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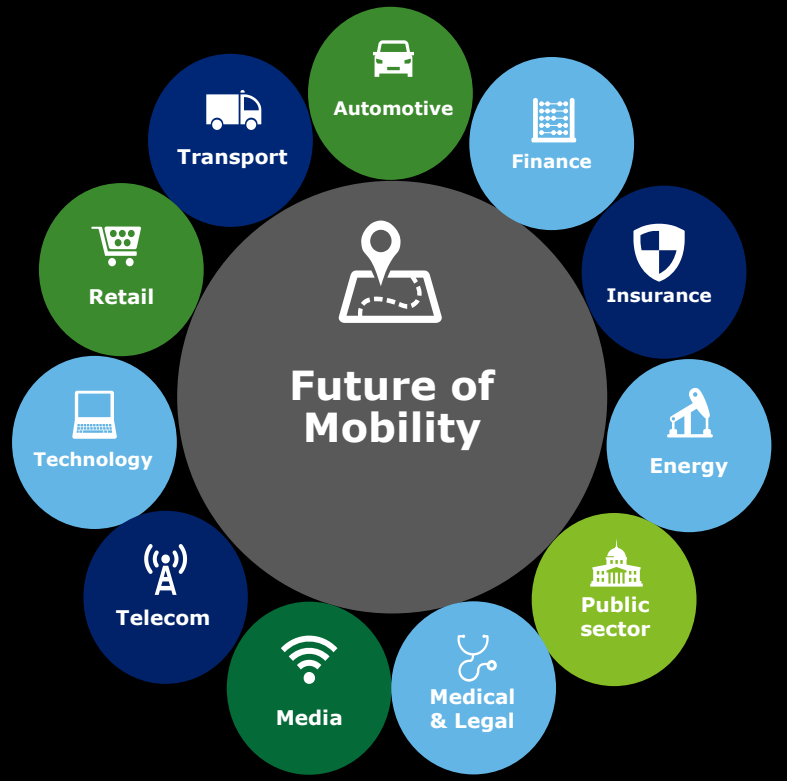


Future of Mobility & Smart Cities

Non-Executive Directors Forum

29 November 2017

www.deloitte.co.uk/futureofmobility

Welcome,
Danny McConnell, Technology Partner,
Deloitte Belfast

Colin Mounstephen, Deloitte Belfast, Survey Results

Mobility in Belfast

The future of mobility is a huge issue for society, including here in Northern Ireland, where Belfast too regularly appears in the media on a list of 'the most congested cities'.

We wanted to capture some data and insights from our Deloitte colleagues in Belfast.

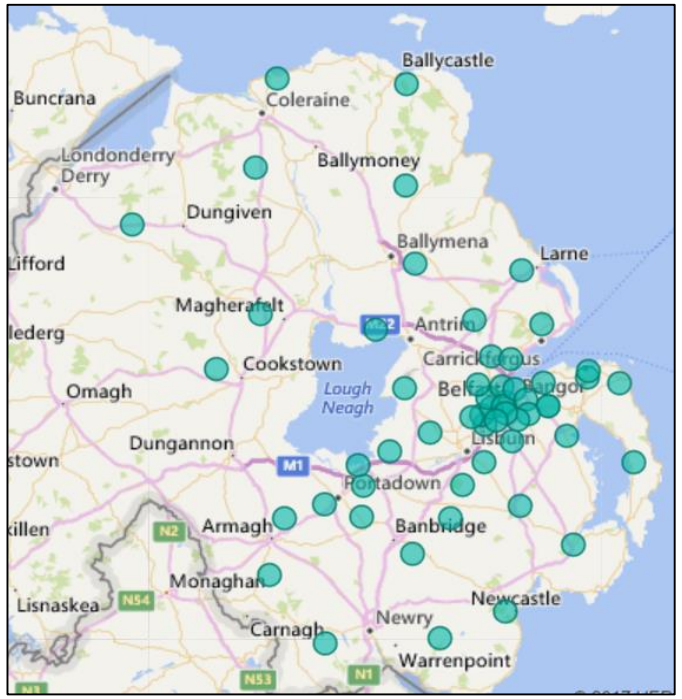
"Mobility in Belfast" survey to all staff members from the Deloitte Belfast office.

- The survey ran for one week in February 2017
- 332 responses were received

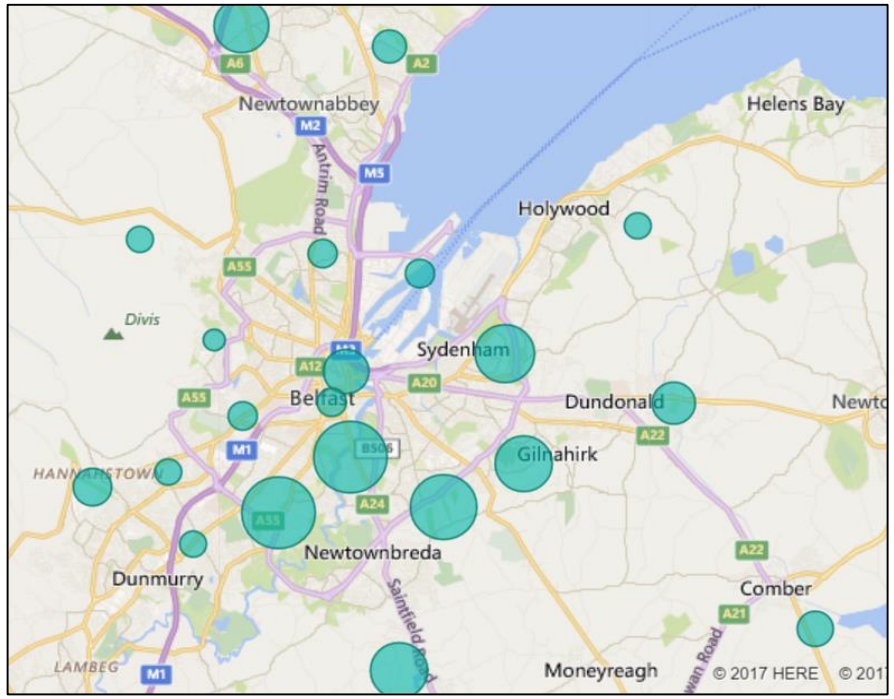
Location, Location, Location

Where our respondents are travelling from

Northern Ireland



Belfast area

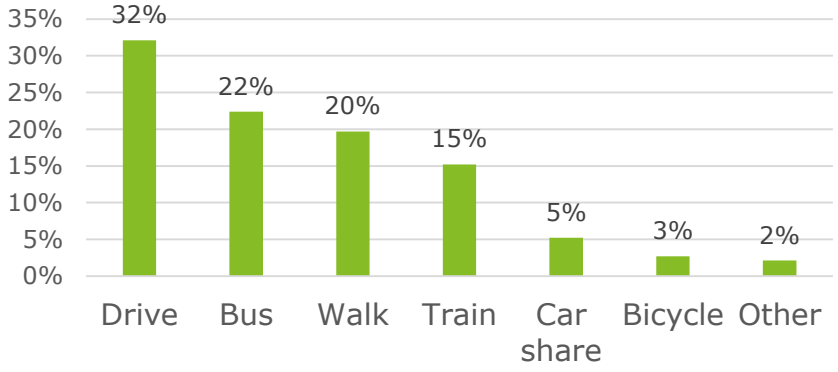


Circle sizes indicate numbers of staff who live in the area (the bigger the circle the more staff)

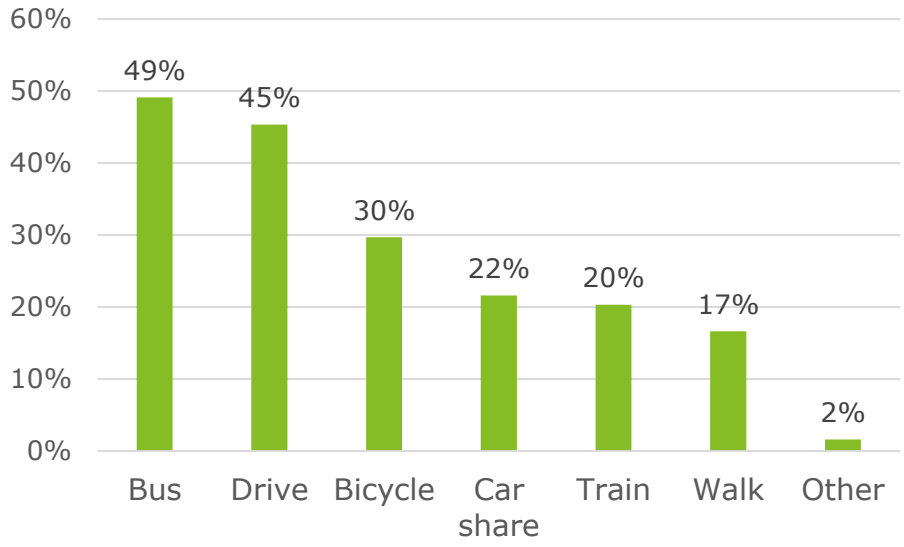
The daily commute…

How our staff travel to work and how we could ‘reasonably’ travel

Modes of transport taken to work



Other modes of transport, which staff said they “could reasonably use to travel to work”



