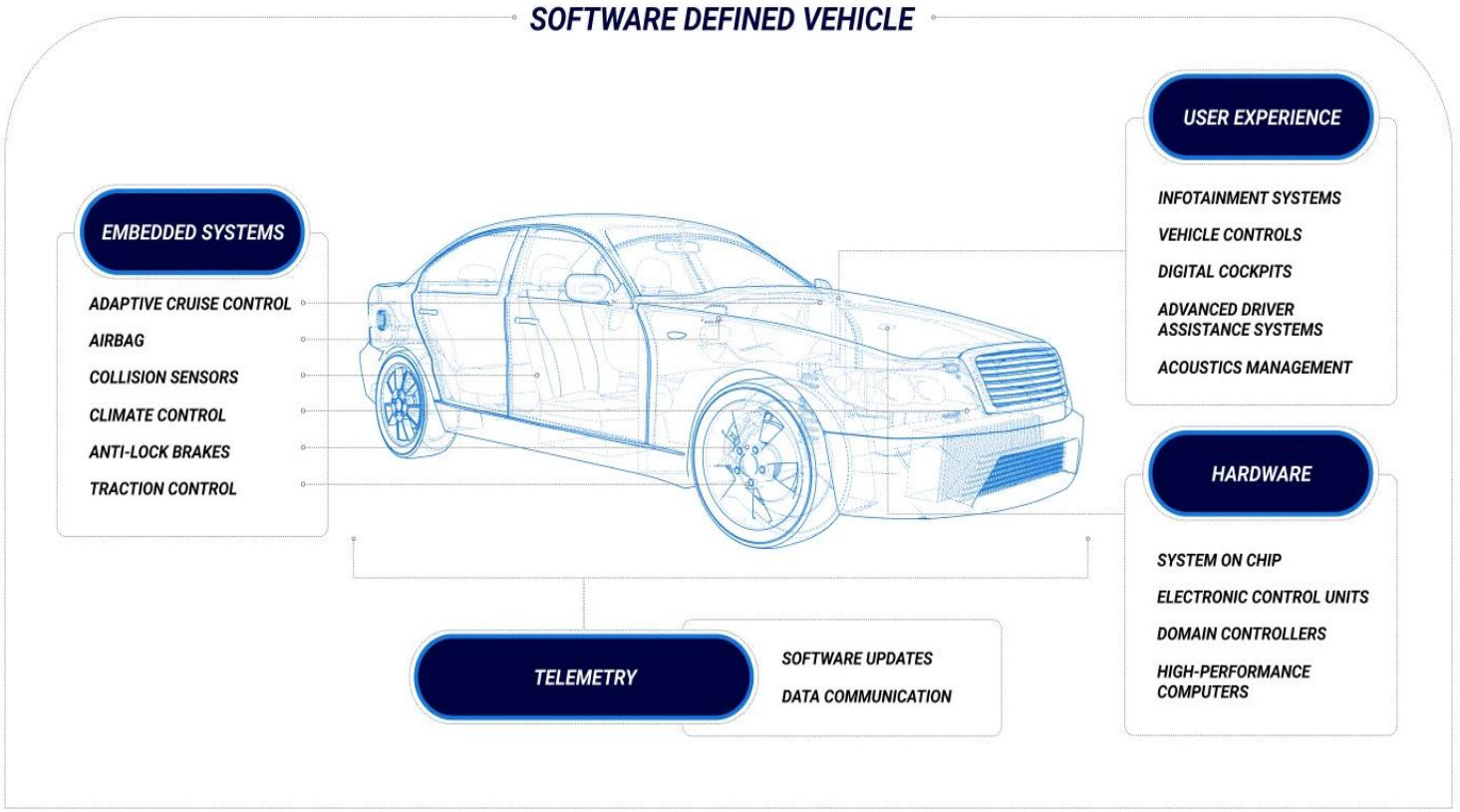
- The focus is no longer only on hardware, which never the less has a significant importance, but more and more on software.

