MCKINSEY GLOBAL INSTITUTE

Smart Cities
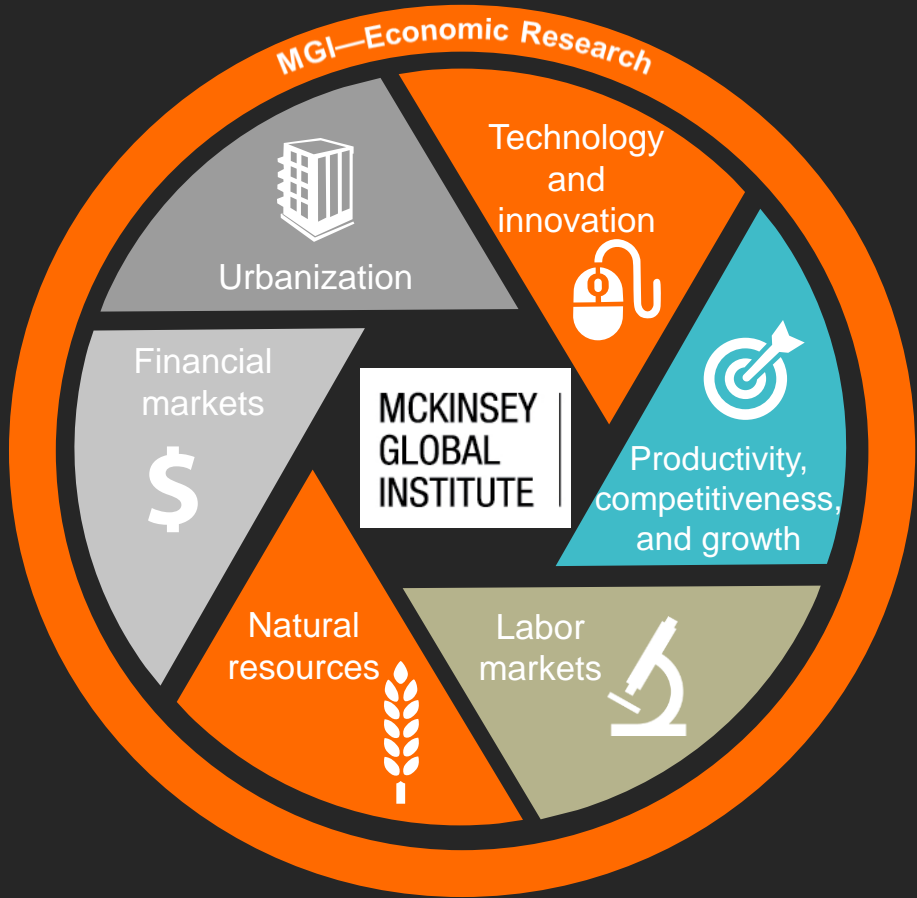## Digital Solutions for a more livable future

Sarah Tucker-Ray

McKinsey Global Institute is McKinsey's business and economics research arm, founded in 1990 and fully McKinsey funded

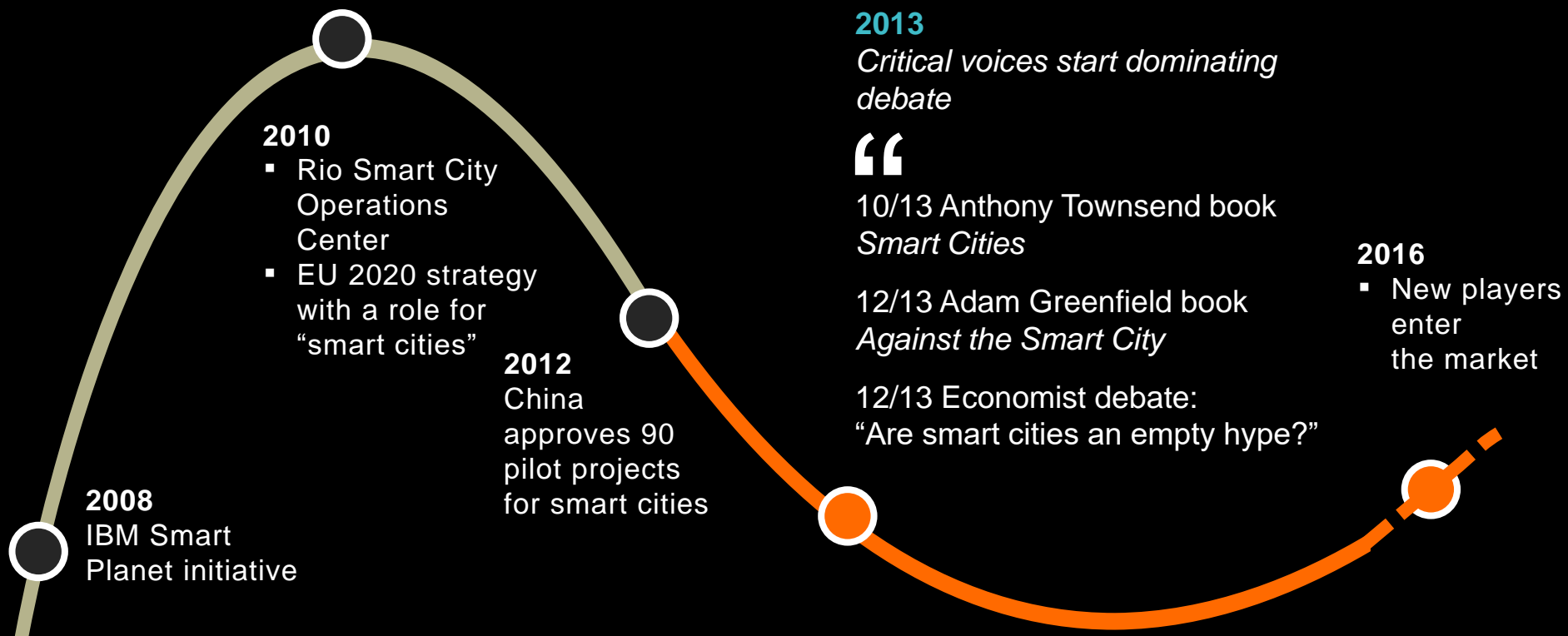*MGI is a global network of experts, combining McKinsey's best business insights with leading macroeconomic thinking…*

… focusing on six core research areas

MGI's mission

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Smart city reality has frequently fallen short of outsized expectations – now is the time to deliver

2008
IBM Smart Planet initiative

2010
- Rio Smart City Operations Center
- EU 2020 strategy with a role for "smart cities"

2012
China approves 90 pilot projects for smart cities

2013
Critical voices start dominating debate

"

10/13 Anthony Townsend book *Smart Cities*

12/13 Adam Greenfield book *Against the Smart City*

12/13 Economist debate: "Are smart cities an empty hype?"

2016
- New players enter the market

~2008-2012
Smart City 1.0

~2013 to the last few years
Criticism of Smart City 1.0

Going forward - Smart City 2.0?

