

Infrastructure for Growth and Modernisation - Vision 2031



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- **Urbanization**
 - Challenges
 - Opportunities
- **Smart Transportation**
 - Characteristics
- **Recommendations**



- **Trends**

- Rising personal income
- Affordable vehicle
- Growth in private vehicle
- Low density urban sprawl





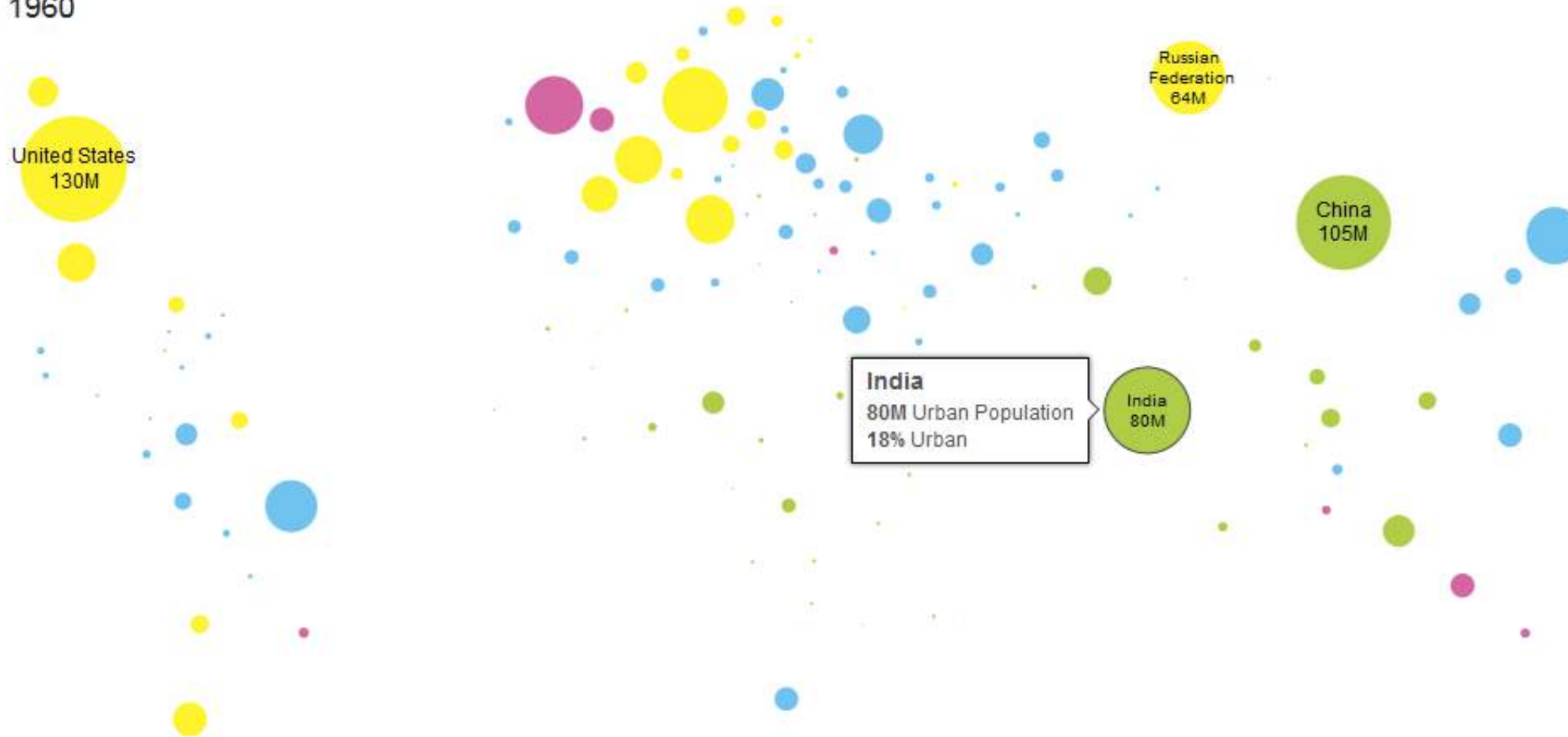
1950



Urbanization



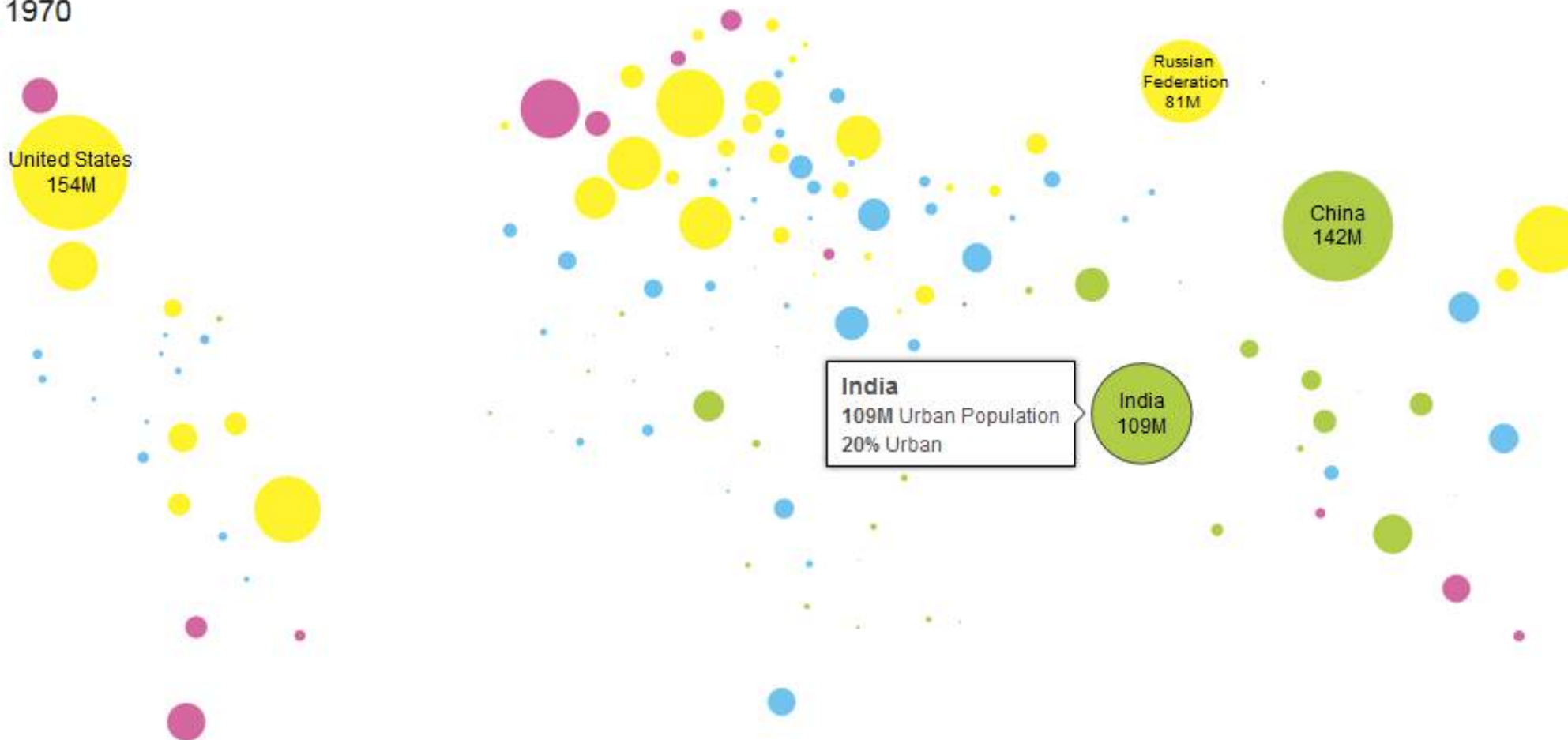
1960



Urbanization



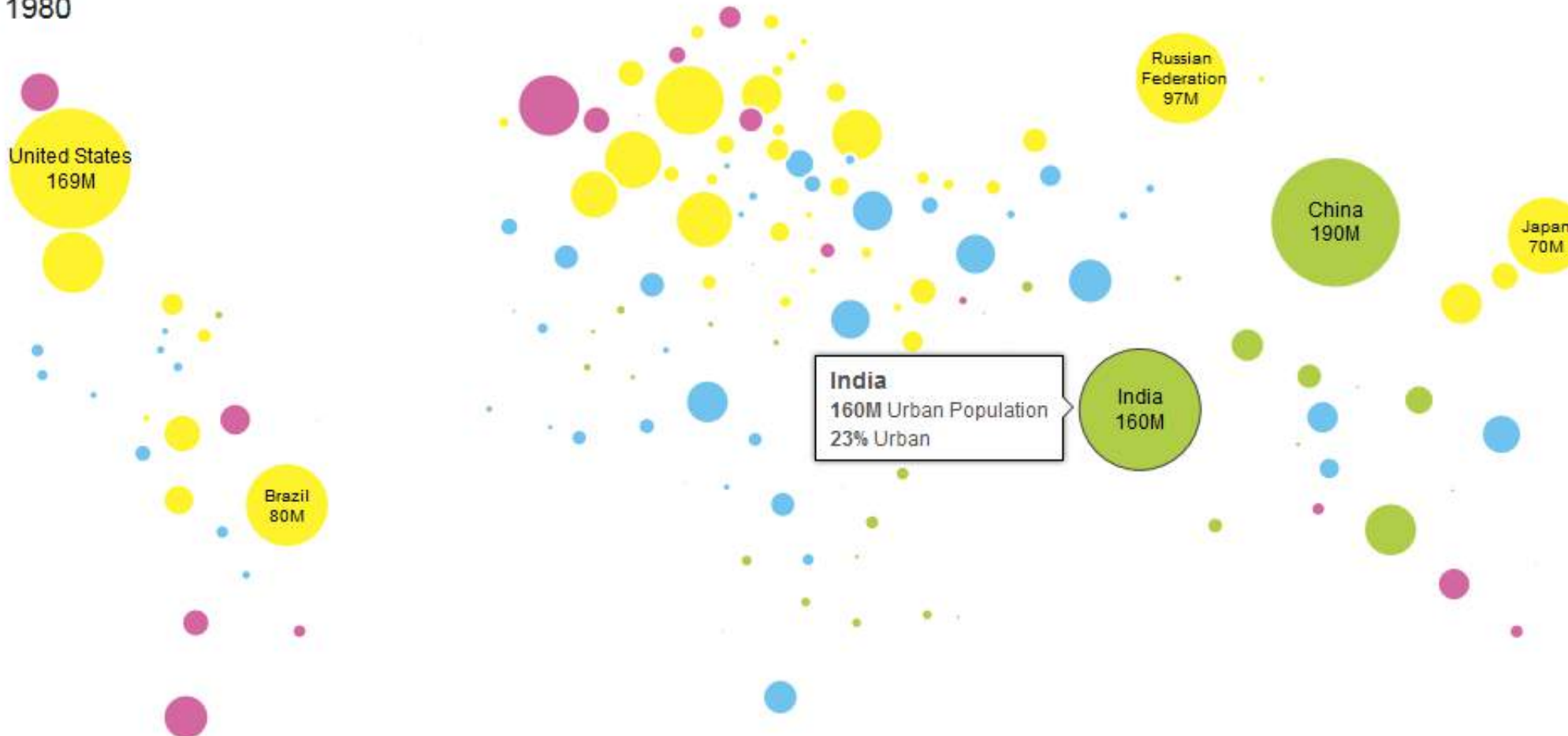
1970



Urbanization



1980



Urbanization



1990

