iCity-CATTS

What Does the Future Hold for Smart Transportation in Canada?

Overview: **C**entre for **A**utomated and **T**ransformative **T**ransportation **S**ystems

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Matthew Roorda
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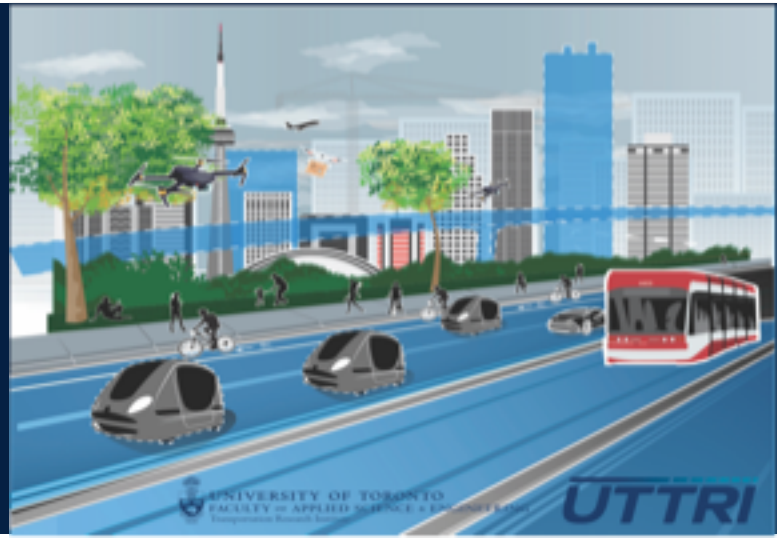
1st Annual iCity-CATTS Symposium
June 28th , 2018



UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING
Transportation Research Institute

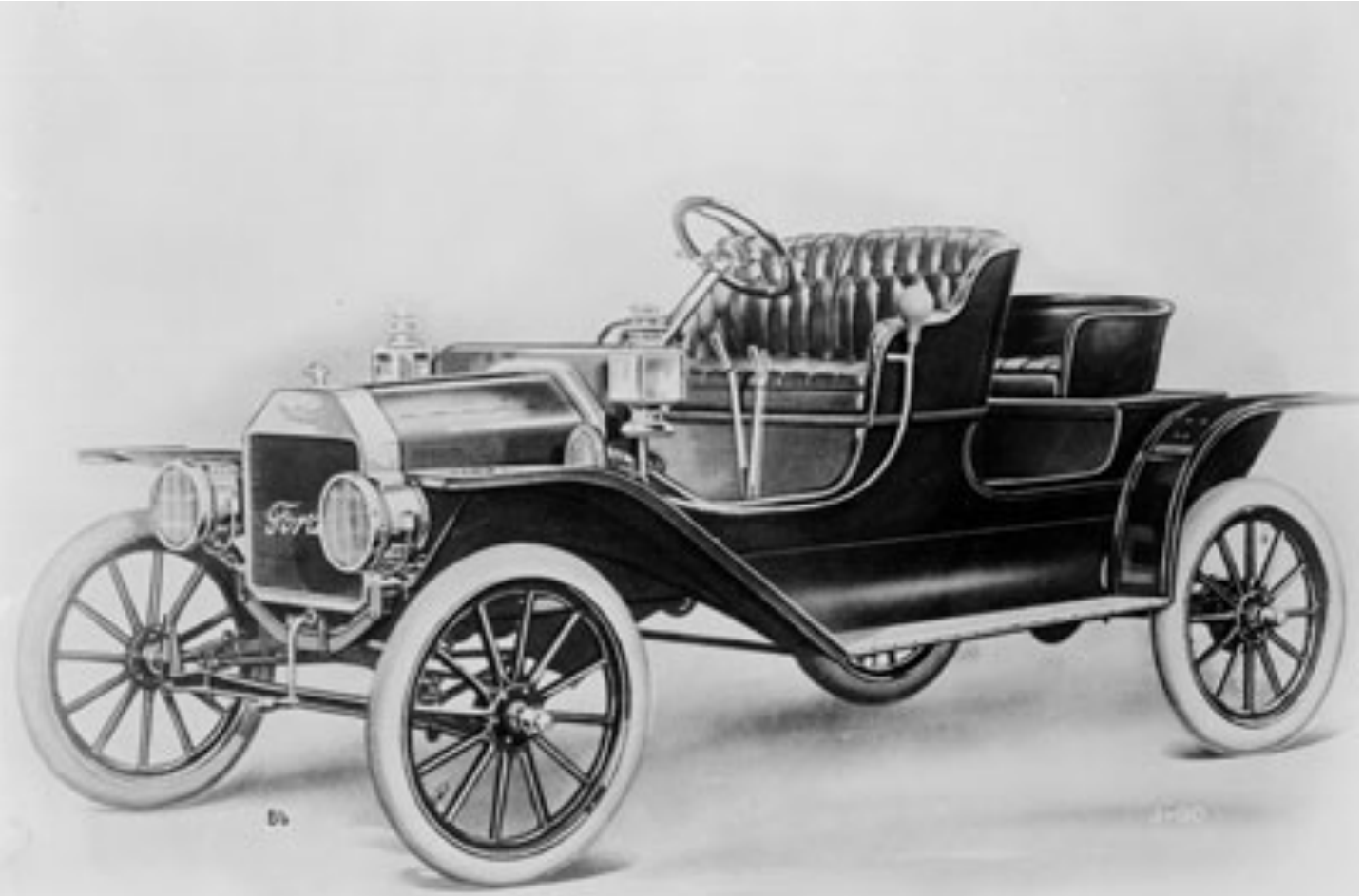
UTTRI

Transformative Transportation?

- "A new transportation system emerges from a groundswell of market-driven innovation in **technology**, **service provisioning** and ***social organization***, with **government** providing **frameworks** and **platforms** for bottom-up change"

http://reprogrammingmobility.org/trends/

The First Revolution - October 1st, 1908:
Ford Motor Company Unveils Model T

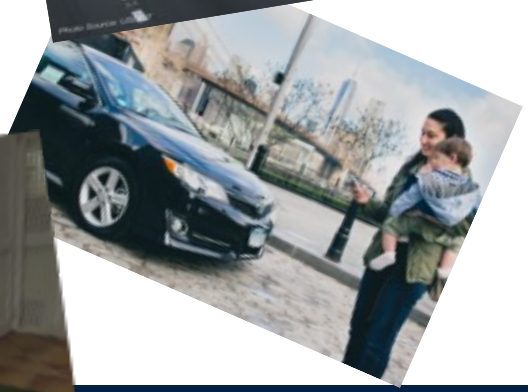


The promise: Travel farther, faster, in comfort and style!

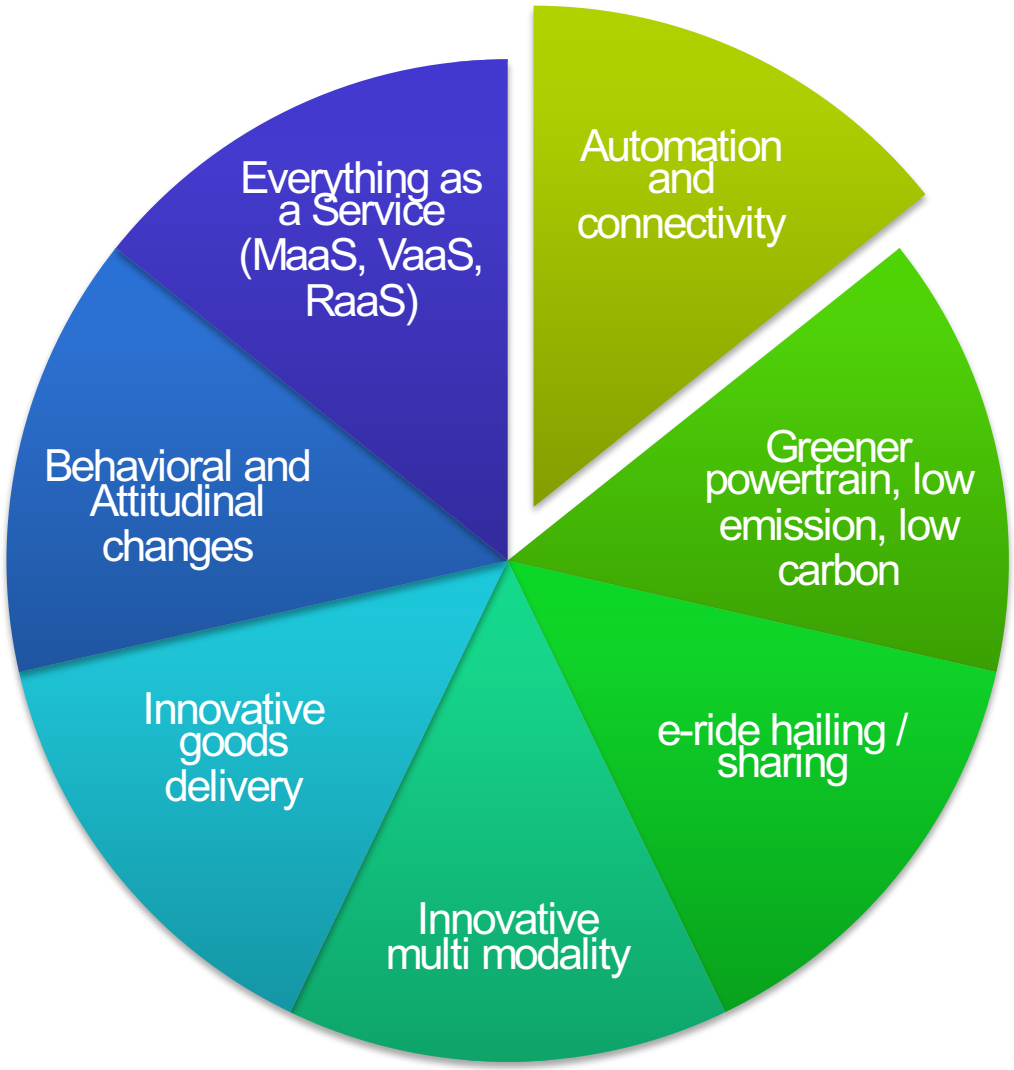
21st Century:

The Three Revolutions

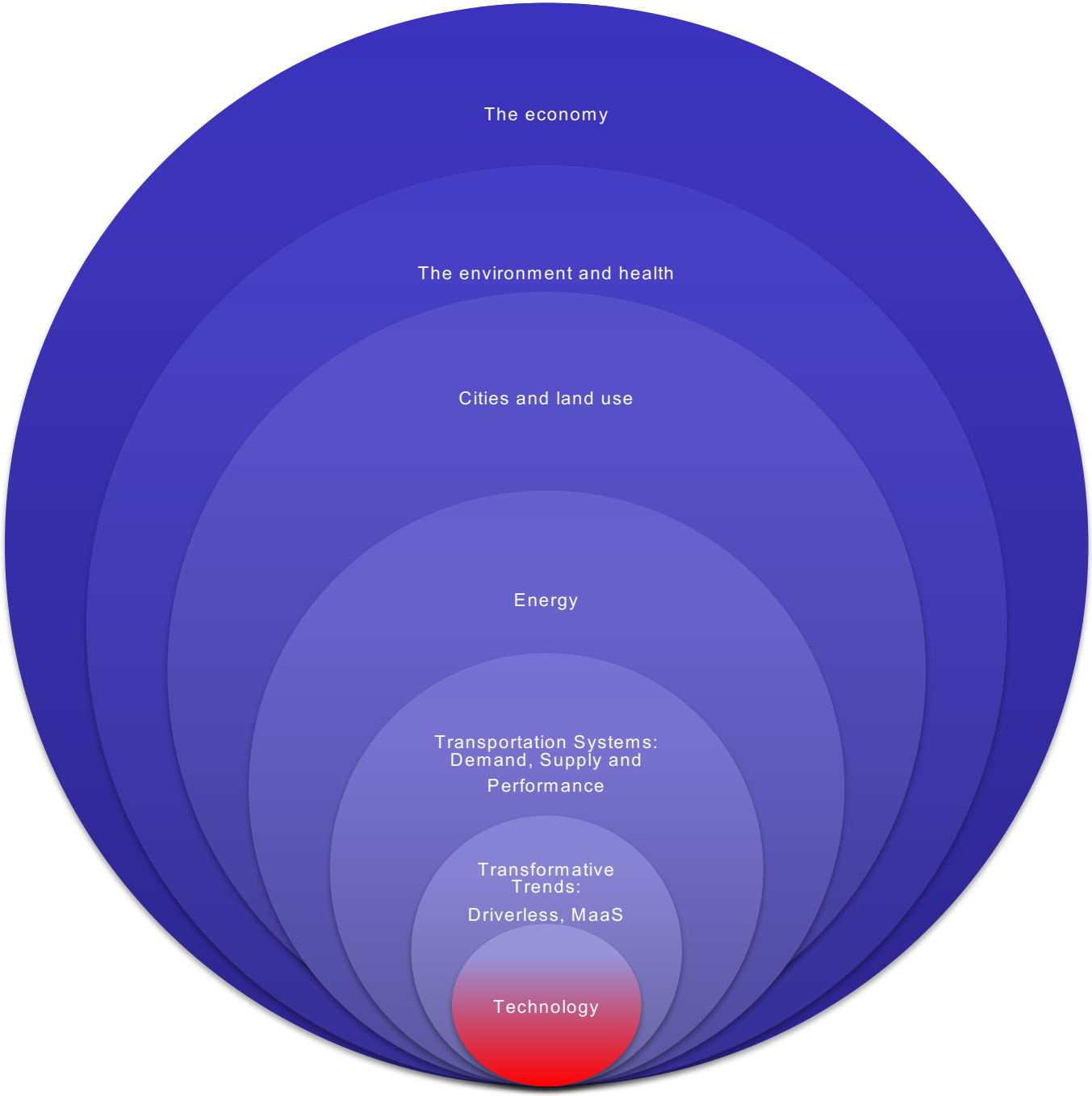
- Automated (and connected), green (/electric) and shared.
- Disruptive and transformative,
- Same promise, but 21st century high tech!
- Same issues, on steroids!
- The fundamentals of mobility are changing again.
- Bold vision for the future of transportation and cities, but equally high risks and potential for crises.
- Immediate need to develop quantitative tools to guide the evolution of our cities in the era of disruptive technologies,
- Empower people and business, protect the environment, harness and maximize potential and minimize risks.



Causes of Disruption and Transformation



The Ripple Effects



Automated and Transformative Transportation:

Opportunities to Harness and Expand

Automated and Transformative Transportation:

Risks, Unknowns and Unintended Effects

Fundamental Dilemma:

- Fundamental Dilemma:
  - As travellers face new choices
  - They will do what is best for them, individually, even if detrimental to the system
  - Unmanaged, the system will evolve towards undesirable state

- Policy makers, planners, operators, engineers and researchers must mind the user but must also mind the system and make it evolve in an orderly manner

- What is our vision for the cities we want to live in?

iCity-CATTS:

The Initiative

- July 1st, 2017: UofT Launches The Centre for Automated and Transformative Transportation Systems (CATTS),
- Not about automating a car but about a million of these on the road!

iCity-CATTS:

The Vision

- Centre for:
  - Quantifying transformation
  - Enabling positive transformation
  - Sustaining cities under transformation:
    - Social, Environmental and Economic Sustainability
  - **Reusable Virtual City Analysis Platform**:
    - Travel demand, transportation supply and systems (roads, transit, freight, active transportation)

- Key Characteristics:
  - Multi-disciplinary multi-sector *collaboratory*:
    - Academia, Industry, Technology Experts, Government
  - Cities and metropolises scale,
  - Integrated, quantitative and evidence-based approach.

Partners and Funding to Date

- Committed:
  - Universities of Toronto, Waterloo and Ryerson, California Irvine
  - City of Toronto
  - City of Mississauga
  - Region of York
  - Region of Peel
  - ESRI Canada
  - GM Canada
  - Toronto Atmospheric Fund
  - IBI Group
  - Residential Civil Construction Alliance of Ontario – RCCAO
  - Waterfront Toronto
  - MaRS Innovation
- In Progress:
  - Province of Ontario