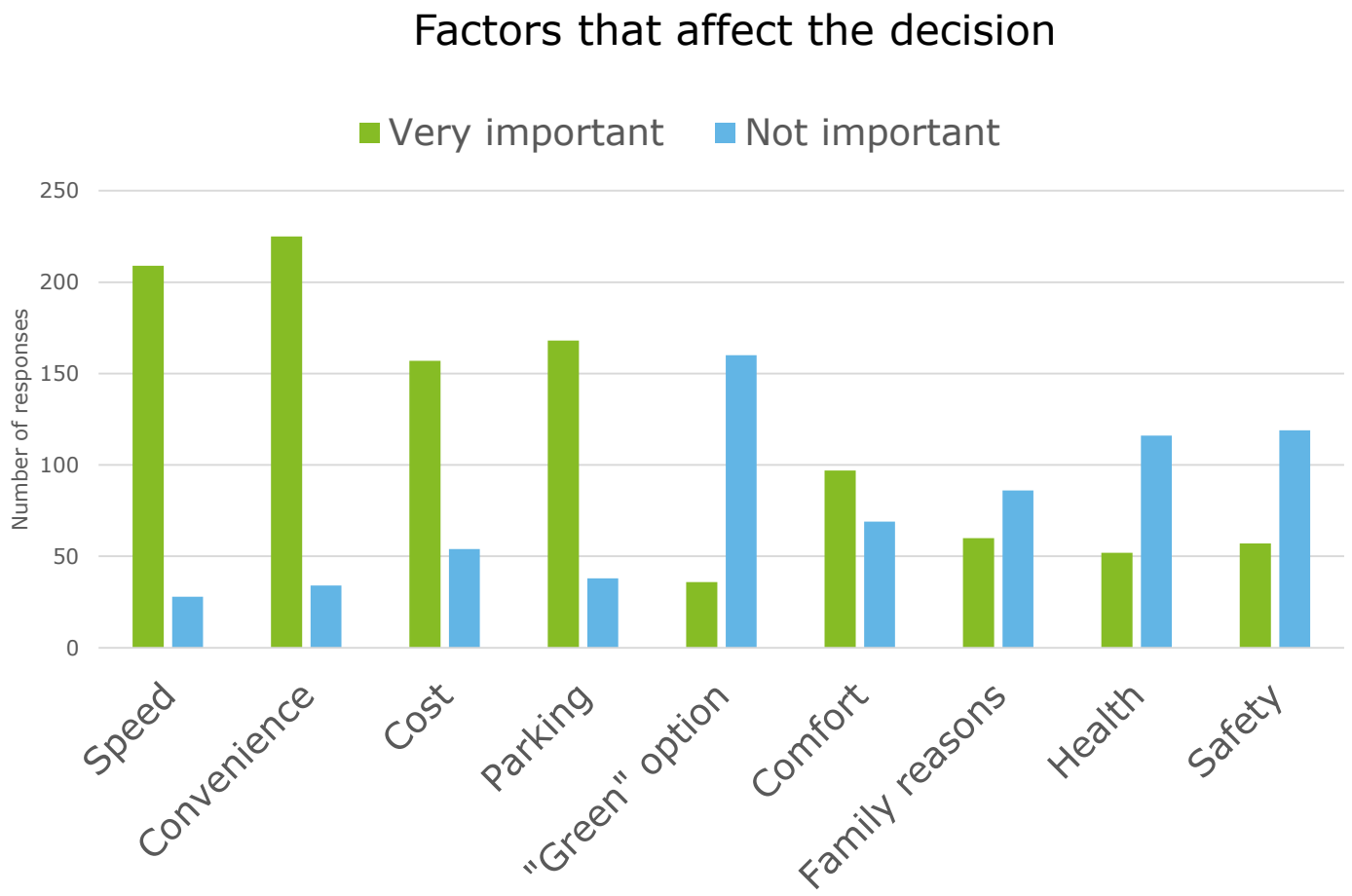
Most potential:

Bus 49% Drive 45%

Bicycle 30% Car share 22%

What is important…

The reasons behind our mode of travel



Coming from near and far…

Comparing those who live close to the office and those who live further away

Distance from the office	**1 mile**	**5 miles**	**25 miles**
Mode of transport	Walk	Car	Car
Average Age	26	35	31
Journey to work start time	8:15-8:30	8-8:15	7:00
Journey to work	10-20 mins	30 mins	An hour or more
Journey home start time	5:15-5:30	5:45	5:30
Journey home	10-20 mins	Just over 30 mins	An hour

The wheels on the bus…(and the train)

We asked "What would encourage you to use public transport more often?"

Top ways to encourage staff to use Public Transport more often	Count
Lower fares	91
More frequent services	67
More punctual	54
Faster journey time	36
Better routes	23
More access	22
More comfortable / less crowded	21
Better service	12

"I use public transport every day and I am happy with the service."

"A more consistent bus schedule in which buses are more punctual"

"Cost - there are trains and buses available to me but they are expensive when compared to car travel and parking. It is not an attractive option to spend more, be inconvenienced by standing in the cold and a journey which takes longer - there is nothing attractive about our public transport to make it worthwhile."

Get on your bike…

We asked "What would encourage you to ride a bicycle to work?"

Top 4 ways to encourage staff to cycle to work	Count
Safer/better cycle lanes	99
Bicycle storage facilities	45
Better office facilities (Shower, lockers, changing room etc.)	31
Owning a bicycle	16

"I wouldn't - it is too dangerous to cycle in Belfast. Motorists do not care about cyclists"

"safer roads. The road network within Belfast is not safe enough to cycle and there are is not an adequate place to safely store bike at work"

A final word…

Finally, we asked staff to "Please list any suggestions for improvement or any other concerns around the availability and quality of Transport in Northern Ireland"

Most suggested improvements
1. Develop the train network to provide to more parts of NI / greater frequency of trains
2. Get rid of bus lanes within the city
3. Real time tracking for public transport with incident updates
4. The ability to buy and use electronic tickets, or contactless payment to avoid waiting in ticket queues or having cash on hand
5. Increase the bus lane network with fewer staggered bus lanes

Simon Dixon, Global Sector Transport Leader, Deloitte UK

How people will likely experience a seamless intermodal journey in the future?