United States
192M

Brazil
111M

Russian
Federation
109M

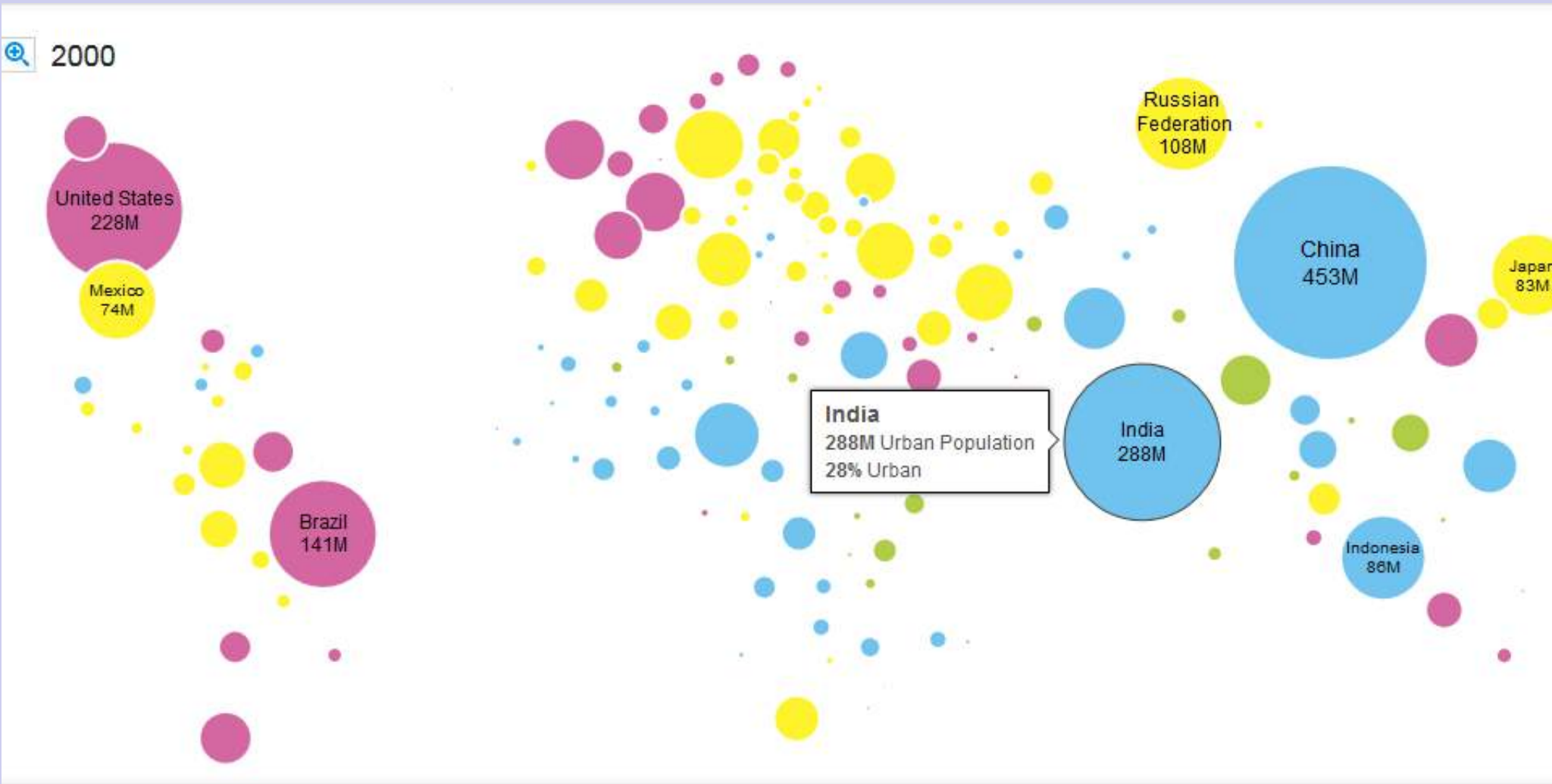
China
302M

Japan
78M

India
220M Urban Population
26% Urban

India
220M

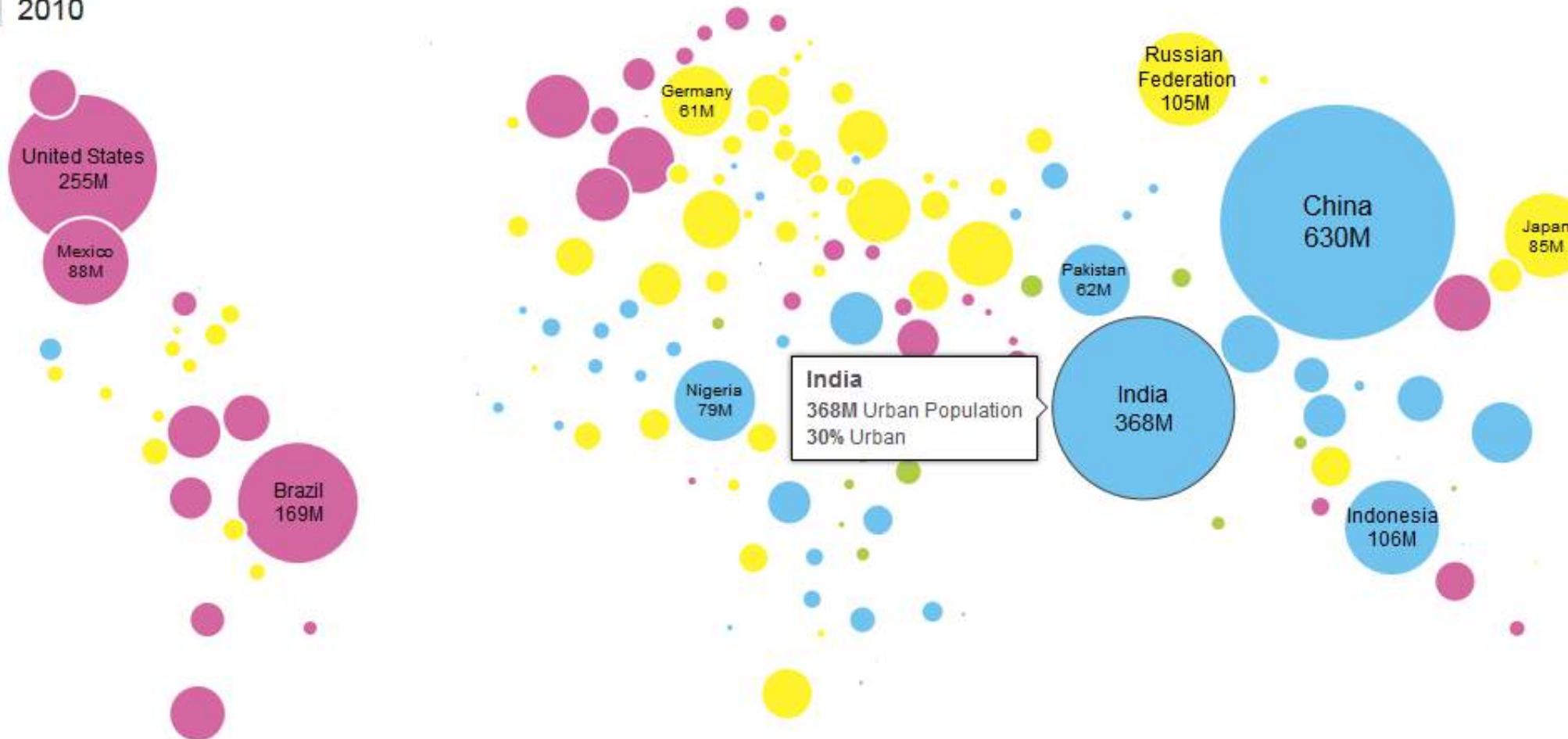
Urbanization



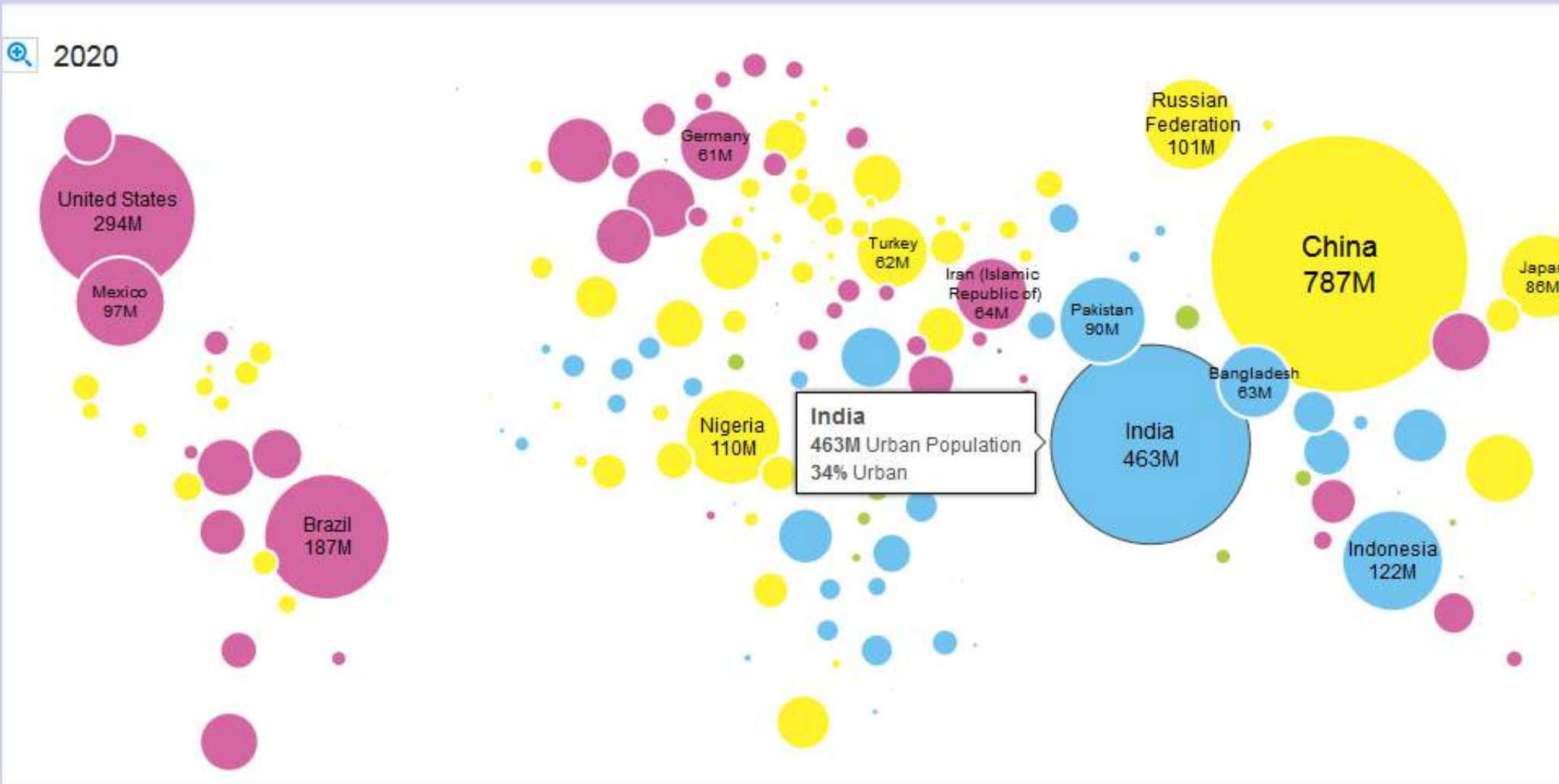
Urbanization