1 What is a Smart City?
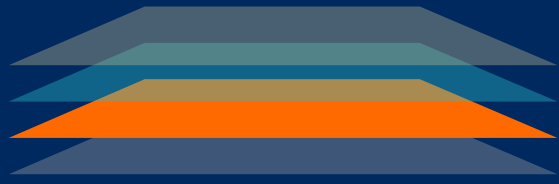
Traditional Infrastructure
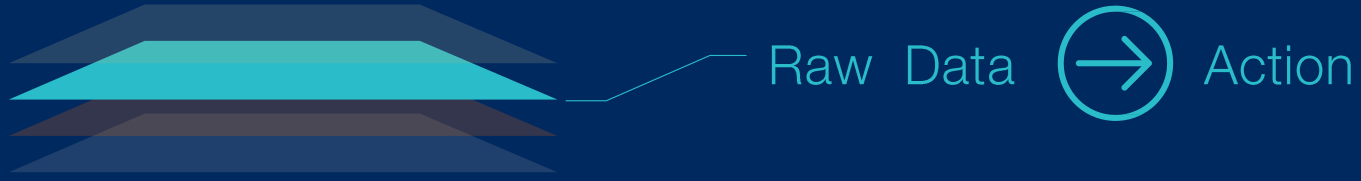

Physical & Social

1 Technology Base Network of connected devices and sensors

- Sensors
- Smartphones
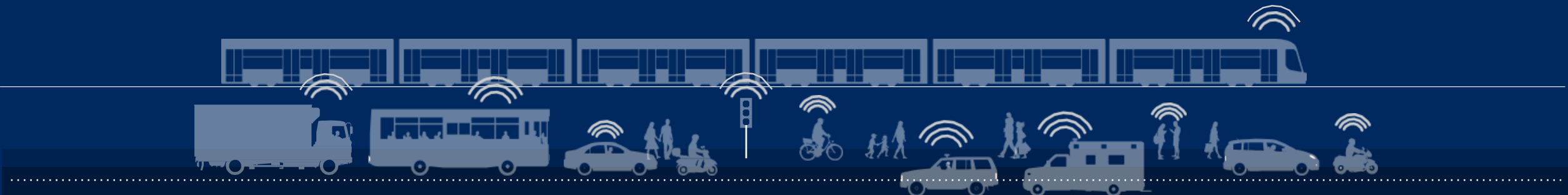- High-speed communication networks
- Open data portals

2 Applications Data analysis capabilities and tools

Raw Data → Action

3 Public adoption & usage

- Adjust travel
- Use less energy & water
- Take charge of their own health

The power of an 'intelligence layer'

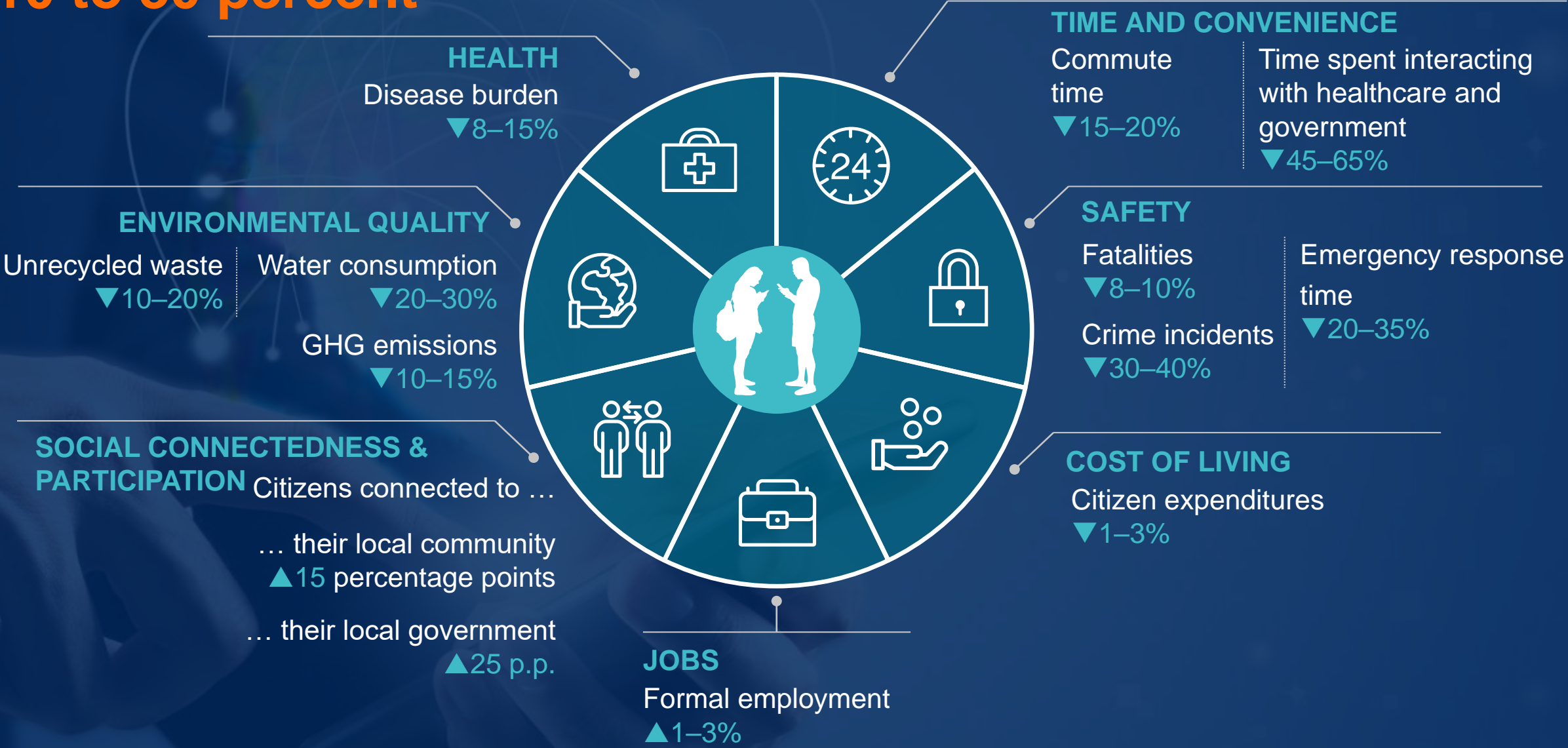*Millions of small, individual actions sum to make the city work better for everyone*

2

What is the opportunity?

Smart city applications can improve quality-of-life indicators by 10 to 30 percent

HEALTH
Disease burden
▼8–15%

TIME AND CONVENIENCE
Commute time
▼15–20%

Time spent interacting with healthcare and government
▼45–65%

ENVIRONMENTAL QUALITY
Unrecycled waste
▼10–20%

Water consumption
▼20–30%

GHG emissions
▼10–15%

SAFETY
Fatalities
▼8–10%

Emergency response time
▼20–35%

Crime incidents
▼30–40%

SOCIAL CONNECTEDNESS & PARTICIPATION
Citizens connected to …

… their local community
▲15 percentage points

… their local government
▲25 p.p.

