Self-Driving Cars: Disruptive vs Incremental

Authors: Uma Ayyer, Sajid Husain, Tao Jiang, Srdjan Petrovic, Anand Tolani

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“Autonomous Drive is about relieving motorists of everyday tasks, particularly in congested or long-distance situations. The driver remains in control, at the wheel, of a car that is capable of doing more things automatically. Self-driving cars, by comparison, don’t require any human intervention – and remain a long-way from commercial reality. They are suitable only for tightly-controlled road environments, at slow speeds, and face a regulatory minefield.”

- Carlos Ghosn, CEO of Nissan Motor Co, Ltd.
**Automakers**

Cars that **assist** humans while driving.

**Google**

Cars that **taxi** humans around.
Automakers

- Realtime view of the world.
- Sonar, radar, and camera technology.

Google

- Pre-mapped world: observing deltas.
- High-precision lidar technology. ($$$)
The adjacent technology industries to watch in this space are the sensors manufacturers, big data, silicon vendors with compute power in the embedded space and companies working on artificial intelligence, Google is moving forward with its plan to change the game by providing autonomous mobility services such as “robo taxi” rather than selling cars. It plans to release this technology within 4 years.

Auto-manufacturers predict that fully autonomous vehicles may not reach mainstream for at least another decade. The current sensor systems are very expensive. They are working on incremental automation technologies but not a driverless future.
Automakers

AUTOMATED PARKING ASSIST (Now)
Toyota, Ford, Mercedes-Benz, Volkswagen, Tesla

Adaptive Cruise Control (2016)
BMW, GM, Volkswagen, Mercedes-Benz, Toyota

Highway Assist (2018)
Nissan, Mercedes-Benz, GM

Highway Auto Driving (2020)
Nissan, Mercedes-Benz

Driverless Car (2030)
Nissan, Mercedes-Benz

Google

Driverless Car (Now to 2020)
**Market Summary**

- Semi Autonomous Features bring in $30B additional revenue in 2014
- Semi Autonomous features Expected to grow to $250B by 2030
- Google SDC is in prototype stage in 2014
- SDC will bring in additional $80B revenue by 2030
- 75% of car by 2035 will be either Semi Autonomous or SDC
- **New entrant Google will capture 8% of total Car market by 2035**

**Market Disruption due to SDC**

- $200B Auto Insurance industry will transformed as Premium will go down due to less accidents
- Rental Car Industry, Taxi Service and Ride share will merged and evolve into Robo-Taxi Model.
- Auto Service industry will be consolidated into few big Automated service companies
- **Software/Electronics content of car will be 50% of the cost of car**

**Total Car Market Size Prediction**

**Opportunities for Supplier of Components for SDC**

- **Data from multiple sources: IHS and Market research**
### State Legislation

<table>
<thead>
<tr>
<th>Bill</th>
<th>Year</th>
<th>License</th>
<th>Routes</th>
<th>Driver’s Seat Occupant(1)</th>
<th>Distracted Driving Ban(2)</th>
<th>Vehicle OEM Liability</th>
<th>Safety &amp; Operating Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>NV</td>
<td>2011</td>
<td>✓</td>
<td>Testing for now</td>
<td>Designated state highways</td>
<td>Lic driver &amp; passenger req.</td>
<td>exempt when autonomous</td>
<td>TBD by NV DOT</td>
</tr>
<tr>
<td>CA</td>
<td>2012</td>
<td>✓</td>
<td>Mandate for testing and public operation</td>
<td>Not explicitly restricted</td>
<td>Lic. driver req.</td>
<td>exempt when autonomous</td>
<td>Due from CA DMV before Jan 2015(3)</td>
</tr>
<tr>
<td>FL</td>
<td>2012</td>
<td>Testing only</td>
<td>Not explicitly restricted</td>
<td>Lic. driver req.</td>
<td>exempt</td>
<td>Drafter report was due Feb 2014</td>
<td></td>
</tr>
<tr>
<td>MI</td>
<td>2013</td>
<td>X</td>
<td>Testing only</td>
<td>Not explicitly restricted</td>
<td>Lic. driver req.</td>
<td>MI DOT to submit report by Feb 2016</td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>2013</td>
<td>X</td>
<td>Testing only</td>
<td>Lic. driver req. with kill switch</td>
<td>exempt when autonomous</td>
<td>Bill indefinitely tabled by Sen. Brophy citing transportation committee opposition</td>
<td></td>
</tr>
</tbody>
</table>

(1) Driver’s seat occupant must be a licensed driver with access to steering, throttle, and brake controls.
(2) Ban on use of cell phones and texting while driver is operating the vehicle.
(3) Intent for public operation by Jun 2015.