Meet Ben…

…he is a millennial living just outside the city

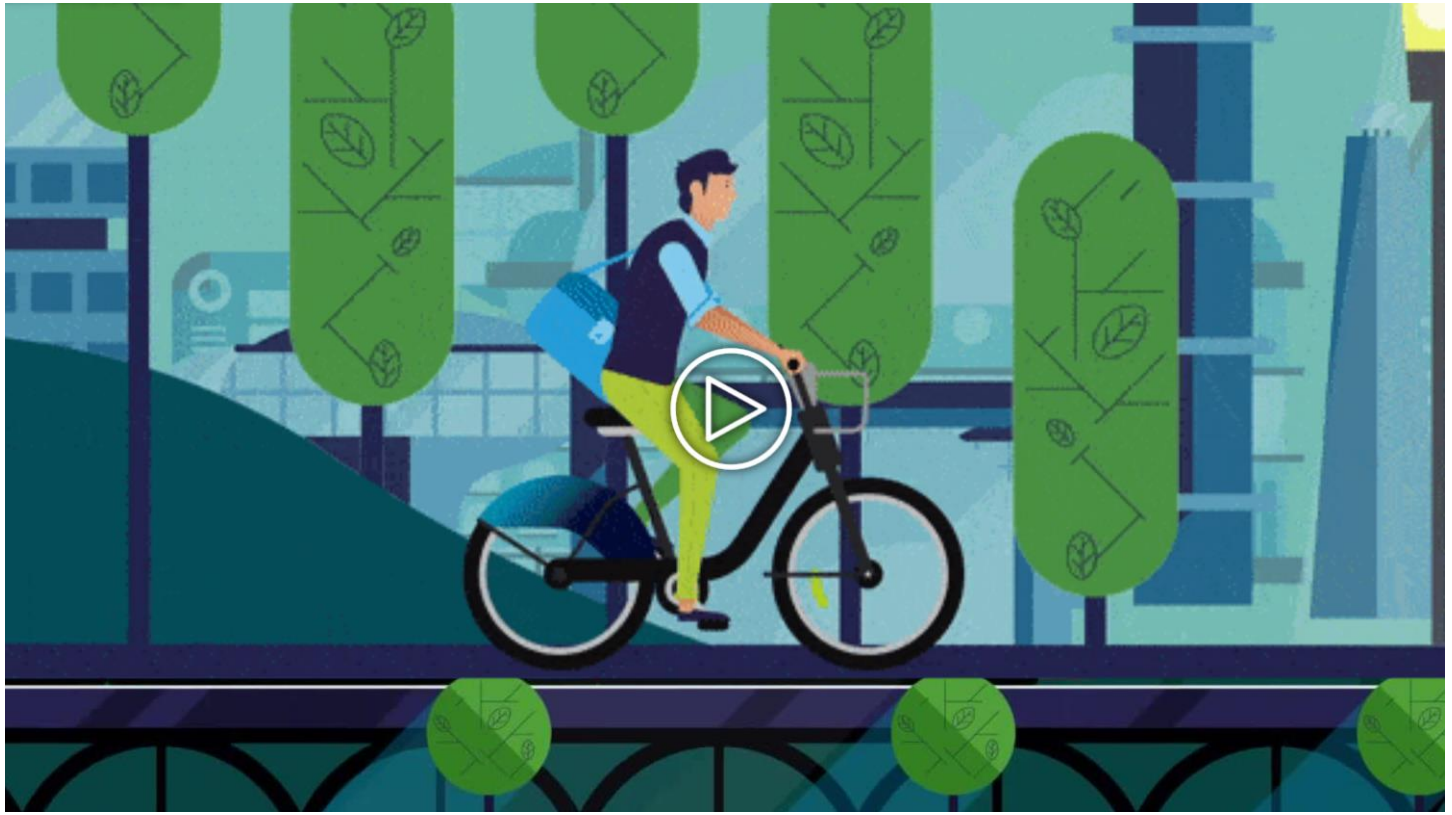
…he wants to pick up groceries

…he is ready go home after a long day at work

Let’s see what his journey home and the supporting ecosystem could look like

Deloitte.
University Press

[The future of mobility: Ben's journey]



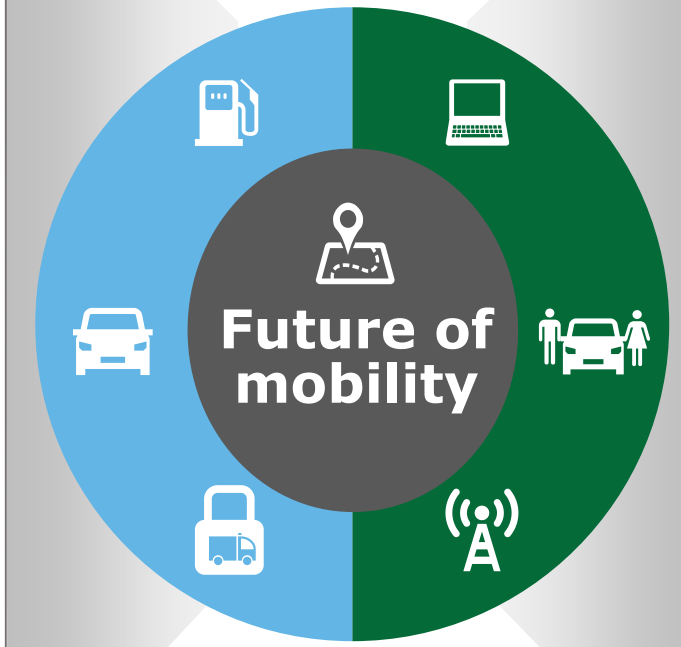
There are two profoundly different visions about how the future could evolve

Insider view

The industry will **evolve naturally** and **incrementally** toward a future mobility system that **retains its roots** in what exists today

The key players, major assets, and overall structure of the **current ecosystem can remain intact** while change progresses in an **orderly, linear fashion**

The incumbent mindset appears **dually focused** on sustaining the current model while **testing change in small ways**



Disrupter view

A **whole new age** is dawning featuring **fully autonomous** cars accessible on demand

Before long, a **tipping point** will occur, after which the **momentum of change will become unstoppable**

New entrants, notably Google and Uber among others, **are catalysts** for transformation

Unlike the stakeholders in today's system, they **do not have vested stakes** to protect

There are a number of forces that will influence the rate at which the new mobility ecosystem takes shape