# SDVs are the next evolution of the automotive industry.

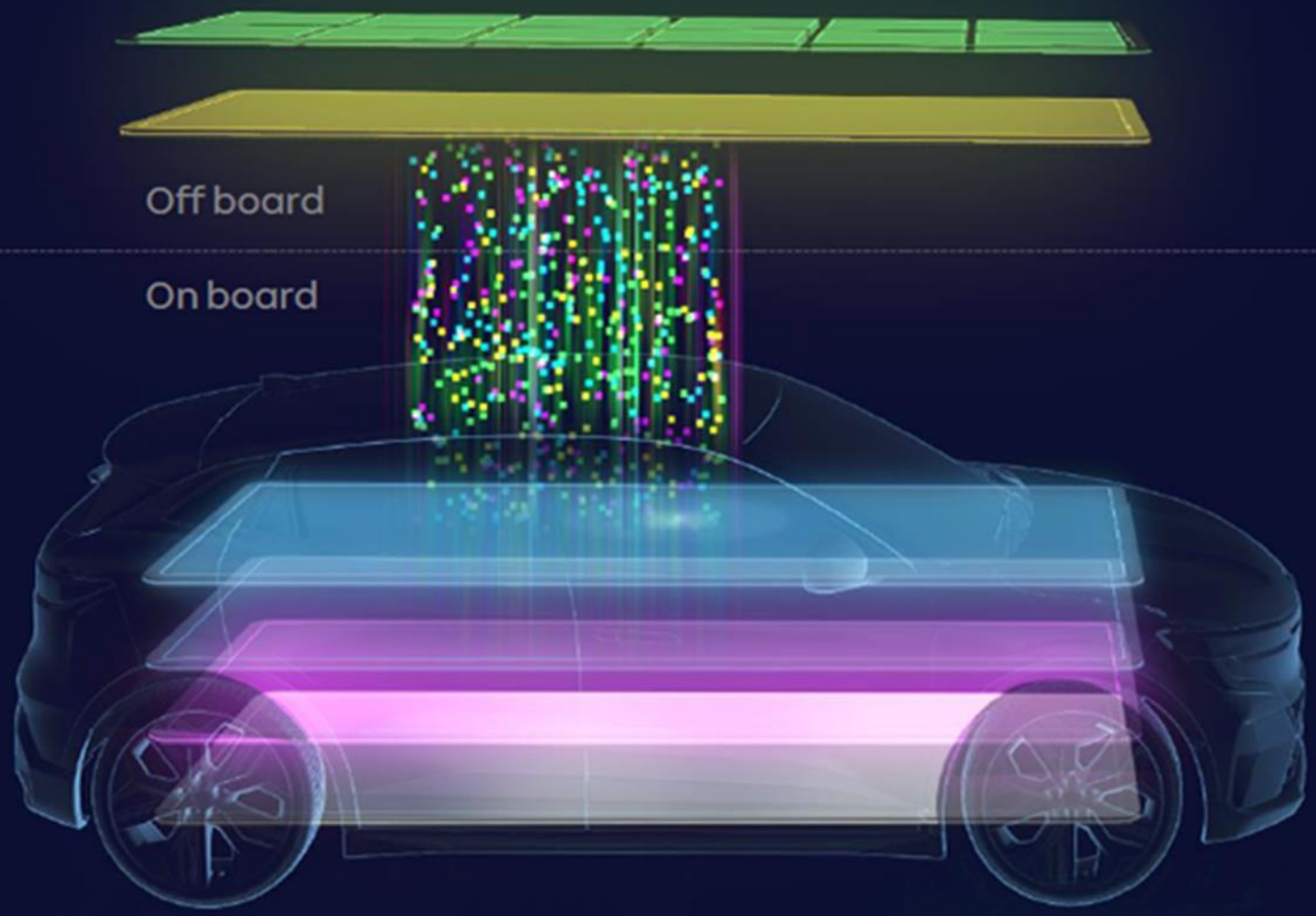
- They are the foundation of many other developments, including autonomous vehicles (Avs) and connected vehicles. Auto industry pioneers note that they ultimately reflect "the gradual transformation of automobiles from highly electromechanical terminals to smart, upgradable mobile electronic terminals that can be continuously upgraded."

