



AI-Driven Transportation Solutions: Lessons from Developed Nations for Emerging Economies

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Agenda



Problem Definition

- Transportation challenges in developing countries
 - AI applications in developed nations
 - Current state of Indian transportation



Research Methodology

- Policy screening framework
- Entropy Weight Method (EWM)
- Comparative analysis approach



Global Case Studies

- US & EU: Smart cities initiatives
- China, Japan: Infrastructure excellence
- Singapore: Congestion pricing



Comparative Analysis

- India's current transportation system
- Global policy initiative tracking
- EWM assessment results



Key Recommendations

- National strategy & data governance
- High-impact AI applications
- Public-private partnerships



Implementation & Conclusion

- Implementation roadmap
- Policy priority areas
- Q&A session

Problem Definition & Current State



Transportation Challenges in Developing Countries



Infrastructure Deficiencies

Inadequate smart transportation systems and digital connectivity



Public Transportation Issues

Insufficient public transportation services in urban areas



Data Quality Challenges

Inconsistent or limited real-time transportation data



Road Safety Concerns

WHO data shows 24.1 road traffic deaths per 100,000 in low-income countries vs. 9.2 in high-income countries



Current State of AI in Transportation



Autonomous Vehicles

NHTSA has issued AV testing guidelines; California, Texas, and Arizona are leading AV testing



Smart City Initiatives

US DOT launched Smart City Challenge; Columbus received \$40 million for implementation



Predictive Traffic Management

New York installed AI-driven adaptive traffic signals to predict congestion



Public-Private Partnerships

Singapore collaborating with Google Cloud to develop AI solutions for public services

Transportation Challenges in Developing Countries



Infrastructure Deficiencies

Smart transportation systems and digital connections are insufficient in developing countries, limiting the implementation of AI-driven solutions.



Data Limitations

Real-time traffic data is inconsistent or limited, hindering the development of AI applications that require continuous data feeds.



Limited Budgets

Government funds have competing priorities, making it difficult to allocate sufficient resources for AI transportation initiatives.



Weak Policy Frameworks

Lack of AI-focused regulations and governance structures to guide the implementation and adoption of AI in transportation.



Security Vulnerabilities

Transportation systems are vulnerable to data leaks and cyber attacks, requiring additional resources for security measures.



Road Safety Concerns

According to WHO data, low-income countries have 24.1 road traffic fatalities per 100,000 people annually, compared to 9.2 in high-income countries.



Key Insight

The transportation challenges in developing countries create a significant gap in the adoption of AI-driven solutions, with road safety emerging as a critical concern that requires immediate attention.

Research Methodology



Policy Screening Method

A systematic approach to identify effective AI transportation policies for India.

- 1 **Country Identification**
Selection of countries with developed AI transportation systems
- 2 **Policy Collection**
Gathering official policy documents and reports
- 3 **Policy Analysis**
Evaluation of regulatory structures and technology applications
- 4 **Comparative Analysis**
Identifying best practices applicable to India



Entropy Weight Method (EWM)

An objective weighting technique used in multi-criteria decision making to prioritize AI transportation policies.

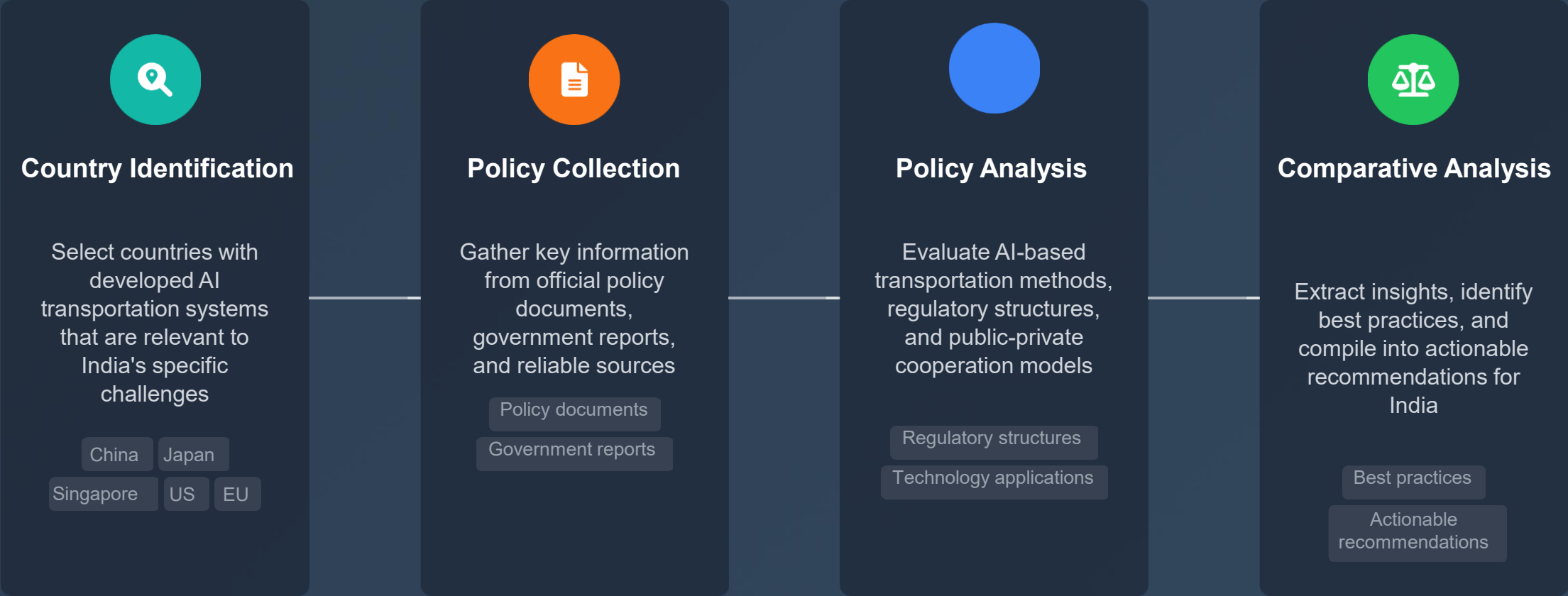
- ★ **Advantages**
Enhances assessment by allocating weights based on data variability