Forces of Delay or Acceleration

Regulation & Government

Federal, state and local policies

Public Attitudes

Human-machine interface, safety, shared economy

Technology Development

Early experiments, pilot programs

Privacy and Security

Cyber-security, communication protocols

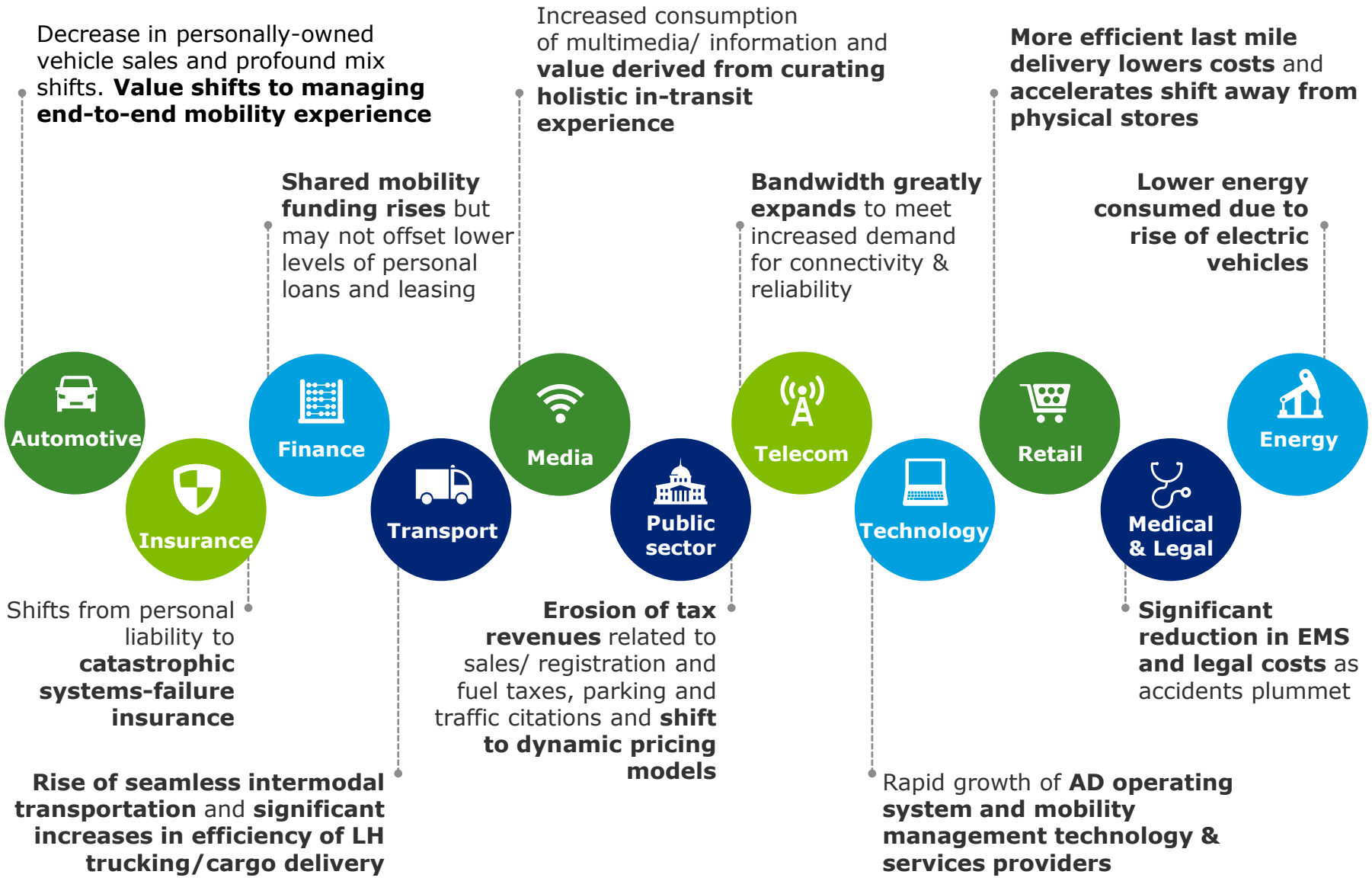
Corporate Valuations

Technology investments, cost-of-capital projections

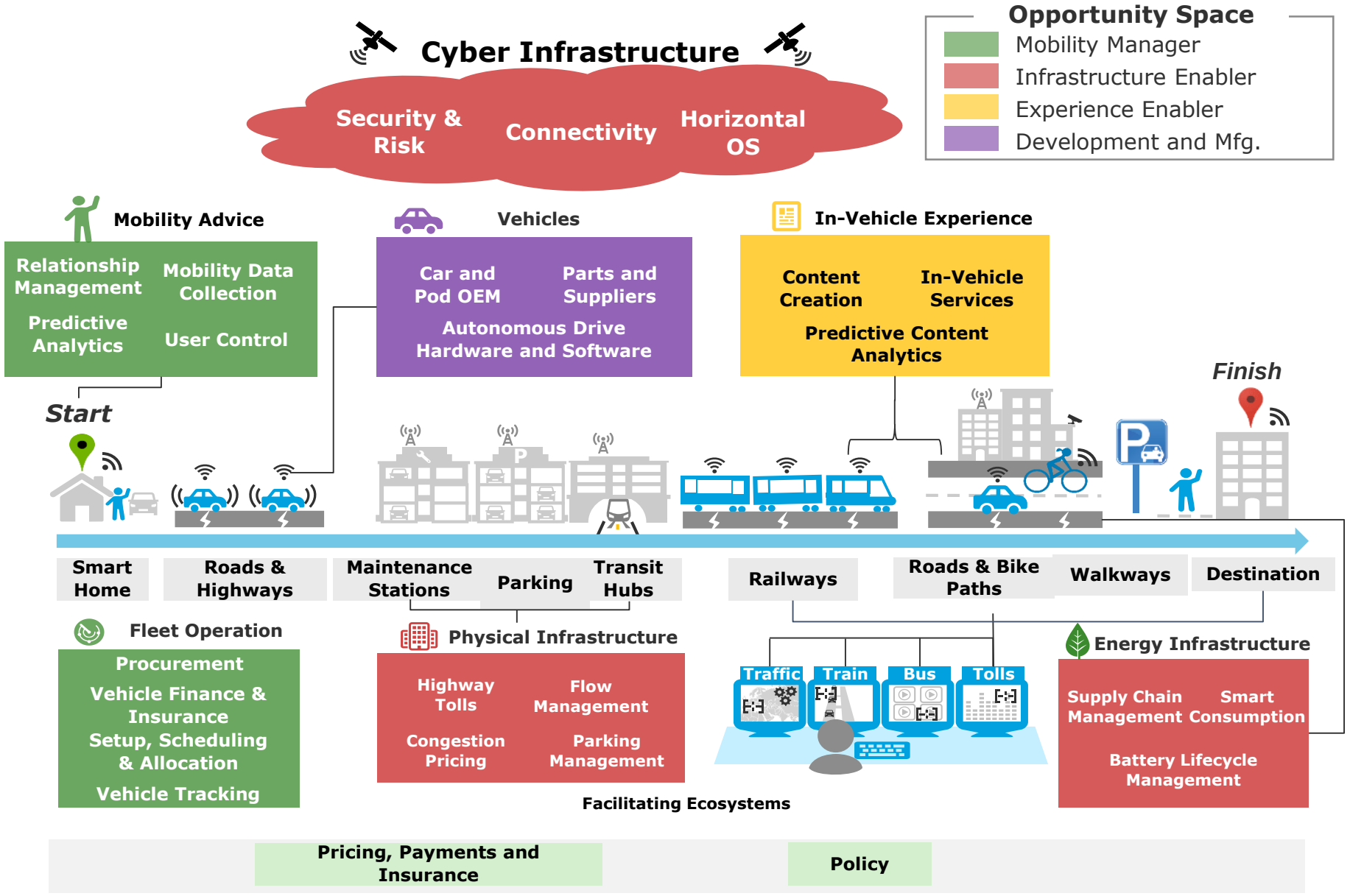
Employment Changes

Dislocation effects, reactions, job retraining

The disruptive nature of this transformation will result in massive shifts in economic value

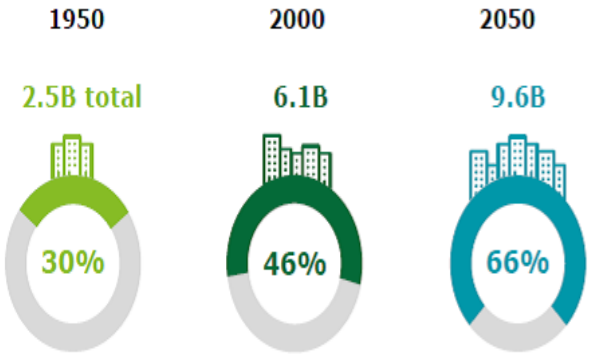


New and different capabilities will be required to compete in this ecosystem, depending on the opportunity space



Cities are straining to keep pace with rapid urbanization and population growth

Population Growth & Urbanization

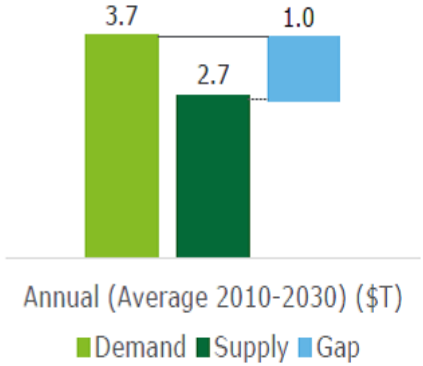


500 cities with populations over 1 million now exist around the world

41 mega-cities with populations over 10 million are expected by 2030

3.4B additional residents will be living in cities by the middle of the century

Infrastructure Shortfall & Impact of Congestion



$1.2T could be lost in US gross domestic product by 2025 due to transportation infrastructure deficiencies, with cities being the most affected regions

73% of the metropolitan workforce commute for 90 minutes or more

30% of traffic in urban areas is caused by cars looking for parking.

Existing transportation systems fall short of meeting current and future demand

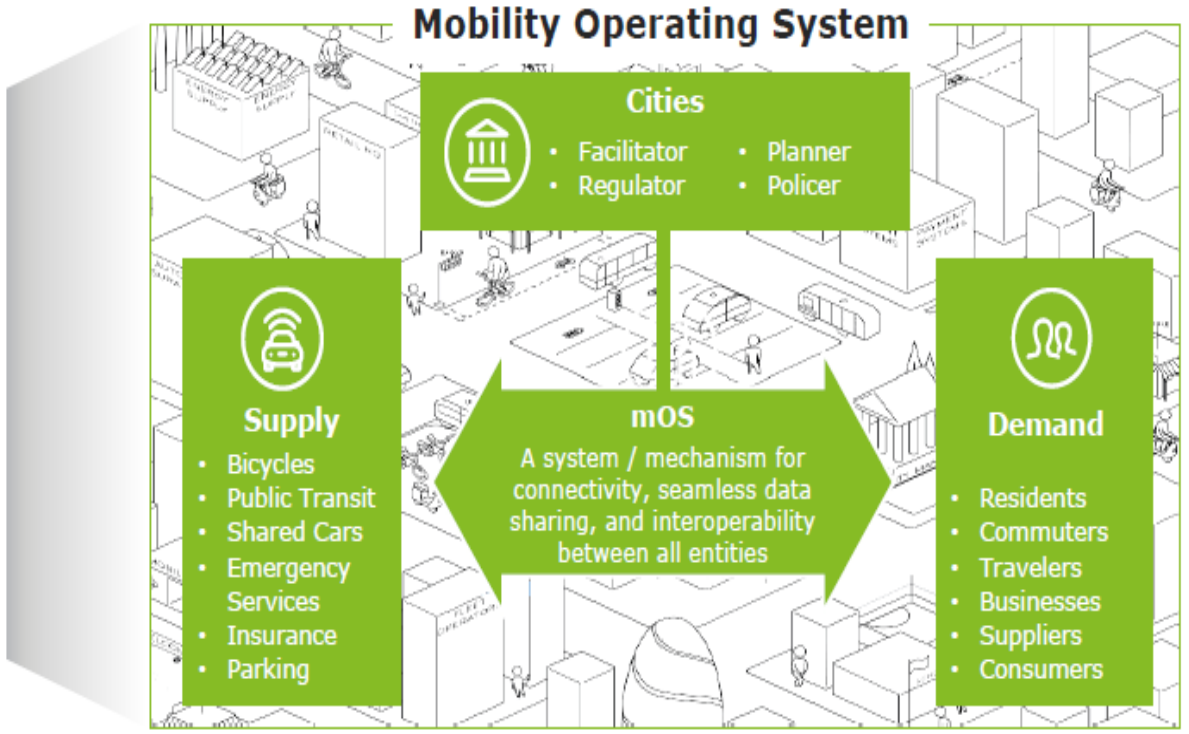
Future of Mobility | Deloitte.

Source: "Smart City Challenge," U.S. Department of Transportation; 2015 Urban Mobility Report, Texas A&M Transportation Institute; "Smart Cities Readiness Guide," Smart Cities Council; TomTom Traffic Index; World Economic Forum, Strategic Infrastructure report; Deloitte Analysis

To manage these challenges, cities will need a Mobility Operating System

To improve urban mobility and through-put, cities need an overarching platform that promotes market efficiencies and behavioral "nudges" across distinct transportation systems

A **Mobility Operating System (mOS)** is an intelligent data platform that combines advances in IoT technologies, Big Data, and cognitive analytics to optimize supply and demand in urban transportation markets



WHAT DOES IT DO

mOS solves urban mobility and transportation challenges by efficiently matching supply with demand, catering to individual preferences, and optimizing transport resources to improve urban living

THE BENEFITS

Mobility is the lifeblood of a city, and the mOS will provide seamless mobility services on demand in an inclusive manner, enabling integrated adjacent services such as unified payment and insurance solutions

What is a Mobility Operating System (mOS)?

The mOS is a system of systems – it is a digital platform that is scalable and intelligent that overlays and connects disparate physical transportation systems

What it *IS*...