### Federal: NHTSA
- Begun 4 year safety standards study, 1st phase to be completed in 2017.
- Research includes “vehicle to vehicle” communication technology.
- Encourages states to allow testing of self-driving.
- Does NOT recommend states currently allow public operation.
- Else, licensed occupant in driver’s seat should be required.
- Suggests operators have special training and licensing

<table>
<thead>
<tr>
<th>Level</th>
<th>Definition</th>
<th>Example / Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 0</td>
<td>No Automation</td>
<td>driver always in complete control</td>
</tr>
<tr>
<td>Level 1</td>
<td>Function-specific Automation</td>
<td>e.g. stability control or brake assist</td>
</tr>
<tr>
<td>Level 2</td>
<td>Combined Function Automation</td>
<td>two or more automated functions</td>
</tr>
<tr>
<td>Level 3</td>
<td>Limited Self-Driving Automation</td>
<td>“the Google car” 2013, BMW X5</td>
</tr>
<tr>
<td>Level 4</td>
<td>Full Self-Driving Automation</td>
<td>driver not available at any time</td>
</tr>
</tbody>
</table>

### Federal: NTSB
- Require EDRs (event data recorders, i.e. “black boxes”).

Automakers

- Nationwide support for assistive technology (e.g., adaptive cruise control).
- Future technology can follow law changes hand-in-hand.

Google

- States currently allow only testing of self-driving vehicles.
- Federal government study completes only in 2017.
- California most likely state to allow public operation.
Auto Insurance Industry


Privacy & Security Concerns

- Traditional insurance law – vehicles are insured not drivers.
- For Level 4 vehicles, does Private Motor Vehicle Insurance \(\rightarrow\) Manufacturer Product Liability Insurance?
- Black Boxes \(\rightarrow\) Easier fault determination?

Can the auto insurance industry survive a 90/90 world?

<table>
<thead>
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<th>Source: The Eno Transportation Foundation</th>
</tr>
</thead>
</table>

| Total Crashes per year in U.S.\(^{11}\) | 5.5 million |
|------------------------------------------|
| % human cause as primary factor\(^{12}\) | 93%        |
| Economic Costs of U.S. Crashes\(^{13}\) | $300 billion |
| % of U.S. GDP\(^{14}\) | 2%        |
| Total Fatal & Injurious Crashes per Year in U.S. | 2.22 million |
| % of fatal crashes involving alcohol | 31%        |
| % involving speeding | 30%        |
| % involving distracted driver | 21%        |
| % involving failure to keep in proper lane | 14% |
| % involving failure to yield right-of-way | 11% |
| % involving wet road surface | 11%        |
| % involving erratic vehicle operation | 9%         |
| % involving inexperience or overcorrecting | 8% |
| % involving drugs | 7%         |
| % involving ice, snow, debris, or other slippery surface | 3.7% |
| % involving fatigued or sleeping driver | 2.5% |
| % involving other prohibited driver errors (e.g. improper following, driving on shoulder, wrong side of road, improper turn, improper passing, etc.) | 21% |

90% fewer accidents \(\rightarrow\) 90% fewer private cars
90% fewer costs in claims \(\rightarrow\) 90% drop in private premiums \(\rightarrow\) $53B industry?
Winners

SDC Adopters
- Google
- Nissan
- Audi
- Mercedes
- Toyota
- Tesla

Intelligent Traffic Highway & Mapping
- IBM
- Google

Integrated Component Suppliers
- BOSCH
- Continental
- Denso

Rental & Ride Sharing Companies
- AVIS, Hertz
- UBER, LYFT

Losers

Auto Manufacturer
- Reduce car sales
- Low Margins

Taxi Services

Auto Insurance Companies
- Reduce Premiums
- New model for collision coverage

Auto Service Industry
- Consolidation with few survivors

** Data from multiple sources: IHS and Market research
Summary

1880-1900
Major Disruption in Transportation

Dispense with a Horse

and save the expense, care and anxiety of keeping it. To run a motor carriage costs about 1½ cent a mile.

The Winton Motor Carriage

is the best vehicle of its kind that is made. It is handsomely, strongly and yet lightly constructed and elegantly finished. Easily managed. Speed from 3 to 20 miles an hour. The hydrocarbon motor is simple and powerful. No odor, no vibration. Suspension Wire Wheels. Pneumatic Tires. Ball Bearings. Send for Catalogue.