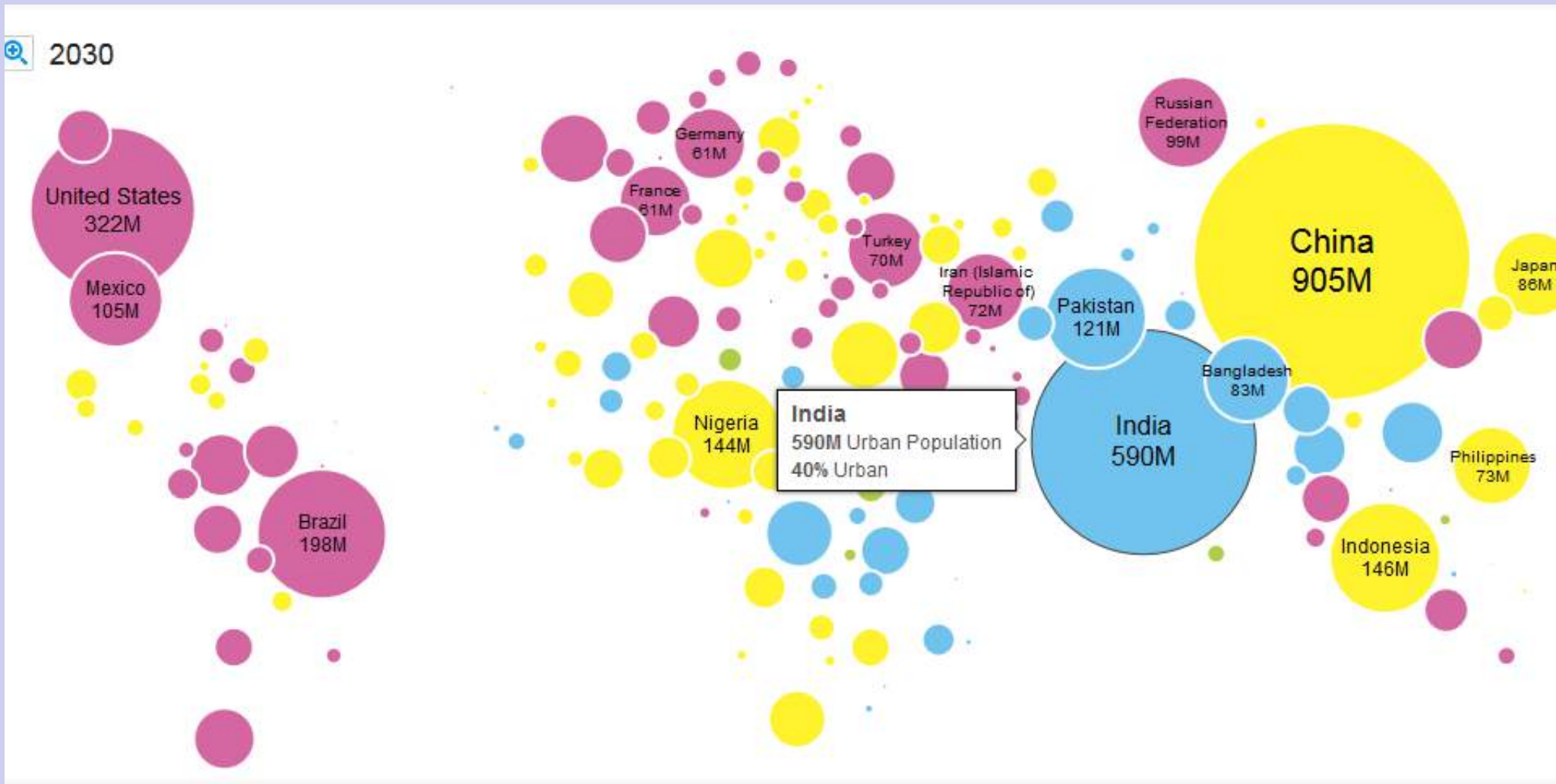
2010



Urbanization

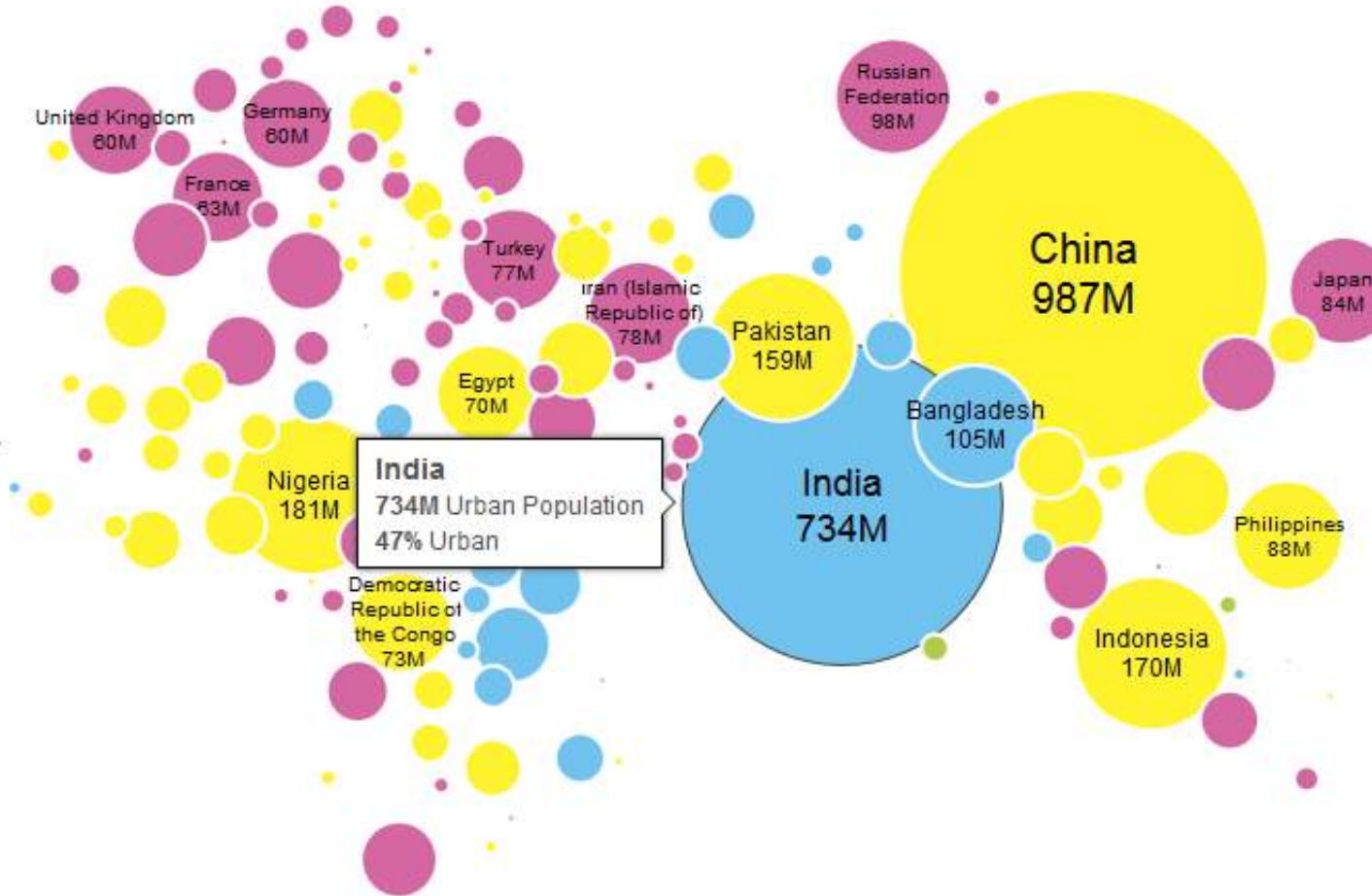
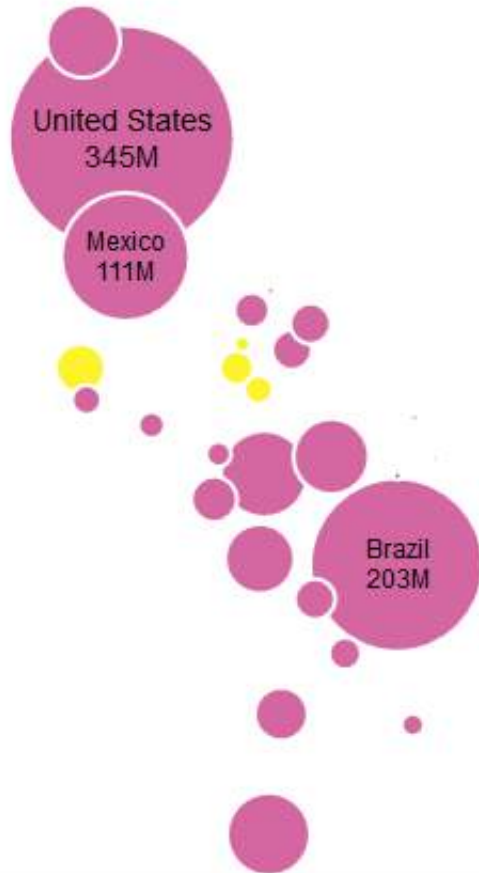


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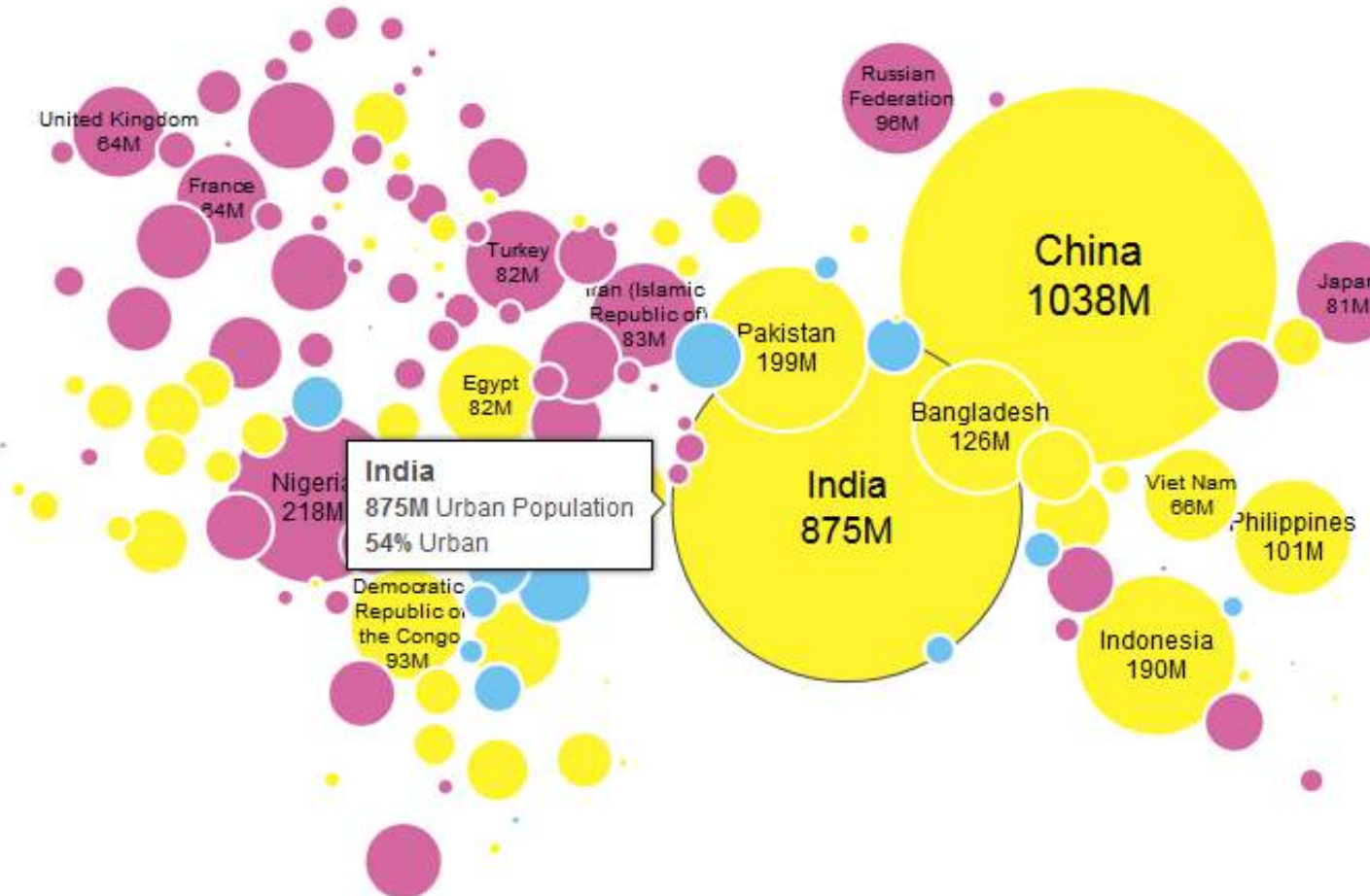
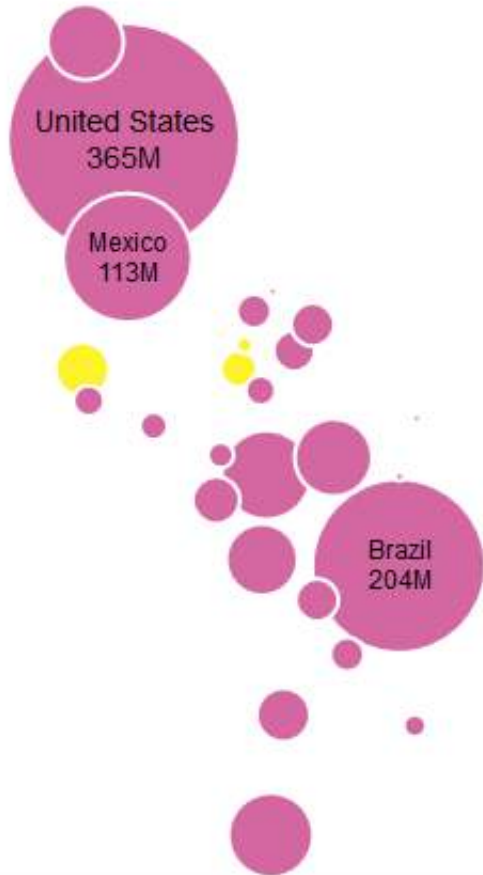
Urbanization