# Software-Defined Vehicle Architecture

- 1. User Applications
- 2. Instrumentation
- 3. Embedded OS
- 4. Hardware



# Towards a Software Defined Vehicle




Business Services

Digital Twin (Cloud based)

Software Defined Vehicle

Digital Chassis

In-Car services

Car Operating System

Hardware

E.V. Skateboard

# Software-Defined Vehicles vs. Connected Vehicles

- **Both are enabled through onboard software.**
- **Both integrate multiple software services and platforms through either middleware or APIs.**
- **both incorporate various advanced hardware such as collision detection and ADAS.**
- **The only tangible difference is that, in theory, connected cars have a slightly different use case, explicitly built to interact and interface with their surroundings.**

# Software-Defined Vehicles and Smart Cities

- **As the smart city moves from concept to reality, the SDV will become even more important as a dynamic node in this system.**
- **In the smart city, data and information technology are leveraged to improve operational efficiency, share services with public citizens, and provide a better quality of government.**
- **This includes helping traffic flow more smoothly, imposing environmental regulations, managing parking more effectively, and reducing energy usage where possible.**
- **SDVs will facilitate the integration of vehicles into the smart city.**

# Software Defined Vehicles and Autonomous Vehicles

- **Autonomous vehicles are primarily a software challenge. While a self-driving hardware system relies on a suite of different sensors, including cameras, radar, LiDAR, and others, what enables autonomy are sophisticated road behavior models developed using intensive Artificial Intelligence and Machine Learning (AI/ML) processed on some of the most powerful supercomputers in the world.**
- **Once implemented, an autonomous driving system requires complete control over core driving functions like acceleration, braking, and steering. This can only be delivered when these functions are interconnected via a central computer running software that integrates them. The SDV provides this with its focus on software as the primary method for delivering functionality.**

# New business models

- **A universal focus across the automotive industry is understanding how upgradable software can unlock new business models and new functionality.**

## Fostering Innovation In Software-Defined Vehicles:

# The Power Of Collaboration

# OPEN INNOVATION & OPEN collaboration

- In the automotive realm, the advent of software-defined vehicles (SDVs) has not only redefined the boundaries of mobility but has also brought forth a unique convergence of diverse sectors.
- The fusion of automotive engineering with cutting-edge digital technologies has carved a new trajectory for innovation, elevating vehicles from mere modes of transportation to intelligent mobility solutions.
- As the narrative around SDVs continues to evolve, the significance of collaborative ecosystems emerges as a cornerstone for accelerating innovation and steering the automotive industry toward a future brimming with possibilities.

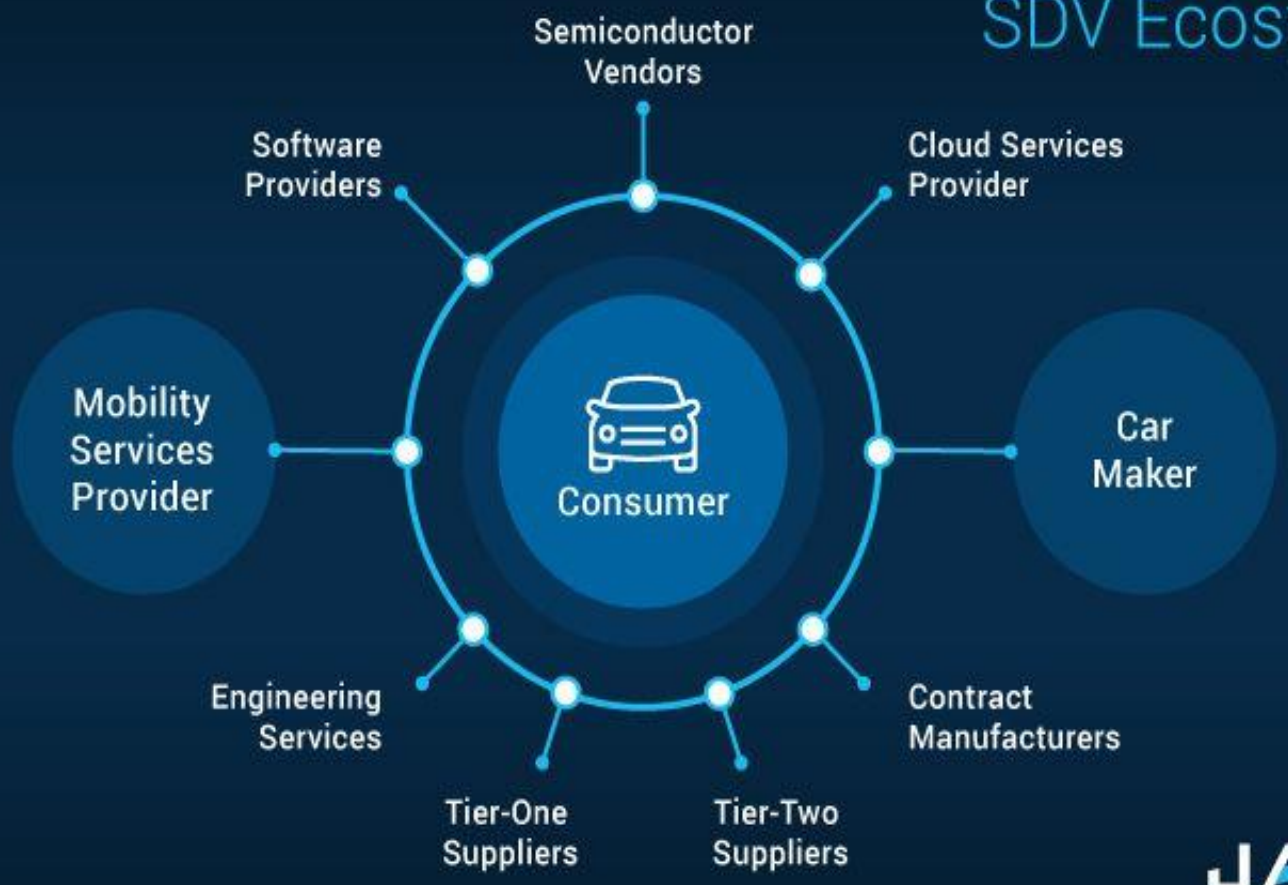
# Cross-Sector Synergy:
# A Catalyst For Breakthrough Innovations