COST OF LIVING
Citizen expenditures
▼1–3%

JOBS
Formal employment
▲1–3%

Impact varies per city: a range of smart city applications can improve health by ~7-16%

Percent of DALYs averted
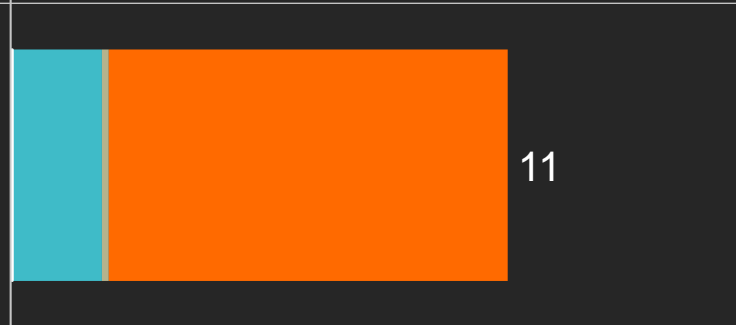
Legend: ■ Water ■ Security ■ Mobility ■ Healthcare

City 1 *(e.g., New York City)*
- Low overall disease burden
- High chronic disease burden
- Low air pollution
- High level of physician access
- Low infant mortality rate

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City 2 *(e.g., Rio de Janeiro)*
- Low overall disease burden
- Mixed disease burden
- Low air pollution
- Medium level of physician access
- Medium infant mortality rate

11

City 3 *(e.g., Lagos)*
- High overall disease burden
- High communicable disease burden
- Medium air pollution
- Low level of physician access
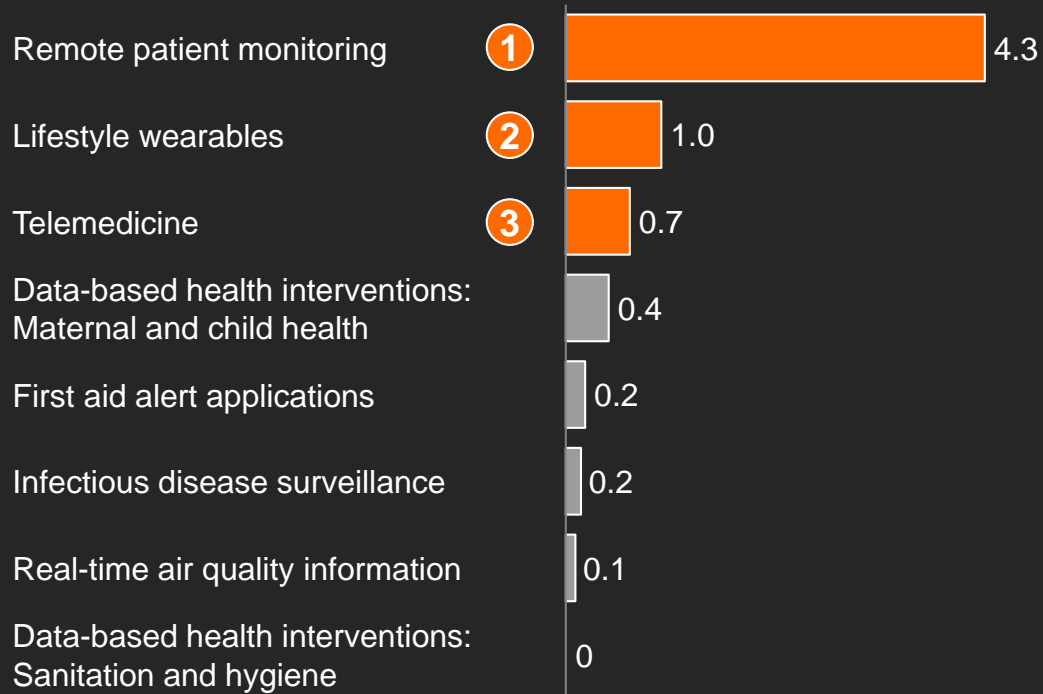- High infant mortality rate

16

High income cities benefit most from improving chronic disease care, lower income ones from controlling preventable and communicable diseases
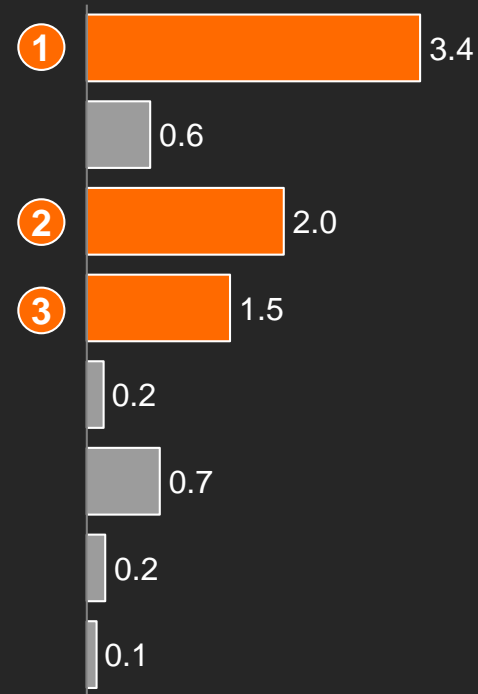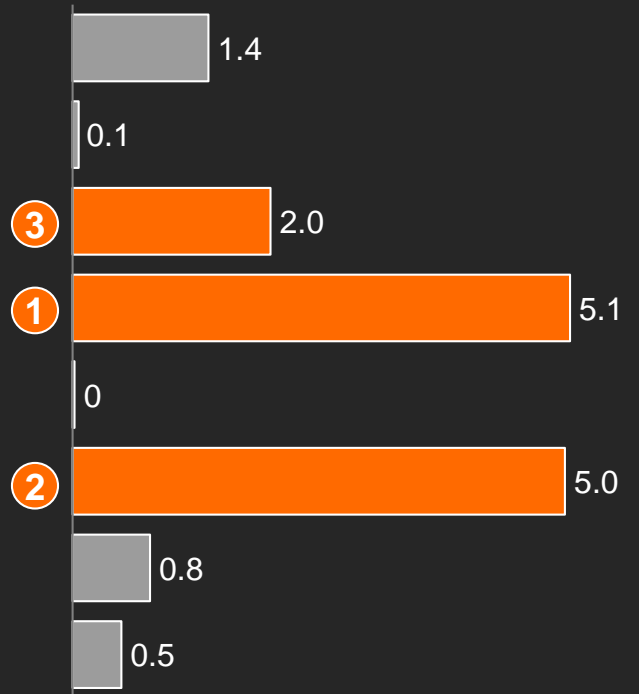
% reduction in DALYs in different cities by application[1]

City 1
Low overall disease burden, with high share of chronic diseases; high access to care; low infant mortality (eg, New York City)

City 2
Low overall (mixed) disease burden; medium access to care; medium infant mortality (eg, Rio de Janeiro)

City 3
High overall disease burden, with high share of communicable diseases; low access to care; high infant mortality (eg, Lagos)

