Autonomous vehicles
Preparing for the changing mobility ecosystem
Agenda

1. Case for AVs, levels of autonomy, likely AV deployment scenarios

2. Benefits and challenges of AV deployment, role of government

3. Key considerations for industry participants to become competitive in the AV space
What are the main forces driving vehicle automation?
## Safety: road traffic fatalities are a global concern...automated driving technologies seen by many as the solutions

<table>
<thead>
<tr>
<th>Alarming safety statistics</th>
<th>Automated technologies address the cause of accidents</th>
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<tbody>
<tr>
<td><strong>Approximately 1.3 million people</strong> die in road accidents per year</td>
<td><strong>Human error</strong> accounts for <strong>95%</strong> of all road accidents</td>
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<tr>
<td><strong>Road traffic injuries: 8th leading cause of death globally; leading cause of death for young people aged 15–29</strong></td>
<td><strong>In 76% of the cases, human is solely to blame</strong></td>
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<td><strong>50 million</strong> injured per year</td>
<td><strong>Misjudging, driving dynamics, weather:</strong> <strong>50%</strong></td>
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<tr>
<td><strong>Cost</strong> of dealing with the consequences of road traffic crashes <strong>runs to billions of dollars</strong></td>
<td><strong>39%</strong> of passenger vehicles and <strong>26%</strong> of trucks <strong>do not activate brakes before a collision</strong></td>
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<tr>
<td><strong>Current trends suggest that by 2030 road traffic deaths</strong> will become the <strong>5th leading cause of death</strong>, unless urgent action is taken</td>
<td><strong>Distraction:</strong> <strong>38%</strong></td>
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<td><strong>Underlying causes: alcohol, inexperience, fatigue</strong></td>
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Growing number of people, vehicles leading to traffic gridlock...threat to personal mobility...automated driving will be a part of future transportation efficiency solutions.

**Rapid urbanization:**
- 60% by 2030 – 4.9 billion
- 70% by 2050 – 6.3 billion

**Population growth/density:**
- 96 cities with limited land but population of more than **5 million** by 2025

**Vehicle growth:**
- 2013: 800 million vehicles
- 2050: 2-4 billion

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### Traffic Gridlock:

- **Delay hours due to congestion:**
  - Double by 2050
- **Traffic jams larger, omnipresent**
- ** Longer commute times**
- **Suppress economic growth opportunities**

Source: UN World Urbanization Prospects, World Business Council for Sustainable Development, EY analysis
Automated driving technologies provide a solution
Vehicles with varying levels of autonomous driving capability will coexist over the next few decades, and therefore different deployment scenarios will be necessary.

- **Levels of autonomy**
  - Low (L0)
  - L1
  - L2
  - L3
  - High (L4)

- **Driver control**
  - Driver present (L0)
  - Driver assistance (L1)
  - Limited driver intervention (L2)
  - High driver assistance (L3)

- **Vehicle control**
  - Manual (L0)
  - Automated (L1)
  - Partial automation (L2)
  - High automation (L3)

- **Connectivity**
  - Low (L0)
  - Basic connectivity (L1)
  - Enhanced connectivity (L2)
  - High connectivity (L3)

*Connectivity includes vehicle-to-device, vehicle-to-vehicle, vehicle-to-infrastructure, and vehicle-to-home.*

Source: EY analysis
AVs to be deployed in controlled environment initially... as benefits outweigh costs, and concerns are addressed, AV landscape will evolve and expand to connected highways, urban centers, public AV transportation.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Description</th>
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<tr>
<td>1</td>
<td>Self-parking structures/lots</td>
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<tr>
<td>2</td>
<td>Dedicated AV highway lanes</td>
</tr>
<tr>
<td>3</td>
<td>Connected urban centers</td>
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<tr>
<td>4</td>
<td>Public AV transportation</td>
</tr>
<tr>
<td>5</td>
<td>Expanded AV highways</td>
</tr>
<tr>
<td>6</td>
<td>Fully AV ecosystem</td>
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</tbody>
</table>
Revolutionary change presents many benefits and challenges
The transformation to automated driving offers many benefits...