EWM Process

- Set original scores (0-10)
- Calculate normalized scores
- Compute probability distribution
- Calculate entropy values
- Compute weights

Policy Screening Framework

Four-step approach for identifying transferable AI transportation policies from developed nations to address India's specific transportation challenges



Output: Actionable Policy Recommendations

A structured framework of transferable AI transportation policies tailored to India's specific needs and context

AI Applications in Transportation: Global Leaders



United States

 AV testing in California, Texas, Arizona

 Smart city challenges initiative

 Predictive traffic management in NYC



European Union

 GDPR ensuring data privacy

 Green agreement targeting 90% reduction

 Smart public transport through CEF



China

 AI managing 45,000 km high-speed rail

 Urban planning with AI analysis

 Intelligent traffic in Xi'an, Hangzhou



Japan

 AI strategy 2022 for resilience

 AI-driven public transit optimization

 Robotic maintenance in railways



Singapore

 ERP congestion charging system

 AI-driven train timetable adjustment

 Public-private partnerships with tech companies

US & EU: Smart Cities and Sustainable Mobility



United States

Smart City Initiatives

- ✓ US Department of Transportation launched "Smart City Challenge" program
- ✓ Columbus city received \$40 million for implementation of smart city plan
- ✓ Integrated connected vehicles, smart grids, and driverless shuttles

Autonomous Vehicle Testing

- ✓ NHTSA issued safety regulations for autonomous vehicles
- ✓ California, Texas, and Arizona actively promoting AV testing
- ✓ NYC installed AI-driven adaptive traffic signals to predict congestion



European Union

Ethical AI Integration

- ✓ GDPR ensures AI systems follow principles of accountability and transparency
- ✓ Focus on data privacy and algorithmic fairness in public AI systems
- ✓ Balance between innovation and privacy protection

Sustainable Transportation

- ✓ European Green Deal aims for climate neutrality by 2050
- ✓ AI plays key role in EV integration and eco-friendly route planning
- ✓ Target: Reduce transportation emissions by 90% by 2050
- ✓ "Connecting Europe Facilities" project invests in AI-driven public transport

China, Japan & Singapore: Infrastructure Excellence



China

World's largest high-speed rail network(45,000 km)

- ✓ AI systems optimize train timetables, safety, and maintenance
- ✓ Cities like Xi'an and Hangzhou deploy AI-driven traffic management
- ✓ Real-time data optimizes traffic signals, reducing congestion

💡 *Focus: Multimodal transport systems and smart city planning*



Japan

AI Strategy 2022emphasizes national resilience

- ✓ West Japan Railway deployed humanoid robots for maintenance
- ✓ AI-driven predictive maintenance systems for infrastructure
- ✓ Public transit optimized for elderly travelers with ML

💡 *Focus: Disaster resilience and elderly-friendly transportation*



Singapore

Electronic Road Pricing (ERP)system

- ✓ AI adjusts pricing based on traffic conditions
- ✓ AI systems optimize train timetables for passenger demand
- ✓ Collaboration with Google Cloud for public service AI

💡 *Focus: Congestion pricing and public-private AI partnerships*

Entropy Weight Method (EWM)

A mathematical framework for objectively weighting policy factors based on data variability, eliminating subjective bias in multi-criteria decision making.