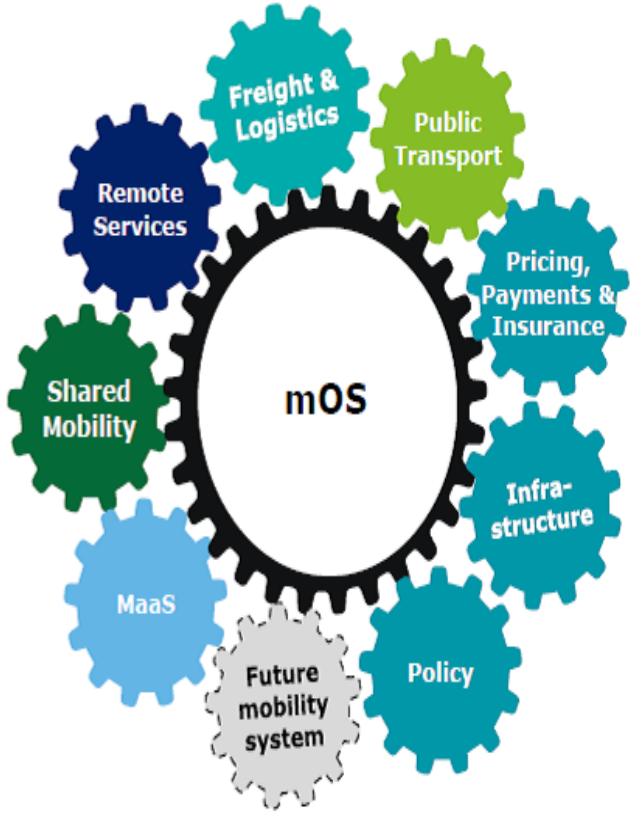
The mOS is an orchestrator for transportation services. It can be described as the following integrated solution:

- A digital platform that integrates and engages with other apps and/or platforms
- A holistic system that intelligently promotes greater ecosystem equilibrium between supply and demand
- A solution that provides accessible, sustainable and multi-modal transportation
- A single interface for all of a city's transportation exchange and commerce
- An intelligent nerve center that gathers data, trends and environmental inputs; creates actionable insights; and guides user behaviors and outcomes

What it is *NOT*...

The mOS may resemble the following, but the system as a whole cannot be identified as a single one of these products:

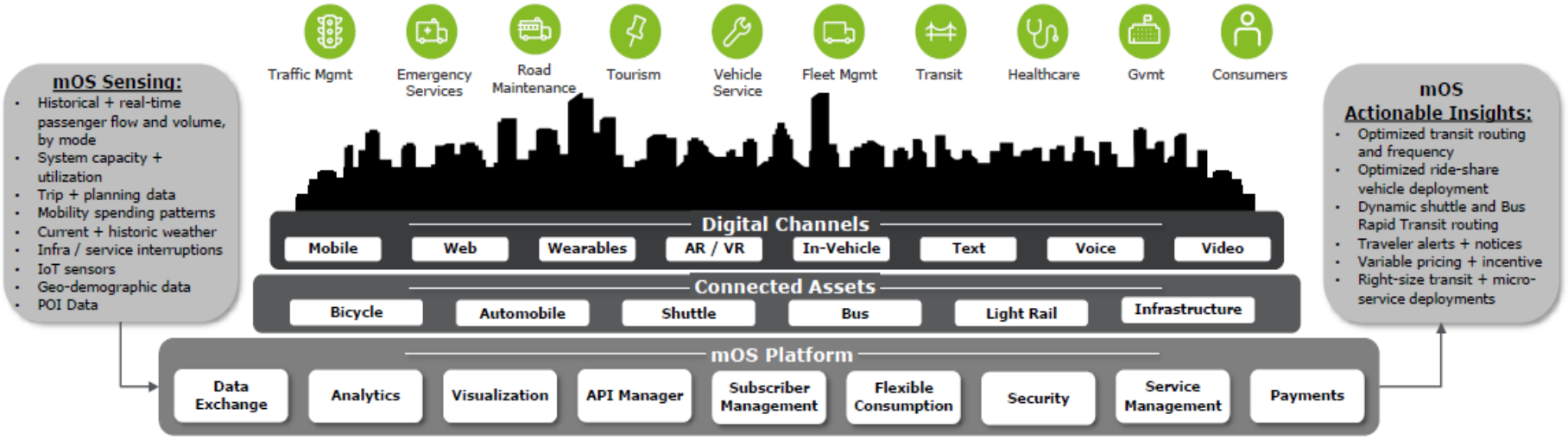
- A stand-alone program or software
- Another disparate point-solution that increases mobility in a single vertical, adding congestion and exacerbating urban challenges
- A simple Mobility-as-a-Service, ride-share or car-share app
- An app store or digital payment system
- A data-crunching repository of transportation information



The mOS optimises supply and demand in a mobility marketplace

The mOS optimizes supply and demand in a mobility marketplace

The Mobility Operating System serves as the digital infrastructure needed to build a future-state transportation system



mOS Capabilities

USER ACCESS
1. Provides end consumers with a single user interface for mobility services

DIGITAL-PHYSICAL
2. Connects physical and digital assets to expand services, gain edge insights

REAL-TIME DATA
3. Ingests multi-source data from physical sensors and digital interactions

PREDICTIVE ANALYTICS
4. Dynamic model predicts system capacity and utilization, adapting for incidents and changing conditions

SCENARIO EVALUATION
5. Performs trade-off and next-best-action analytics to evaluate mobility options in context of city goals

POLICY GUIDANCE
6. Enables city gov. and platform operators to set policy goals and priority outcomes

OPTIMAL CHOICE
7. Equilibrates supply and demand, implements behavioral incentives to encourage optimal aggregate outcomes

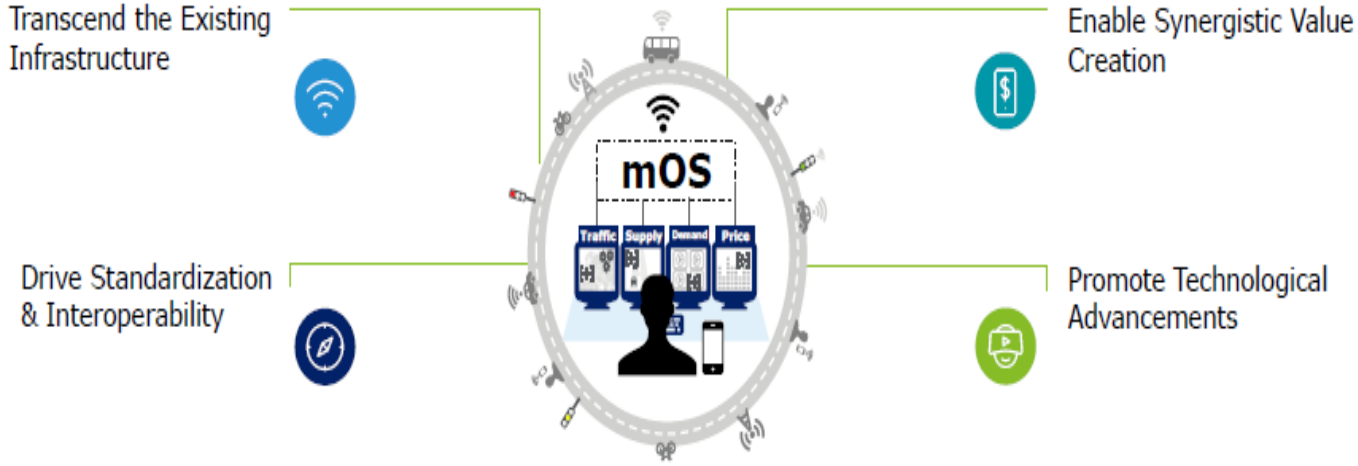
UNIFIED PAYMENT
8. Collects user payments, determines cost allocation, and distributes among service providers

Future of Mobility | Deloitte.

The mOS will enable innovation and transform the urban environment

An interoperable platform will solve major urban challenges and creating new civic and economic opportunities

The mOS will drive changes in urban mobility ...



... and will have broad implications for cities, industry, and the public

City as Platform

Cities themselves will become mobility platforms

Decentralized Data

Large players may lose their current data monopoly

Local Competition

Local players may come to compete with mobility giants

Empowered End Users

Consumers will have more options at reduced cost

Improved City Finances

The mOS will enable new revenue streams for local governments

Deloitte’s Global Smart City Expertise

Smart City | Smart Nation Ecosystem

A comprehensive view is needed to meet the targeted state of improving the quality of life, managing cities effectively, and achieving urban sustainability

Mobility: Shared mobility, autonomous vehicles, dynamic pricing, IoT, and advanced analytics enable more people and goods to move faster, safer, cheaper, and cleaner.

