Mega Trends and Their Impact on Future of Mobility

Key Note

Presentation by:

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Introduction:
- Transformational Shifts Reshaping the Future of Mobility

- New Mobility Business Models
- Mobility Integration
- Convergence of Corporate Mobility
- The City as a Customer
- Women and the Automotive Industry
- Focus on Health Wellness and Wellbeing in the Automotive Industry
- Connected and Automated Mobility
- Growth in high Speed Rail and Public transport spending
- Autonomous Cars New Business Models
- Conclusions, Q&A
Top Transformational Shifts Expected to Shape the Future of Mobility

- New Business Models
- Mobility integration
- Convergence in corporate mobility
- City as a customer

- Women Empowerment
- Health Wellness and Well-being
- Connected and Automated Mobility
- Growth in high Speed Rail and Public transport spending
Transformational Shift No. 1: New Business Models - Growth of Car Sharing

Over 543,000 vehicles to be shared in Europe by 2020

<table>
<thead>
<tr>
<th></th>
<th>2014</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional</td>
<td>49,368, 2.5 million</td>
<td>236,145, 14.9 million</td>
</tr>
<tr>
<td>P2P</td>
<td>81,380, 1 million</td>
<td>222,210, 3.3 million</td>
</tr>
<tr>
<td>Corporate</td>
<td>2,896, 250 companies</td>
<td>84,649, 4,000 companies</td>
</tr>
</tbody>
</table>

Carpooling:

- Members: 16.0, 24.1, 45.0
- Vehicles: 45.0

*Graphs showing growth in members and vehicles from 2012 to 2020 for Traditional, P2P, and Corporate models.*
Transformational Shift No. 1: New Business Models cont. - Growth of Ride Sharing Business Models
Comparative Market Positioning of Ridesharing business models

Public Transport

Planned – Long Distance

“Fixed” Carpooling

Corporate Carpooling?

“On Demand” Carpooling

Lower Price per KM

Higher Price per KM

Instant – Short Distance

“Taxi” & Limosine Services

“Transportation Network Companies”

Source: Frost & Sullivan
Transformational Shift No. 1: New Business Models cont. - Within 3 years ehailing taxis control close to 20% of the global taxi market

eHailing is dramatically revolutionizing the taxi industry business model. By 2020 the global taxi market is expected to reach 5 million vehicles growing at a CAGR of 4%
Transformational Shift No. 1: New Business Models Cont. - The rise of Uber and more is yet to come

As of Jan 2015

- Countries: 58
- Cities: 311
- Driver: 324,074
- Customer: 7,417,139

Business Models Covered:
- Logistics / Courrier
- Private Hire / Limo
- Ridesharing
- Taxi

- Groceries (UberEssentials)
- Food (UberFresh, UberEats)
- Retail delivery (UberRush)
- Parcels & Logistics (UberCargo)
The Arrival of Uber for Trucking Signifies a Dynamic Change in the Trucking Landscape

Mobile Based Freight Brokerage Market: Revenue Scenario Analysis, North America, 2015 and 2025

- CAGR : 39.3%

Year | Revenues (Billions)
--- | ---
2014 | $160.0
2025 | $220.0

3rd Party Logistics | Mobile Based
Transformational Shift No. 2: Integrated Mobility

Technology enabled, any device delivery of real-time, door-to-door, multi-modal travel encompassing pre-trip, in-trip and post-trip services bringing Convenience, Time & Cost Savings to the Mobility User.
Transformational Shift No. 2: Convergence of Vehicle Rental Business

- **Car Sharing**
  - 2012: ~18,745,000
  - 2020: ~236,145,000
  - **Share**: About 30.0–35.0% of the global share is held by Zipcar, Car2Go and Drive Now

- **Car Rentals**
  - 2012: ~49,368,000
  - 2020: ~450,000,000
  - **Share**: ~45.0–50.0% by Enterprise, Hertz, Avis, Europcar

- **Car Leasing**
  - 2012: ~12,200,000
  - 2020: ~14.5 million
  - **Share**: ~75.0–78.0%
  - **Others** include VW Leasing, Arval, Sumitomo Mitsui, Alphabet, RCI Banque, Lex Autolease, Athlon and so on.

