

What Does the Future Hold for Smart Cities in Canada?

Impact of Automated and Transformative Transportation Systems

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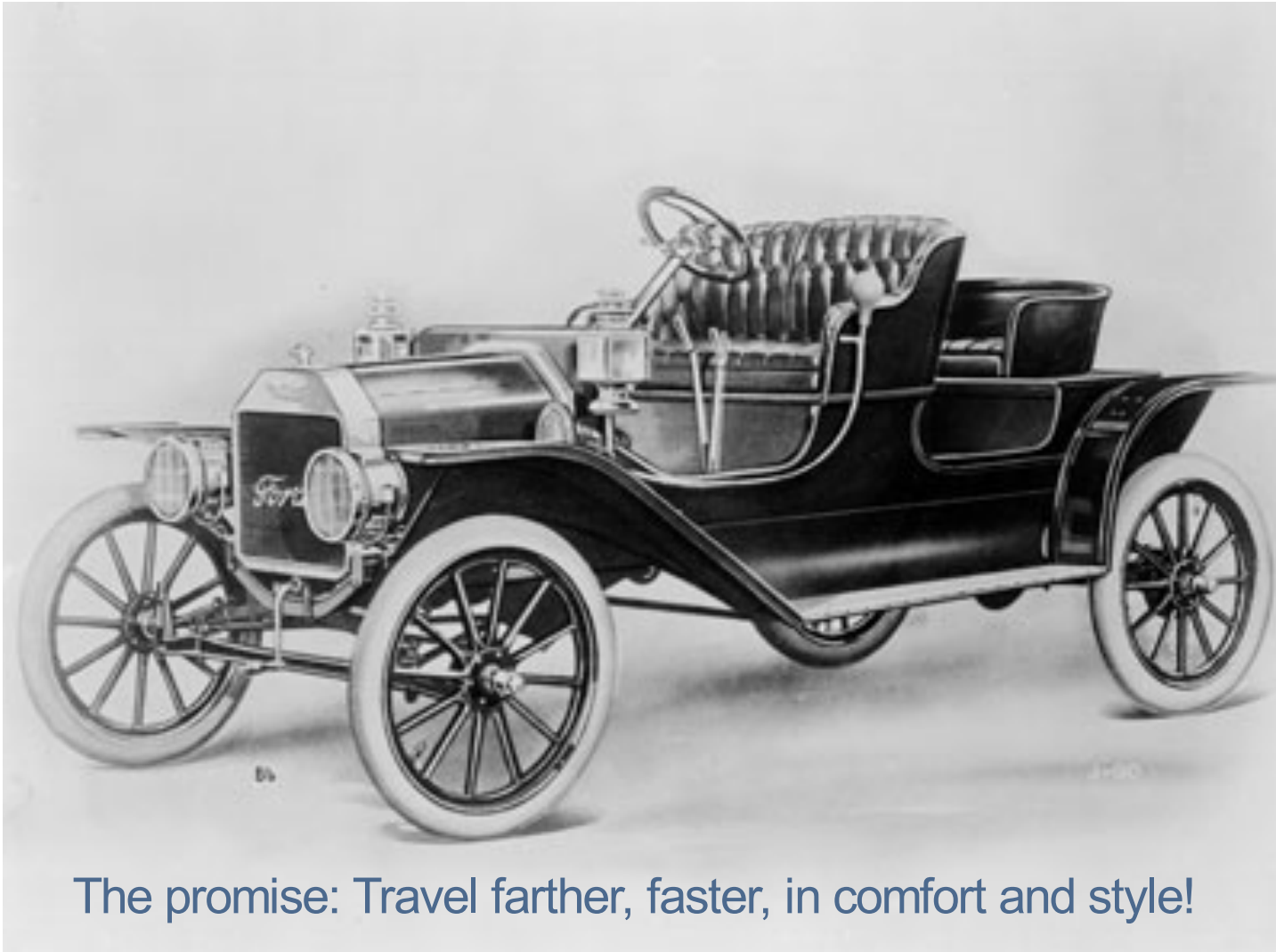
UTTRI

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://reprogrammobility.org/trends/>