EWM Calculation Process



Key Advantages



Objectivity

Automatically assigns weights based on data variability, eliminating subjective bias



Handles Complexity

Suitable for evaluating infrastructure, environmental initiatives, traffic reduction, and economic efficiency



Reflects Dynamic Impact

Gives higher weight to criteria showing more fluctuation, such as congestion management and road safety



Mathematical Transparency

Follows a clear probability distribution model, ensuring uniformity and transparency in weight allocation

India's Current Transportation System & AI Policy Gap

⚠ Transportation Challenges



- 📶 Urban Congestion**
Severe traffic congestion in major cities leading to economic losses
- 📶 Rural Connectivity Issues**
Lack of proper transportation connections in remote areas
- 📄 Lack of Coordinated Policies**
Multiple agencies (MoRTH, NHAI, MoHUA) without unified strategy
- 🧠 Slow Technology Adoption**
Delays in implementing modern solutions for traffic management

🌐 AI Policy Gap Analysis

Key Missing Elements in India's AI Transportation Strategy:

Policy Area	Implemented in Developed Nations	India's Status
Autonomous Vehicle Testing	✓	✗
Smart City Initiatives	✓	✗
Predictive Traffic Management	✓	✗
Public Transit Optimization	✓	✗
AI in High-Speed Railways	✓	✗
Disaster Resilience AI	✓	✗
Congestion Pricing AI	✓	✗
PPPs in AI Transportation	✓	✗
AI in Road Safety	✓	✓

Global Policy Initiative Tracking

Comparative analysis of AI transportation policies across developed nations and India

Policy Initiative	US	EU	China	Japan	Singapore	India
Autonomous Vehicle Testing	✓					✗
Smart City Initiatives	✓					✗
Predictive Traffic Management	✓	✓	✓			✗
Sustainable Transportation	✓	✓	✓			✗
AI in Public Transit	✓	✓		✓	✓	✗
AI in High-Speed Railways			✓			✗
AI for Disaster Resilience				✓		✗
AI-Driven Congestion Pricing					✓	✗
AI for Freight & Logistics	✓	✓	✓			✗
AI for Road Safety						✓

💡 Key Findings

- India has significant policy gaps in AI transportation implementation
- Developed nations lead in smart cities and predictive technologies
- India only has policies for road safety and disaster resilience
- China, Japan, and Singapore show advanced implementation in specific areas

EWM Assessment Results & Policy Priorities

Entropy Weight Method (EWM) evaluates policy importance based on data variability, reducing subjective bias in multi-criteria decision making.

Table 2 – Global Tracking of Policy Initiatives by Countries:				
Policy (Factors) No.	Policy (Factors)	Original Score	Normalized Score	Entropy Weight
1	AI for Road	10	1.0	0.15
2	Predictive Traffic	9.5	0.88	0.13
3	AI in Public Transit	9	0.75	0.11
4	AI for Bridging Urban-Rural	8.8	0.7	0.10
5	Smart City and Urban Mobility	8.5	0.63	0.09
6	AI for Disaster Resilience	8.3	0.58	0.08
7	AI for Freight and Logistics	8	0.5	0.07
8	Sustainable Transportation	7.7	0.43	0.06
9	AI-Driven Congestion Pricing	7.5	0.38	0.05
10	Public Private Partnership in AI	7.2	0.30	0.04
11	AI in High-Speed Rail	6.8	0.20	0.03
12	AI for Green Mobility	6.5	0.13	0.02
13	AI in Smart City Incentive Programs	6.3	0.07	0.01
14	Autonomous Vehicle Testing Deployment	6	0.0	0.0

Top Policy Priorities for India



AI for Road Safety(0.15)

Critical for reducing India's high road accident rate (24.1 deaths per 100,000 people vs 9.2 in high-income countries).



Predictive Traffic Management(0.13)

Addresses urban congestion through AI-driven adaptive traffic signals and route planning.



AI in Public Transit Optimization(0.11)

Enhances efficiency of overcrowded public transit systems through AI-driven scheduling and demand prediction.



AI Bridging Urban-Rural Gaps(0.10)

Improves rural transportation through AI-optimized routes and predictive maintenance.



Smart Cities & Urban Mobility(0.09)

Supports India's 100 smart cities initiative through AI-integrated urban mobility strategies.

Key Recommendations: National Strategy & Data Governance



National Strategy

Unified Vision & Goals

Develop a unified national AI transportation strategy with specific goals and a clear roadmap, led by MoRTH and NITI Aayog.

Department-Specific Focus

Address the current NSAI's lack of specific focus on transportation by creating targeted initiatives for different transport modes.

Cross-Departmental Coordination

Establish a national-level AI transportation coordinating body to align strategies across ministries and agencies.



Data Governance & Sharing

National Transportation Data Repository

Create a centralized repository by MoRTH and NHAI with MeitY, integrating data from GPS systems, IoT sensors, and citizen feedback.