- **The heart of SDV innovation lies at the intersection of the automotive, technology and telecommunications sectors.**
- **By fostering cross-sector collaborations, stakeholders can harness a wealth of expertise and technologies, propelling SDVs to new horizons of safety, efficiency and intelligence.**
- **The integration of 5G, edge computing, artificial intelligence and blockchain, to name a few, are a testament to the monumental advancements achievable through cross-sector synergy.**

# **Traditional Tiered Supply Chain** evolves into the **Software-Defined Vehicle Ecosystem**

## Tiered Model


## SDV Ecosystem

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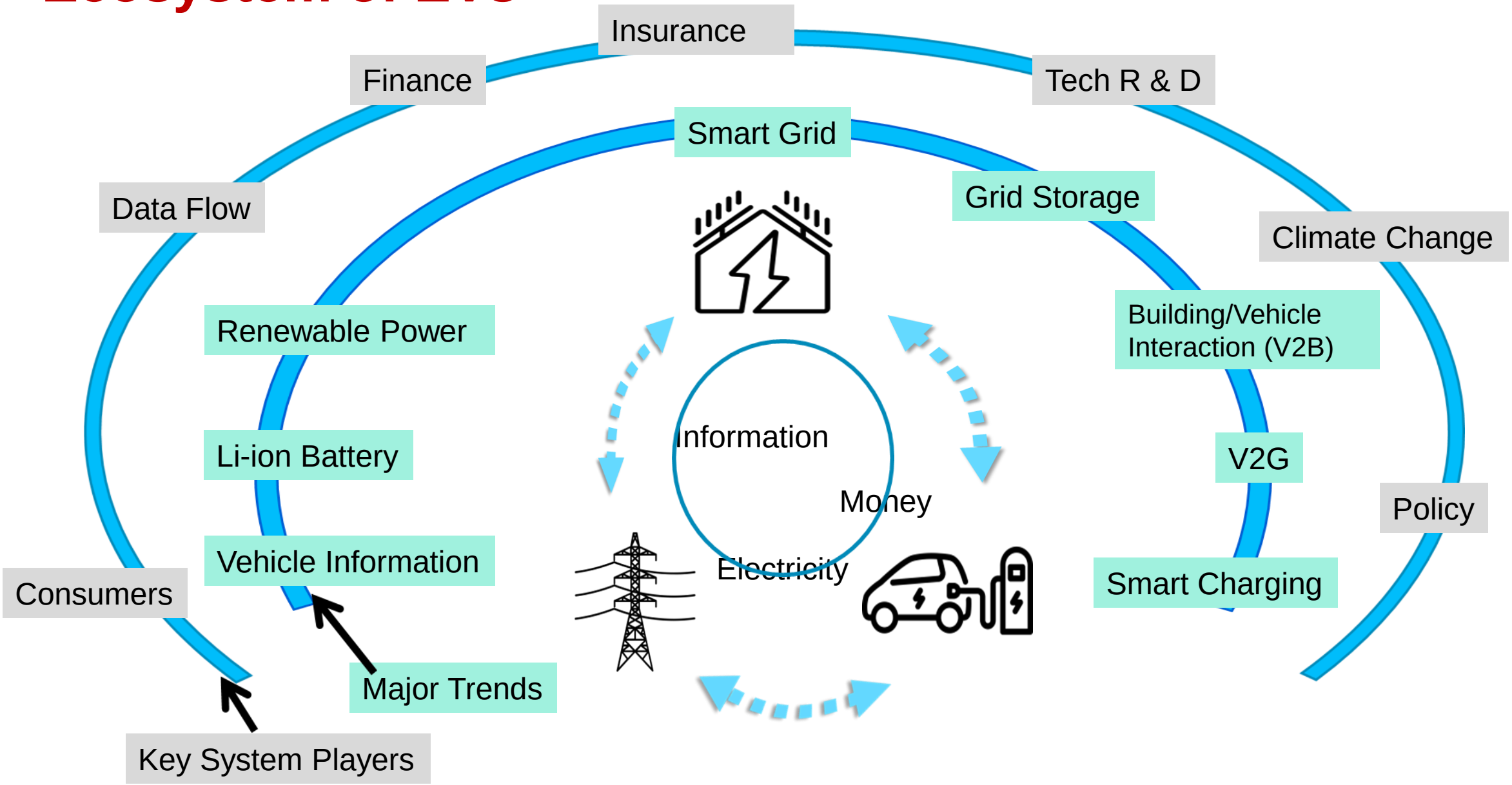
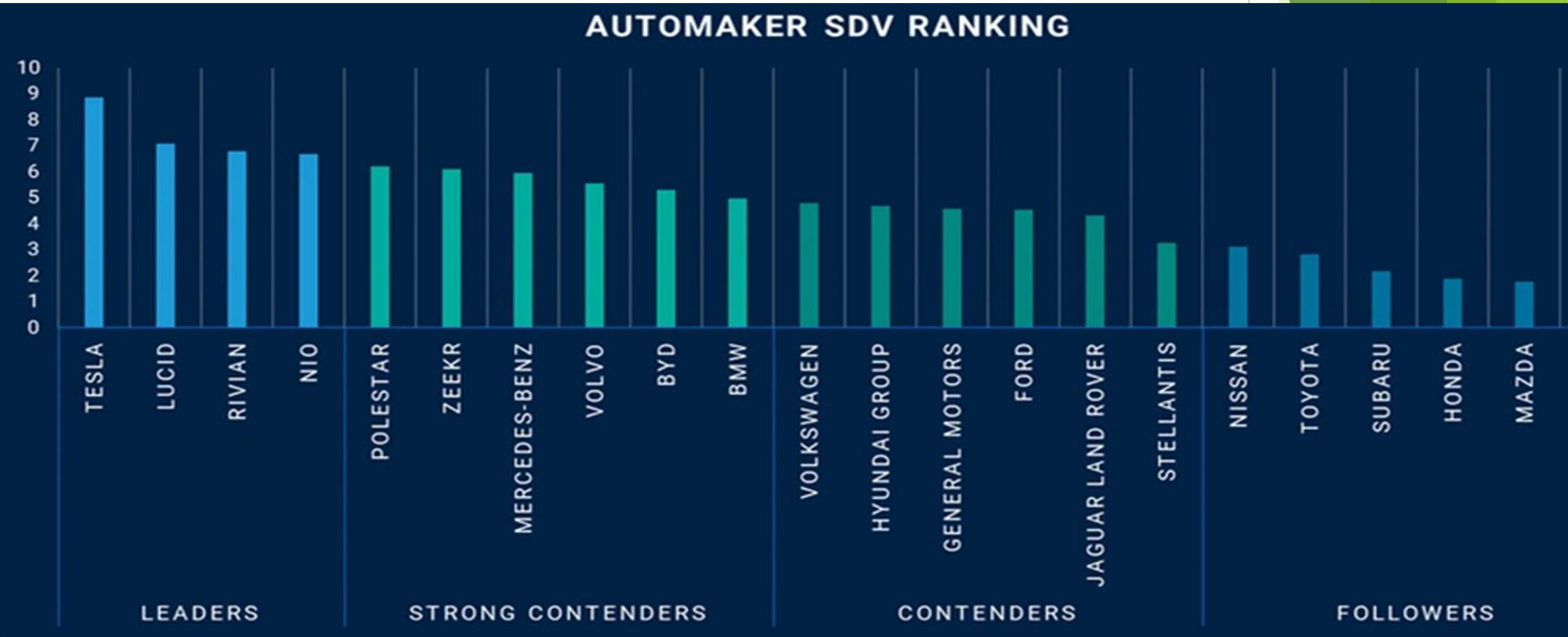
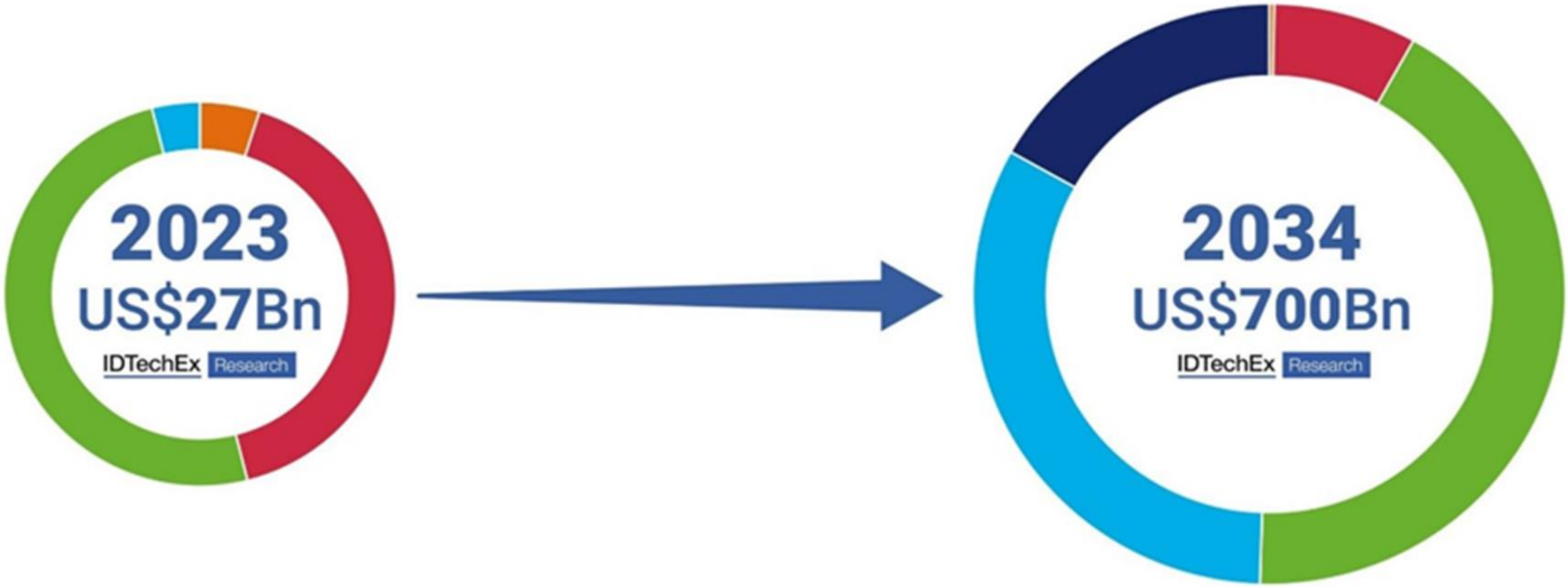
# Ecosystem of EVs



Wards Intelligence evaluates and ranks the advancements of 22 automakers in their transition toward software-defined vehicles, offering a comprehensive snapshot of automakers' existing technical expertise and achievements within the realm of SDVs.



# SDV Feature Forecast (Global Revenue)




- Vehicles with 3G/4G Connectivity
- Vehicles with 4G Connectivity, Level 1 Autonomy, Primary Services
- Vehicles with 4G Connectivity, Level 2 Autonomy, Hardware as a Service, App Store and more
- Vehicles with 5G Connectivity, Level 3 Autonomy, Hardware as a Service, App Store, In-Vehicle Payments and more
- Vehicles with 5G/6G Connectivity, Level 3/4 Autonomy, Hardware as a Service, App Store, In-Vehicle Payments and much more


Thanks
for your attention