2040



Urbanization

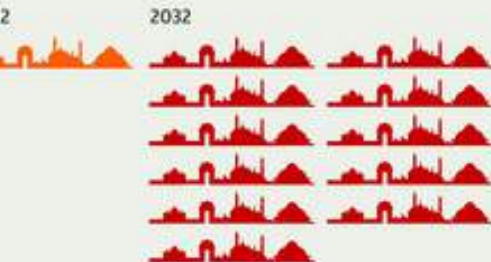
2050



The Urban Effect

Cities

By 2032, India's cities will have to accommodate 250 million to 300 million more people than they do today. That's the equivalent of 11 New Delhis.



Electricity

Of the 1.4 billion people of the world who have no access to electricity in the world, India accounts for over 300 million.

Water

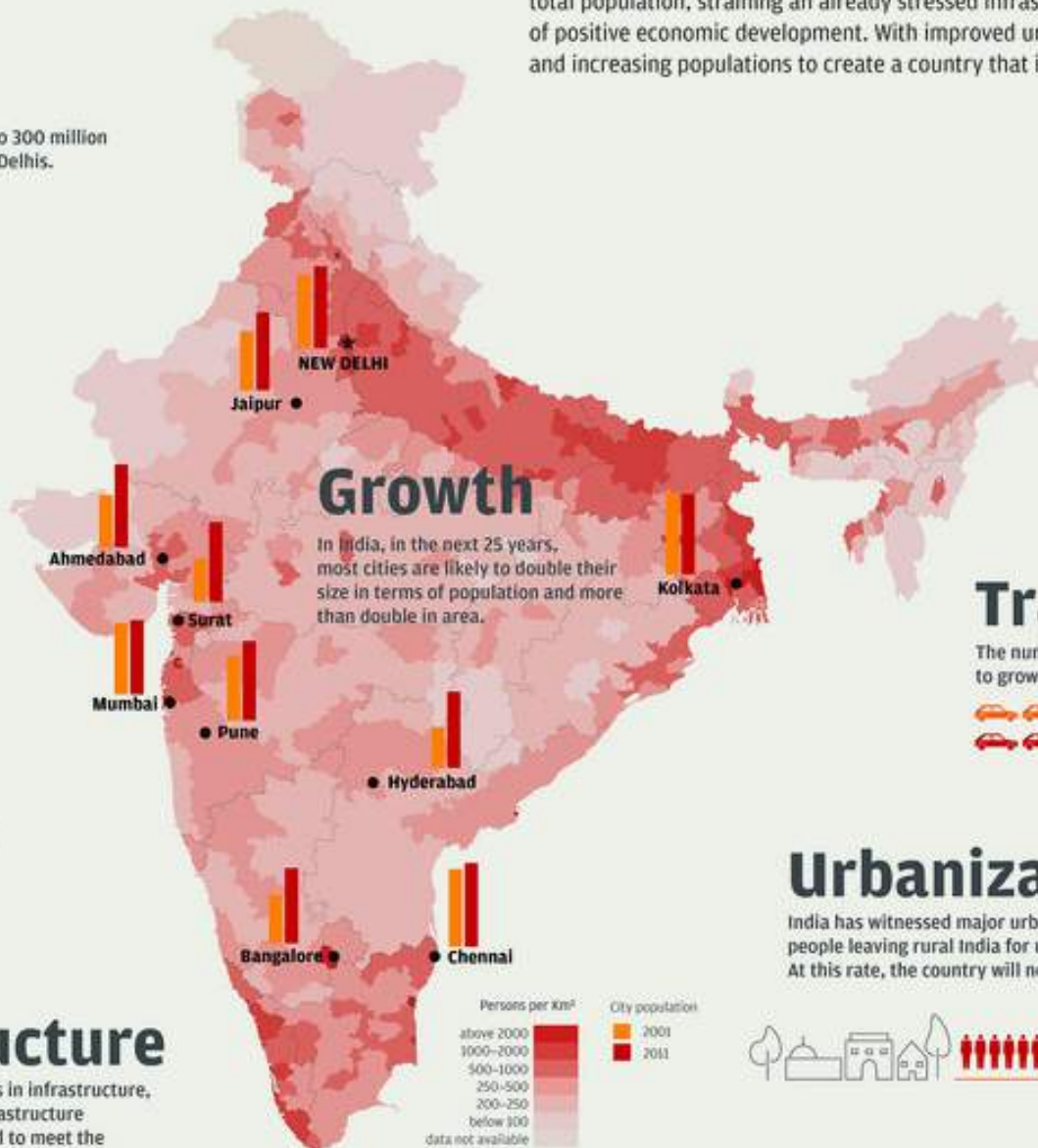
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Sustaining Growth in India through Better Urban Planning

With a population of more than 1.2 billion, India is projected to be the world's most populous country by 2025. By 2050, it is estimated that India's urban population will constitute nearly half of the country's total population, straining an already stressed infrastructure. The good news: urbanization is an indicator of positive economic development. With improved urban planning, India can tackle urbanization challenges and increasing populations to create a country that is poised for sustainable growth.



1. CHINA

2. USA

3. INDIA

Pollution

By 2015, India is expected to become the world's third largest emitter of carbon dioxide—it ranked fifth in 2005.

Transportation

The number of private vehicles in India is expected to grow by more than 3 times by 2021.



