# Infrastructure productivity: How to save $1 trillion a year

GOVERNMENT-UNIVERSITY-INDUSTRY RESEARCH ROUNDTABLE
Policy and Global Affairs

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# Summary

- Just keeping pace with projected global GDP growth will require an estimated **$57 trillion in infrastructure investment** between now and 2030
  - More than the estimated value of today's infrastructure
  - Against a headwind of fiscal constraints and tight lending capacity

- Practical steps can **reduce** infrastructure **spending by 40 percent—an** annual saving of $1 trillion—by boosting productivity
  - Improving infrastructure portfolio planning and project selection
  - Streamlining delivery
  - Making the most out of exsisting infrastructure

- This requires an **overhaul of infrastructure systems** with respect to public-private sector orchestration, data transparency, upgraded capabilities, coordination across institutions and regions, stakeholder engagement, and clear separation of political and technical responsibilities

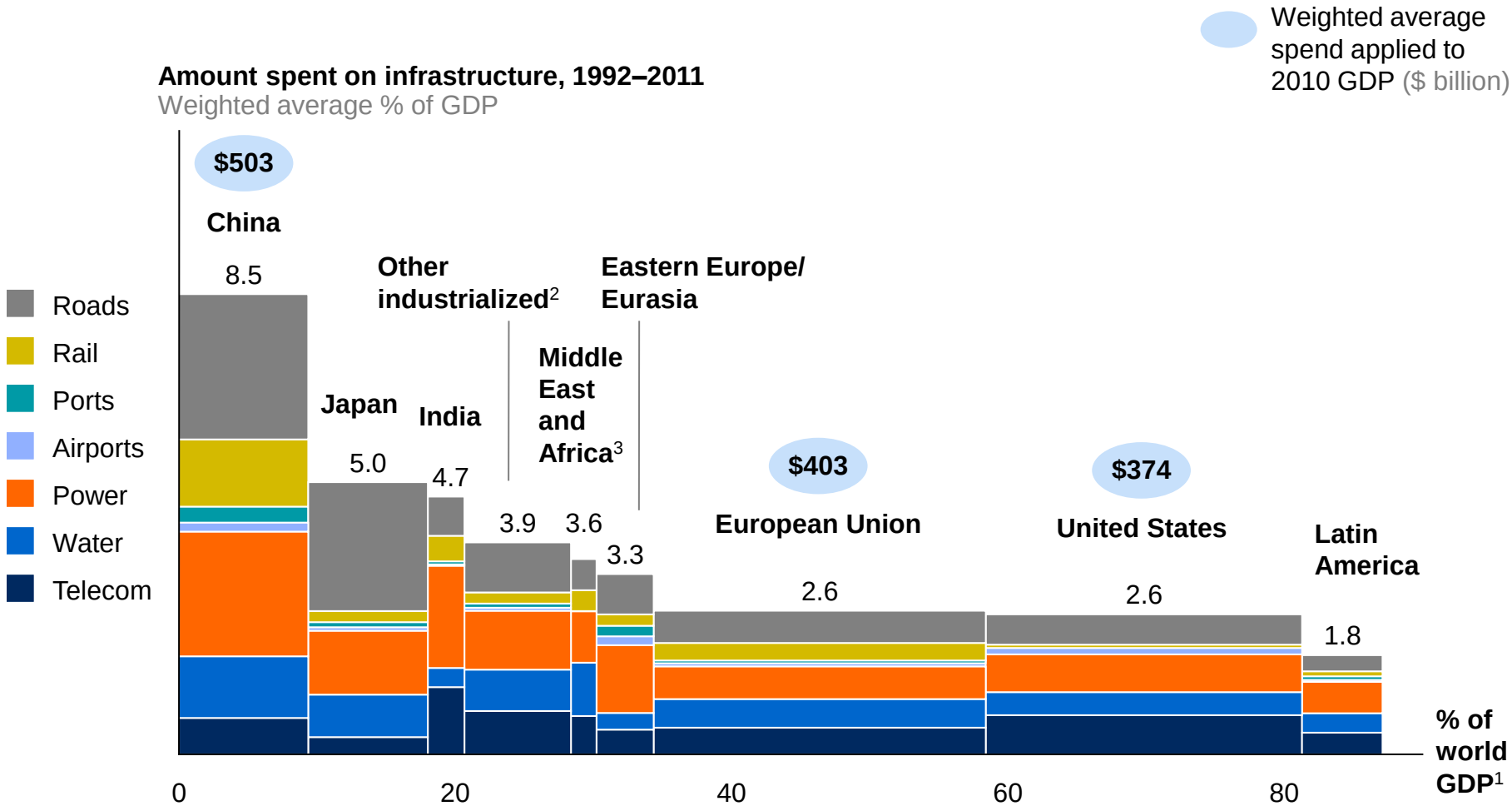
- The **private sector** can drive productivity within company operations, engage in a productive dialogue at industry level with public sector stakeholders, or develop new business and contracting models