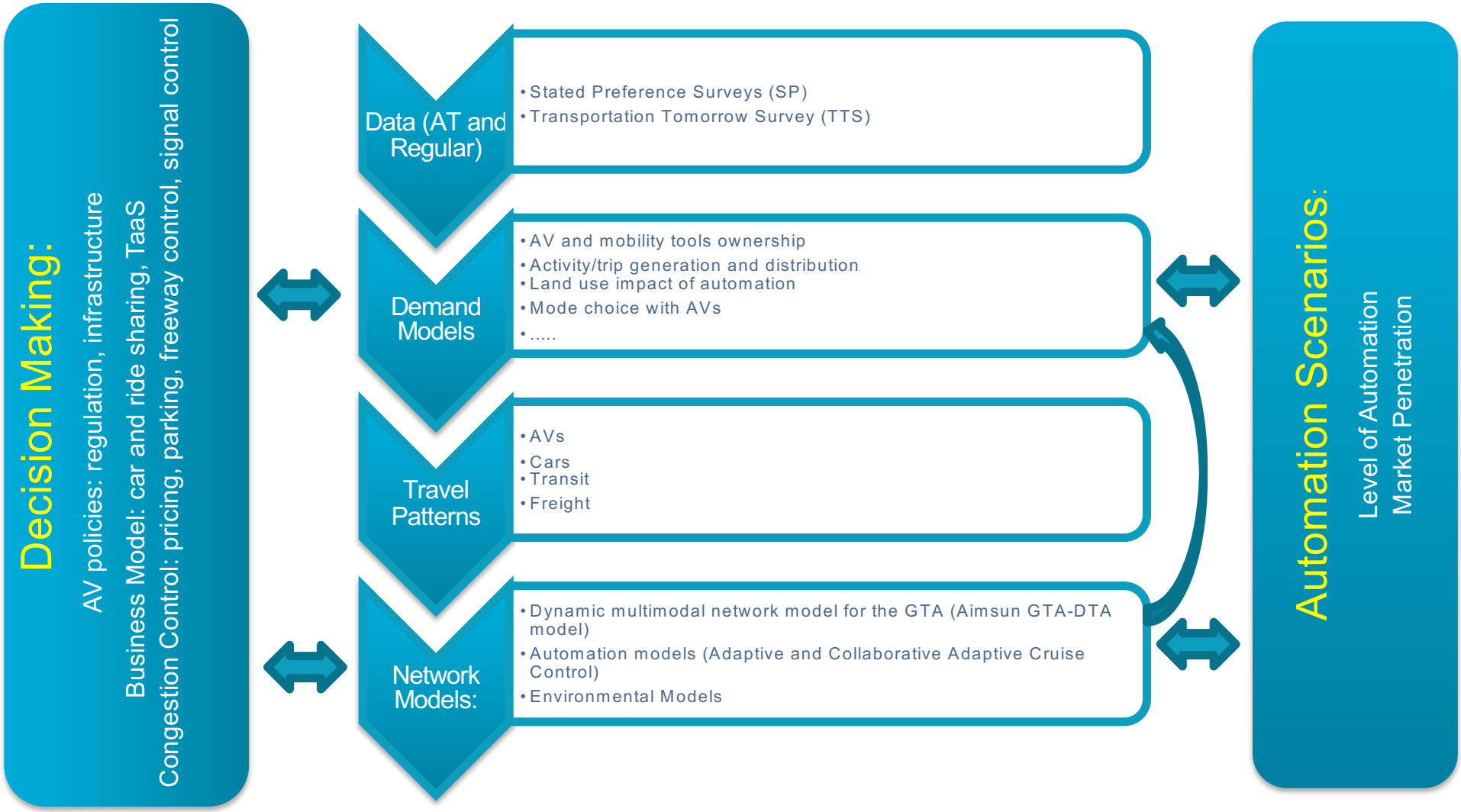
Yes, The Boldest Vision Is:

Automated, Connected, Green, Shared

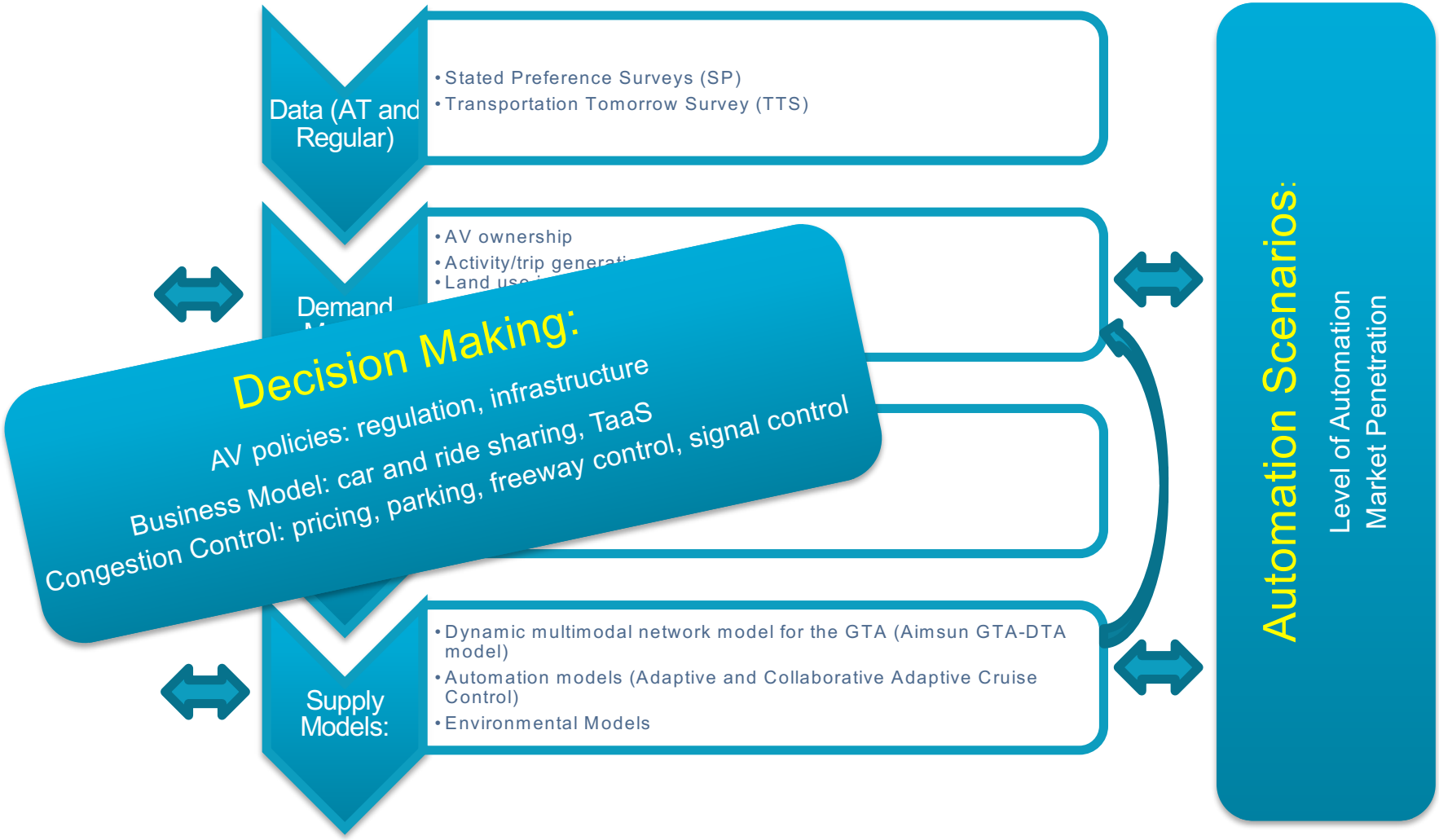
Beyond Speculation

Centre for Automated and Transformative Transportation Systems

How to, The Foundation:
Analyzing Transformative Transportation Systems

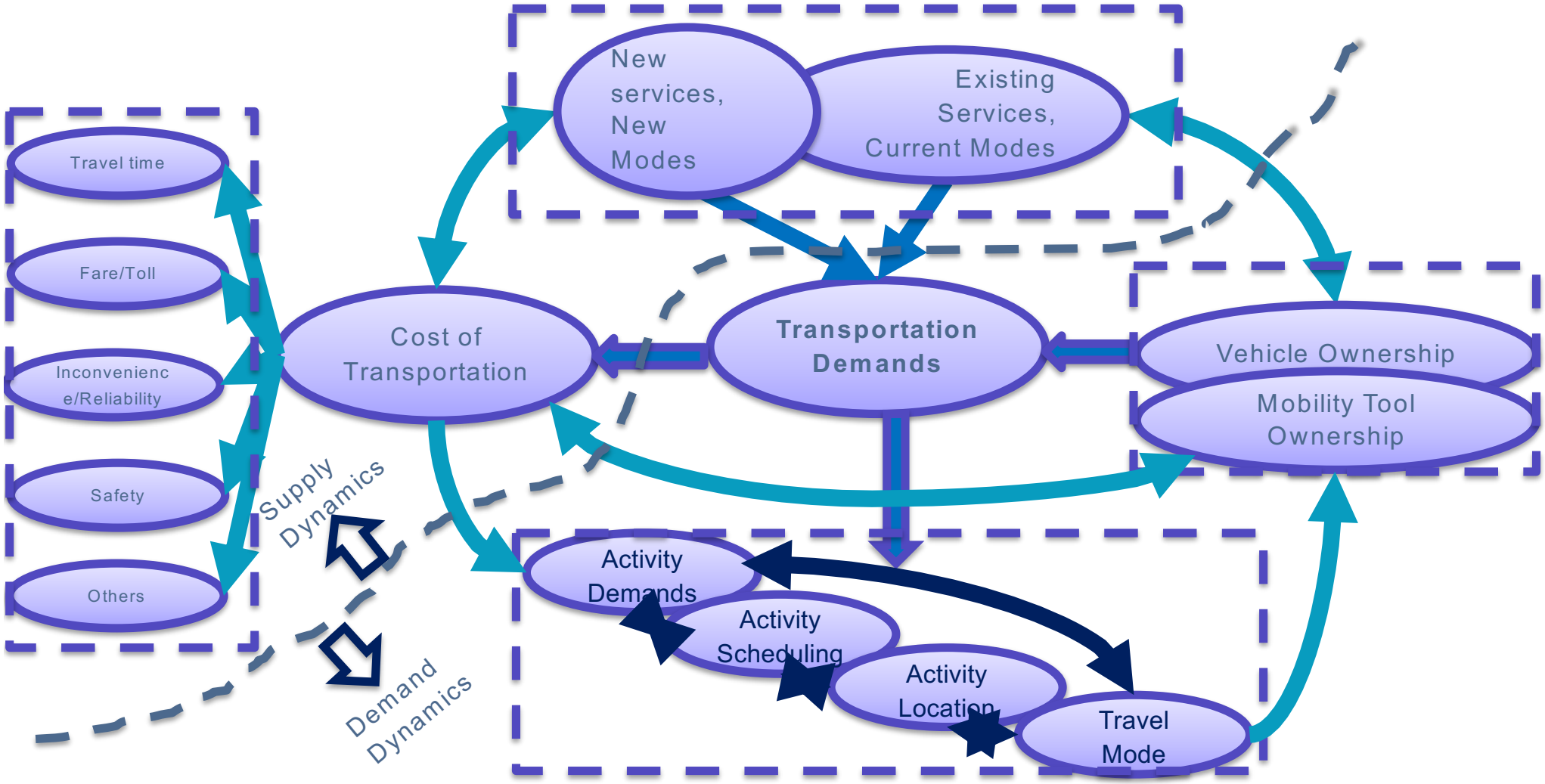


The Foundation:
Analyzing Transformative Transportation Systems



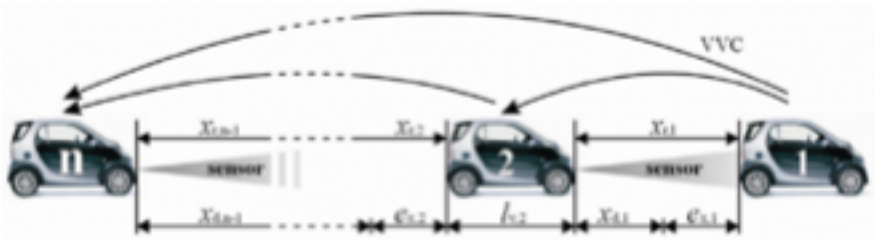
Transportation Demand and Land Use:

Impact of Transformative and Automated Transportation



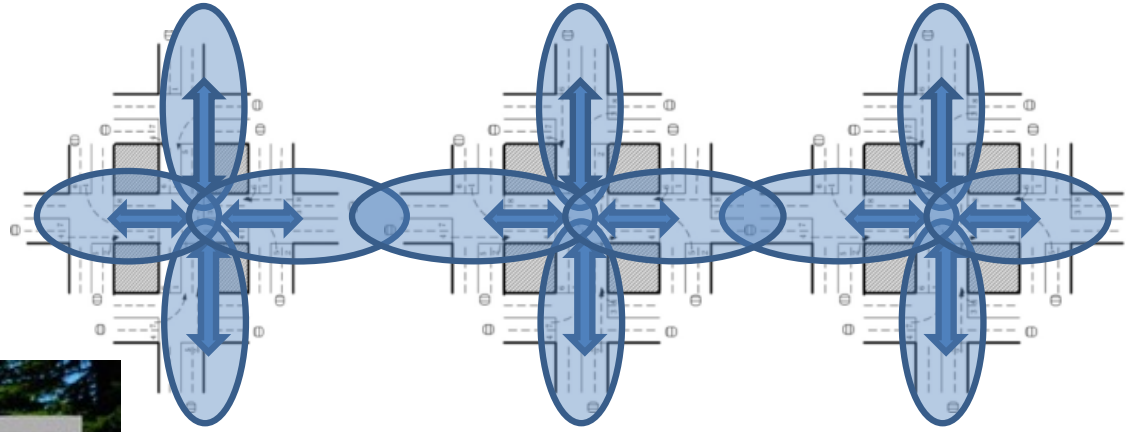
Infrastructure Networks

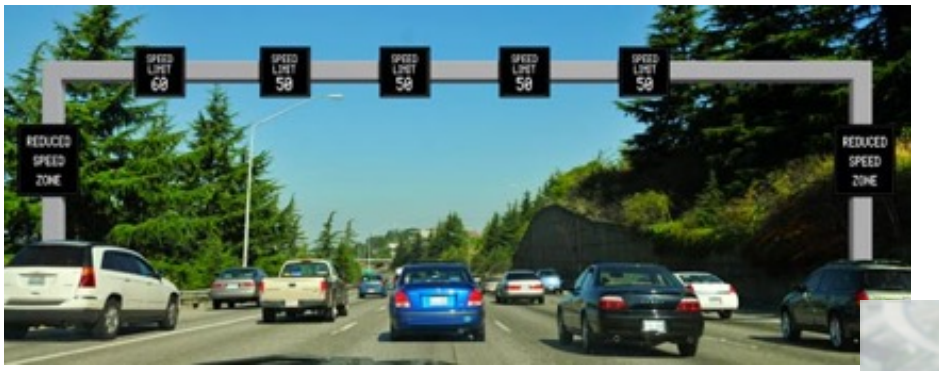
- Dynamic Simulation (DTA) with Automation
- Adaptive Cruise Control,
- Collaborative Adaptive Cruise Control (Platooning)
- Automating Lane Changing and Merging
- Dynamic Headway Control
- Dynamic Speed and Acceleration Control
- V-2-I based traffic management



Source: modeling connected vehicles using Aimsun

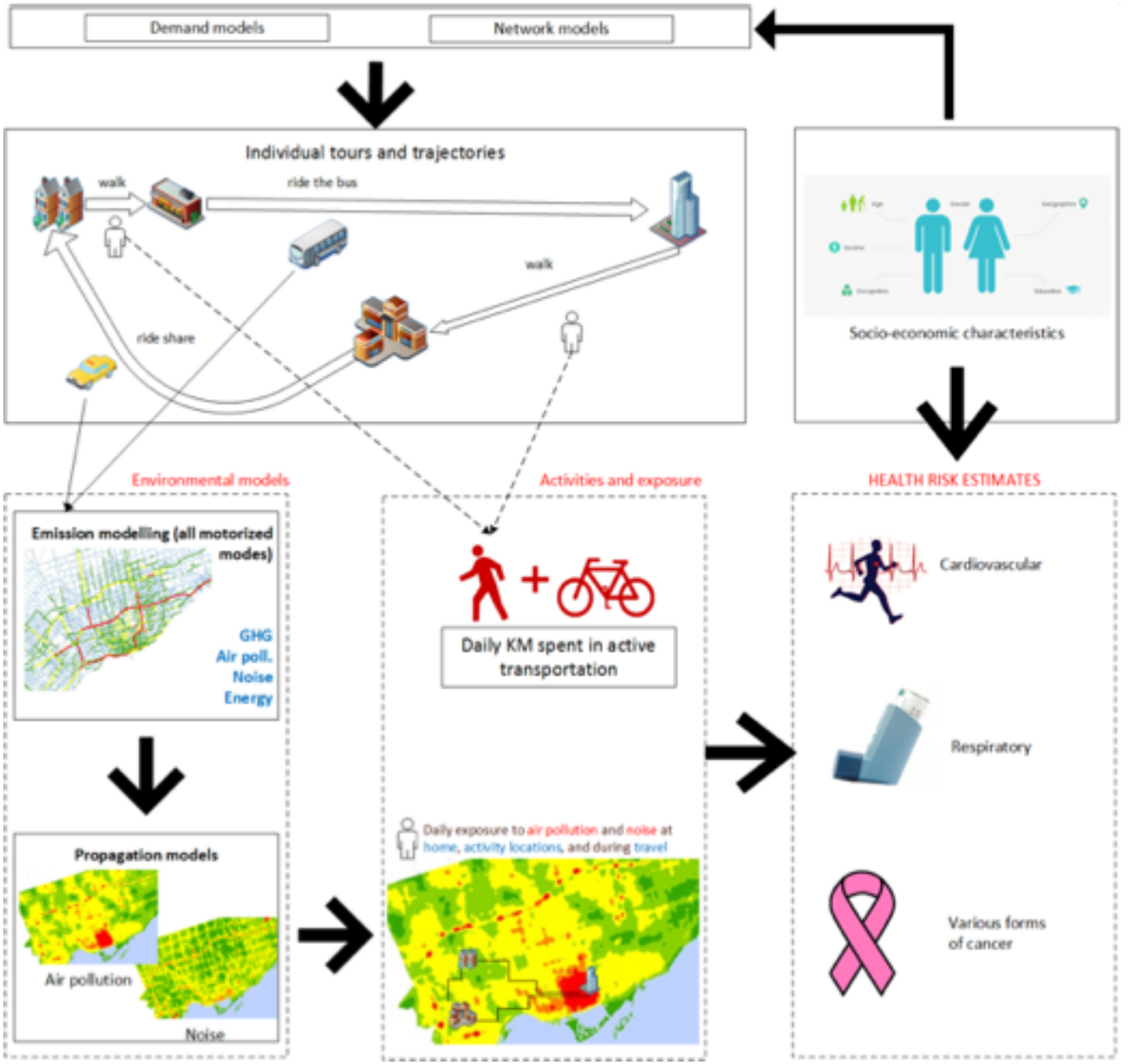
Infrastructure Control and Management:
Exploiting Automation and Connectivity