- Eliminate human driving error, responsible for 95% of road accidents
- Decrease traffic accidents:
  - saving lives
  - preventing injury
  - avoiding the US$ billions in accident-associated costs
- Expansion of car- and ride-share, commuter programs; first mile/last mile services
- Increased mobility for elderly, disabled, children too young to drive

- Transportation efficiencies:
  - reduced traffic congestion
  - increased roadway capacity
  - shorter commute times
  - Decline in vehicle ownership; vehicles/family reduced

- Benefits
  - Safety
    - Traffic safety
    - Accident cost
  - Efficiency
    - Fuel consumption
    - Traffic flow
  - Mobility
    - Vehicle sharing
    - Vehicles per family
    - Transport for all
… however, the road to autonomous driving is not without its challenges

- Maintain privacy while collecting data to run robust network
- Data accuracy, processing speeds critical to a safe transport environment
- Increasing vehicle IT content increases the threat of malicious software, hardware manipulation
- High cost of automated driving technologies
- Updating infrastructure with communication, monitoring technologies costly for governments & municipalities
- Responsibility for malfunctions, accidents?
  - Liability shifts from vehicle owner to AV providers
  - Who pays the premiums?
  - Governments reluctant to allow AVs on public roads
  - Ensure safety of AVs before allowing mass adoption
Governments, academia, sector councils play an important role in AV deployment
Government will need to play a key role in facilitating the introduction and adopting of AVs, through suitable regulations, incentives and requisite infrastructure development.
Governments, automotive councils and academic institutes work together to facilitate the introduction and mass adoption of AVs.
Detailed considerations for key AV stakeholders
Commercial deployment of AVs presents significant changes to the automotive sector with far reaching implications and considerations for stakeholders across the value chain...
...who is prepared for the transformation?

Opportunities and challenges

<table>
<thead>
<tr>
<th>AV market stakeholders</th>
<th>Opportunities and challenges to value chain</th>
</tr>
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<tbody>
<tr>
<td>Vehicle manufacturers (VM)</td>
<td>Business model transformation</td>
</tr>
<tr>
<td>Suppliers</td>
<td>Suppliers developing automated technologies play a vital role in the growing AV market</td>
</tr>
<tr>
<td>Technology/Telecom companies</td>
<td>Opportunity for tech firms to enter AV market, surpass OEMs(?)</td>
</tr>
<tr>
<td>Government</td>
<td>Governments tasked to implement policies, safeguard consumers, ensure AVs are proven prior to mass market growth</td>
</tr>
<tr>
<td>Dealer/retail network</td>
<td>Integrate services (aftermarket, maintenance, insurance, roadside assistance) to maintain brand recognition, consumer connection</td>
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</table>
...who is prepared for the transformation?

AV market risks/threats

- AVs lessen the need for replacement vehicles
- Question the need for personal vehicles, a clear threat to VMs
- Decrease in personal vehicles a threat to supply base, especially suppliers not developing automated components
- Tech firms reduce the cost of automated systems and sell aftermarket devices, AVs could be on the road within 5 years
- Prominent AV issues: insurance and legal liability, operating regulations, data security and privacy
- Dealer networks challenged to transform business models
- Competition from non-automotive retailers
### Strategic considerations for AV stakeholders