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

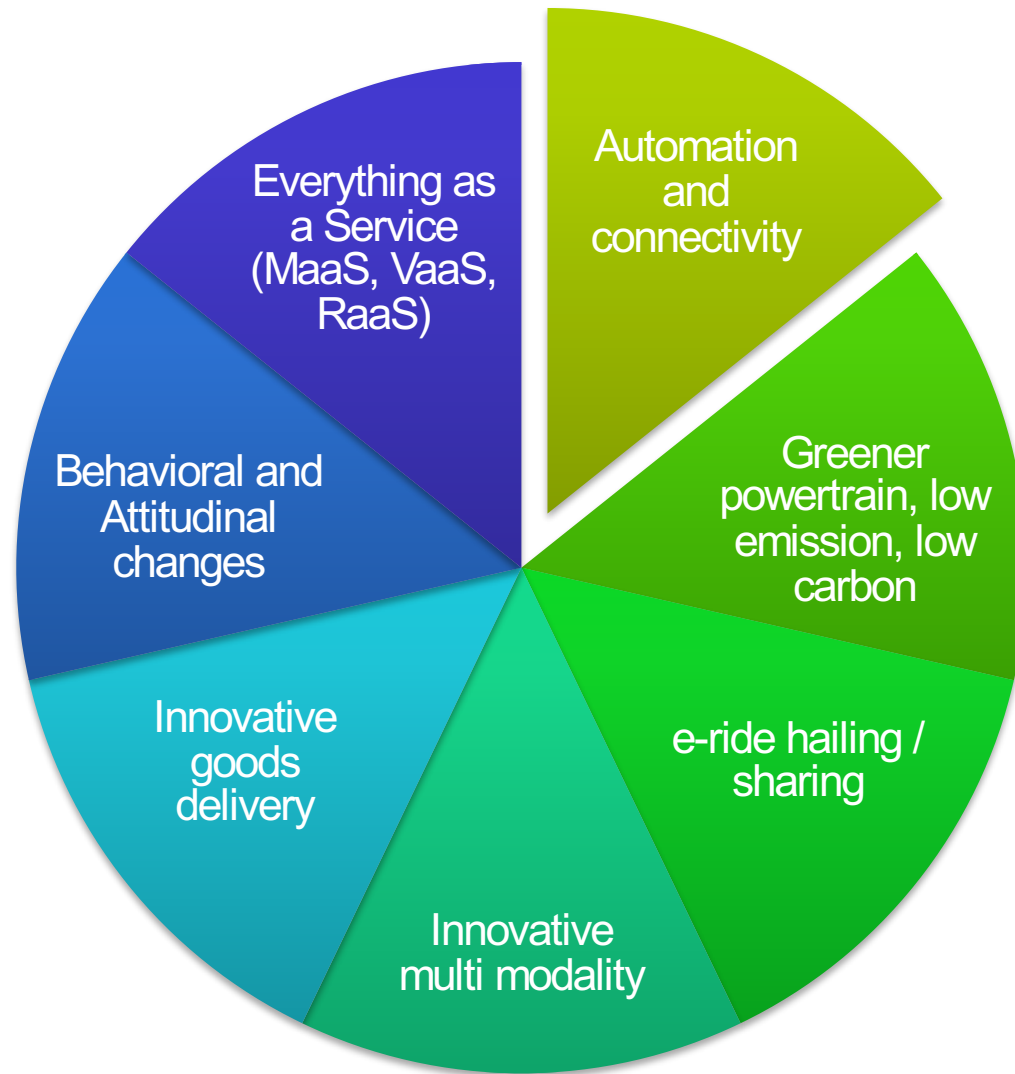


21st Century: The Three Revolutions

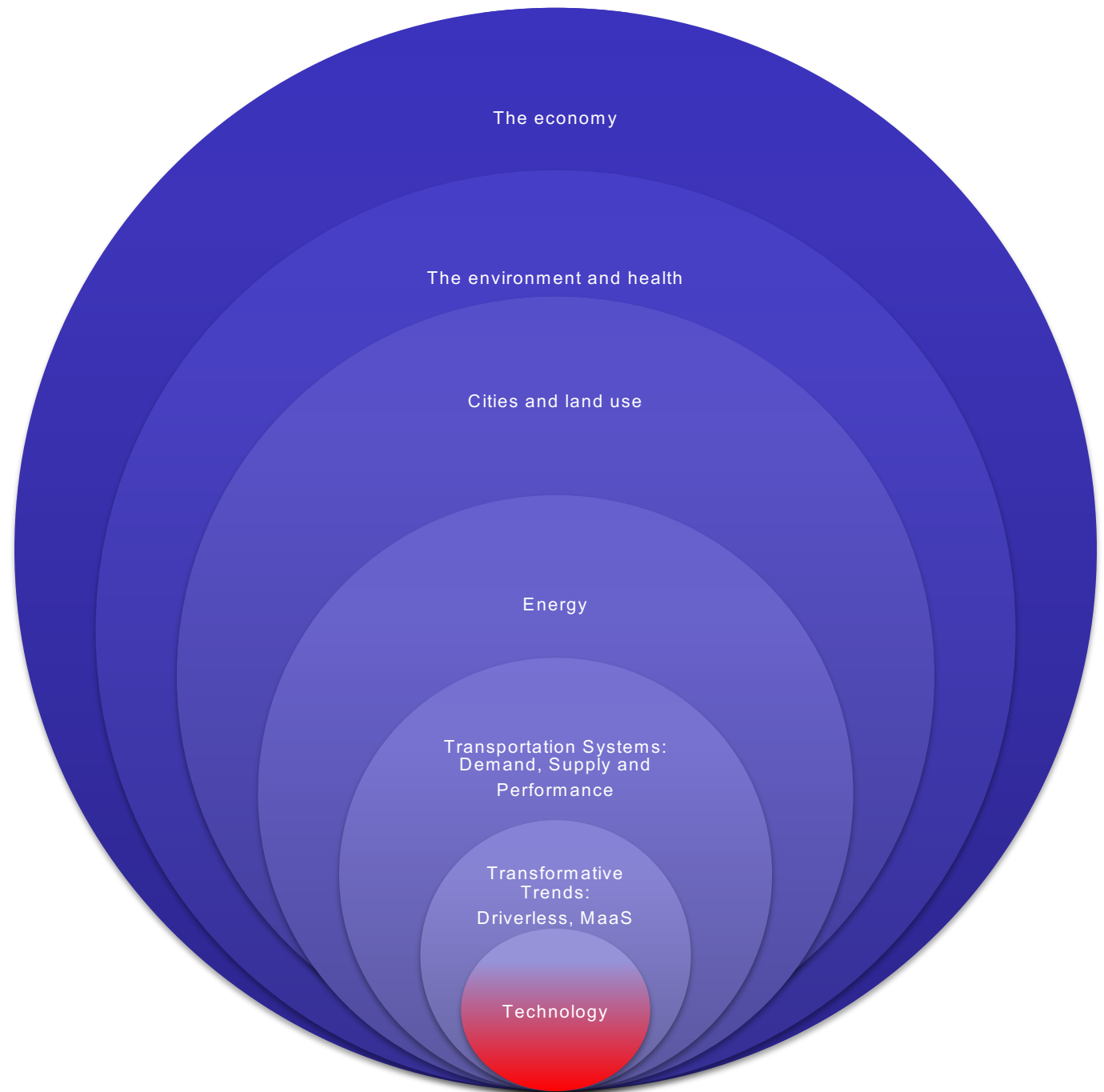
- Automated (and connected), green and shared.
- Disruptive and transformative,
- Same promise, but 21st century high tech!
- Same issues, on steroids!
- The fundamentals of mobility are changing again.
- Bold vision for the future of transportation and cities, but equally high risks and potential for 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



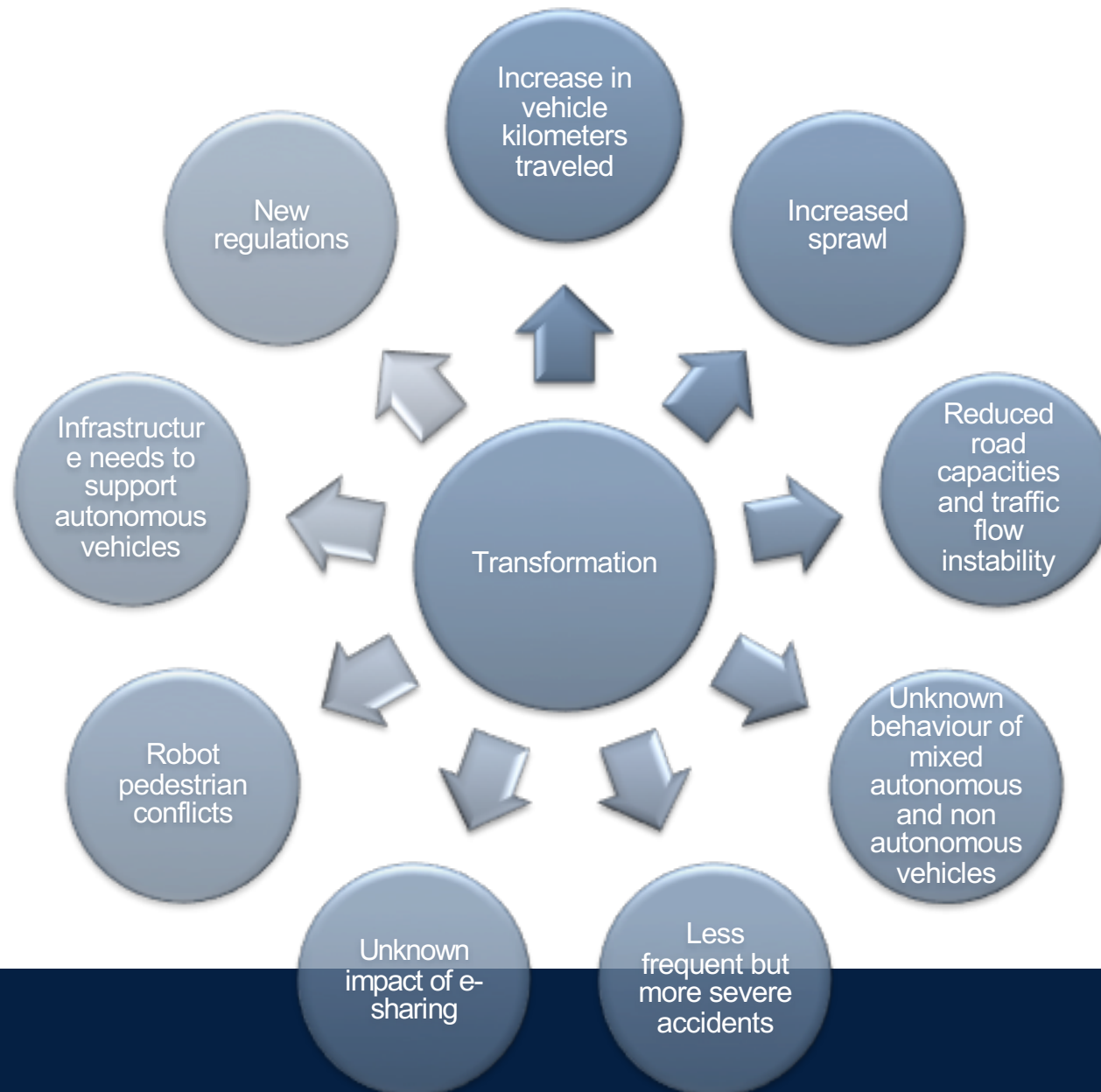
The Ripple Effects



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.
 - National and international collaboration

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:

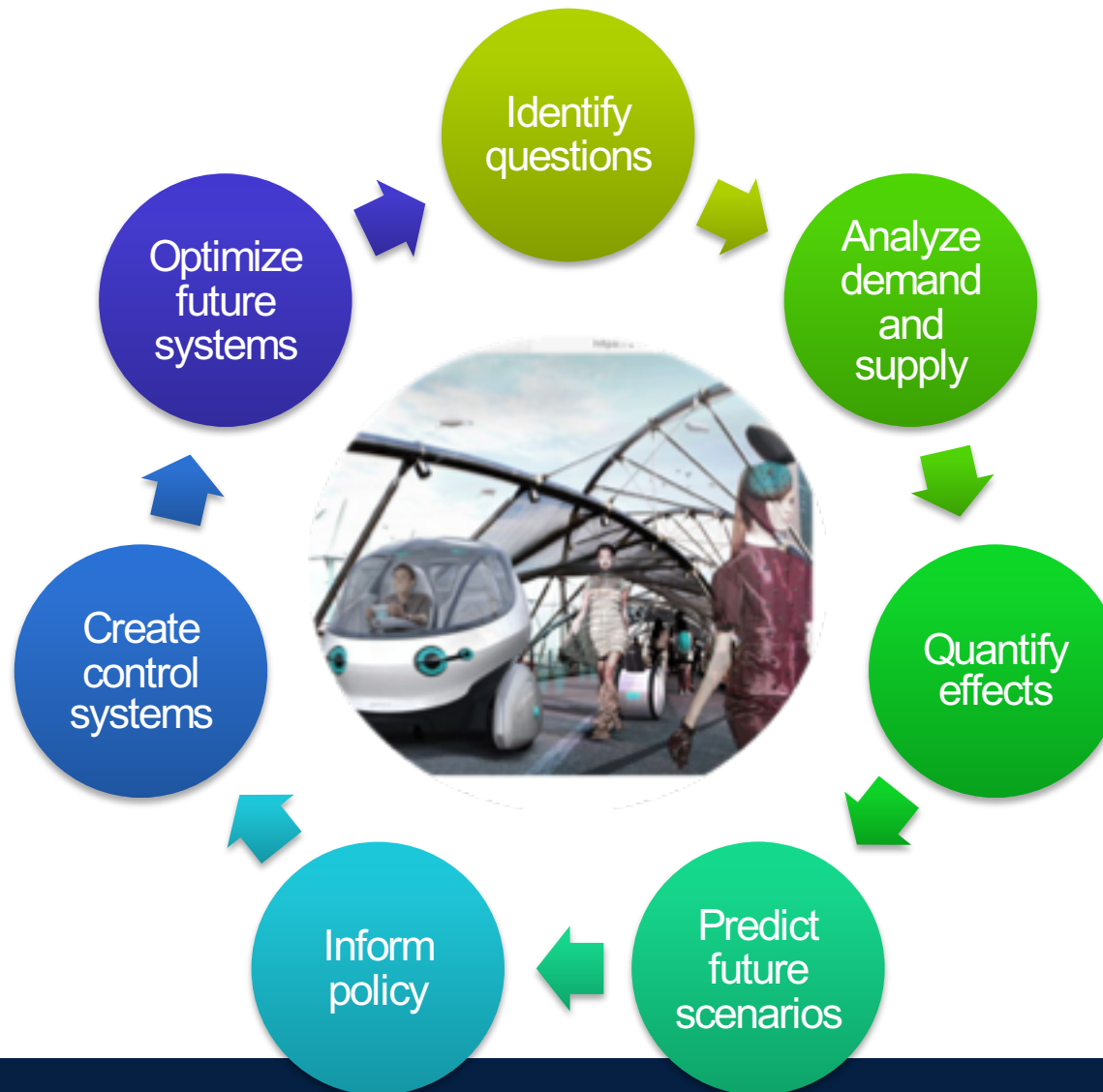
- Province of Ontario

Yes, The Boldest Vision Is: Automated, Connected, Green, Shared

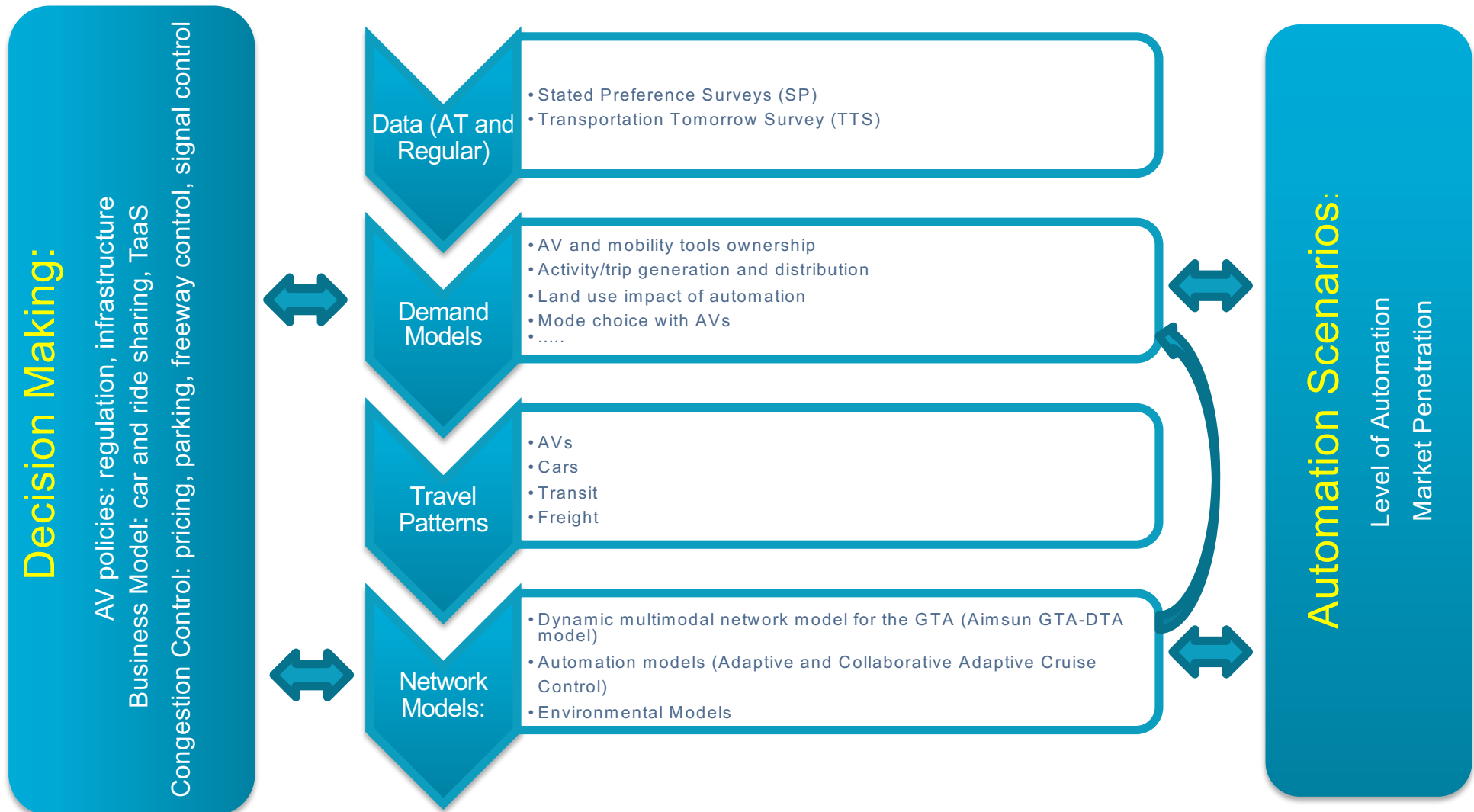


Beyond Speculation

Centre for Automated and Transformative Transportation Systems

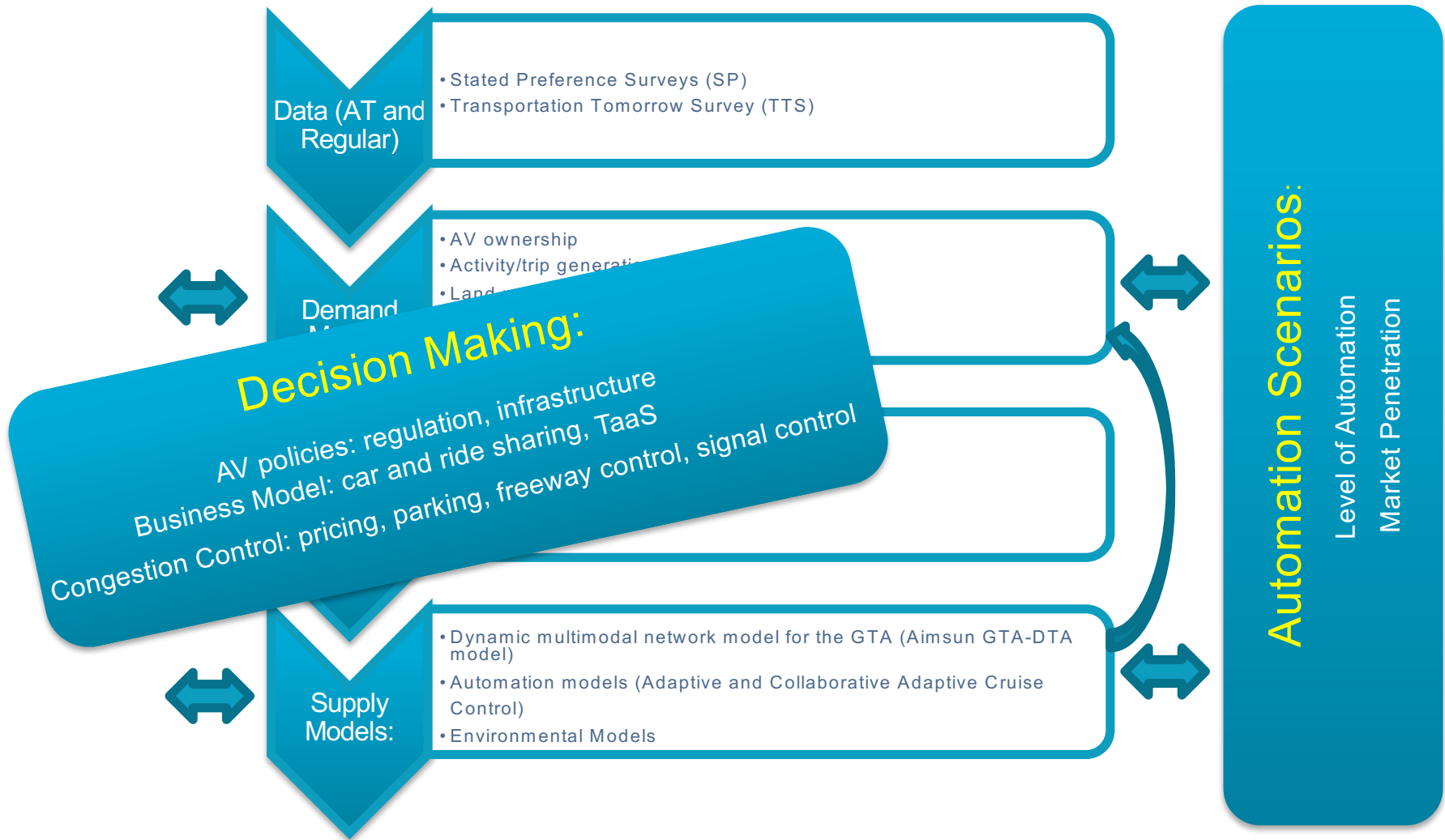


How to, The Foundation: Analyzing Transformative Transportation Systems

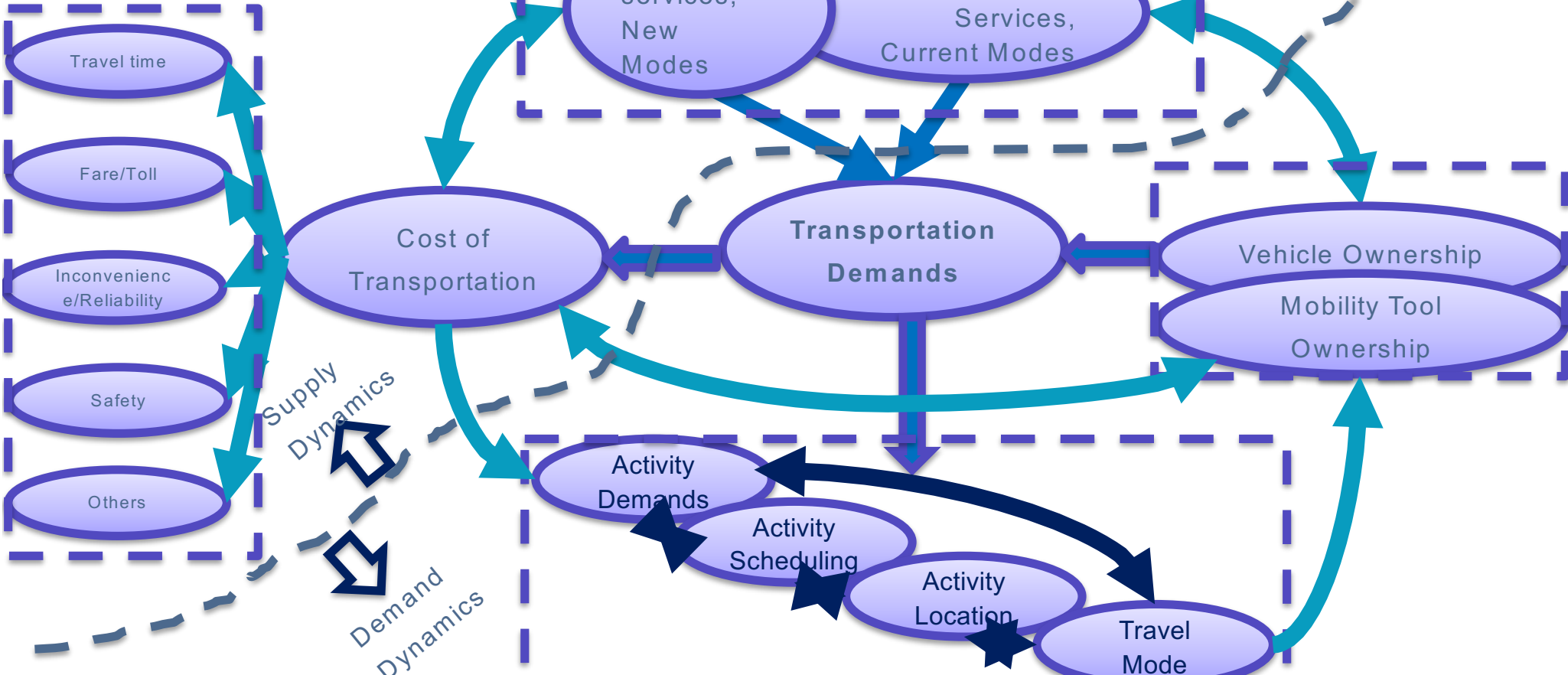


The Foundation:

Analyzing Transformative Transportation Systems

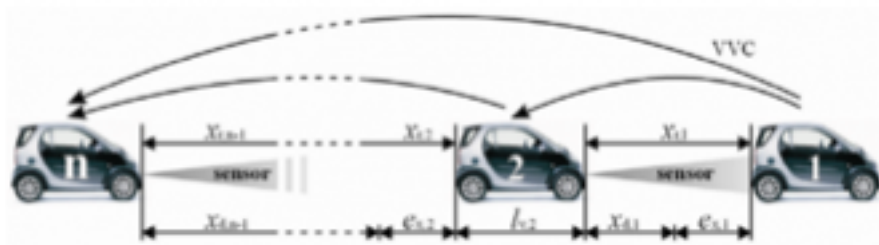