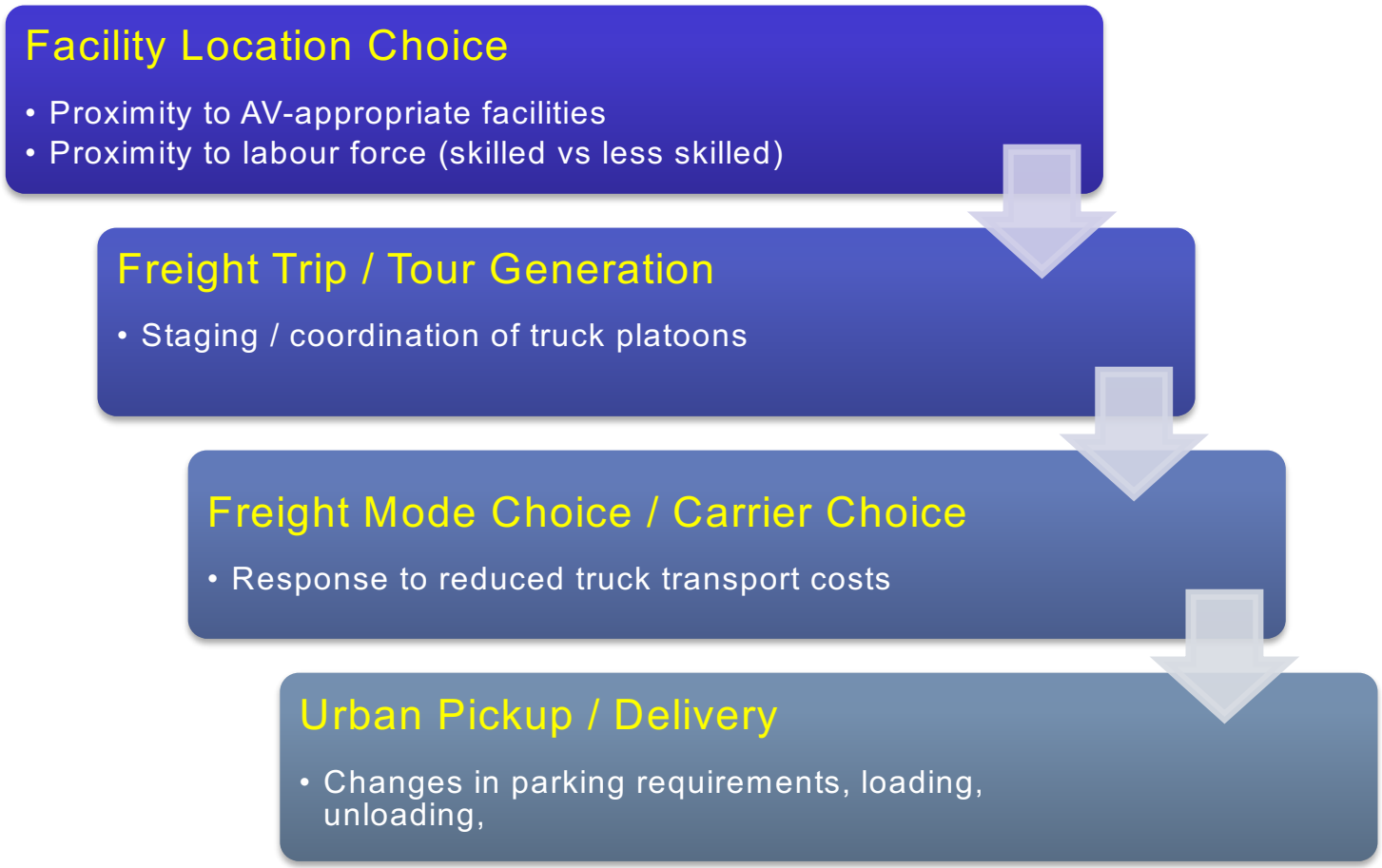


SOV, HOV, ZOV

Sustainability and the Environment

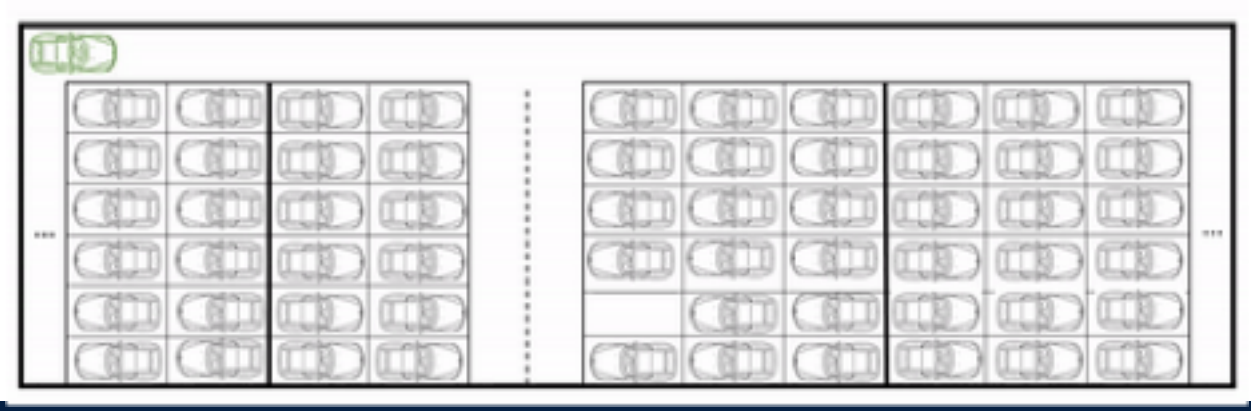


Freight Transportation Demand



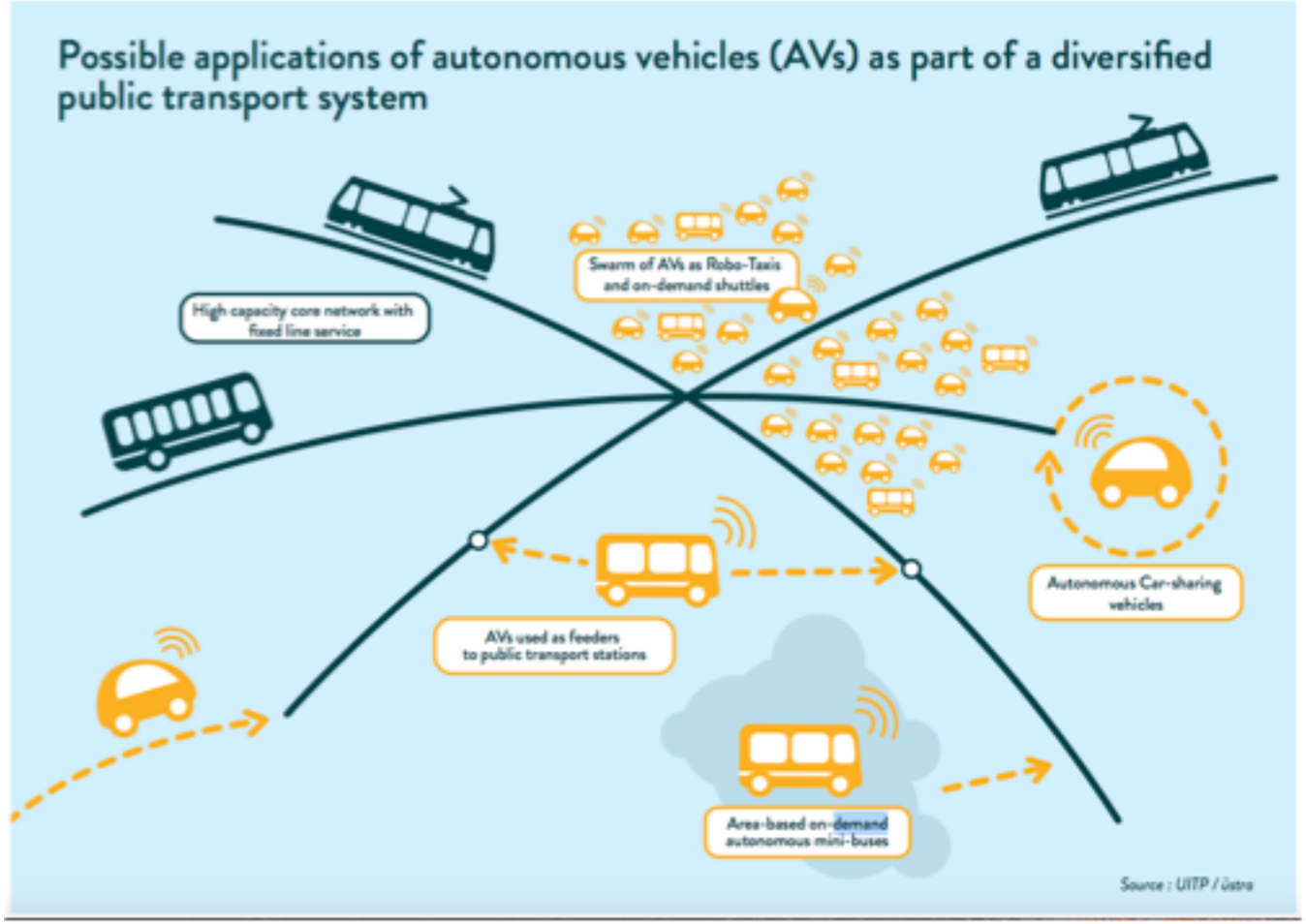
Automated vehicle parking

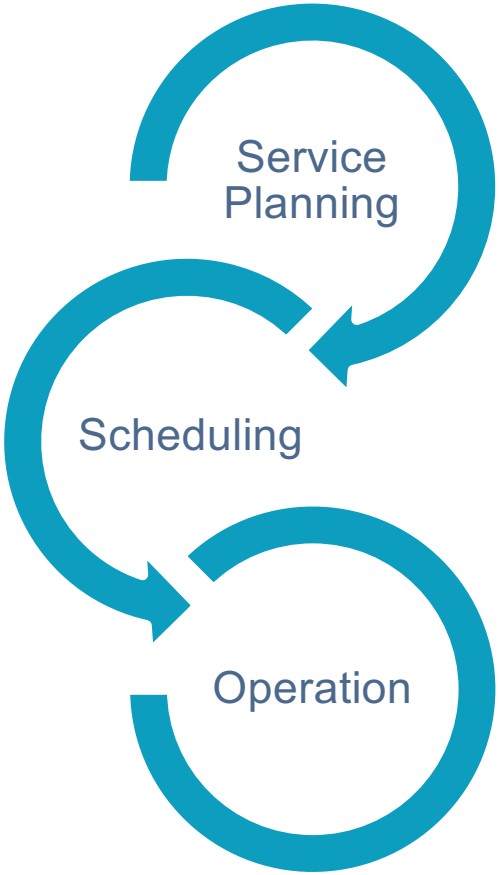
- Parking demand will change
  - mode choice, activity choice, drop-off / pick-up location, parking location and duration, and response to pricing and enforcement
- Parking supply may change