SOURCE: McKinsey Global Institute

# Infrastructure productivity: How to save $1 trillion a year

- **Sizing the world's infrastructure investment challenge**
- How to boost infrastructure productivity by 60 percent
- Overhauling the infrastructure system
- What it means for you

# China has overtaken the United States and the European Union to become the world's largest investor in infrastructure




1 Percentage of 2010 world GDP generated by the 86 countries in our analysis.
2 Australia, Canada, Croatia, Iceland, Lichtenstein, New Zealand, Norway, Singapore, South Korea, Switzerland, Taiwan (Chinese Taipei), and the United Arab Emirates.
3 Excludes unusually high port and rail data for Nigeria; including these data brings the total weighted average to 5.7 percent.

SOURCE: IHS Global Insight; GWI; IEA; ITF; McKinsey Global Institute analysis

# It will be a challenge to just sustain current levels of infrastructure investment

## Fiscal pressure

10%

Average reduction, as a proportion of GDP, of G20 government spending to achieve debt targets

## Constrained debt

60:40

Debt-to-equity ratio of the Pennsylvania Turnpike in 2008, versus 85:15 for the Indiana Toll Road just two years earlier

## Shift to emerging markets

70%

Share of current investment pipeline comprising riskier green-field projects

## Resource constraints

30–80%

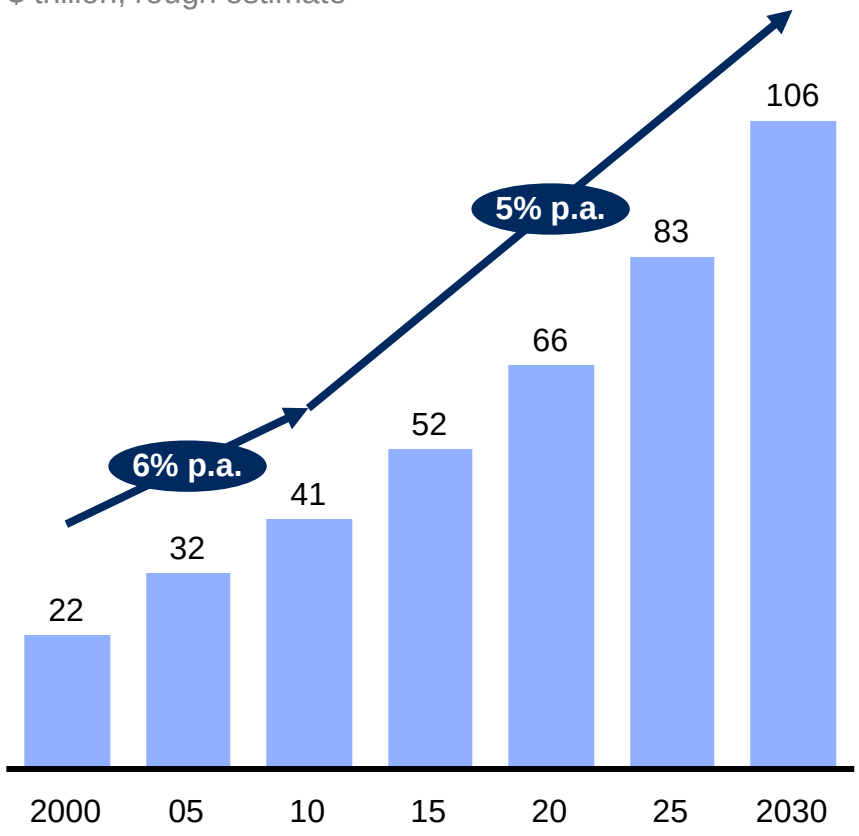
Increase in demand for commodities over the next 20 years

