The Future of Mobility
Impacts of Evolving Vehicle Technology Transitions on Suppliers

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About Plante Moran

95 Years serving clients (founded in 1924)

2,500+ Manufacturing & distribution clients

21 Years on FORTUNE’s Best Workplace list

39,000 Professionals worldwide

3,200+ In U.S.

Wide Range of Professional Services

- Strategy and Operations Consulting
- Audit and Accounting
- Tax Compliance and Consulting
- Information Technology Consulting
- Cyber Security
- Transaction Advisory Services
- Human Capital
- Government & Infrastructure
- Wealth Management
- Life Insurance
- Investment Banking (PM Corporate Finance)
- Real Estate Development (Plante Moran CRESA)
Case Study: Disruptive Technology

Easter morning 1900: 5th Ave, New York City. Spot the automobile.

Source: US National Archives.

Easter morning 1913: 5th Ave, New York City. Spot the horse.

Source: George Grantham Bain Collection.
Where is the Automotive Industry Going?

Integration of Technologies will Drive Mobility Futures

1. Autonomous

2. Mobility – “sharing”

3. Electrification

4. Manufacturing the Vehicle
Mobility Drivers

Economics Change the Transportation Business Model

Today

Private Vehicle Ownership

Vehicle Price

Buying Vehicles

Future

Shared Mobility

Asset Efficiency

Buying Miles

New “Mobility” Business Model

1. Extended Vehicle Life:
   • Enabled by enhanced engineering, advanced materials and manufacturing
   • Metric – kilometers traveled

2. Vehicle Uptime (Availability):
   • Enabled by rigorous preventative maintenance discipline
   • Metric – % availability (uptime)

3. Vehicle Utilization:
   • Enabled by matching riders with vehicles – right place, right time
   • Metric – % of day vehicle is utilized
Autonomous + Mobility
Projections for U.S.

Personal miles traveled drives volumes
- Testing and prototyping environments are still growing rapidly – over 1,400 vehicles by 80+ companies in 36 states
- Lack of national policy is slowing progress for now, but private sector is pushing forward
Future Mobility Business Model

Dramatic Reordering of the Automotive Value Chain

Manufacturing, MaaS, Mobility Operations and Energy Management will all be required to enable the future mobility industry, as well as to be tightly integrated.

Vehicle Manufacturing “Value Chain” (including Engineering)

MaaS and Mobility Operations

Ownership & Financing
Vehicle Owners
- Fleets
- Private
- Fractional
Financing
- Loans
- Leases
- Subscription
- Pay per mile
Insurance
- Personal
- Vehicle
- Ride

Mobility Services Provider
- Pay per ride/sharing
- Freight/package service
- Specialized mobility services
- Mobility technology broker/interface

Connectivity
- V2V communications
- Telecommunications access
- Vehicle data – OTA updates, monitoring
- In-vehicle infotainment services

Mobility Operations Services
- Vehicle maintenance and repair
- Vehicle staging – cleaning, charging, storage
- Vehicle roadside assistance
- Passenger biometrics support

Mobility Infrastructure
- Parking location, availability, price
- Traffic flow, route optimization
- Vehicle to infrastructure (SmartCity)

Energy Management
- Battery pack/cell production and raw materials
- Battery financing
- Charging infrastructure manufacturing and installation
- Energy storage and discharge:
  - V2G
  - 2nd use batteries
- Battery recycling

Key Vehicle Manufacturing Characteristics
- Utilitarian styled vehicles
- Common platform architectures
- Modular design for component replacement
- High volume production for cost efficiencies
- Electrified powertrains
- Autonomous capability
- Connected technology
Business Opportunities in Mobility

Future Revenue Streams

MaaS, Mobility Operations, Energy Management, and Manufacturing will increase enormously from transportation shifts in autonomy, mobility, electrification and manufacturing of vehicles.
By 2050, disruptive changes in the industry will drive significant shifts in how transportation is consumed.
Transportation MaaS Spending Increases
Driven by Personal Consumption and Commercial Use

Mobility as a Service (MaaS) to experiences Massive Growth
Autonomy allows personal transportation to shift from private vehicle ownership to “buying kilometers” for travel, in highly utilized shared fleet vehicles of multiple configurations (1-10+ passengers)

New Vehicle Sales and Production Increase
Higher vehicle utilization accelerates vehicle life span, increasing vehicle turnover and resulting in shorter replacement cycles of 3-4 years

Used Vehicle Sales Decrease
Shared fleet vehicles are driven to the end of maximum useful life, then retired from operation; eliminating much of the secondary market for resale

Repair and Maintenance Cost Increases
Scheduled preventative maintenance will be required to support high vehicle utilization and service, increased vehicle life longevity and expedited repairs
Vehicle Technology - Electrification