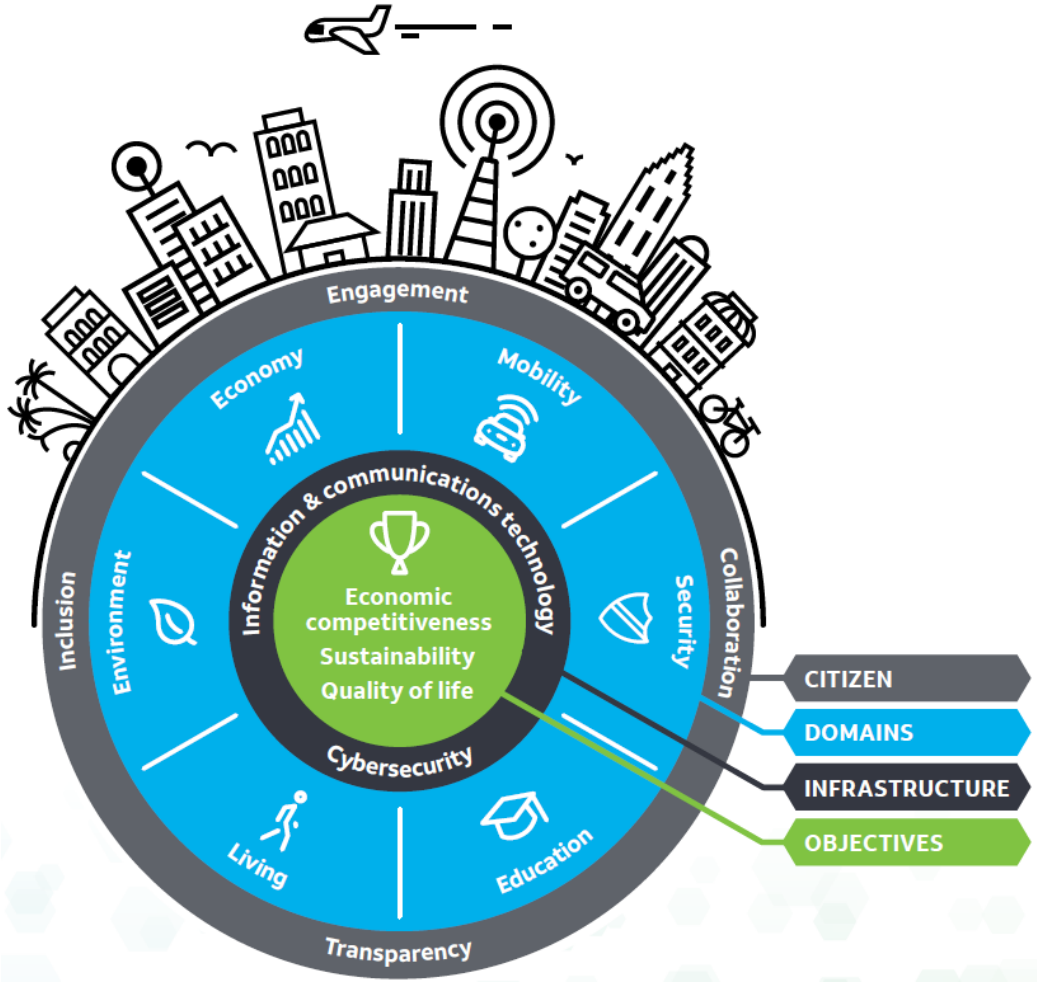
Security: Drones, wearable computing, and predictive video secure buildings and help law enforcement. Secure data platforms, clear governance, and smart access protocols help safeguarded against cyber threats.

Education: Virtual learning, digitization, and augmented reality transform the way we learn. The focus shifts from digital content in the classroom to real-world experiential learning.

Living: Cities promote connected communities through smart buildings and health care innovations, which contribute to improved quality of life and sustainability.

Environment: Sensors detect leakage to preserve natural resources, like water. Cities use behavioral economics and gamification to encourage positive resourcing decisions.

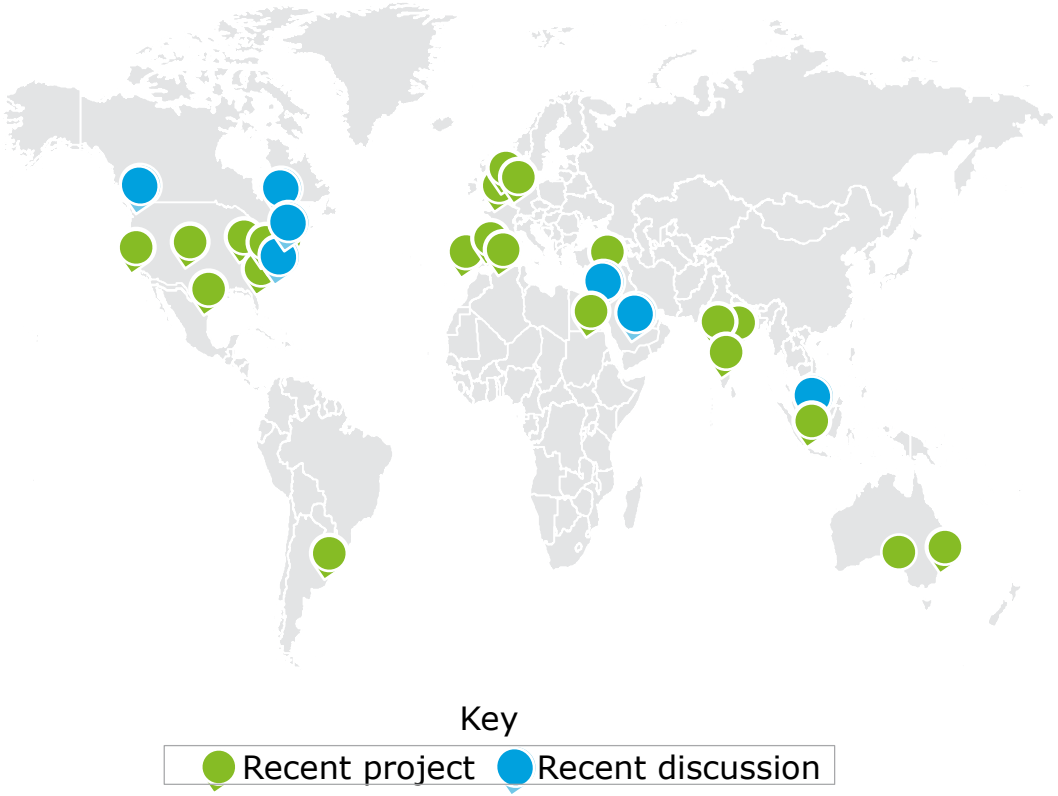
Economy: Technology helps cities streamline government procedures, such as permitting. Digitization and big data analytics improve city regulators' ability to track performance.



Recent Deloitte Smart City projects and efforts

Our efforts provide insight into challenges that cities face and best practices from smart city efforts

Deloitte's recent Smart City efforts

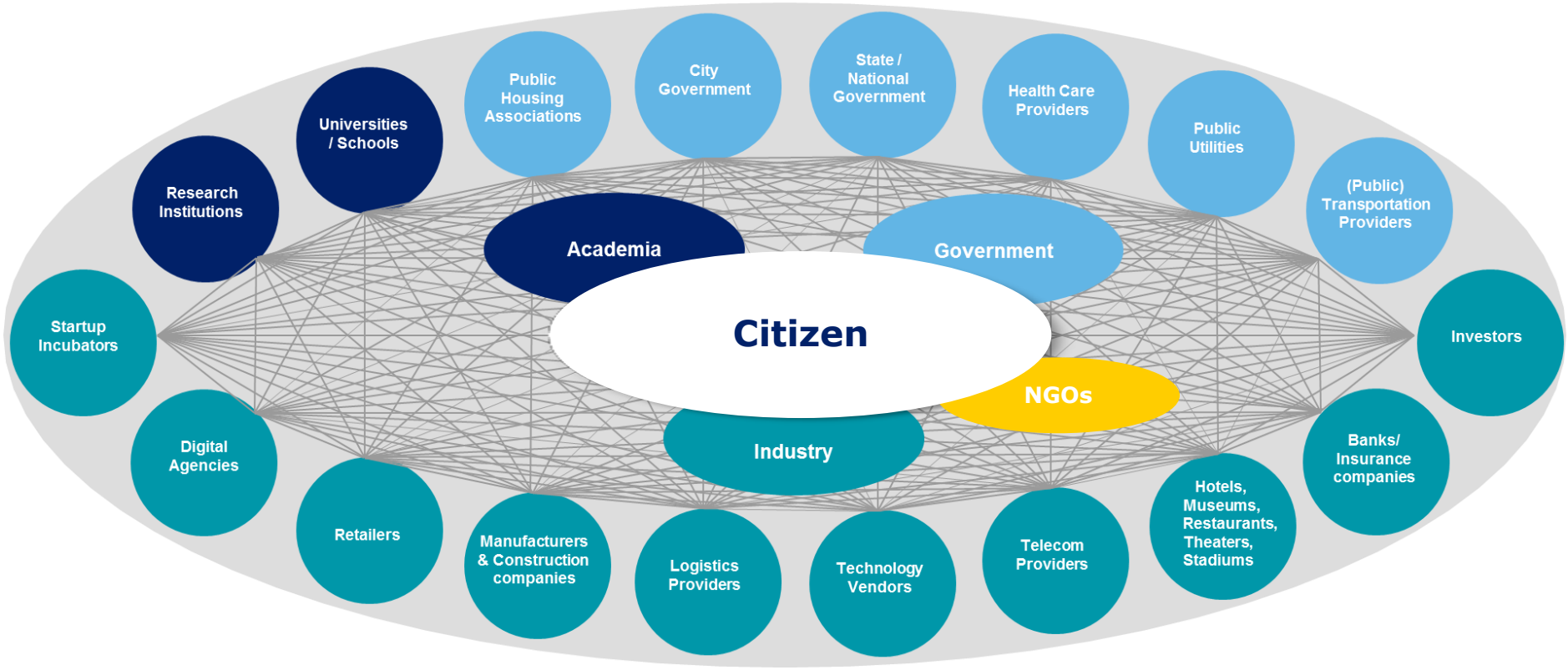


Common Smart City project challenges

- Citizen Engagement
- Governance
- Funding and financing

Complex Citizen Ecosystem

A Smart City needs to engage various stakeholders to create a vision, implement a strategy, and plan for the future