Open Data Policy

Implement open data policies promoted by MeitY to facilitate collaboration between public and private sectors for AI innovation.

Data Privacy & Ethics

Establish comprehensive data privacy laws ensuring informed consent, data security, and algorithm accountability in AI-driven transport applications.

Key Recommendations: High-Impact AI Applications



AI for Road Safety(Weight: 0.15)

- AI-enhanced traffic monitoring to detect violations
- Automated AI-driven enforcement to improve compliance
- Predictive maintenance to address infrastructure weaknesses



Predictive Traffic Management(Weight: 0.13)

- AI-driven adaptive traffic signals to optimize flow
- Intelligent parking management to reduce congestion
- Real-time traffic monitoring and incident detection



Public Transportation Optimization(Weight: 0.11)

- AI-driven demand prediction for efficient scheduling
- Real-time vehicle tracking and arrival time prediction
- AI-enabled non-contact ticketing systems



Rural-Urban Connectivity(Weight: 0.10)

- AI-optimized rural transportation routes
- Predictive maintenance for rural roads
- Mobile-based rural transit solutions



AI cameras implementing road safety monitoring

💡 Key Insight

Based on the EWM analysis, **road safety** emerges as the highest priority with a weight of 0.15, followed by predictive traffic management (0.13) and public transportation optimization (0.11). These applications directly address India's most critical transportation challenges.

Key Recommendations: Public-Private Partnerships & Governance



Public-Private Partnerships



Public-Private Partnership Framework

Establish a structured framework encouraging cooperation between government agencies and private tech companies to jointly develop AI-driven transportation solutions.



Funding Incentives

Provide financial incentives, tax breaks, and funding mechanisms to support companies developing AI transportation solutions.



Pilot Projects

Prioritize projects in AI-driven road safety and predictive traffic management, focusing on practical implementation rather than early-stage autonomous vehicle testing.



Governance Structure



National AI Transportation Working Group

Establish a cross-departmental working group led by NITI Aayog and MoRTH to coordinate AI policy implementation and resolve regulatory challenges.



Standardized AI Framework

Develop a unified AI framework to ensure effective integration of AI technology into India's transportation ecosystem and promote cooperation among stakeholders.



Implementation Support

Provide technical and financial support to states and cities implementing AI transportation projects, with a focus on capacity building and institutional arrangements.

Key Recommendations: Sustainability Integration

AI technology can transform transportation while meeting environmental goals.



AI-Driven Green Mobility

Integrate AI in logistics optimization and emission control to reduce environmental impact.



Energy Efficiency

Use AI for route planning and freight optimization to reduce congestion and pollution.



Emission Control

Implement AI-driven emission tracking and control systems for cleaner transportation.



Sustainable Development

Align AI transportation solutions with India's long-term sustainable development goals.



Implementation Strategy

Create a sustainable AI transportation framework with measurable goals.

Implementation Roadmap



Short-term
1-2 years



Medium-term
3-5 years



Long-term
5+ years



Short-term Priorities

- ✓ Establish national AI transportation strategy with unified vision
- ✓ Build data governance framework and storage repository
- ✓ Prioritize AI for road safety and predictive traffic management
- ✓ Launch pilot projects in high-impact areas



Medium-term Implementation

- ✓ Scale AI applications for public transportation optimization
- ✓ Develop urban-rural connectivity solutions
- ✓ Enhance data sharing mechanisms across government
- ✓ Establish public-private partnerships for AI transportation



Long-term Vision

- ✓ Integrate AI across all transportation modes
- ✓ Create sustainable, AI-driven logistics
- ✓ Develop exportable AI transportation standards
- ✓ Transform India into a global AI transportation hub

Key Milestones

Year 1: National AI Transportation Strategy

Year 3: Data Repository Implementation

Year 5: Smart City Integration

Year 7: National Coverage

Conclusion

Key Findings

India faces significant transportation challenges:

- Urban congestion and inadequate public transportation
- Rural connectivity issues and inefficient logistics
- Limited budget for transportation infrastructure
- Weak policy framework for AI integration in transportation

EWM analysis reveals priority areas:

- **AI for road safety**(highest priority)
- **Predictive traffic management**
- **AI in public transportation optimization**
- **AI bridging urban-rural gap**

 Create a sustainable AI transportation framework with measurable goals



National AI Transportation Strategy

Create unified vision with specific goals for AI in transportation, addressing current gaps in NSAI



Data Governance & Sharing Mechanism

Establish national transportation data repository and open data policies to enable AI-driven insights



Public-Private Partnerships

Create structured frameworks for government and private tech companies to collaborate on AI transportation solutions



Sustainability Integration

Integrate AI-driven logistics optimization and emission control measures into sustainable development policies

By implementing these strategies, India can effectively leverage AI to overcome transportation challenges and achieve its vision for intelligent transportation systems and smart cities.



Thank you
Q & A