Application	City 1	City 2	City 3
Remote patient monitoring	(1) 4.3	(1) 3.4	1.4
Lifestyle wearables	(2) 1.0	0.6	0.1
Telemedicine	(3) 0.7	(2) 2.0	(3) 2.0
Data-based health interventions: Maternal and child health	0.4	(3) 1.5	(1) 5.1
First aid alert applications	0.2	0.2	0
Infectious disease surveillance	0.2	0.7	(2) 5.0
Real-time air quality information	0.1	0.2	0.8
Data-based health interventions: Sanitation and hygiene	0	0.1	0.5

1 Overlaps not considered.

Smart city applications can reduce commute time by 14-20% depending on city characteristics

Impact of smart city applications on commute time
Percent of average commute time reduced

City 1: High-income with high share of metro and long peak wait times (e.g., New York City) — 14

City 2: Medium-income with high share of large public busses and short peak wait times (e.g., Rio de Janeiro) — 20

City 3: Low-income with high share of mini busses and long peak wait times (e.g., Lagos) — 16

24 Cities with long waits for public transit benefit most from real-time public transit info applications, while intelligent traffic signals work best in cities where driving is prevalent
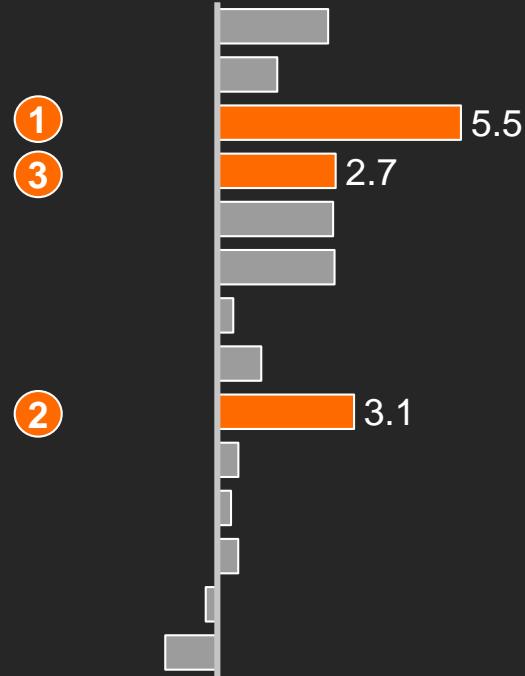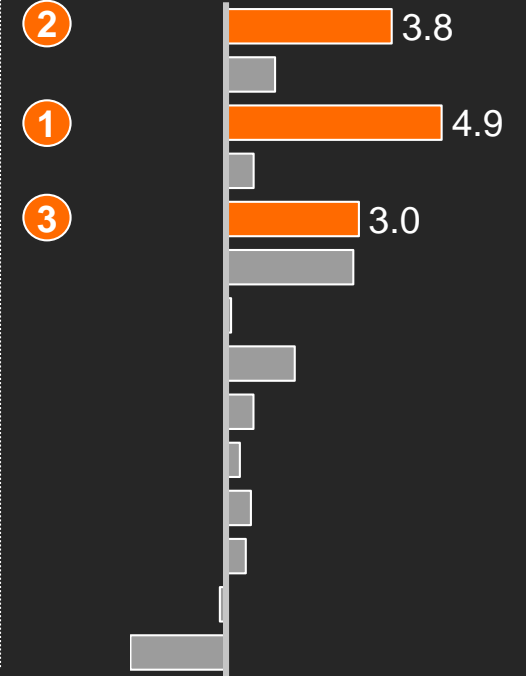
City 1
High-income, with high share of metro and long peak wait times (e.g., New York)

City 2
Medium-income, with high share of large public buses and short peak wait times (e.g., Rio)

City 3
Low-income, with high share of minibuses and long peak wait times (e.g., Lagos)

% decrease in average commute time by application[1]

	City 1	City 2	City 3
Real-time public transit information[2]	**①** 5.2		**②** 3.8
Predictive maintenance of transport system	**②** 2.3		
Intelligent traffic signals	**③** 2.2	**①** 5.5	**①** 4.9
Smart parking		**③** 2.7	
Real-time road navigation			**③** 3.0
Demand-based microtransit			
Bike sharing			
Congestion pricing			
Digital payment in public transit[2]		**②** 3.1	
Smart parcel lockers			
Parcel load pooling			
Integrated multi-modal information			
Car sharing			
E-hailing (private and pooled)[3]			

1 Overlaps not considered   2 Includes informal busses   3 E-hailing assumed 50% private, 50% pooled

In a metro of 2 million residents, this could mean…

10-150
Lives saved per year

4,000 - 20,000
Crime incidents prevented per year

5 - 15
Minutes shaved off the daily commute

10 - 30
Liters of water saved per person per day

Note: Range of impact depends on city-specific characteristics

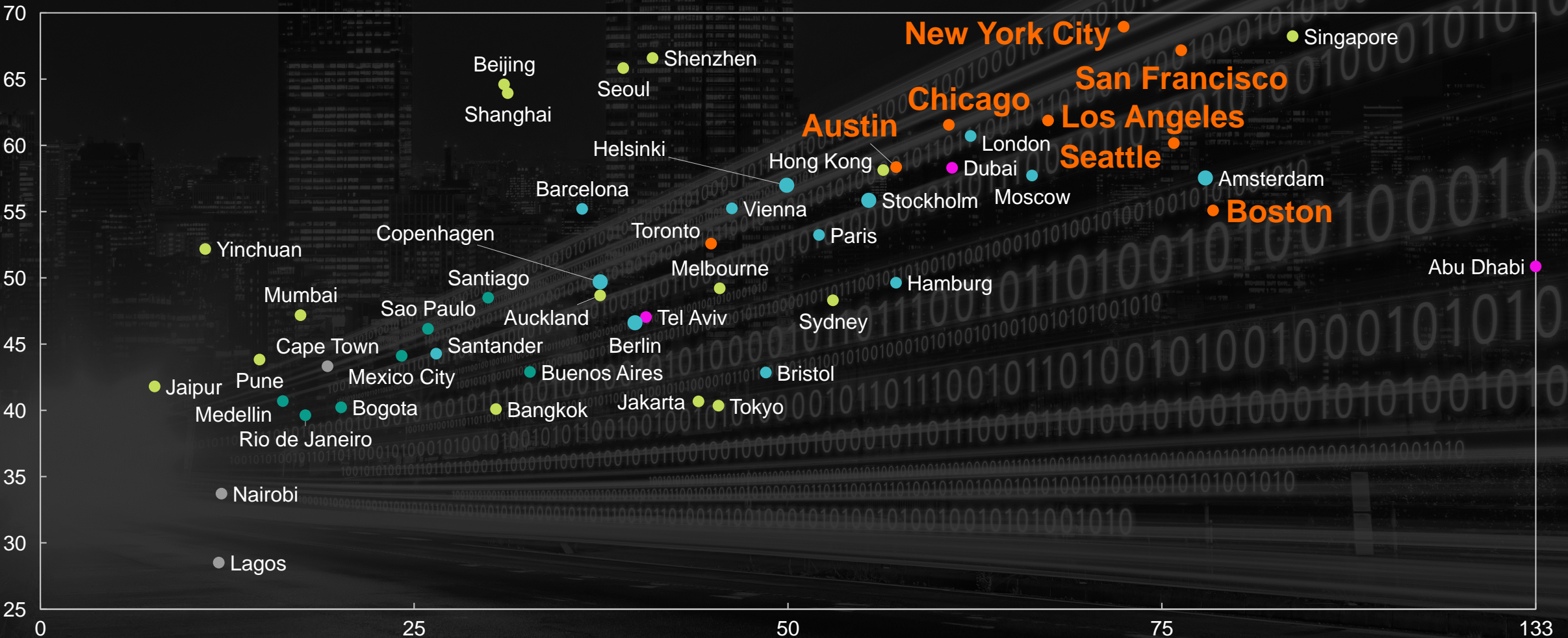## Better decisions enable
- ⬆ capacity
- ⬆ flexibility
- ⬇ cost