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<th>Key stakeholders</th>
<th>Strategic considerations</th>
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</table>
| **VMs**                           | • Use new business models that optimize new sales and service opportunities, such as AV sharing, innovative finance programs, targeting fleet customers  
• Collaborate within and outside the auto industry on R&D to maintain leadership position in AV innovation and be the first to market with new AV technologies  |
| **Suppliers**                     | • Focus R&D investments on AV solutions that generate the most value for your customers — breakthrough technology pioneers  
• Partner with technology and telecom companies to accelerate innovation and reduce costs  |
| **Technology/Telecom companies**  | • Consider expanding scope of business to include all aspects of AVs’ technology and data requirements — holistic solutions for connectivity, security and privacy, data processing, management and analytics  
• Investigate opportunities to establish partnerships with existing VMs to develop new, AV-only offerings  
• Identify and partner with cities and integrated mobility providers to address impact of autonomous vehicles on their respective business models, infrastructure and networks  |
| **Government/regulatory bodies**  | • Develop future state urban network plans that address the gradual increase in vehicle automation, network connectivity and data requirements of AVs  
• Engage early (and often) with key stakeholders in AV policy and legislation design and implementation, certification, license requirements and training  
• Conduct independent research and analysis of automated driving and the implication for urban infrastructure and mobility planning over the next 50 years  |
| **Dealer/retail network**         | • Establish integrated service offerings (maintenance, software upgrades and customization, insurance, charging stations) to maintain brand recognition and consumer connection  
• Consider developing new service opportunities such as AV driver training and certification  
• Restructure aftermarket business model to address new retail competition that may spawn from AV deployment  |
| **Integrated mobility providers** | • Evaluate investment opportunities within urban networks most likely to adopt AV usage and establish a presence in these areas  
• Collaborate with VMs on new AV fleet and commuter services that are likely to grow in the new AV ecosystem  |

* includes car sharing companies
## Operating and performance considerations for AV stakeholders

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<th>Key stakeholders</th>
<th>Operating and performance considerations</th>
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</table>
| VMs                                    | - Devise methods of data analytics to manage and interpret significant volume of AV data  
- Assess readiness for regulatory changes in local markets  
- Manage warranty costs owing to rising technological complexities  
- Institutionalize checks to ensure data privacy and security |
| Technology/ Telecom companies          | - Explore a more active role in the automotive value chain by providing the requisite infrastructure, data mining, privacy and bandwidth solutions |
| Government/ regulatory bodies          | - Institutionalize a framework to enable and run smart and integrated megacities  
- Provide regulations and policies around deployment of AVs — data privacy and cybersecurity, safety and liability, incentives and taxation  
- Seamlessly integrate public transportation into smart cities  
- Integrate vehicle registration, state taxes and tolling charges  
- Re-license drivers to be certified for using AVs  
- Collaborate and develop industry-wide certification process for levels of autonomy and safety |
| Dealer/retail network                  | - Invest in employee (on-floor, sales and technicians) and driver training, and customer awareness  
- Use digital media and smartphones to promote features and facilitate customer transactions  
- Service the AV network and infrastructure |
## Investment and capital considerations for AV stakeholders

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<th>Investment and capital considerations</th>
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<tr>
<td>VMs</td>
<td>• Form need-based and strategic alliances, JVs and acquisitions to gain technology and reduce costs</td>
</tr>
<tr>
<td></td>
<td>• Create a network of partners to enable new revenue streams — car-sharing programs, on-demand mobility, AV fleet service, in-vehicle entertainment/advertising, etc.</td>
</tr>
<tr>
<td>Technology/Telecom companies</td>
<td>• Explore opportunities to emerge as a mobility solutions provider</td>
</tr>
<tr>
<td></td>
<td>• Potentially partner with existing VMs in expanding deployment of AV scenarios</td>
</tr>
<tr>
<td></td>
<td>• Partner with local government, VM’s, other technology companies for investment in requisite infrastructure; targeting cities as customers</td>
</tr>
<tr>
<td>Government/regulatory bodies</td>
<td>• Invest in requisite infrastructure to enable deployment of AVs</td>
</tr>
<tr>
<td></td>
<td>• Support AV research through R&amp;D incentives, testing infrastructure, and encouraging local stakeholder participation in process</td>
</tr>
<tr>
<td>Dealer/retail network</td>
<td>• Adapt business model to the evolving landscape and compete with non-automotive retail competition</td>
</tr>
<tr>
<td></td>
<td>• Explore other revenue streams, such as car-sharing programs and on-demand mobility</td>
</tr>
</tbody>
</table>
Thank you
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