Urbanization

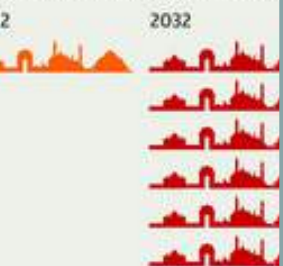
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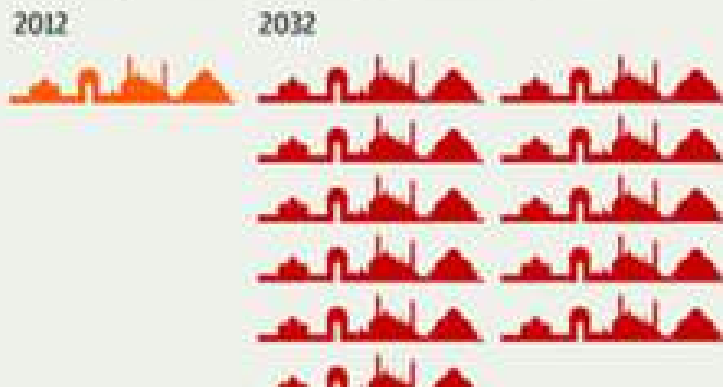
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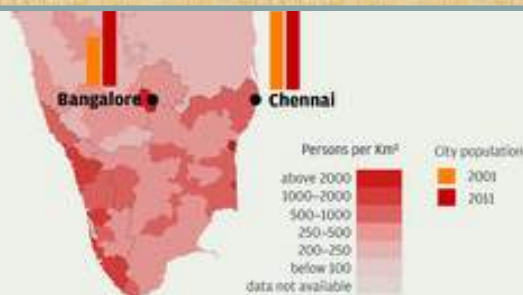
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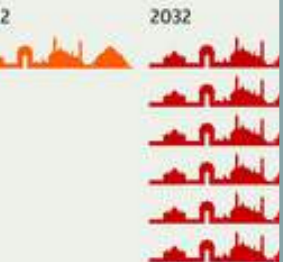
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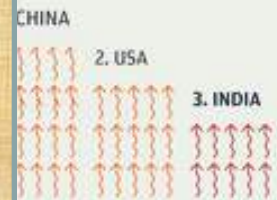
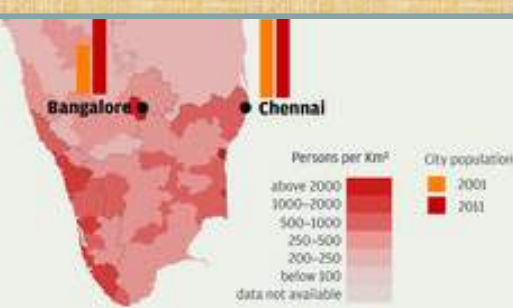
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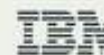
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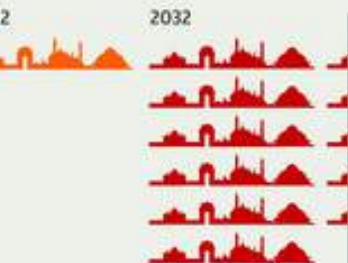
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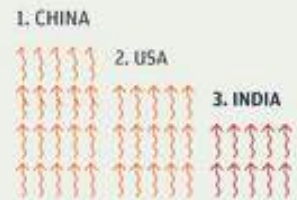
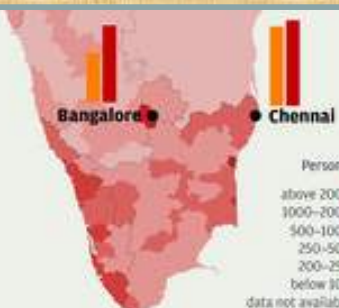
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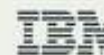
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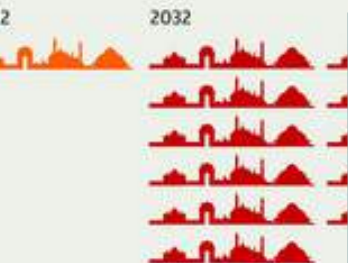
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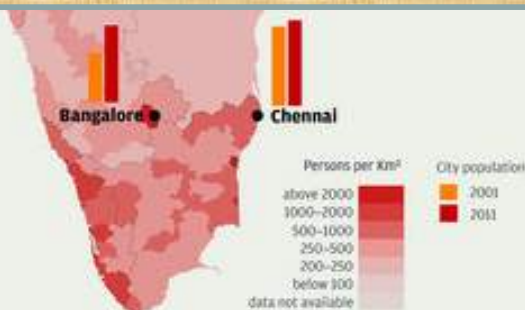
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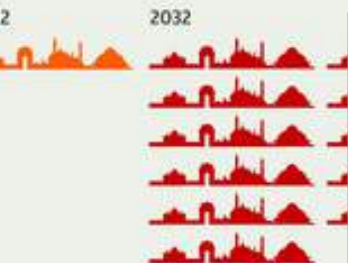
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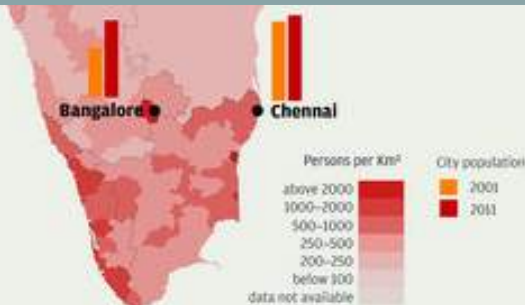
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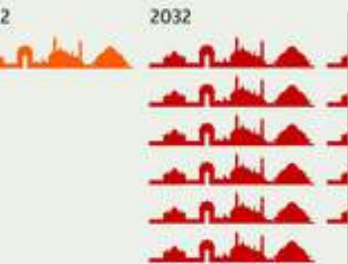
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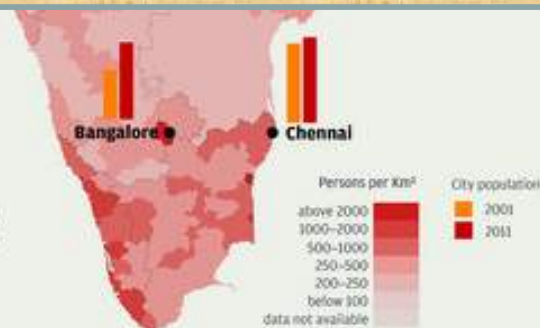
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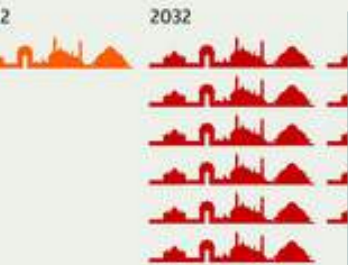
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250-300
200-250
below 100
data not available





- **Consequence**

- High density
- Greater mobility ?

- **Motorization**

- Shift to private modes
- Congestion and delays
- Fuel consumption and Emissions



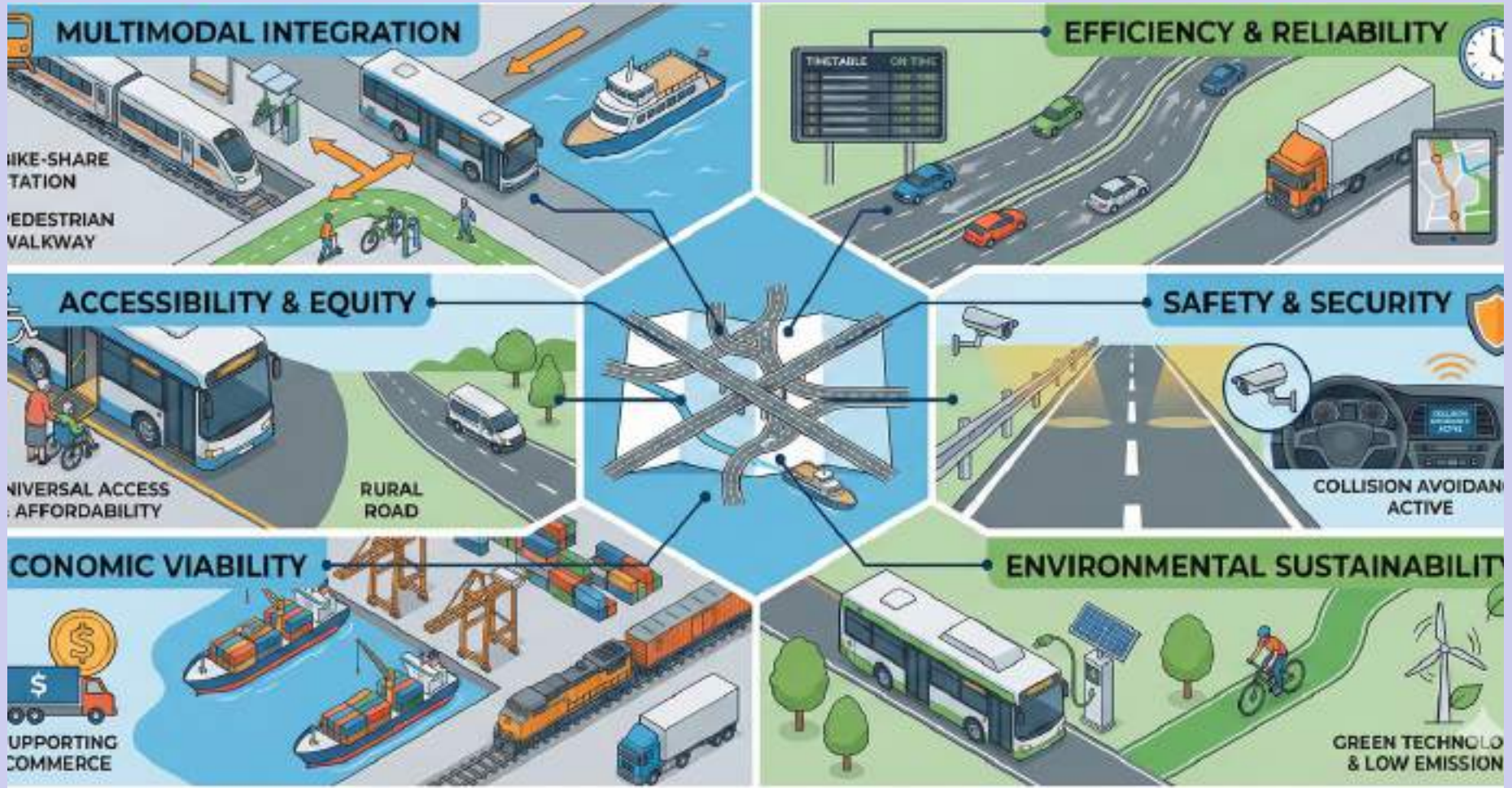
- **Urban Transportation**

- Cities consume three quarters of energy generated and are responsible for 80% of CO₂ emissions worldwide