3

Where do Cities Stand Today?

Higher-income cities are generally further along in their journeys
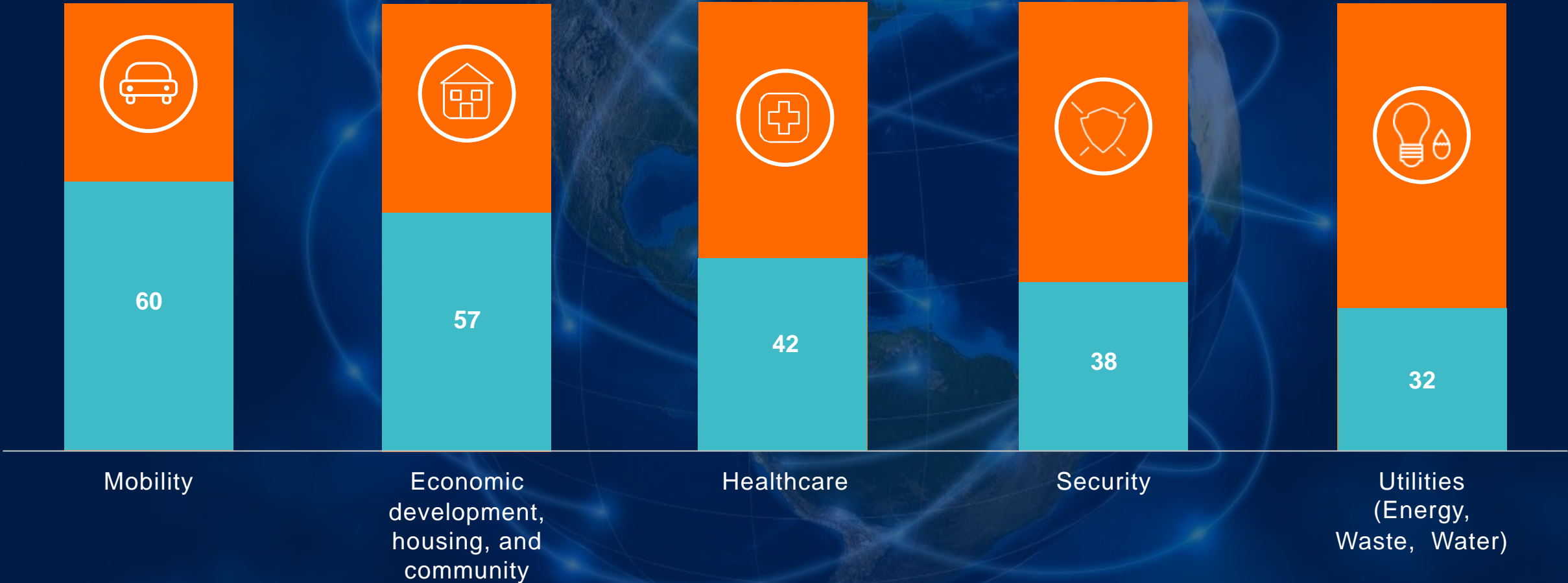
Overall benchmarking score

Middle East ● | Europe ● | Asia-Pacific ● | North America ● | Latin America ● | Africa ●

GDP/capita, USD thd. (2015)

Global application rollout

Cities around the world are not implementing all the tools available today in any area

Applications Index Score (average across all cities)

100%

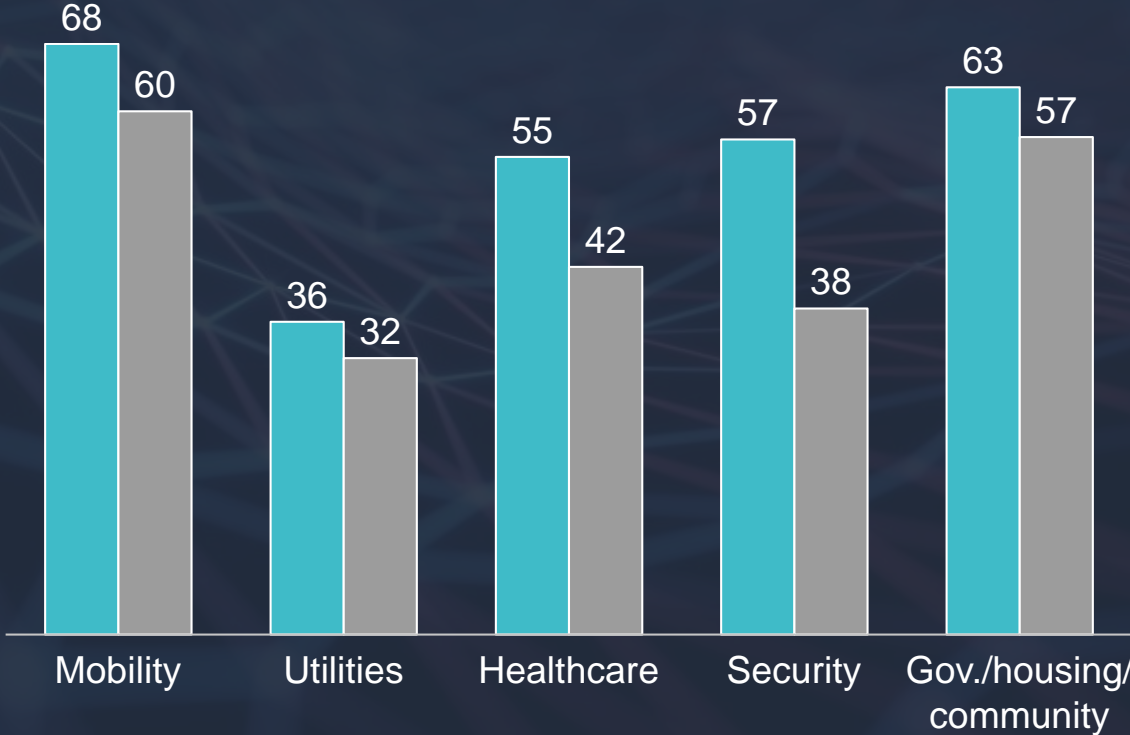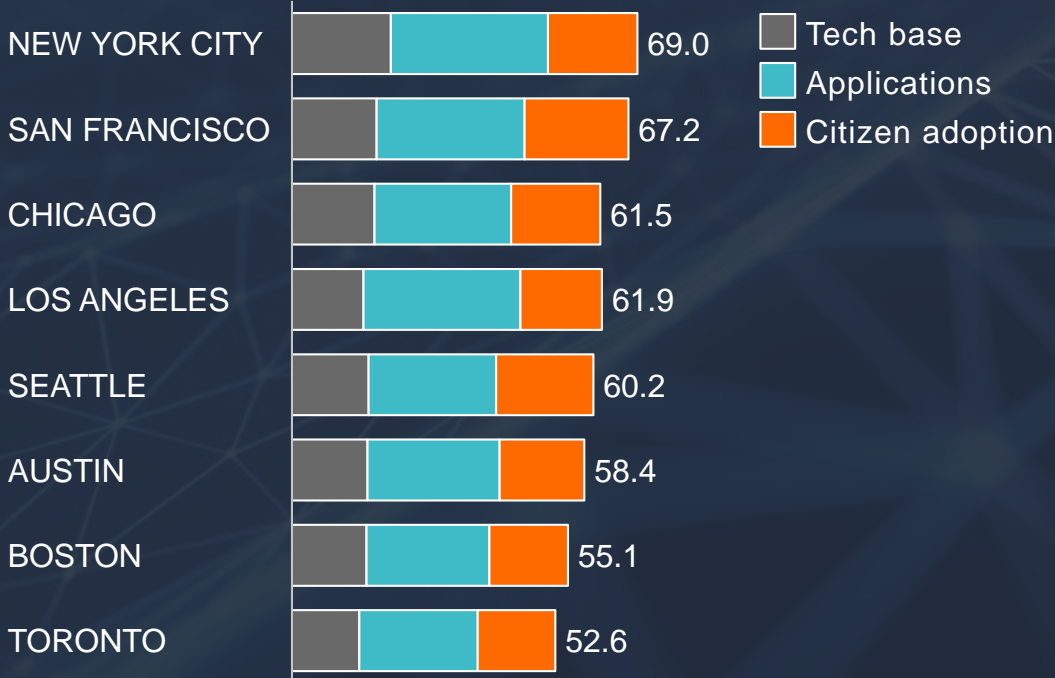| Mobility	Economic development, housing, and community	Healthcare	Security	Utilities (Energy, Waste, Water)
60	57	42	38	32