**Units (Millions)**

- **Car Sharing**
  - 2012: ~18,745
  - 2020: ~236,145
- **Car Rentals**
  - 2012: ~49,368
  - 2020: ~450,000
- **Car Leasing**
  - 2012: ~12,200
  - 2020: ~14.5 million

**Notes:**
- All figures are rounded; the base year is 2014.
- Sources: LMC Automotive, Frost & Sullivan.

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Frost & Sullivan
Transformational Shift No. 2: Mobility Landscape – Many Actors, New Partnerships, New Models, New Competitors

- OEMs
- Leasing Companies
- Travel Management Companies
- Car Rental Companies
- Integrated Solution Providers
- Public Transport Operators
- Software Platform Providers
- Fleet Management Providers
- Integrated Mobility
## Transformational Shift No. 2: Mobility Integration Platform Example

### Case Study - Qixxit – Deutsche Bahn Launches Mobility Integration Services

<table>
<thead>
<tr>
<th>Current Services</th>
<th>Integrated booking</th>
<th>Real-time information of integrated means of transport</th>
<th>Alternative routing</th>
<th>Cross- &amp; upsell-products (Hotel, luggage service...)</th>
<th>Social travelling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

### Current partners

<table>
<thead>
<tr>
<th>Rental car</th>
<th>Taxi</th>
<th>Local public transportation</th>
<th>Bicycle</th>
<th>Car Sharing</th>
<th>Car</th>
<th>Flight</th>
<th>Long-distance transport</th>
<th>Coach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sıxt</td>
<td>AVIS</td>
<td>Europcar</td>
<td>DB</td>
<td>Call a Bike</td>
<td>Flinkster</td>
<td>ADAC</td>
<td>via</td>
<td>FlixBus</td>
</tr>
<tr>
<td>BetterTaxi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>multicity</td>
<td>PTV Group</td>
<td></td>
<td>IC Bus</td>
</tr>
<tr>
<td></td>
<td>+ partners</td>
<td>+ partners</td>
<td></td>
<td></td>
<td>book-n-drive</td>
<td></td>
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</tr>
</tbody>
</table>

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Frost & Sullivan
Transformational Shift No.3: Future of Corporate Mobility - From TCO to TCM

Total Cost of OWNERSHIP
• Running Core Fleet & Keeping Company Drivers Informed

Total Cost of USERSHIP
• Managing Overall Fleet & Educating All Company Drivers

Total Cost of MOBILITY
• Delivering Integrated Services & Empowering All Employees
Transformational Shift No.3: The Business & Leisure Convergence = “Bleisure”

Business travellers

82% Business travellers explore the city

60% take a “Bleisure” trip

30% added 2 vacation days

54% Bleisure travellers bring family

But…Policy is Unclear…only 14% of employees are aware of a Business & Leisure travel policy

Reason for interest:

Business Travel is a >$1 Trillion Market and Moving Towards A Self Service Concept

Transformational Shift No.3: Frost & Sullivan’s Vision for the Future of Corporate Mobility

- Integrated Multi Modal Platforms (for business)
- OEMs increase Corporate Mobility footprint
- Growth of “sharing” reducing need to own / sole use (e.g. company car)
- Mobility Auditing & Mobility Budgets
- Changing working locations/patterns change mobility requirements
- Rise of Internet Aggregators (smartphone enabled)
Transformational Shift No.4: City as a customer
Over 5 million vehicles in the global taxi fleet by 2020. Close to 500,000 taxis to be replaced every year globally.

- **Sao Paulo**: Fiat Siena, Fiat Idea, Chevrolet Spark
- **Hong Kong**: Toyota Comfort, Prius (HK$420,000)
- **Beijing**: Hyundai Elantra (¥90000), Sonata (¥120,000), Volkswagen Jetta (¥115,000)
- **Mumbai**: Tata Indigo, Renault Logan, Toyota Innova
- **Dubai**: Toyota Camry (86,900AED)
- **Paris**: Peugeot 406 (€12000), Mercedes C (€35224)
- **London**: LTI Blackcab and Mercedes Vito both (£35,000-40,000)
- **New York**: Ford Escape ($21,215), Toyota Prius ($26,650), Nissan NV200
- **Toronto**: Toyota Camry ($24,900), Chevrolet Impala ($30,395), Lincoln Town Car
- **Tokyo**: Toyota Comfort, Nissan Crew ($18,500-20,000)
- **Singapore**: Hyundai Sonata
- **Dubai**: Nissan NV200
- **London**: LTI Blackcab and Mercedes Vito both (£35,000-40,000)
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- **Singapore**: Hyundai Sonata