The Winton Motor Carriage Co., Cleveland, Ohio.

2020-2050
Dispense with a Driver

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ENGINEERING LEADERSHIP PROFESSIONAL PROGRAM
IF YOU THOUGHT YOU WEREN’T IN THE AUTO INDUSTRY, THINK AGAIN.

The rise of connected, shared, self-driving cars

BIG DATA AND SURVEILLANCE

EVERY PART OF YOUR CAR WILL BE MONITORED AND RECORDED.

New federal rules require every new vehicle by 2014 to have a “black box” recorder.

ENERGY

INTELLIGENT DRIVING AND PARKING WILL MAKE MANY NEW FUEL OPTIONS Viable.

40% of gasoline in urban areas is consumed looking for parking.

REAL ESTATE

THE UP TO 80% OF URBAN LAND THAT IS DEDICATED TO CARS WILL BE FREE FOR OTHER USES.

Automated carsharing could reduce total vehicles by 85%.

HEALTH

DEMAND FOR ORGAN REPLACEMENTS WILL SKYROCKET.

61% of traffic accidents, the main source of organ donations, could be mitigated using connectivity and sensors.

RETAIL AND DELIVERY

THE $168BN LOCAL DELIVERY INDUSTRY WILL BE UPRENDED.

Models indicate deliverybots could operate at 96% below today’s costs.

THE FOURTH PLACE INDUSTRY

WE WILL GAIN A WHOLE EXTRA MONTH OF PRODUCTIVE TIME EACH YEAR WITH SELF-DRIVING CARS.

The average worker spends 250 hours per year commuting.

SMARTPHONES AND APPS

THE HOTTEST APPS AROUND WILL BE THE ONES IN YOUR CAR.

The percentage of vehicles that connect to mobile devices will increase from 4% to 90% by 2020.

INFRASTRUCTURE

MUCH OF THE $168BN IN ANNUAL TRANSPORTATION SPENDING WILL BE REROUTED TO TECH SPENDING.

Coordinated vehicles could increase highway efficiency by up to 500%.

WIRELESS CONNECTIVITY

CARS WILL BE JUDGED BY THEIR SENSORS AND CPUs, NOT BY THEIR ENGINES.

20% of the value of new vehicles ($600bn) will come from connectivity by 2020.

COME SEE, PITCH, AND DISCUSS THE DRIVING REVOLUTION AT THE THINKSACT PARTY MAY 23RD AT PARISOMA

 faberNovel
 PARISOMA


ELP²
UC BERKELEY
ENGINEERING LEADERSHIP PROFESSIONAL PROGRAM
Morgan Stanley estimates that self-driving vehicles could deliver the following:

- **$1.3 Trillion** in annual savings to the U.S. Economy
- **$507 Billion** in annual productivity gains
- **$488 Billion** in annual accident cost reduction savings
- **$158 Billion** in annual fuel cost savings
- **$138 Billion** in annual productivity savings from less congestion
More than 90 percent of all accidents are caused by human failure, according to the Network of Employers for Traffic Safety (NETS).

The financial cost for US car accidents are estimated to be $165 Billion every Year as per AAA 2008 report.

Average Car is Parked 96% of it lifespan

Massive Parking Area required for Car Parking

Self Driving cars would Save lives

Commute will become quicker and less stressful

Driverless Cars will be more fuel-efficient

Driverless car will make car-sharing program more popular

Driverless Car could bring billions of dollars in benefits
Self Driving Car Market Forecast

Behind-the-Scenes Software Will Capture the Largest Slice of the Autonomous Car Opportunity

Cost of SDC Feature Add By IHS

SDC Volume forecast by IHS

SDC Market Share Forcast by Region by IHS (2030)
Automated Driving Market: Functional Roadmap, Europe and North America, 2010–2020

- AEBS
  - Automated Parallel Parking (Semi-automated steering)

- ACC
  - LCA (partial steering autonomy)

- Smart Navigation (vehicle deciding on routes)
  - Traffic Jam Assist

- Automated Highway Systems
  - Platooning
  - Intersection Assist (powered by V2x)

- Emergency Steer Assist
  - Automated vehicle taking control of navigation, transmission, steering, braking, and parking

- Driver still has the override switch controls to all operations

Source: Frost & Sullivan MIRA Ltd