SOURCE: IMF, Bloomberg, Infrastructure Journal, Public Works Financing newsletter, Infrastructure Investor magazine; McKinsey Global Institute analysis

# As pension, insurance, and sovereign wealth funds grow, their investments in infrastructure should grow, too

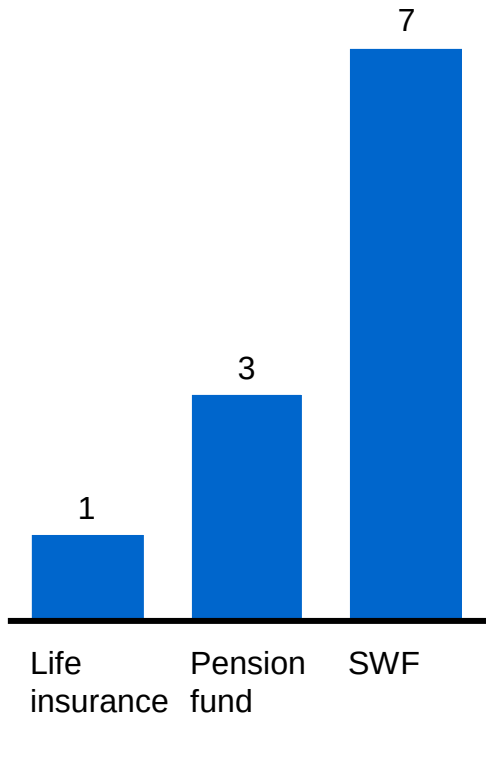
## Global funds under management are assumed to continue to grow through 2030

**Global pension, life insurance, and sovereign wealth fund (SWF) assets under management**
$ trillion, rough estimate

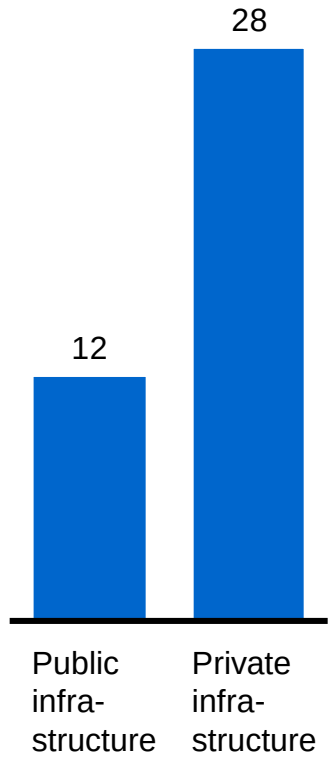



## … and there is solid evidence that infrastructure assets can capture some of that growth

**Average infrastructure allocations by fund type**
%




**Investors who expect to increase allocations to infrastructure**
% of total respondents




SOURCE: Russell investments 2012 global survey on alternative investing; OECD; McKinsey Global Banking Pools; McKinsey Global Insurance Pools; SWF Institute; TheCity UK; Preqin; McKinsey Global Institute analysis