  - potential replacement of downtown on-street and garage parking with drop-off / pick-up zones, and AV parking at the outskirts
- Parking design will change
  - AV parking lots



Future Transit

The Evolution from Mass to MaaS Transit!





Putting the Pieces Together:
What If - Quantitative Impact Assessment

Inputs:

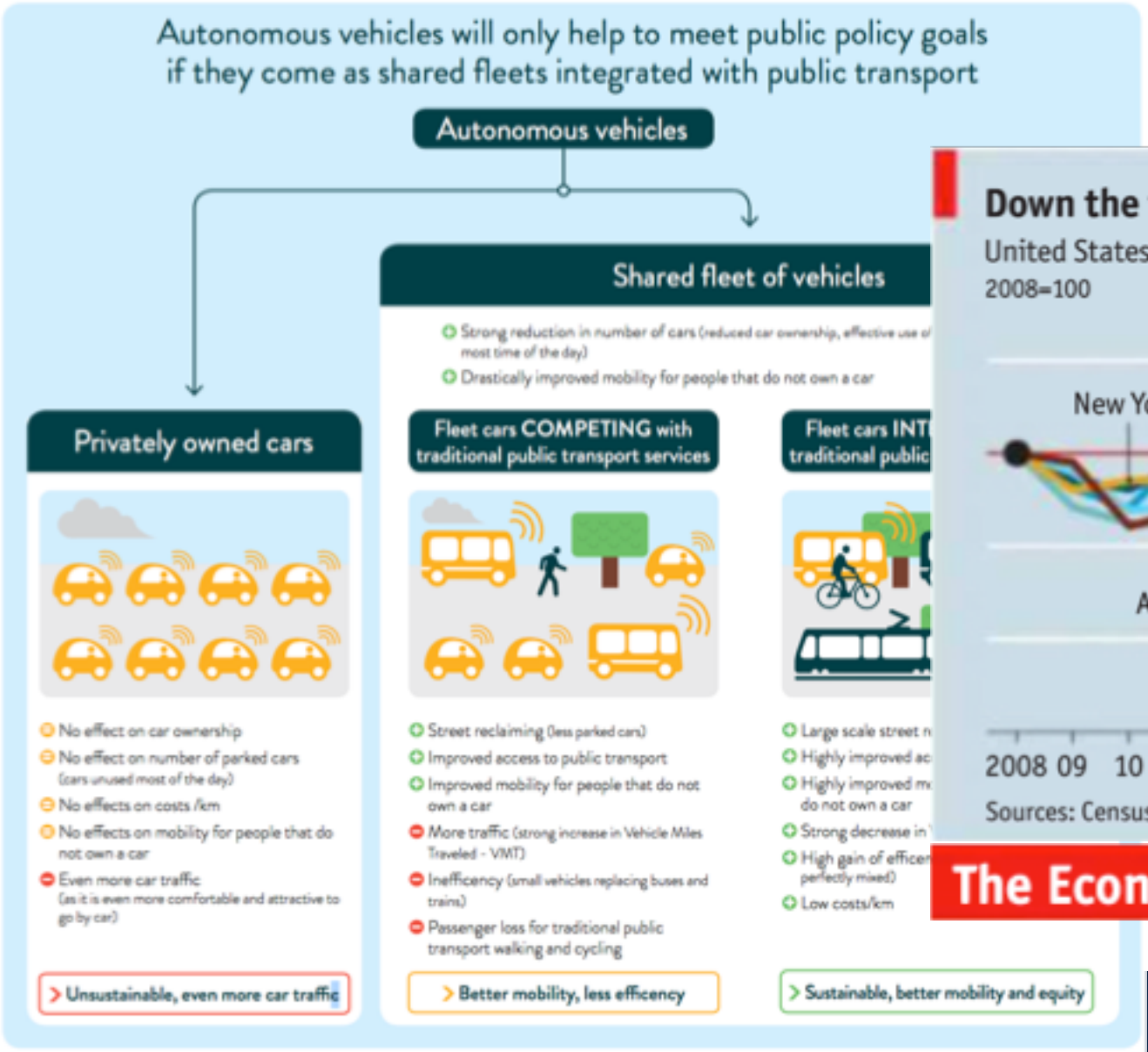
- Demographics and Socioeconomics
- Network Data
- Demand Data
- Mode Split
- Vehicle Fleet
- Pedestrians
- Scenario Specification
- .....

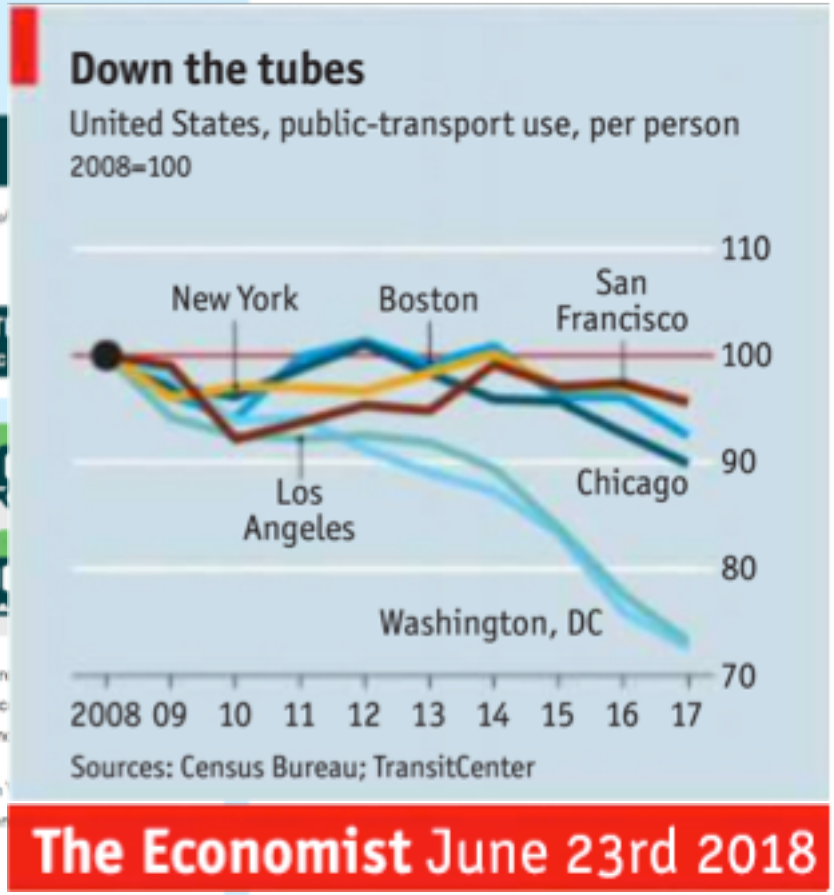
Impact Assessment and System Performance:

- Travel Times & Congestion
- Reliability
- Carbon Foot Print
- Economic impacts
- Mobility, Accessibility, Jobs
- Sustainability

Putting the Pieces Together:

Integrated Solutions NOT More of the Same Problems

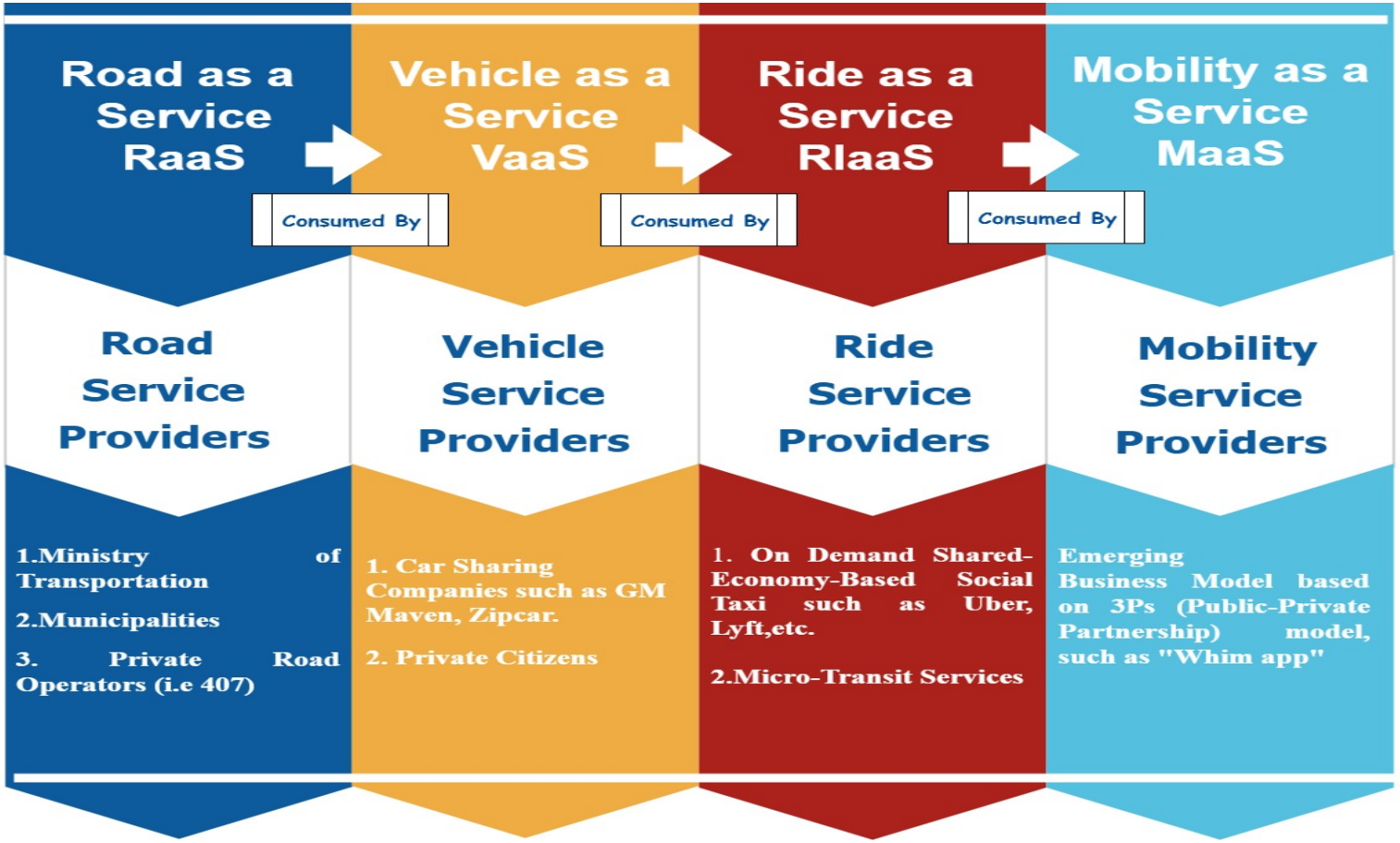




The Economist June 23rd 2018

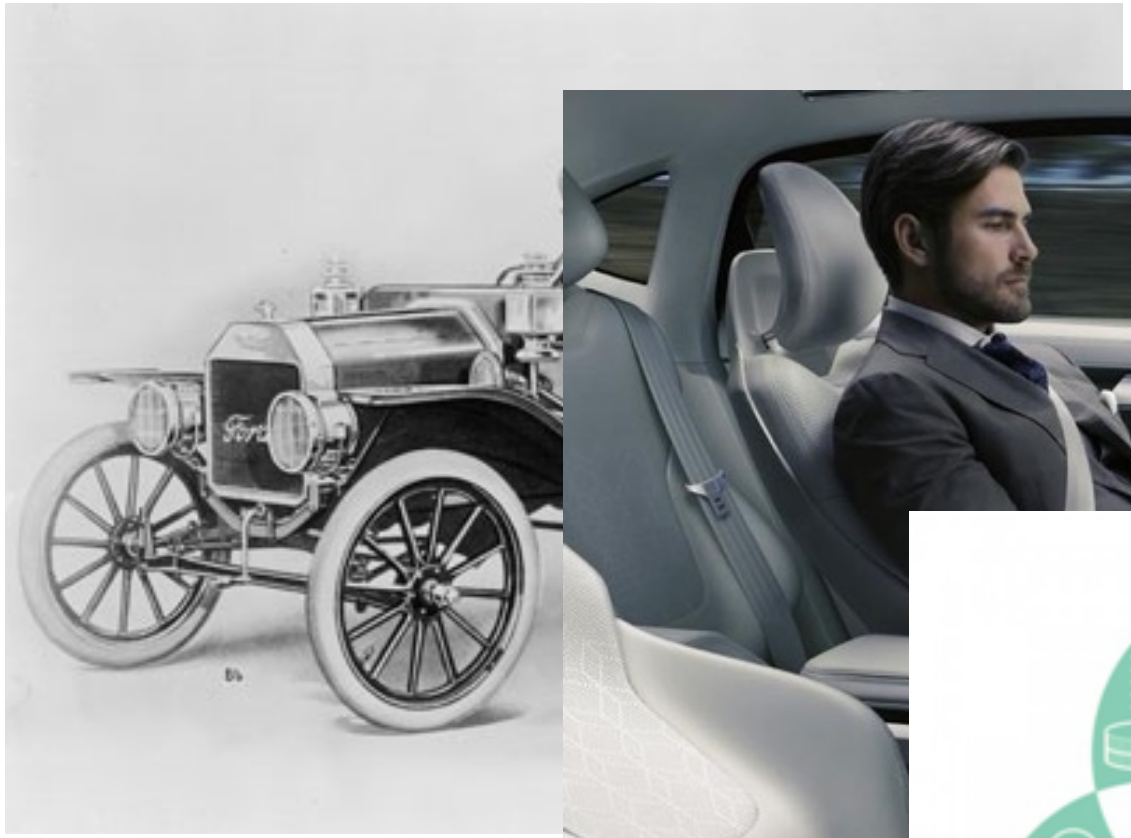
Putting the Pieces Together:

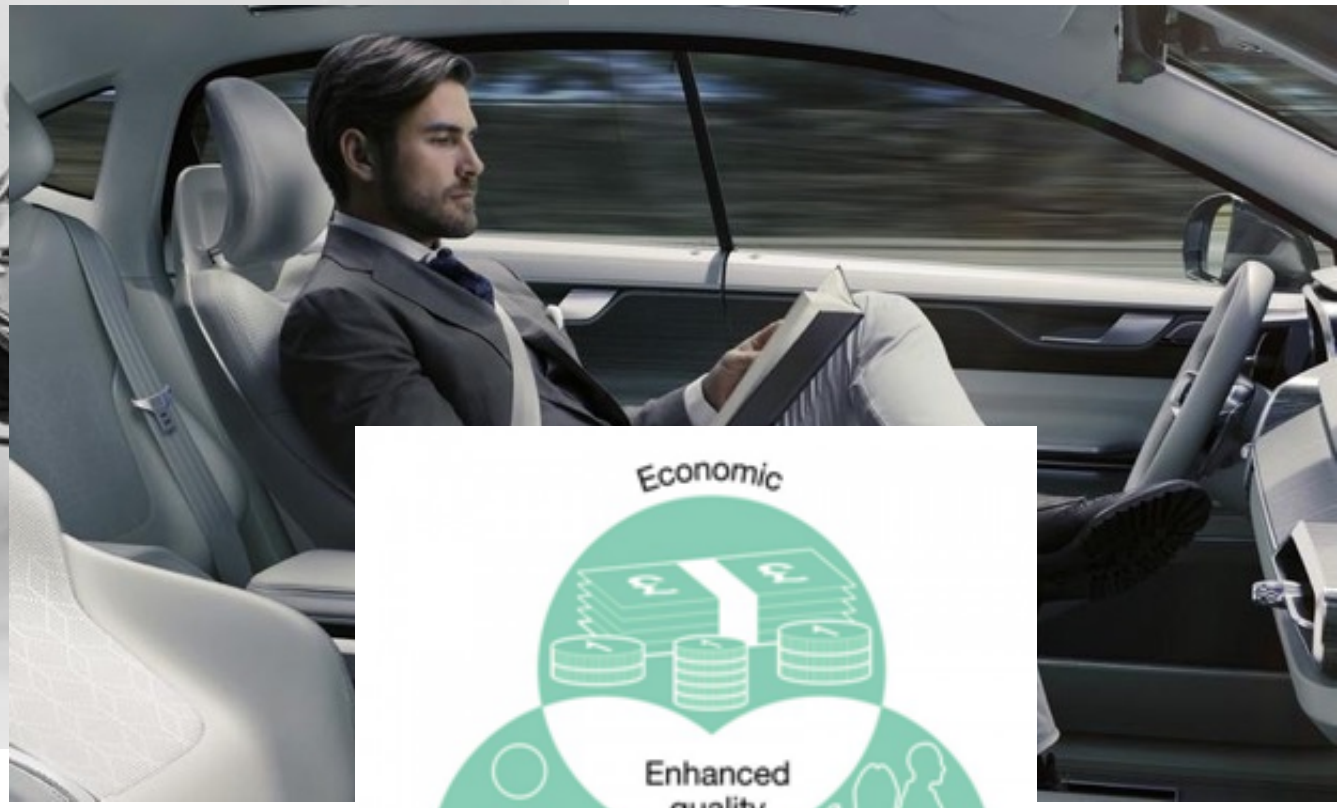
Everything as as Service for Seamless Mobility



Putting the Pieces Together:

The New Mobility Revolution: Think Ahead This Time





Triple Bottom Line Sustainability ➡

Principal Research Team


Eric Miller, UTTRI Director


Baher Abdulhai, iCity CATTS Director, Traffic Control Focus


Khandker Habib, Demand and Planning Focus


Marianne Hatzopoulou, Sustainability and the Environment Focus


Matt Roorda, Freight, Parking and Curb Space Focus


Amer Sahalaby, iCity CATTS Associate Director, Transit Focus

Extended Research Team


Baher Abdulhai, Civil Engineering


Chris Bachmann, Civil, U Waterloo


Jeff Brook, Dalla Lana School of Public Health


Timothy Chan, Mechanical and Industrial Engineering


Mohamed El-Darieby, Software Systems Engineering


Greg Evans, Chemical Engineering & Applied Chemistry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Shoshanna Saxe, Civil Engineering

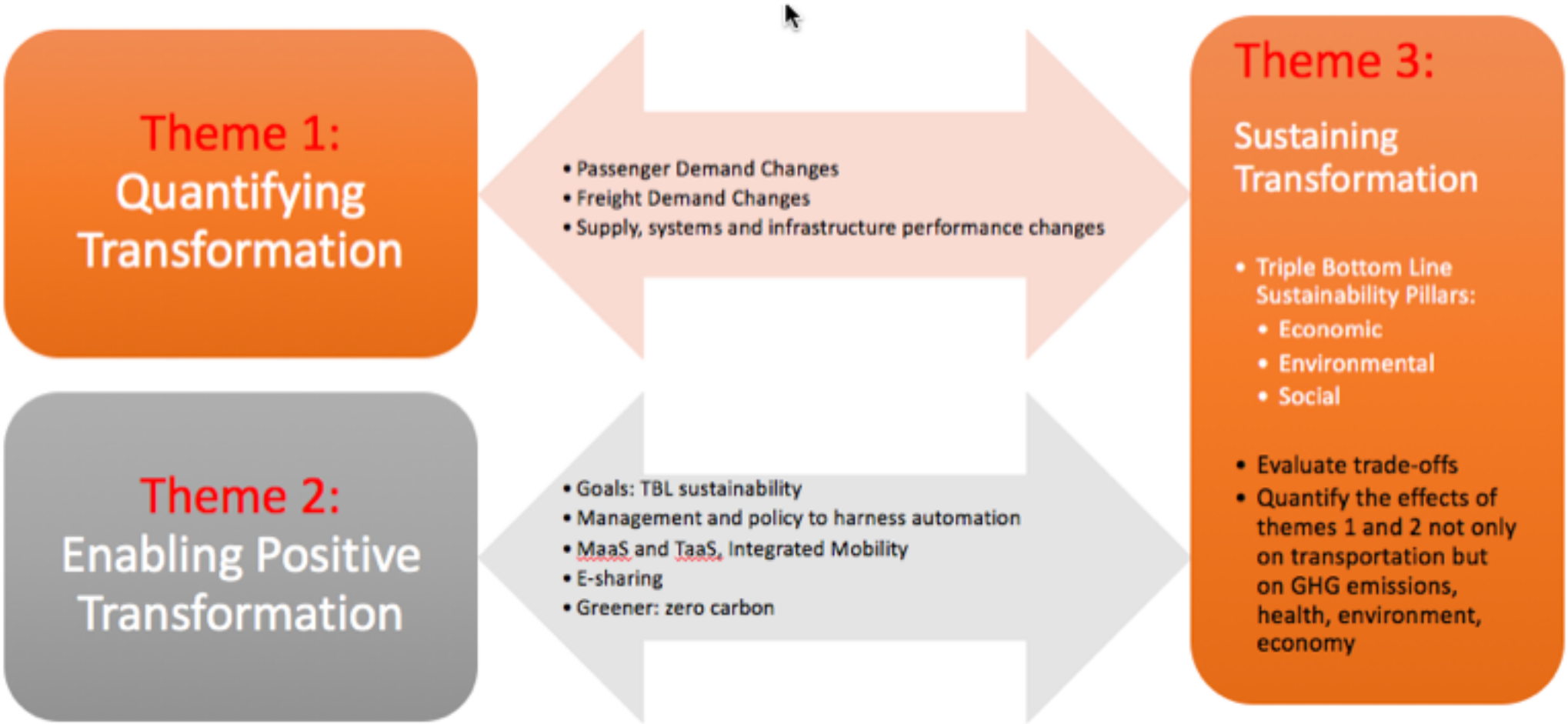

Angela Schoellig, Institute of Aerospace Studies


Amer Shalaby, Civil Engineering


Shahrokh Valaee, Electrical and Computer Engineering


Michael Widener, Geography and Planning

Research Themes



TRANSFORMATIVE TRANSPORTATION '18 iCity-CATTS Symposium

June 28, 2018

AGENDA

8:30-9:00 Registration and Coffee

9:00-9:30 Welcome, Opening Remarks, and iCity-CATTS overview, Professor Eric Miller and Professor Baher Abdulhai

9:30-10:30 Themes and Project Overview Presentations – I, Moderated by Prof. Baher Abdulhai

- *Understanding Impact of Transformation on Travel Demand and Travel Behavior,* Professor Khandker Nurul Habib
- *Traffic and Control and Management with Vehicle Automation and Connectivity in the 21st Century*, Professor Baher Abdulhai

10:30-10:45 Coffee Break

10:45-12:00 Themes and Project Overview Presentations – II, Moderated by Prof. Baher Abdulhai

- *Transit in the Era of Automated and Transformative Technologies: Opportunities and Research Needs*, Professor Amer Shalaby
- *Implications of Automation on Parking, Curb Space, and Urban Goods Delivery*, Professor Matthew J. Roorda
- *Implications of Automated Vehicles on Urban Sustainability*, Professor Marianne Hatzopoulou

12:00-1:00 Lunch Break

1:00-3:00 Partners' Talks, moderated by Dr. Judy Farvolden

- *Mississauga Moves: City in Transformation*, Hamish Campbell, RPP, Project Lead, Parking Master Plan-City of Mississauga
- *City of Toronto AV Tactical Plan*, Ryan Lanyon, Transportation Services, City of Toronto
- *Zero sum NOT a game,* Ted Graham, GM Canada
- *Human-Focused Design to Technology-based Transportation Solutions*, Bruce Mori, IBI Group
- *Catalyzing Innovation in the Mobility Sector*, Sasha Sud, MaRS
- *Automated Vehicles: The Road Ahead for Municipalities*, Sabbir Saiyed, Region of Peel
- *Preparing for the Impacts of Technology on the Future of Transportation in York Region*, Lauren Crawford, Manager Transportation Long-Term Planning, York Regional Municipality of York
- *Integrate, Collaborate, Harmonize*, Bern Grush, Harmonize Mobility- RCCAO

3:00-3:15 Concluding Remarks, Professor Baher Abdulhai

3:15-3:30 Coffee Break

3:30- 5:00 Partner's Planning Workshop (Closed session with partners only), moderated by Professor Baher Abdulhai