Public vs Private







1. Multimodal Integration

- Diverse Options
 - Integrates roads, railways, airports, seaports, public transit (buses, metros), last mile connectivity (auto, taxis) and active transport (cycling, walking)
- Seamless Connectivity
 - Transfers between modes should be easy
 - Schedule and fare integration





2. Efficiency and Reliability

- Reduced Congestion
 - Use smart traffic management and sufficient infrastructure capacity to minimize congestion
- Predictability
 - Public transit: should run on time
 - Freight logistics: predictable delivery windows





3. Accessibility and Equity

- Universal Access
 - Transportation must be available to everyone, including rural populations, the elderly, and people with disabilities.
- Affordability
 - Costs should not be a barrier for low-income residents to access jobs, healthcare, or education.





4. Safety and Security

- Accident Reduction
 - Infrastructure is designed to minimize accidents (bike lanes, well-lit highways, adaptive signaling)
- Resilience
 - The system can withstand and recover quickly from disruptions like disasters or emergencies





5. Economic Viability

- Support for Commerce
 - It should facilitate the smooth movement of freight to support local industries and trade
- Cost-Effectiveness
 - The system should be financially sustainable, balancing public funding with revenue generation (like tolls or fares) without overburdening taxpayers





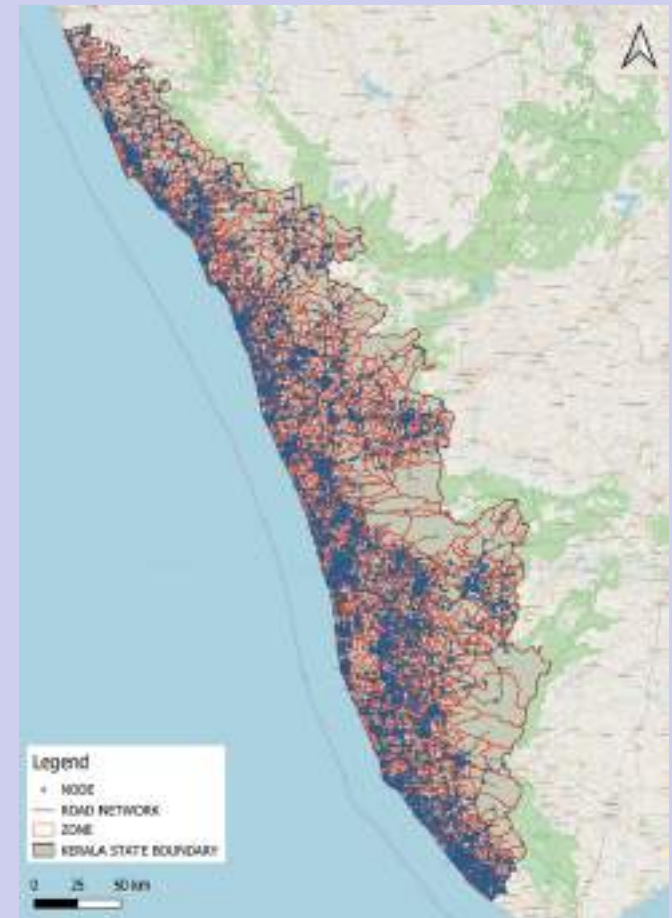
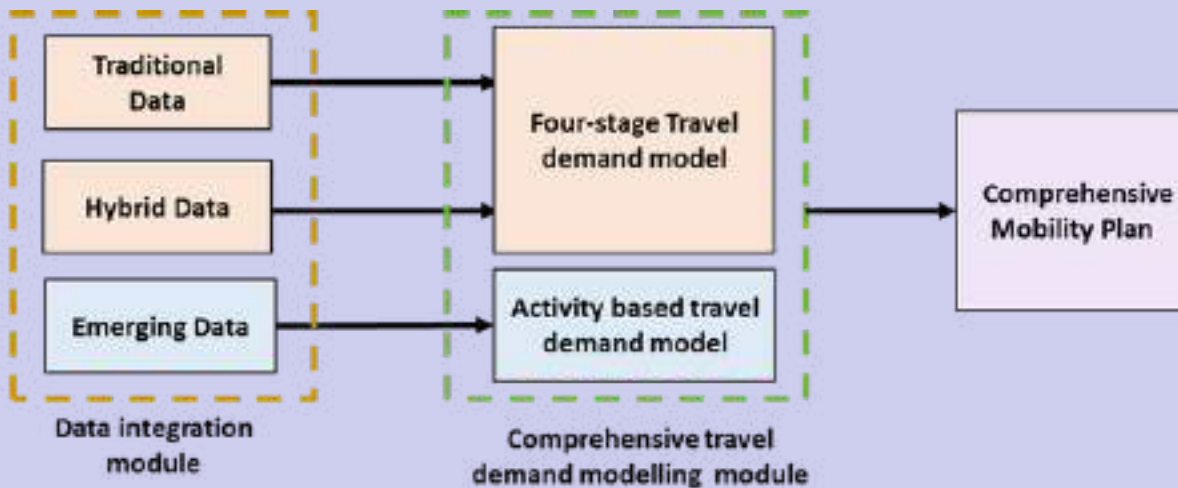
6. Environmental Sustainability

- Green Technology
 - Encouraging the use of electric vehicles (EVs), investing in clean energy public transit, and promoting non-motorized transport to reduce carbon footprints.



• Planning

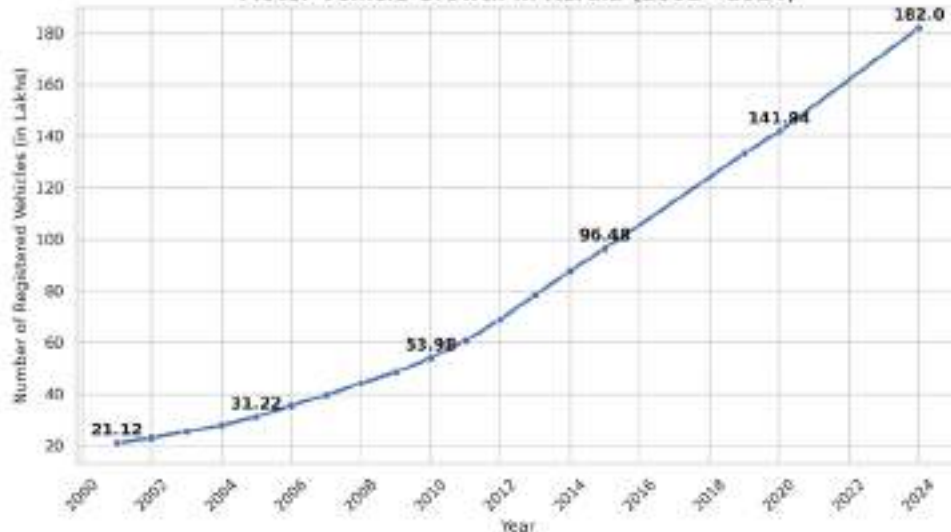
- State Level Travel Demand Model
 - Multi-modal
 - Activity based
 - Emerging data sources