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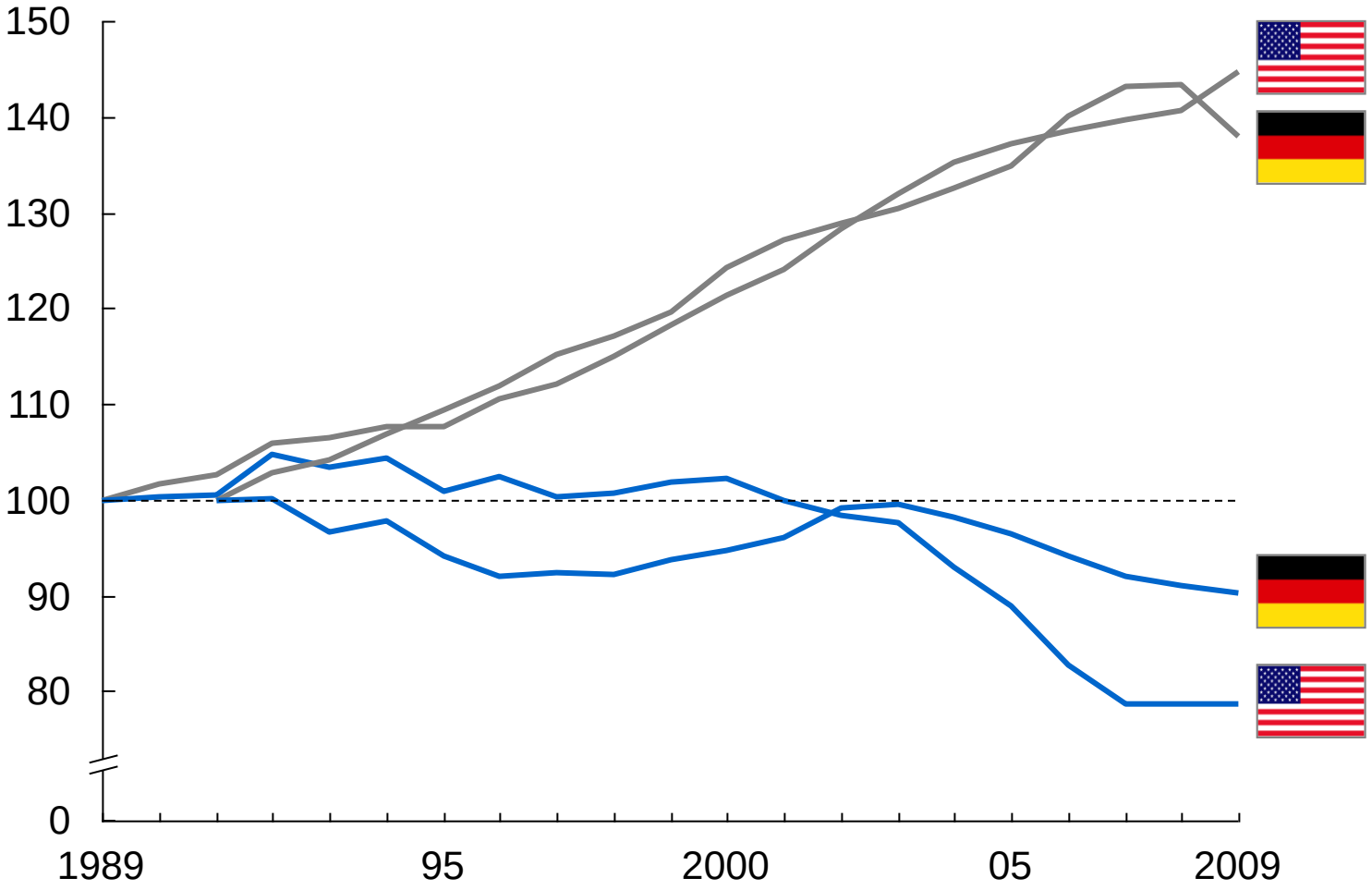
# Construction productivity has been flat or falling in many advanced economies