US cities typically feature fast communication networks and lead in deployment of applications, though some cities are far ahead

North America smart city benchmarking,
Out of 110 points (Applications scaled to max. 50 points; tech base and citizen usage & satisfaction max. 30 points)

City	Score
NEW YORK CITY	69.0
SAN FRANCISCO	67.2
CHICAGO	61.5
LOS ANGELES	61.9
SEATTLE	60.2
AUSTIN	58.4
BOSTON	55.1
TORONTO	52.6

Legend:
- Tech base
- Applications
- Citizen adoption

Application roll-out,
Out of max. points, percent

Legend:
- US Average
- Global average

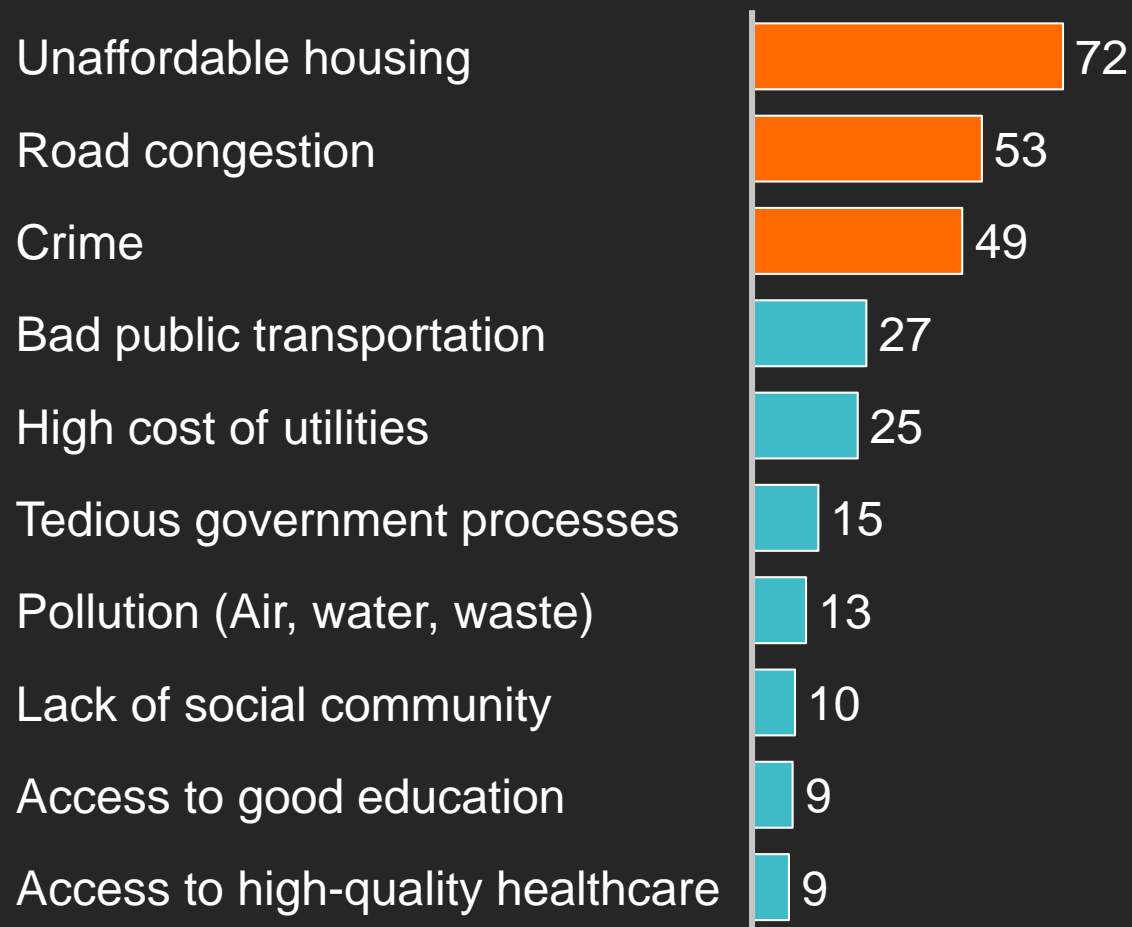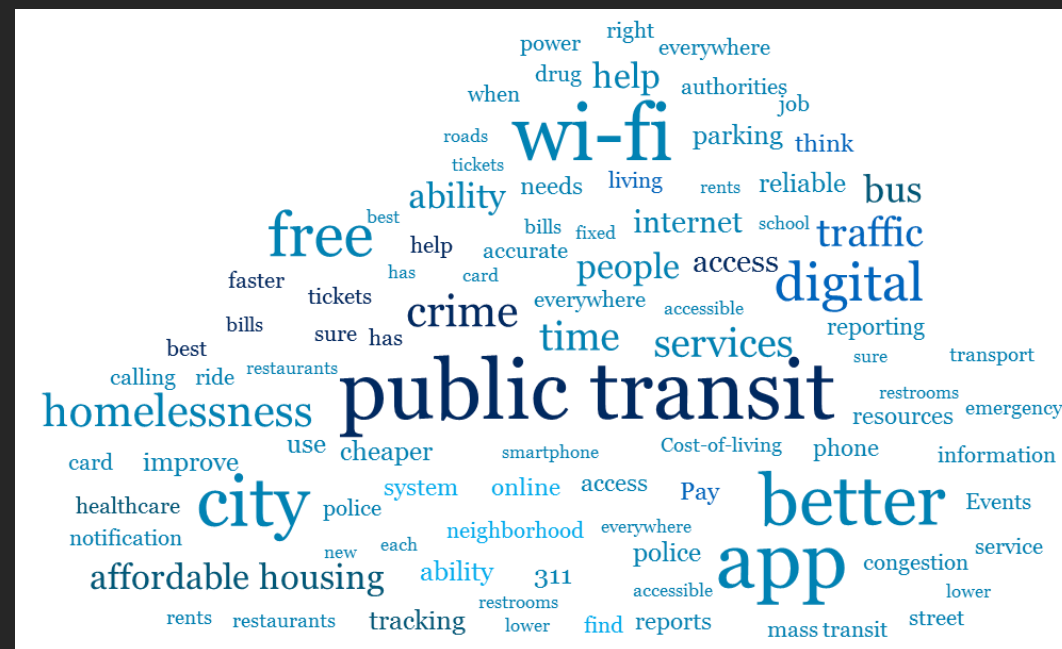| Category	US Average	Global average
Mobility	68	60
Utilities	36	32
Healthcare	55	42
Security	57	38
Gov./housing/community	63	57