Impact of Transformative and Automated Transportation



Infrastructure Networks

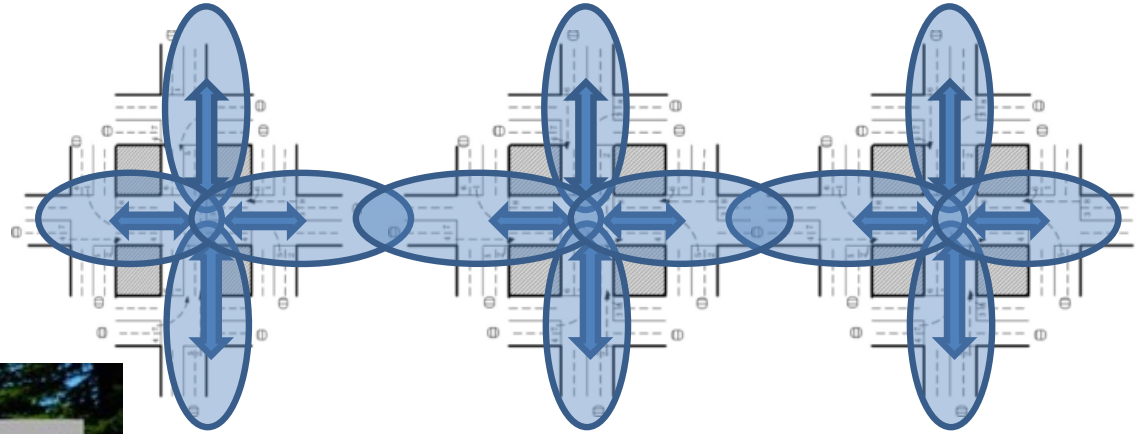
- Dynamic Simulation (DTA) with Automation
- Adaptive Cruise Control,
- Collaborative Adaptive Cruise Control (Platooning)
- Automating Lane Changing and Merging
- Dynamic Headway Control
- Dynamic Speed and Acceleration Control
- V-2-I based traffic management



Source: modeling connected vehicles using Aimsun



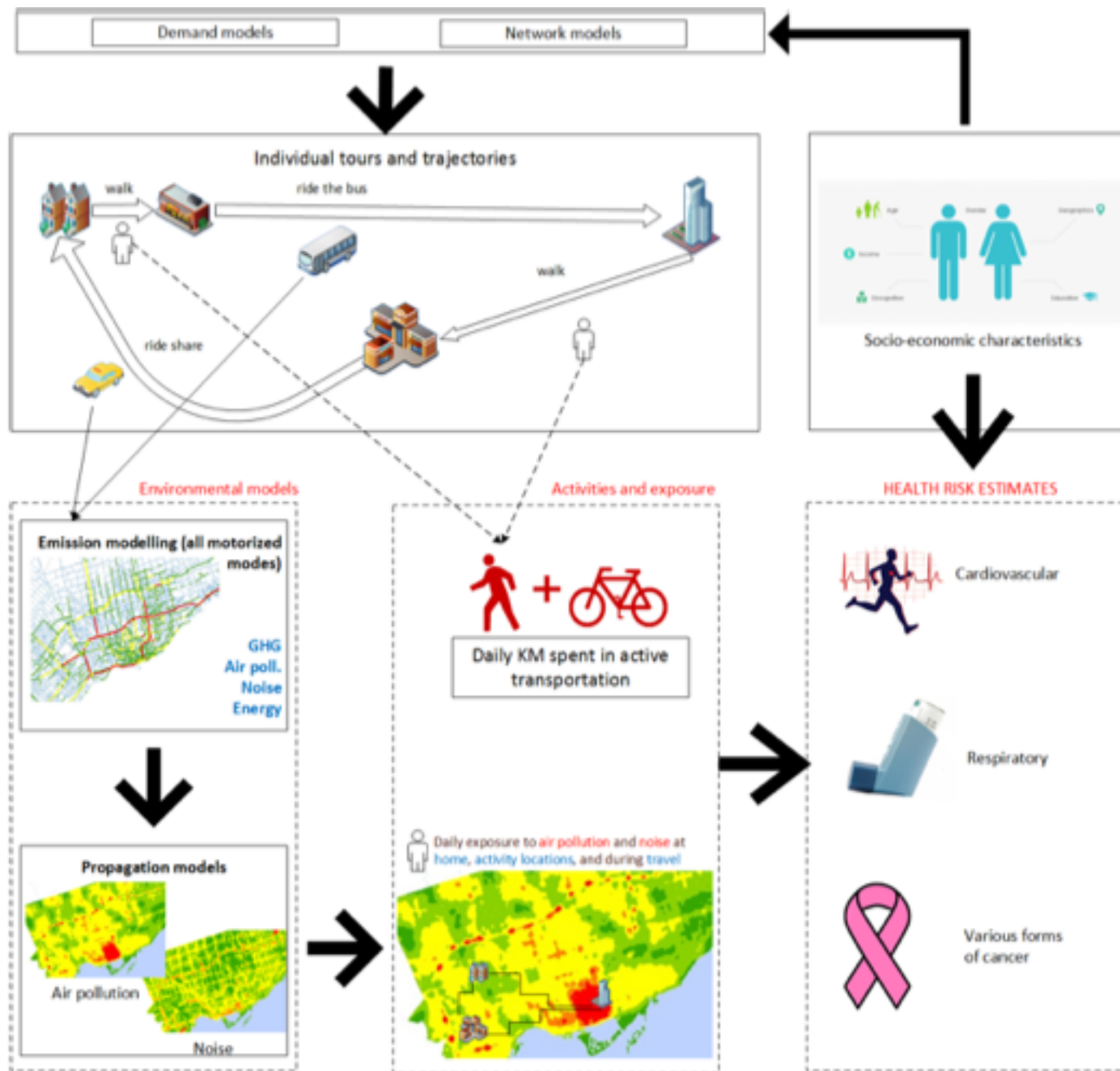
Infrastructure Control and Management: Exploiting Automation and Connectivity