Evolution of the Powertrain

- Converging disruptions (autonomy, sharing and powertrain efficiency) will increase the pace of adoption of electrification
- Powertrain components will transition to EV specific technology over time, eliminating the need for ICE products throughout the vehicle
Electrified Vehicle Production – by Region
China and Europe lead the way

**China Production Volumes**
- 2020: 26.7M
- 2025: 28.6M
- 2030: 32.4M
- 2035: 35M

**Europe Production Volumes**
- 2020: 22.5M
- 2025: 23.3M
- 2030: 24.1M
- 2035: 25M

**North America Production Volumes**
- 2020: 16.9M
- 2025: 17.3M
- 2030: 18.1M
- 2035: 20.3M

**ROW Production Volumes**
(includes Japan, Korea)
- 2020: 29M
- 2025: 30.2M
- 2030: 31.4M
- 2035: 32.4M

**2020-2035 CAGR**
- China: 19%
- Europe: 17%
- North America: 15%
- ROW: 5%

**Source:** Plante Moran/AFS
Evolution of the Automobile Chassis
Changing Requirements to be Common, Modular

- Vehicle differentiation requirements for end customers decline
- Utilitarian applications provide broader, common customer experience through autonomous, shared, electrified vehicles

Variable Skateboard Applications
- Pickup Application
- SUV Application
- Shuttle Bus Application

ICE Chassis

Electric Vehicle Skateboard Chassis
Evolution of the Interior Space

Shifting Expectations of the User Experience

2000 – 2015
Traditional Interior of the Past

- Cockpit focus to layout of the interior

2015 – 2020
Current Interiors

- Interior focus still in the cockpit, but with more technology available

2020 – 2025
“Personalized and Connected”

- Interior physical features highly streamlined
- Interior design is used to differentiate their vehicles in the market

2025 and Beyond
“Autonomous and Shared”

- Interior is the “3rd living space”
- Interior maximizes user enjoyment and satisfaction through their experiences inside – air, light, touch

2008 Chevrolet Trailblazer SS

2018 Chevrolet Equinox

2018 Tesla Model 3 Featuring Next Gen Design / Technology

Mercedes-Benz F 015 Luxury in Motion Concept
Evolution of the Exterior

Design Changes Resulting from Mobility

Autonomous, shared, electrified vehicles will be more “utilitarian”

Utilitarian Design for Functionality

• Vehicle ownership will transfer from personal owners to fleet owners and **exterior differentiation could be less of a factor in vehicle designs**
• Emphasis will be on “interior” differentiation
• 3rd Living Space (home, work, vehicle)

Size Variations

• Vehicles transporting “one individual” could be smaller
• Multi-individual vehicles could be larger

Mixed Materials

• Increased safety resulting from Autonomy drives fewer collisions and more safety
• **Exterior materials shift to a variety of materials, including carbon fiber and composite plastics - frequency of collisions dramatically decreases**
**Evolution of Manufacturing Business Model**

**Manufacturing and Supply Relationships will Radically Change**

<table>
<thead>
<tr>
<th>Today</th>
<th>Future</th>
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<tbody>
<tr>
<td><strong>Transportation Model</strong></td>
<td><strong>Future</strong></td>
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<tr>
<td>Vehicles produced</td>
<td>Miles driven</td>
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<td><strong>Customers</strong></td>
<td><strong>“MaaS” fleet operators</strong></td>
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<td>Private owners</td>
<td>Commodity product, convenience, availability</td>
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<td><strong>Value Proposition to Customer</strong></td>
<td><strong>Platform architectures requiring major redesigns in 7-8 year development cycle</strong></td>
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<td>Differentiated, personalized products,</td>
<td>Skateboard platforms requiring refresh designs in 2-3 year development cycles</td>
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<td><strong>Product Design</strong></td>
<td><strong>OEMs internal RD&amp;E is duplicative and costly; viewed as a market differentiator</strong></td>
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<td>Platform architectures requiring major redesigns in 7-8 year development cycle</td>
<td>OEMs depend on RD&amp;E for innovation with proven, capable suppliers</td>
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<td><strong>Research Development &amp; Engineering</strong></td>
<td><strong>OEMs focus on mobility and customer experience. More responsibility of vehicle manufacturing shifts to suppliers</strong></td>
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<td><strong>Manufacturing</strong></td>
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<td>Manufacturing is core competency with OEM control of end-to-end processes</td>
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Transitioning for Technology
Strategies for Meeting the Mobility Future

Plante Moran’s Structured Approach to Strategic Planning

“Create Strategic Vision”

Market Dynamics
- Market Attractiveness
- Competitive Position

Company Assessment
- Capabilities
- Plans
- Performance

Strategy Synthesis

Alternatives/Business Models
- Product/Service Technologies
- Distribution/Supply Chain

Core Competencies

“Plan and Implement”

Strategic Plan
- Actionable Plans
- Progress Monitoring
Contact Information

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