But what are residents seeking?

Top concerns of San Francisco residents
Percent of respondents reporting as a top 3 issue

Concern	Percent
Unaffordable housing	72
Road congestion	53
Crime	49
Bad public transportation	27
High cost of utilities	25
Tedious government processes	15
Pollution (Air, water, waste)	13
Lack of social community	10
Access to good education	9
Access to high-quality healthcare	9

New or improved services San Francisco residents prioritize[1]

- Residents seek **improved e-services** related to **housing, congestion, public transport** and **security**
- **Healthcare is not a top concern, yet is an area where improved services are desired**

1 From survey question: "If you could choose one new or improved digital service in your city, what would it be?"

100%

70%

Front-
runners

All cities have
more work to do

4

How do we move smart cities forward?

1 Cities leading the smart charge need to build collaborative ecosystems with diverse stakeholders

Public Sector ⇄ Private Sector ⇄ Non-Profits Academia ⇄ Residents

Players vary in their roles and sometimes have conflicting interests in local smart city value chains

Network platform providers
- **Provide connectivity crucial to** smart city transformations
- Build direct access to broad customer base and city governments

Systems integrators
- Create **technical compatibility across vendors**
- Opportunity to extend role into **data analytics**

Disruptors
- May define **new use cases and address unsolved needs**
- Often compete with incumbents in their industry

Tech providers
- Increasingly taking roles as **horizontal smart city platforms**
- May provide financing to address budget concerns of public sector customers

Classical industry players
- Tackle market as **vertical solution providers** with new business models

New York City built deep insights from data across government to identify a set of high impact interventions and partnerships

United multiple departmental efforts under single vision with shared guidelines…

Invited collaboration with one of the most sophisticated open data portals worldwide
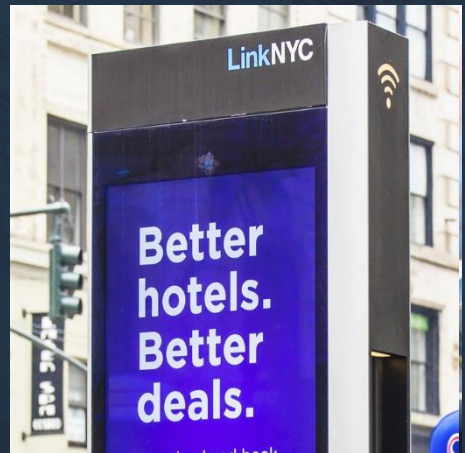
Created series of partnerships across stakeholder ecosystem…

…based on extensive analysis of city data and public feedback

…supported by legislation mandating release of 1600+ public datasets from 60+ agencies

…co-creating funding mechanisms, entrepre-neurship hubs and procurement platforms

Moscow focused on a core pain point – mobility – to deliver one of the most comprehensive systems solutions worldwide

Leveraged diverse datasets to identify 3 key challenges

- Inflow of residents from across Russia
- High volume of commuters from greater Moscow region
- Residents' cultural desires to own a car

Combined systemic solutions with user-facing enhancements to every step in the commuter journey

Backend modeling of traffic flows, facilities construction impacts, traffic control