Source: Frost & Sullivan
Transformational Shift No. 5: More women drivers and customers in future than men ... and women prefer leasing vehicles

Driving licence parity data by country

Source: Frost and Sullivan Analysis
Spacious children’s play area

Stylish interiors - polished wooden floors

Female staff – sales and mechanics

Larger, pink painted parking spaces for women*

*Seoul only currently

Source: Nissan website, image – YouTube, Frost & Sullivan
Transformational Shift No.6: Health, Wellness and Wellbeing the Next Big Differentiation Factor for OEMs

- **Built-in (Embedded)**
- **Brought-in (Peripheral Integration)**
- **Cloud-enabled (Broadcast)**

Source: Frost & Sullivan
Transformational Shift No.6: HWW Focal Points - HWW features are focused on the mind, body, and soul

Automotive HWW Technologies: Key Features List, Global, 2014–2025

- Driver drowsiness detection
- Fatigue monitoring
- Stress level monitoring
- Muscle therapy
- Palm and facial temperature monitoring
- Erratic driving pattern recognition
- Outside ambient air quality monitoring
- Pollen/allergen level monitoring
- Drunk-driving prevention
- Heart rate monitoring
- Blood pressure monitoring
- Breathing rate monitoring
- Glucose level monitoring
- Comfort/ease of access/egress
- In-car ambient temperature monitoring
- In-car ambient lighting monitor
- Driver workload estimation

Source: Frost & Sullivan
Transformational Shift No. 7: Connected Cars Accelerating Big Data Opportunities

Connected and Non-Connected Cars, North America and Europe, 2013 and 2020

Note: All figures are rounded. The base year is 2013. Source: Frost & Sullivan analysis.
Transformational Shift No. 7: Impact of Connected Cars: Big Data

- Digital Leads
- Internet Aggregators
- Warranty Costs Reduction, Predictive Maintenance
- Product Performance Analysis, Production and Supply Chain
- User & Dealer Satisfaction
- Advanced Mobility services, Dynamic Navigation and Parking

Images and logos are only for representation. Source: Frost & Sullivan analysis.
Transformational Shift No. 7: From Hands Free to Mind Free: Future Will See Fully-automated Vehicles

Drive and Let Drive Concept
Can be manually driven or self-driven by the vehicle

Predetermined A-to-B
Ideally suitable for Personal Rapid Transit (PRT)

Personal Mobility with Route Inputs
Ideally suitable for urban commuters and people with special mobility needs

Fully-automated vehicles hold the potential for fundamental rethinking of vehicle designs. For instance, partially collapsible vehicles also save parking space when not in motion.

Source: Frost & Sullivan
Transformational Shift No. 8: Driverless Technology Not Just a Trend for Cars, Rail has a Better Business Case

Automatic Train Protection (ATP)

ATP is the first step towards automation. All primary safety functions are automated.

Empty Driving cab concept
Can be manually driven or self-driven by the vehicle

Automatic Train Operation (ATO)

Driving functions of the train can be automated through the ATO (basic driving to zero staff).

Higher speeds of operation
Maximum wait time of 60 seconds on the platform for the next train

Automatic Train Supervision (ATS)

Real time automation of train management and operations regulation through ATS.

High speed end to end connectivity
Rapid dissemination of data and information to all parties involved
Transformational Shift No. 8: 200 Year old rail Will Still be a Mega Trend in 21st Century  Over 10,000km of HSR planned in Europe by 2030

Length of High-speed Rail Infrastructure by Region, 2013 and 2020

*Includes both Eastern and Western Europe

Note: Center chart depicts length of high-speed infrastructure by region for 2013. Source: UIC, Frost & Sullivan
Autonomous Cars New Business Models
Autonomous Cars New Business Models  Four key areas impacted by Fully-Autonomous Mobility

Opportunities from Fully-Autonomous Mobility, Global, 2015

Fully-Autonomous Mobility Opportunities

- Vehicle on-demand
- First & Last mile Commuting
- Mobility as a utility
- Peer-to-peer sharing

Source: Frost & Sullivan
## Autonomous Vehicles to revolutionize the e-Hailing Business Model – Case Study – New York Yellow Taxi