Citizen Engagement: Thinking about Smart City initiatives

Smart City initiatives have faced many challenges, in part because of an over-emphasis on left brain, "product-centric" thinking and individual point solutions

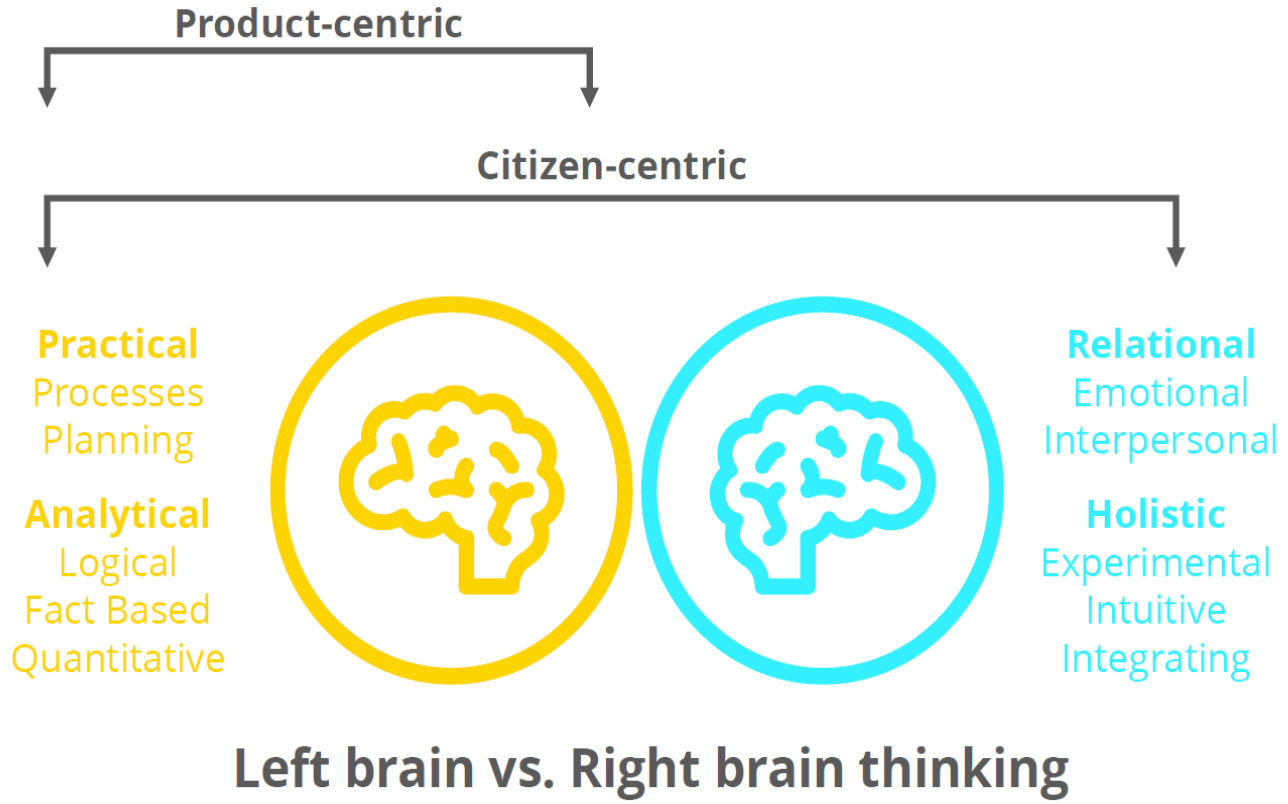
Including participants across the ecosystem brings "whole brain thinking" to smart city projects

Government

Citizens

Academia

Industry/Non Profit



Left brain vs. Right brain thinking

Citizen Engagement: Responsive City

A responsive city solution extends the reach of city resources by allowing residents and visitors to submit complaints regarding city assets via an app, call center, or social media channels.

Feedback Management Solution

Solution Objectives

- Engage citizens as problem solvers
- Increase reliability of information
- Improve city appearance
- Increase citizen satisfaction

Solution Outcomes in Buenos Aires

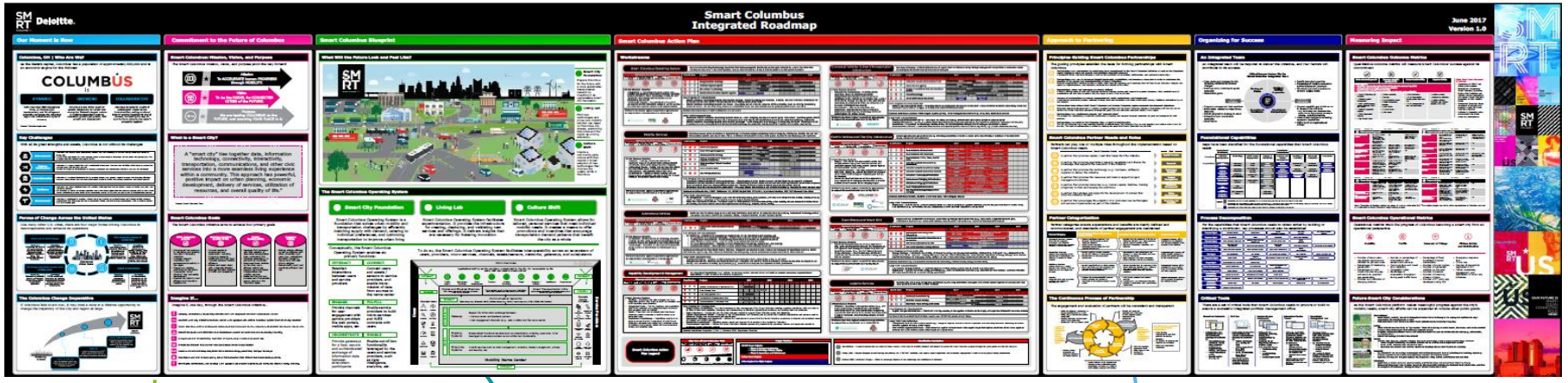
3.40 x
Increase in street work satisfaction

1.55 x
Increase in green space satisfaction

3.46 x
Increase in storm drain satisfaction

Governance: Columbus, USA

Columbus' roadmap provides an integrated approach to initiative alignment, execution, and governance



Vision

Commitment to the Future

Provides necessary context i.e., **current state**; vision, mission, and purpose; and goals that Smart Columbus has set

Smart City Blue Print

Creates a **clear articulation of the desired end state for the Smart Columbus initiative** i.e., what is the static conceptual model we are working to create and unifying everything against ("The Platform")