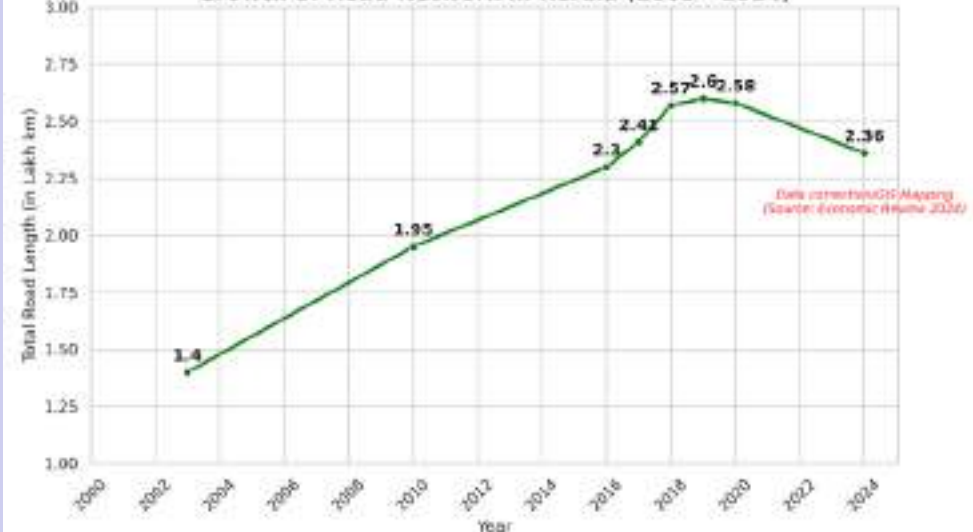
• Road Network

- Vehicular Vs Road growth: 760 vs 70 %
- Augment the Reserve Capacity
- Strategic Network Improvements

Motor Vehicle Growth in Kerala (2001 - 2024)

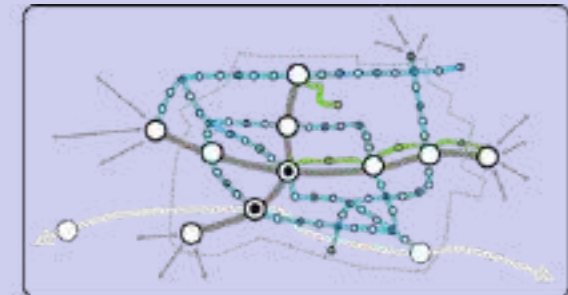


Growth of Road Network in Kerala (2003 - 2024)

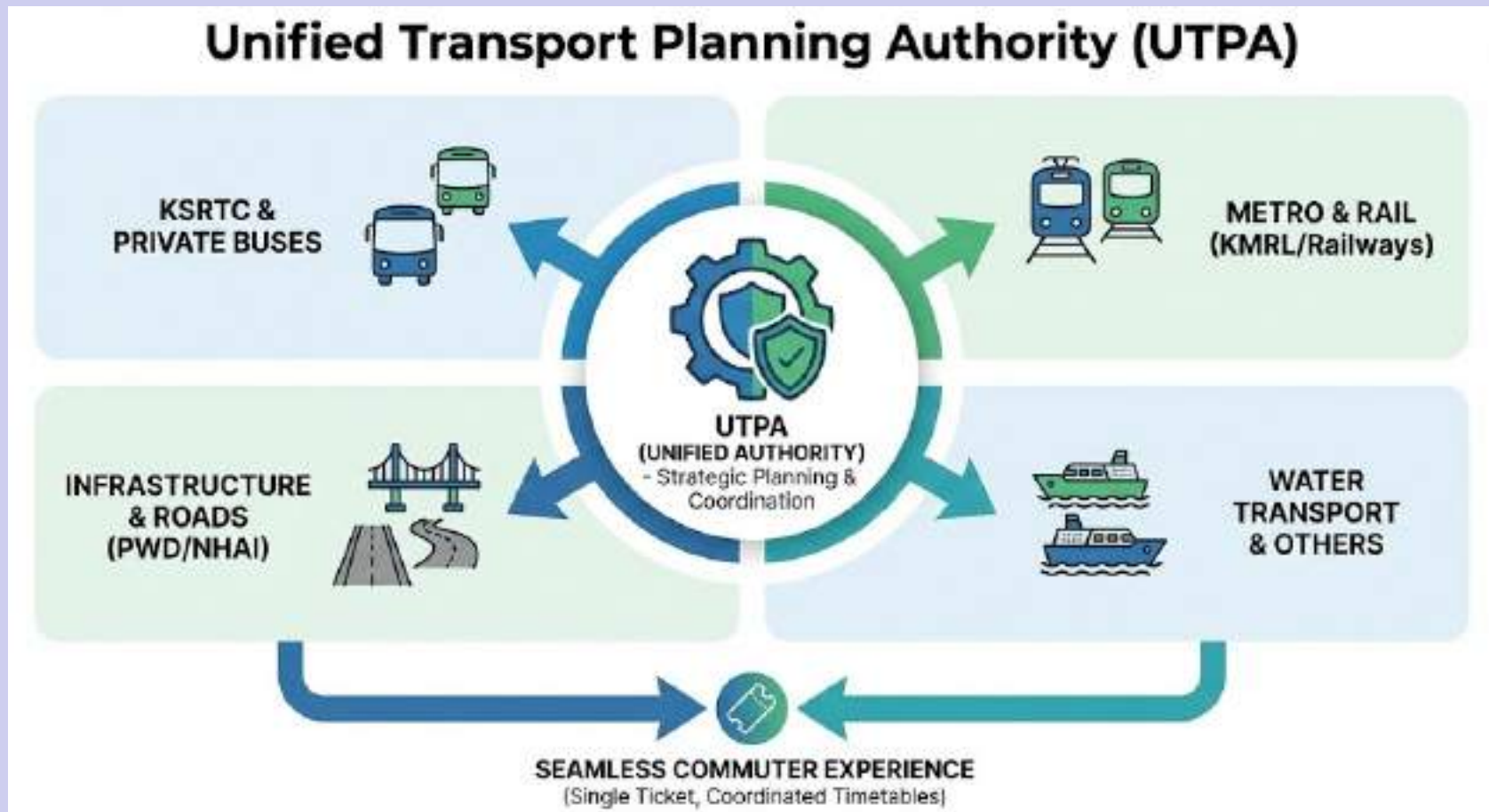


• Public Transportation

- Dynamic Scheduling
- Passenger Information System
- Last Mile Connectivity
- Operational efficiency
- Performance Measure
 - Mode share
 - E.g. Kochi:
 - 60% in 2001 to 25% in 2023



- **Institutional Framework**
 - Unified Planning Authority

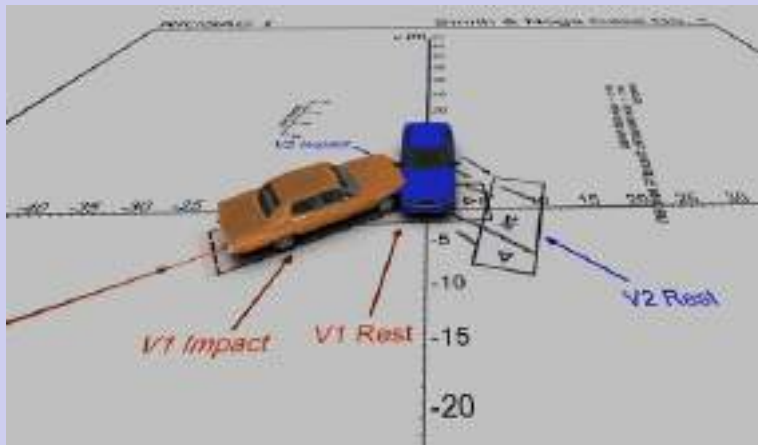
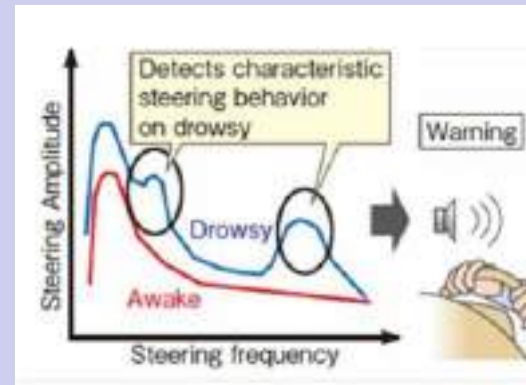




- **Human Resources**
 - Trained manpower
 - KHRI, NATPAC, KSTP ...
 - Trained in
 - Planning
 - Modern tools
 - Long-term deployment

• Safety

- Mission Zero
 - Zero Fatal Accidents
- Accident
 - Warning
 - Reconstruction



- **Congestion**

- Adaptive Traffic Signal Control
 - Isolated, Corridor, and Network
 - Machine Learning based



Adaptive Traffic Control System
(isolated, corridor, and network level)



A nighttime photograph of a city skyline with a complex multi-level highway interchange in the foreground. The sky is a mix of orange, pink, and blue, suggesting dusk or dawn. The buildings are lit up, and the highway lights create long, colorful streaks of light. A semi-transparent white box with a yellow border is centered at the top, containing the text 'Thank You' in yellow. A pink rectangular box is at the bottom, containing the email address 'tvm@civil.iitb.ac.in' in blue.

Thank You

tvm@civil.iitb.ac.in