### Automated Driving Business Models: Case Study – New York Yellow Taxi, NA, 2015

<table>
<thead>
<tr>
<th>Current Taxi Market</th>
<th>Parameter</th>
<th>Future Taxi Market</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>Average number of daily Trips per taxi</td>
<td>~50</td>
</tr>
<tr>
<td>200</td>
<td>Average Daily Miles Covered by a Taxi</td>
<td>~350</td>
</tr>
<tr>
<td>7.1%</td>
<td>Taxi User Base (% of Population)</td>
<td>15-20%</td>
</tr>
<tr>
<td>22.39</td>
<td>Number of Taxis per 1000 Daily commuters</td>
<td>~18</td>
</tr>
<tr>
<td>$540 (2013)</td>
<td>Driver cost per day</td>
<td>$0</td>
</tr>
<tr>
<td>50,000</td>
<td>Number of Drivers</td>
<td>0</td>
</tr>
<tr>
<td>$6.31 (2013)</td>
<td>Average Fare per mile</td>
<td>~$4</td>
</tr>
<tr>
<td>$29,700 (2014 Nissan NV200)</td>
<td>Taxi Price</td>
<td>$40000</td>
</tr>
</tbody>
</table>

Note: Taxi user base in New York City was 600,000 passengers per day in 2014

Source: NYC Taxi And Limousine Commission, Frost & Sullivan
Group Rapid Transit to Replace Public Transport Buses To reduce congestion and reduce queuing in the event of demand spike

Peak Hour Routing

Scenario 1

- During peak hours, group rapid transit (GRT) will act as a point-to-point service, picking passengers en route.
- Frequency is increased to meet the demand.
- No of GRT Required to transport passenger: 3

Scenario 2

- During off-peak hours, group rapid transit (GRT) will picks more passengers to make optimal utilization of capacity.
- No of GRT Required to transport passenger: 1

GRT is assumed to have a capacity to transport 8 passengers.

Source: Frost & Sullivan
## Case Study – Public Transport in London

### Automated Driving Business Models: Case Study – Public Transport in London, Europe, 2015-2050

<table>
<thead>
<tr>
<th>Current Public Transportation</th>
<th>Parameter</th>
<th>Future Rapid Transportation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,073</td>
<td>Fleet size per million Population</td>
<td>~3000</td>
</tr>
<tr>
<td>56 - 87</td>
<td>Seating Capacity per Vehicle</td>
<td>8 - 56</td>
</tr>
<tr>
<td>4.86</td>
<td>Average Waiting Time for a Bus Along Frequently Availed Route (Minutes)</td>
<td>2 - 3</td>
</tr>
</tbody>
</table>

- Government appointed body
- **Ownership**: Could be owned by housing society
- Predefined/Supply Driven
- **Route**: Demand Driven
- Designated along main road
- **Boarding and Alighting Point**: Flexible to accommodate origin and destination of journey desired by user group
- Commuter waits for the vehicle
- **Basis of boarding**: Charted GRT awaits designated commuter

Note: Current and Future transportation includes only road based vehicles such as buses

Source: TfL, Frost & Sullivan
With Increasing Autonomy, Insurance Liability Likely to Shift to OEMs

Present-day Motor Insurance Model in driver centric

Driver centric evaluation

Future Motor Insurance Model

1. Brand centric evaluation
   Crash Prevention, Crash Worthiness, Algorithm.

2. Product centric evaluation
   Or
   Pods, personal vehicles, group rapid transit vehicles

3. System centric evaluation
   Or
   Increased Comfort, Option To Take Manual Control.

*Vehicle owner pays premium to cover some excesses such as stray incidents like theft, fire and vandalism

Source: Frost & Sullivan
At Present, Driving Behaviour & Incident History Key to Calculating Premium

**Insurance Premium Risk Calculating Factors**

**Vehicle-related**
- Brand, Vehicle age & Value
- Model features (safety technology)
- Performance
- Vehicle Size and Usage
- Modifications
- Annual Mileage
- Desirability (vulnerability to theft)

**Driver-related**
- Age/Driving Experience
- Claim Frequency
- Occupation
- Driving intervals and duration
- Type of cover (Comprehensive vs third party)
- Driving record and no-claims bonus

**Social Trends**
- Residential Locality
- Average number of occupants
- Coverage Gaps
- Accident history of locality (route)
- Where the car is parked (secured, covered space, curb side, garage)
- Frequently used routes

The above is not an exhaustive list and it contains some of the key parameters.