Launch of new transit routes

35k intelligent traffic lights

Smart surveillance for traffic and parking violations

Control center traffic forecast 3h ahead with flow detectors

Resident design features

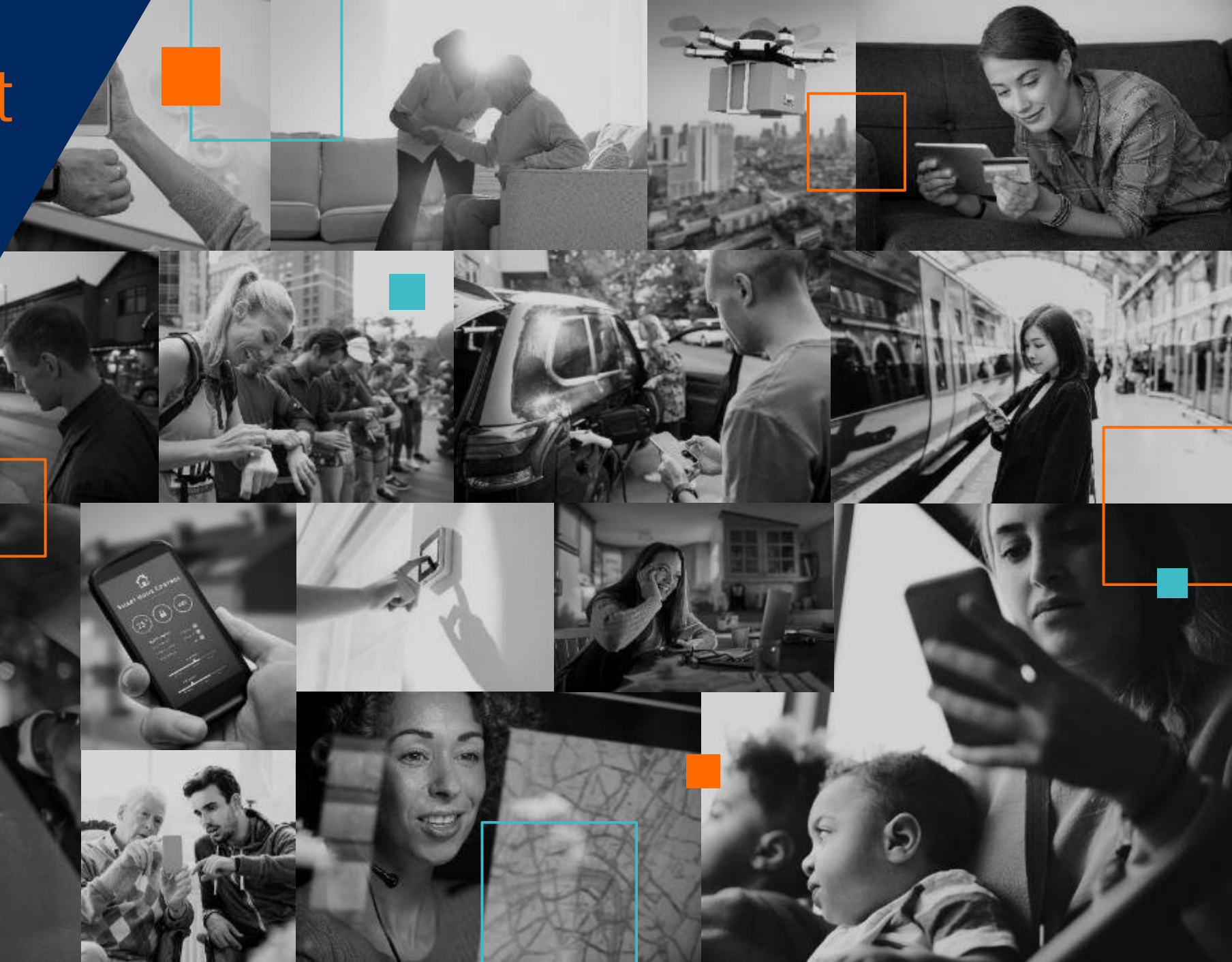Smart route planning and public transit tracking

Unified chip card ticketing with remote top-up and partnerships with public spaces e.g., museums

Fully digitized services

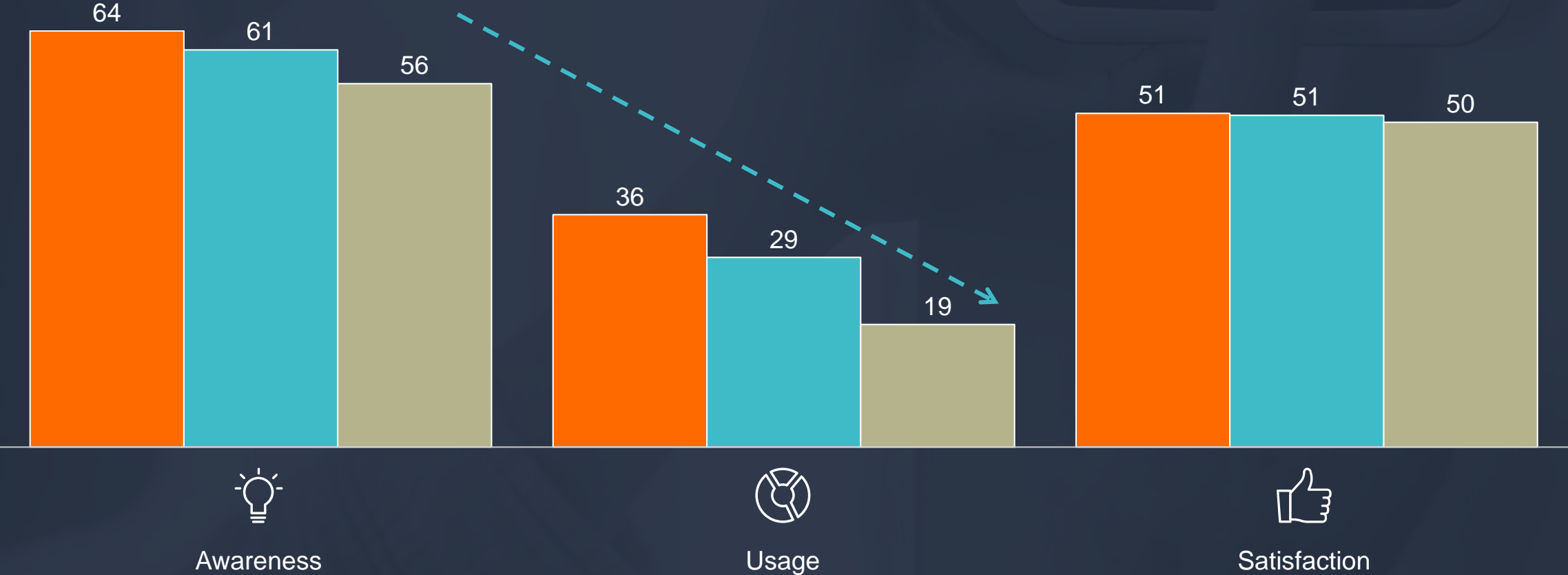**2** Need to put technology to work for everyone

Older citizens are underserved in all cities – The US is no exception

US cities' public adoption by age group, Percent of respondents

Awareness
- 64
- 61
- 56

Usage
- 36
- 29
- 19

Satisfaction
- 51
- 51
- 50

Aging cities have a large opportunity to innovate to provide better service to older citizens – often with a lower cost

Applications like remote patient monitoring, wearables, telemedicine and e-hailing may **help more seniors age at home**

Social media networks, video chats and virtual reality can **help seniors stay more connected and form cross-generational bonds**

Specialized e-career and education platforms may **help match retirees with opportunities to apply their skills**

Seoul combines tech and policy measures to make the city work for older citizens

Age-friendly city programs

Category	Measures
Physical infrastructure	Outdoor spaces and building · Transportation
Social & civic engagement	Senior community centers
Economic participation	"50+" campuses · Volunteer matching · Education opportunities
Independent living	Care provision & training · U-Seoul Safety Service
Healthcare	U-Silver services · Remote monitoring and treatment
Access to public services	Seoul Senior digital portal · m.Seoul

3. Most industries have opportunities to shape – or be shaped by – smart cities

Logistics and transport providers

Automo-tive OEMs

Real estate companies

Real estate companies

Financial institutions

Healthcare providers

Telecom providers

ICT providers

Lifestyle consumer companies

Cities

Non-profits

Utility providers

Infra-structure providers (e.g., con-struction)

Logistics and transport providers

Companies preparing for the rise of smart cities will consider the following

Adapt current offerings to meet smart city needs

Successful players will dynamically alter their existing product and service lines to suit changing urban needs

Prepare for value shifts and unexpected competitors

As value chains are re-drawn, some companies will find new opportunities, while others will face disruption to their business models

Leverage opportunities to make a play in net new spaces

The advent of smart cities will create opportunities for additional business – successful players will be ahead of the curve

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