SOV, HOV, ZOV



Environment and Health



Freight Transportation Demand

Facility Location Choice

- Proximity to AV-appropriate facilities
- Proximity to labour force (skilled vs less skilled)

Freight Trip / Tour Generation

- Staging / coordination of truck platoons

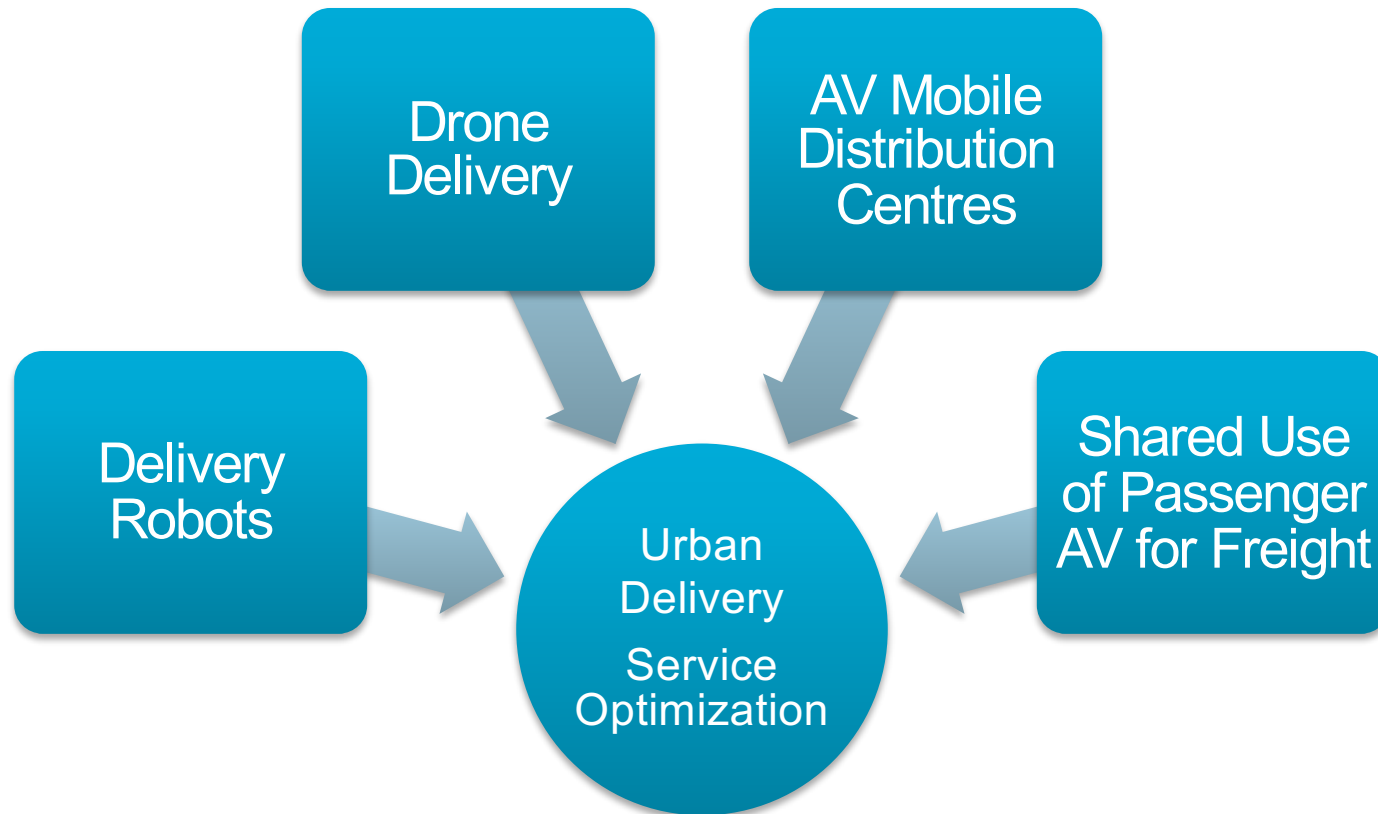
Freight Mode Choice / Carrier Choice

- Response to reduced truck transport costs

Urban Pickup / Delivery

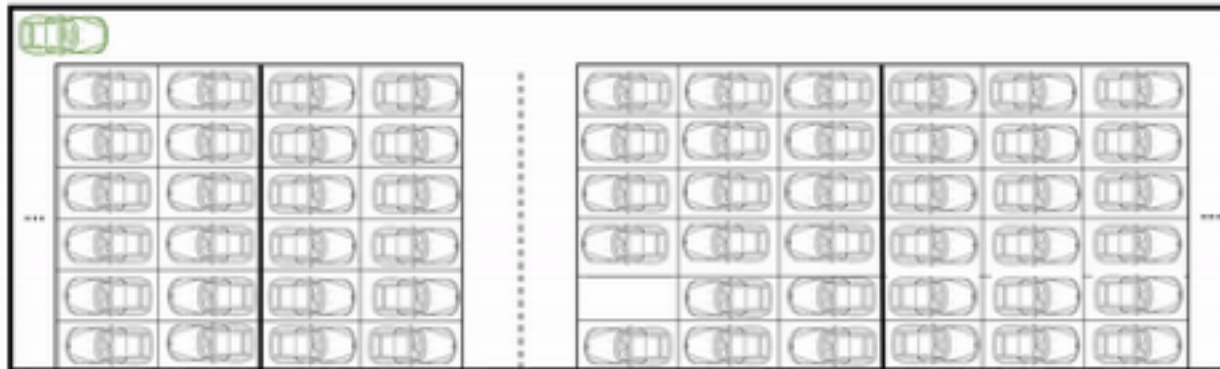
- Changes in parking requirements, loading, unloading,