Source: Frost & Sullivan
Parameters Considered for Motor Insurance Premium Calculations

Parameters with continued relevance for Level 4 Automated Vehicles:
- Brand
- Peer Traffic
- Vehicle Size and Usage
- Frequently Used Routes
- Desirability, Vehicle age & Value
- Recall History Of Vehicle Model
- Time & Duration Of Journey
- Average Daily Miles Driven
- Vehicle Density
- Residential & Parking Locality
- Damage due theft, fire and vandalism
- Claim Frequency
- Average number of occupants

Parameters not relevant to Level 4 Automated Vehicles:
- Type of Cover
- Occupation
- Age/Driving Experience
- Driving Record
- Driver Behaviour
- Driver Alert / Warning Systems

New-to-bracket parameters relevant to mainly Level 4 Automated Vehicles:
- Driving Algorithm
- Cyber-security vulnerability
- Control logic robustness
- Access security robustness
- Privacy

Source: Frost & Sullivan
Risk slicing and risk-sharing models are to evolve, with manufacturer’s product liability and other stakeholders’ limited liability offsetting the risk borne by the insured.

Motor Insurance for Automated Driving: Risk Split Between Entities, Global, 2015 - 2050

- Manufacturer’s product liability
- Insured’s liability
- Other Stakeholders’ liability

Active Safety
- Semi-automated Mode
- Highly-automated Mode
- Fully-automated Mode

Potential impact on premium
- -20%
- -15%
- -15%
- -20%

Source: Frost & Sullivan
With decline in average premium per vehicle, the EU motor insurance market is expected to reduce by a CAGR of 3.88% over the next 35 years.

In 2013, Motor Insurance accounted for 29% of the total non-life insurance premiums in Europe.

- **Total Motor Premium (2013)**
  - €130 Billion
  - -0.5% Y-o-Y

- **Total Motor Claims (2013)**
  - €103 Billion
  - 4.8% Y-o-Y

**Coverage Split (2013):**
- 60% Third Party
- 40% Own Damage

**Average premium per vehicle is €470**

<table>
<thead>
<tr>
<th>Year</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>2050</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assuming vehicle in use to reduce by</td>
<td>10%</td>
<td>30%</td>
</tr>
<tr>
<td>Vehicle in Use (Million)</td>
<td>249.3</td>
<td>193.9</td>
</tr>
<tr>
<td>Total motor insurance market size</td>
<td>€70.30 Billion</td>
<td>€54.67 Billion</td>
</tr>
</tbody>
</table>

Assuming average premium per vehicle for motor insurance to decrease by 50%

Source: Frost & Sullivan
Future to evolve to bundling of motor insurance with other services

ADAS & Semi Automated Driving

Traditional Motor Insurance Model

Evolved Insurance Model with New Set of Premium Calculation Criteria

Fully-automated Driving Traffic

1. Motor insurance built into extended warranty
2. Motor insurance bundled along with property insurance
3. Insurance risk split between manufacturer and other stakeholders
4. Motor insurance offered by Vehicle Manufacturers

Source: Frost & Sullivan
Conclusions and Recommendations
Impact of Mobility Business Models on OEMs impacting Design, Size and Shape

Future growth from new mobility business models

Private Ownership

Sub compact

1 series  2 series

Sedan

3 series  5 series  7 series  X1

SUV

X5  X7

Trifecta effect?
Merging of 3 segments
• SUV
• Sedan
• Minivan or Hatchback

Sedan (Sports) + Minivan + SUV

Tesl Model X

Hatchback + Sedan + SUV

Volvo S60 Cross Country
Key Takeaways on Future of Mobility

1. Transformational shift to tech enabled platforms – driving customer expectations

2. New mobility business models changing the automotive landscape – vehicle sharing business models estimated to reach €10bn by 2020

3. Door to door is the way forward – driven by public and private integration

4. Competition, cooperation and collaboration between stakeholders in the field

5. Corporate mobility to be a key focus area with the merger of fleet, travel and expense management

6. Future mobility solutions need to be tailored to customer groups, e.g. women, gen Y, corp.

Source: Frost & Sullivan
Learn More About “New Mega Trends”

Published Book:
New Mega Trends
*Implications for our Future Lives*
By Sarwant Singh

Publisher: Palgrave Macmillan

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Mega Trends: Strategic Planning and Innovation Based on Frost & Sullivan Research

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Jay Nagley, UK Trade & Investment (Senior Specialist Automotive)

Andrey Berdichevskiy (World Economic Forum) Senior Manager Automotive Community

Steve Yianni, Transport Systems Catapult (CEO)

Dr. George Gillespie, MIRA (OBE, CEO)