Action plan

Organizing for Success

Approach to Partnering

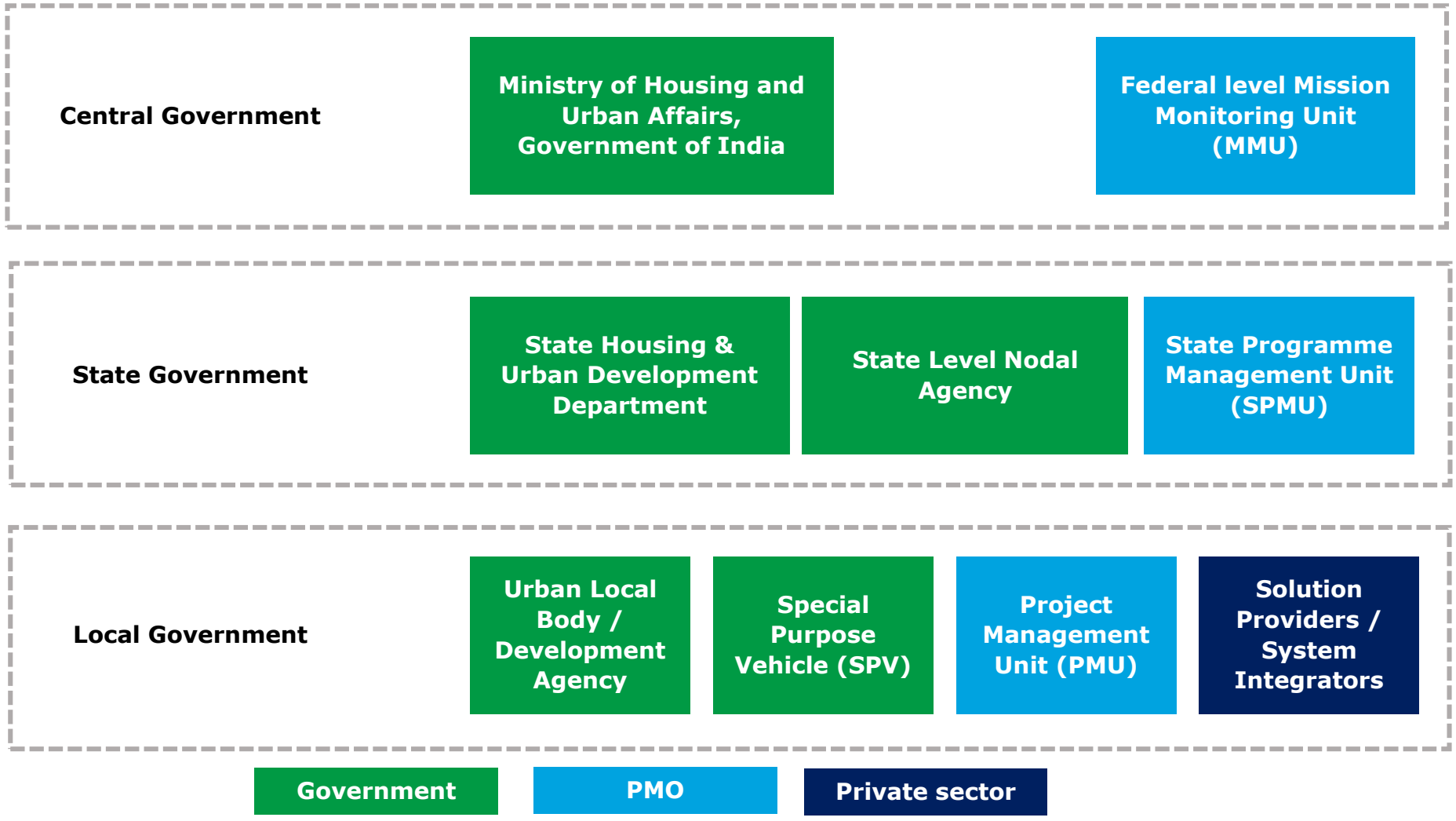
Measuring Impact

Provides an **integrated approach that enables Smart Columbus to make decisions and take actions to build its platform**, which consists of:

- Organizing framework for activity to deploy technology and offer new services
- Capabilities to deliver success
- Governance, structure, and accountabilities
- Guiding frameworks for critical of the work
- Clear definition of success

Governance: India

The India government has implemented a 3-tier governance structure to oversee their Smart City mission

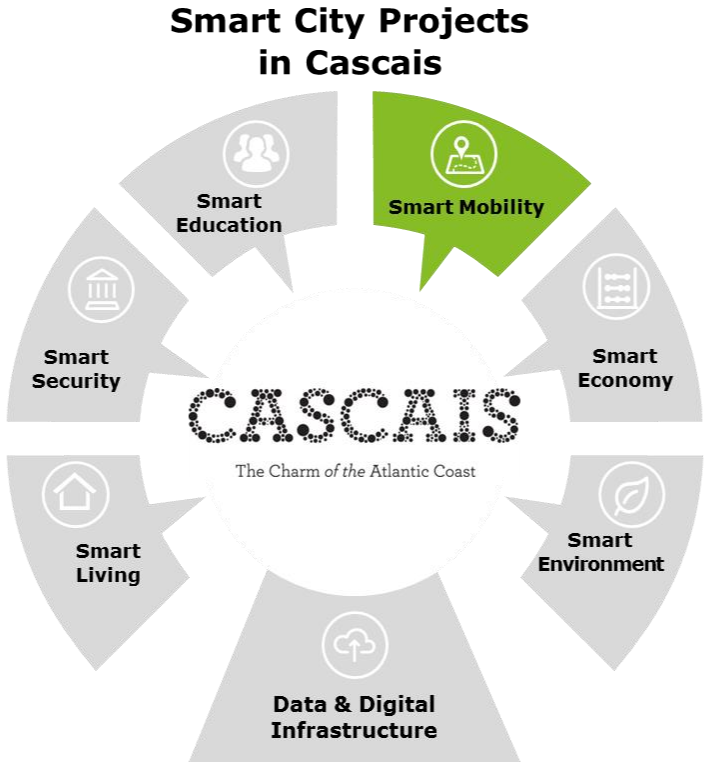


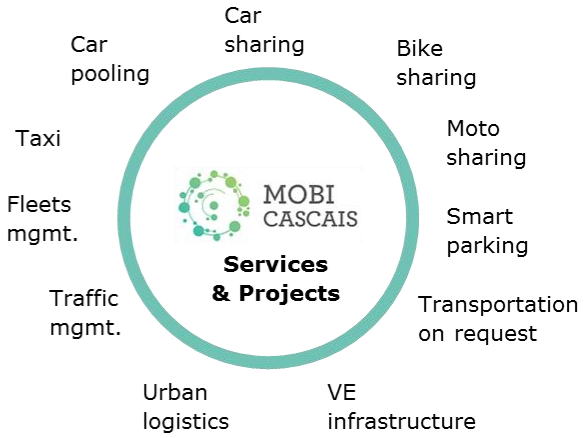
Governance Data and Mobility Challenge: Cascais

Smart mobility is a key part of Cascais's vision for their Smart City and is integrated with the other 'verticals'

Mobi Cascais

- Integrated mobility platform that holds information regarding the multimodal transportation system
- Promotes the use of bicycles and public transportation





Future initiatives

Funding and financing: Funding types

Capital intensive smart city projects likely require various funding mechanisms to supplement government budgets

PPPs

- This model is prevalent in financing projects related to transport, commercially viable technologies, education and healthcare.
- Private players share the risk associated with the project and provide the capital.

→ **Contractual partnership**
  - → **Concession–build and operate**
  - → **Concession model**
→ **Institutional partnership**
  - → **Special Purpose vehicle**
  - → **Joint Enterprise**

Government Funding

- The government of a particular country/ state, finances project through grants, loans, bonds or other financial instruments.
- Governments with surplus budgets and the expertise to manage and control project risk and operations will directly fund projects.

→ **Municipal Bonds**
→ **Industrial Revenue Bonds**
→ **Self financing**

Others

- **<u>Special Development Funds</u> –** are set up for implementing urban development or smart city initiatives.
- **<u>User fees and green bonds</u>** – can be used by both governments and corporations to raise capital for specific projects such as energy efficiency or renewables.

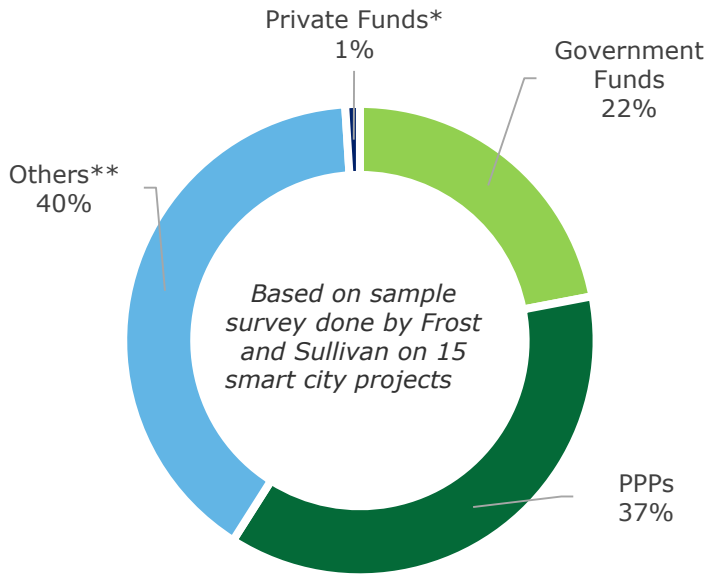
→ **User fees**
→ **Special development funds**
→ **Green Bonds**

<u>Other Innovative Funding</u>

- Innovative funding models ensure that the project meets the specifics objectives of both public and private sectors.
- Innovative funding mechanisms are used by cities at a small scale, but can be effective in the long-term with more public participation.

→ **Tax Increments**
→ **Green Revolving**
→ **Crowdfunding**

Most adopted funding mechanism for smart cities



**Private funds are the funding done by private companies alone.*

***Special development funds form a major portion of "others" category*

Sources: EU smart city guidelines; International journal, Frost & Sullivan

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Questions