City Logistics: Urban Freight Pickup and Delivery



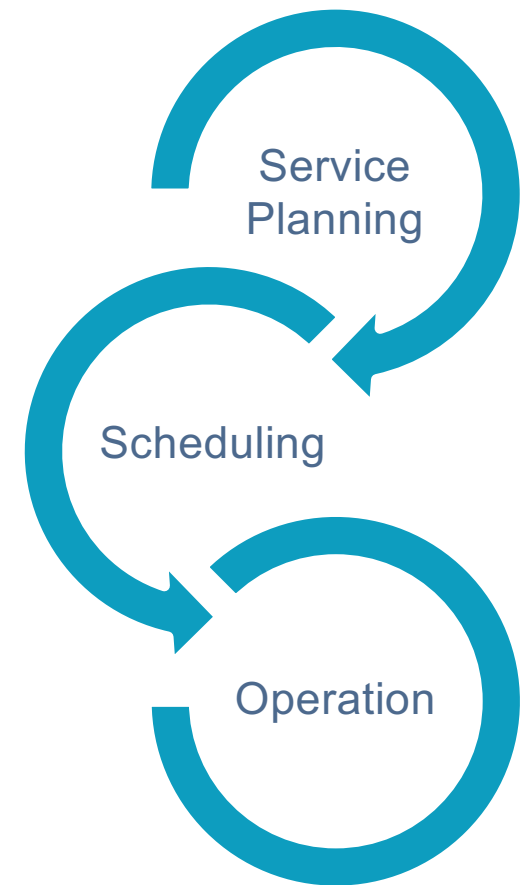
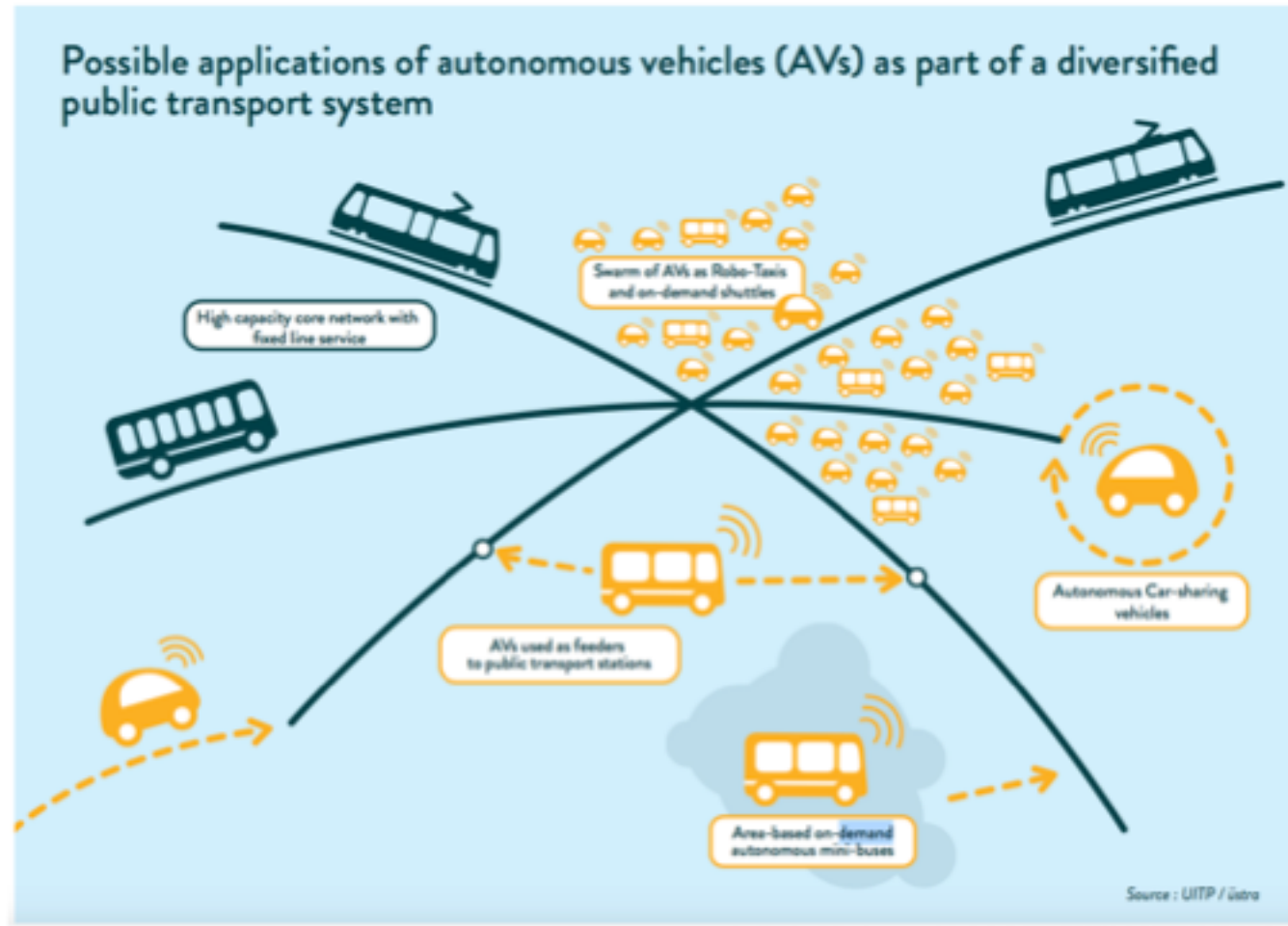
Automated vehicle parking

- 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

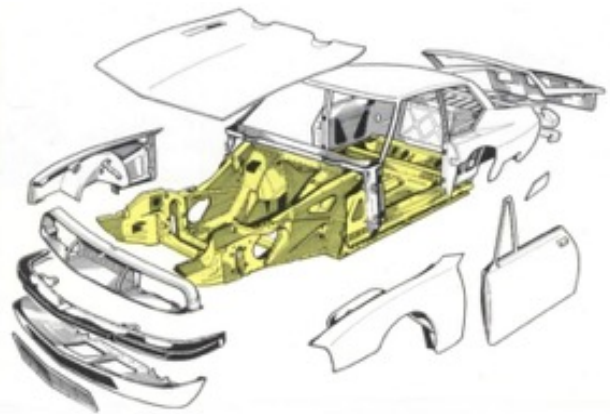


Future Transit

The Evolution of MaaS Transportation!



Economic Impacts of Transformative and Automated Transportation



Changing Supply Chains
/ Competitiveness



Job Loss and Creation



New Energy Demands



Construction and
Reconstruction



Training and Retraining



Increased Discretionary
Income / New
Consumption Patterns

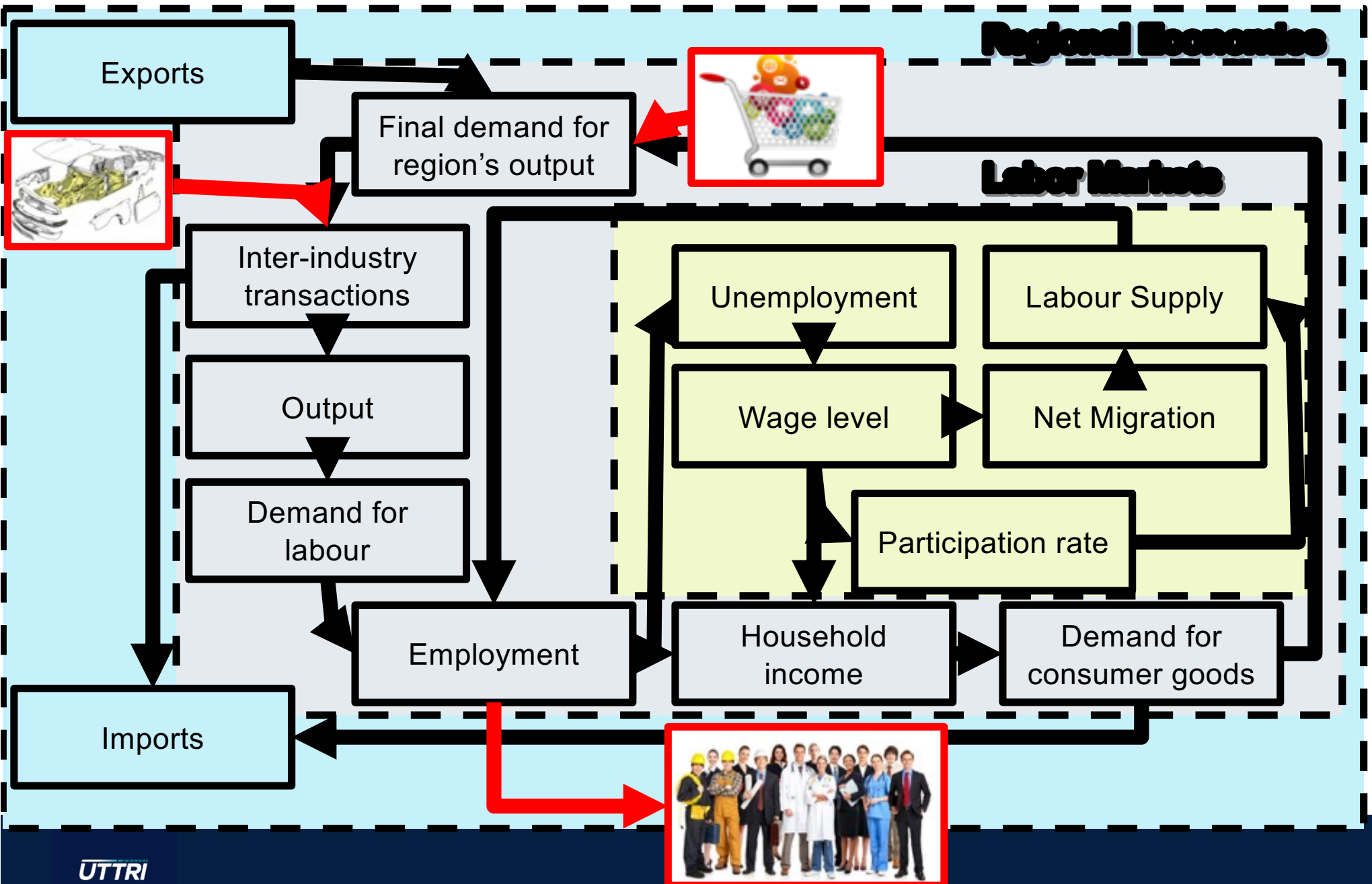


Economic Impact Analysis

Trade

Regional Economies

Labor Markets



Putting the Pieces Together:

What If - Quantitative Impact Assessment

Inputs:

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

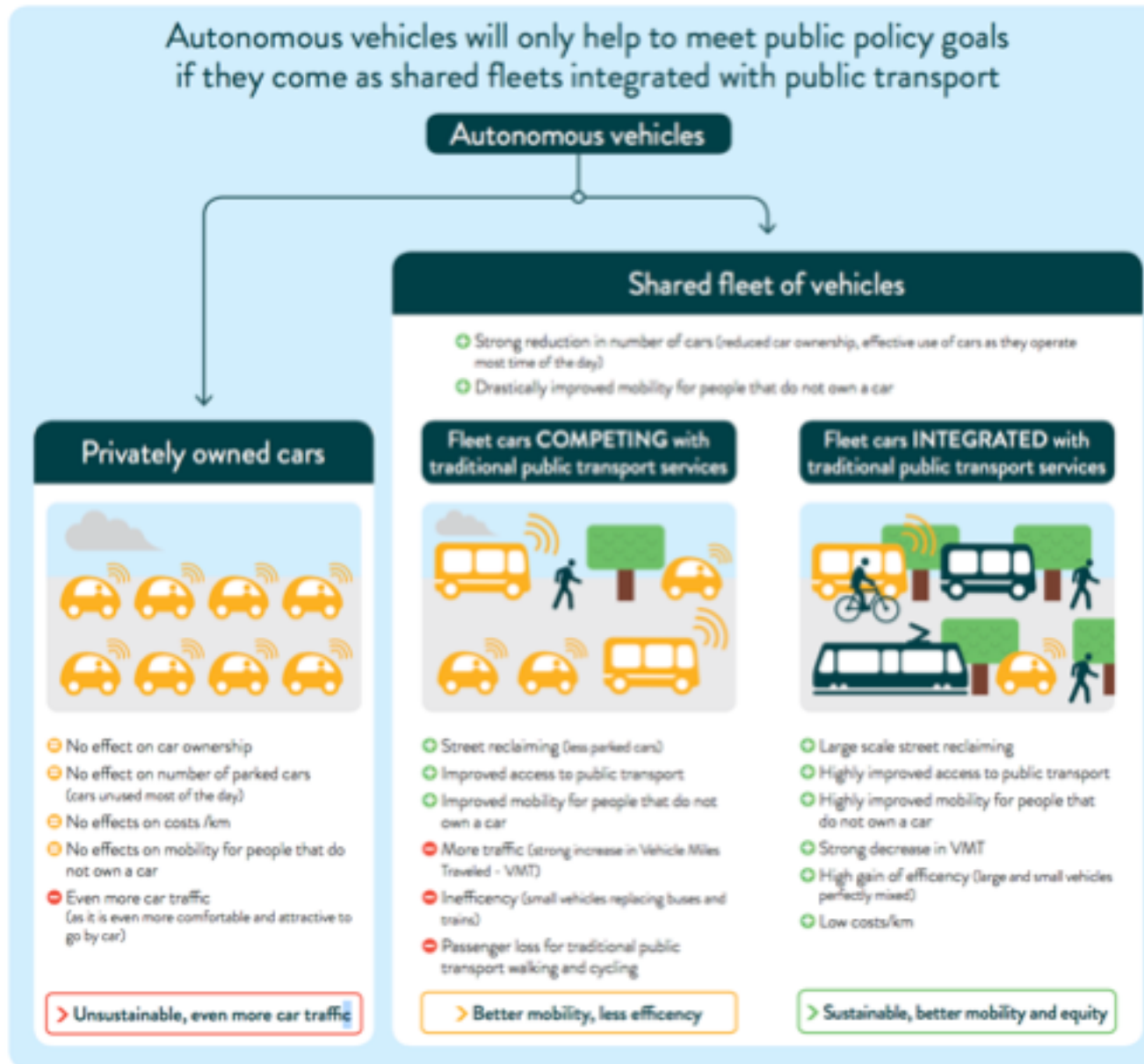


Impact Assessment and System Performance:

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

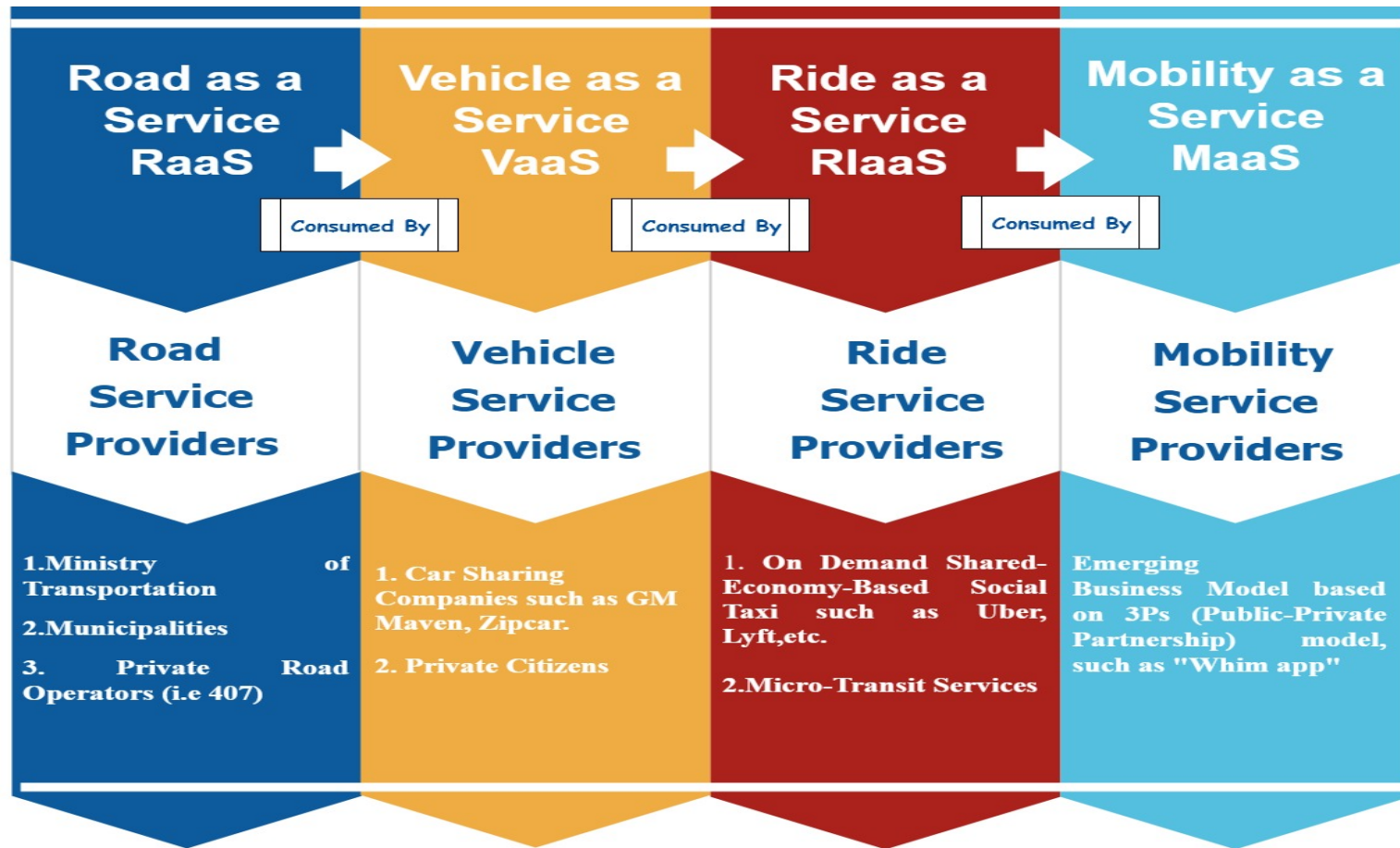
Putting the Pieces Together:

Integrated Solutions NOT More of the Same Problems



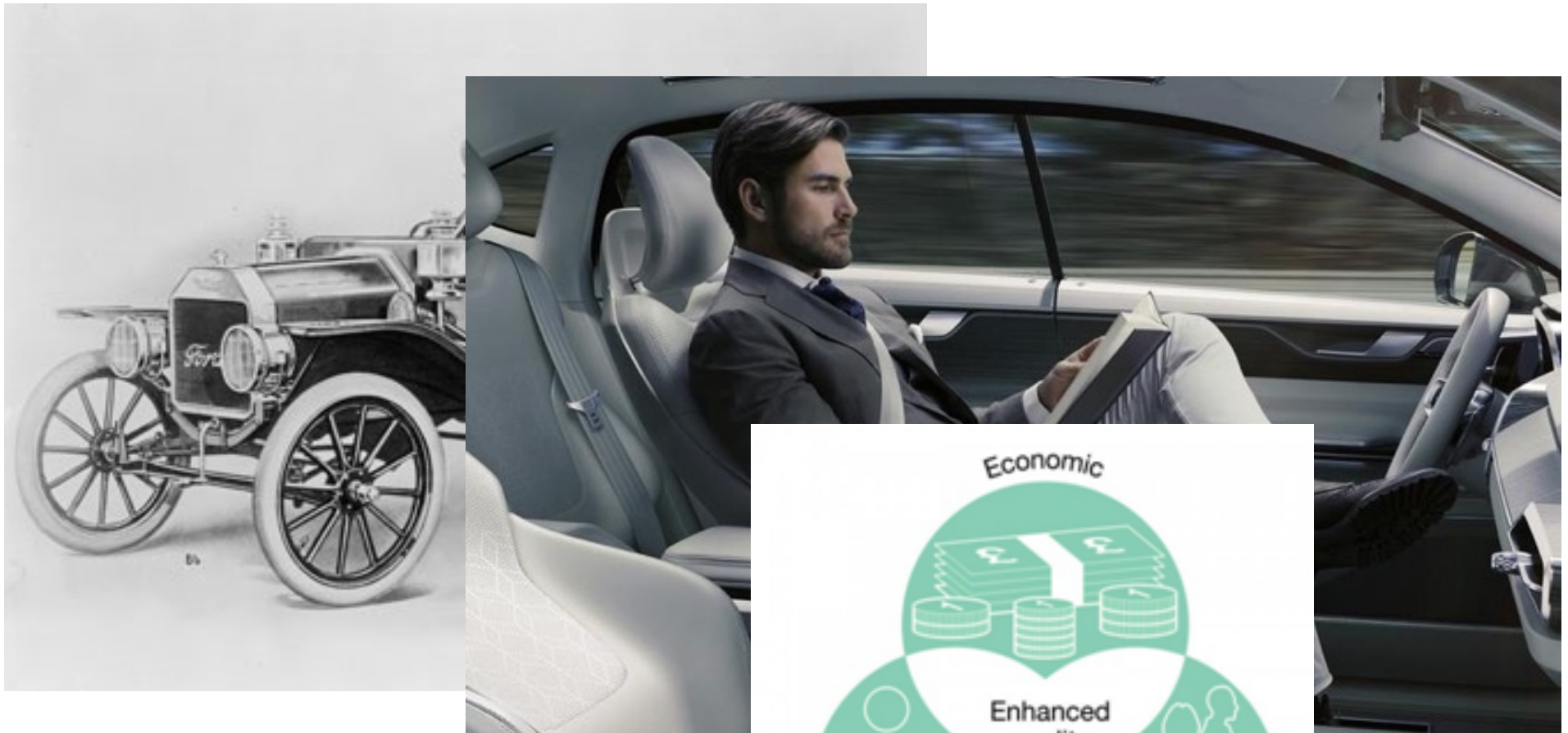
Putting the Pieces Together:

Everything as as Service



Putting the Pieces Together:

The Car 2.0 Revolution: Think Ahead This Time



Triple Bottom Line Sustainability ➡

Research Team



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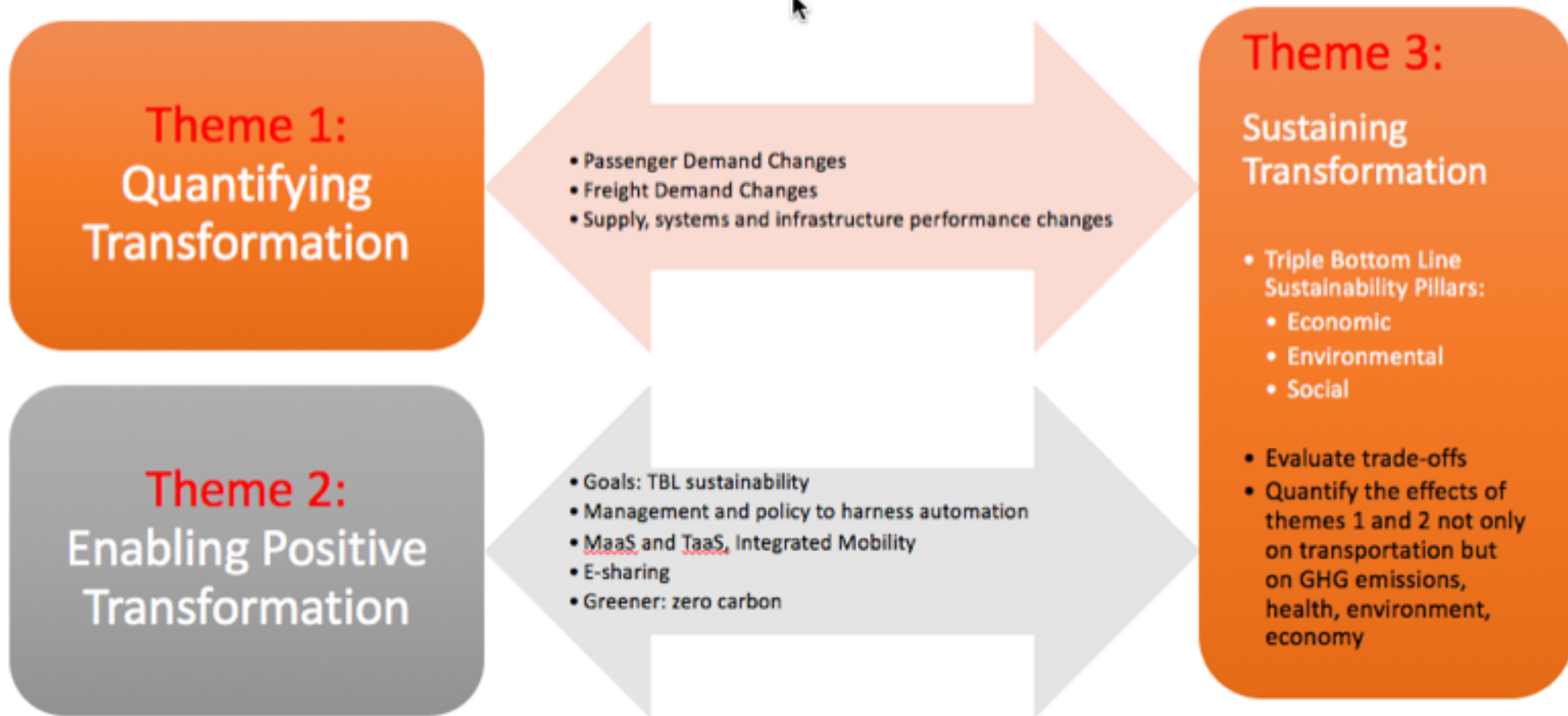
Michael Widener, Geography and Planning

Themes

- **Quantifying Transformation:**
 - Transportation Demand and Landuse
 - Transportation Systems and, Networks (roads, transit, freight, active transportation)
- **Enabling Positive Transformation:**
 - Automation Scenarios (type of automation, automation levels, market penetration)
 - Service Concepts and Business Models (e.g. e-Sharing, MaaS, multi-modality)
 - Traffic Control under Automation
 - Transit and Goods under Automation
 - Policies
- **Sustaining Transformation (Triple Bottom Line Sustainability):**
 - Social (Health, Accessibility, Equity)
 - Environmental (Energy, Emissions, Pollution)
 - Economy (Labour, Business, Employment, Household Income)



Research Themes



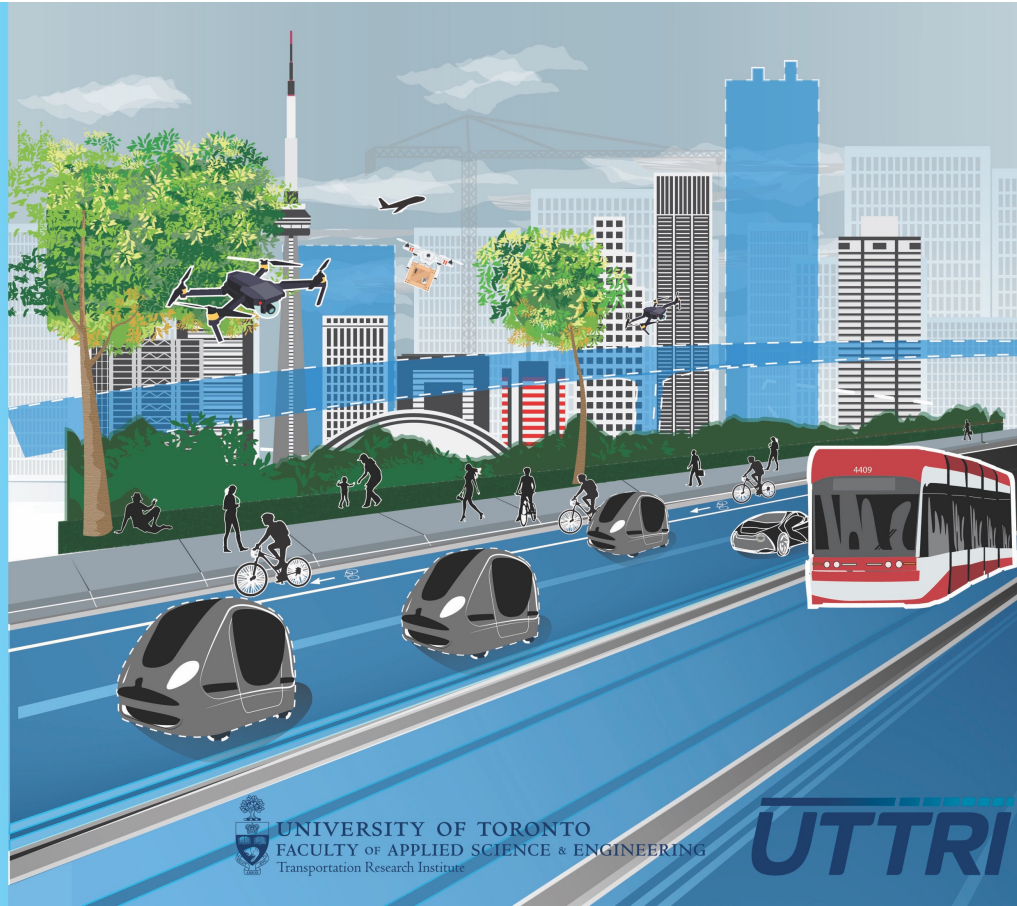
Conclusion

- Q: So what does the future of transportation look like?
- A: What do you want it to look like?
- The best way to predict the future is to actively create it!:
 - Quantify transformation
 - Enable positive transformation
 - Positive = Triple Bottom Line Sustainability,

Partner with us, Join us!

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TRANSFORMATIVE
TRANSPORTATION '18



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Presented by

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