**Labor productivity**

Index: 100 = 1989 for the United States, 1991 for Germany

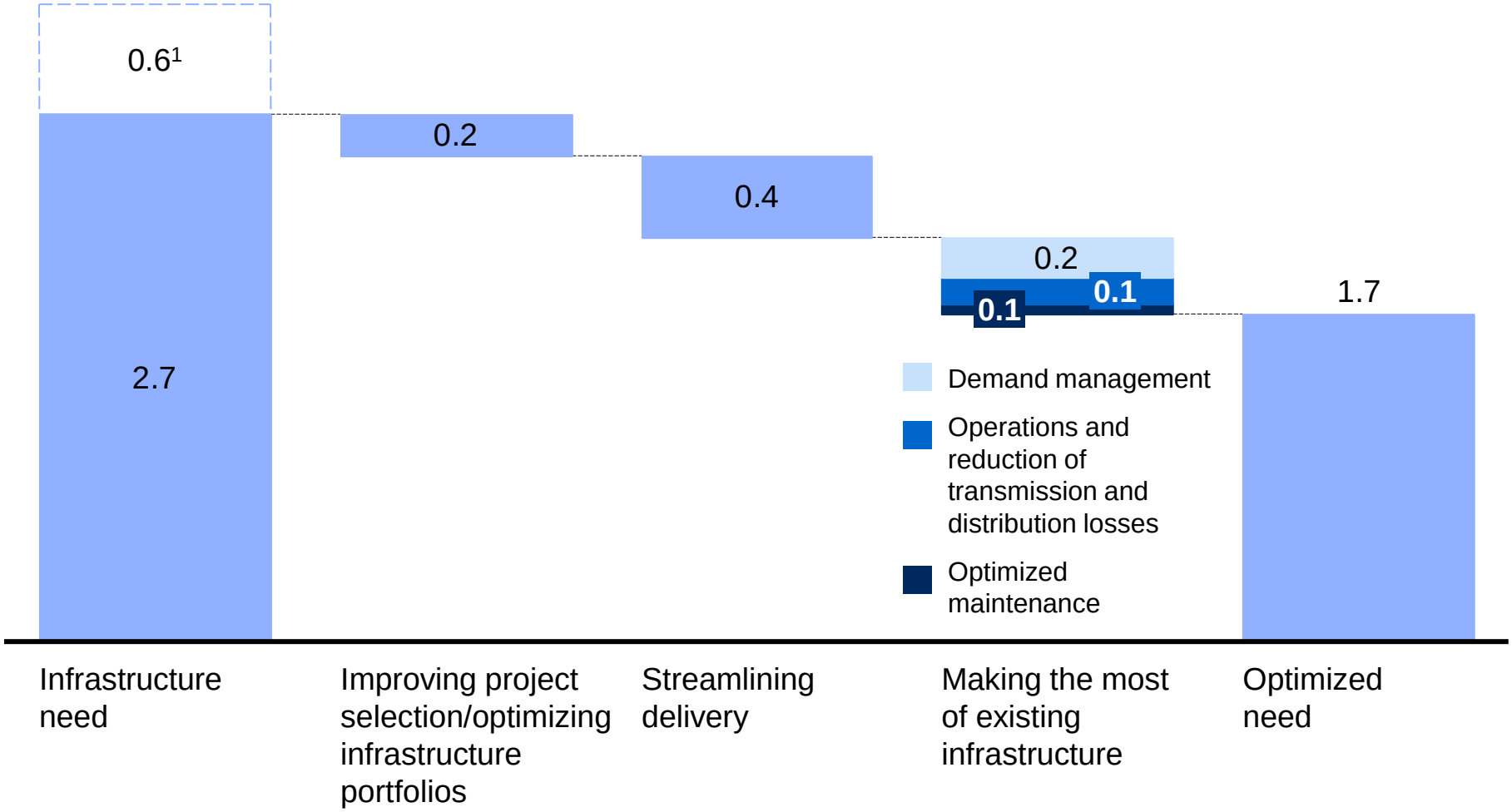



SOURCE: OECD Labour Productivity by Industry (ISIC Rev. 3); McKinsey Global Institute analysis

# The $1 trillion-a-year infrastructure productivity opportunity

## Global infrastructure investment need and how it could be reduced

Yearly average, 2013–30
$ trillion




1 Telecom investment need beyond the scope of this paper.

SOURCE: McKinsey Global Institute analysis

# Productivity gains will come from three main sources

**Making better decisions about project selection**

- Clear socio-economic objectives
- Standard cost-benefit analyses
- System-wide decision-making

Chile's quantitative, transparent project evaluation system screens out 25–35% of proposals

**Streamlining delivery**

- Streamlining approvals & land acqu.
- Better tendering & procurement
- Design optimization & planning
- Lean construction
- Advanced contractor management
- Construction sector development

New South Wales sped up permitting processes by 11% while increasing their effectiveness

**Making the most of existing assets**

- Increased asset utilization
- Preventive maintenance
- Transmission and distribution
- Demand management

Phnom Penh reduced non-revenue water consumption from 72% to 6%

SOURCE: McKinsey Global Institute

# Singapore's LTA identifies and evaluates projects based on master plans that cascade from economic, labor, and housings plans

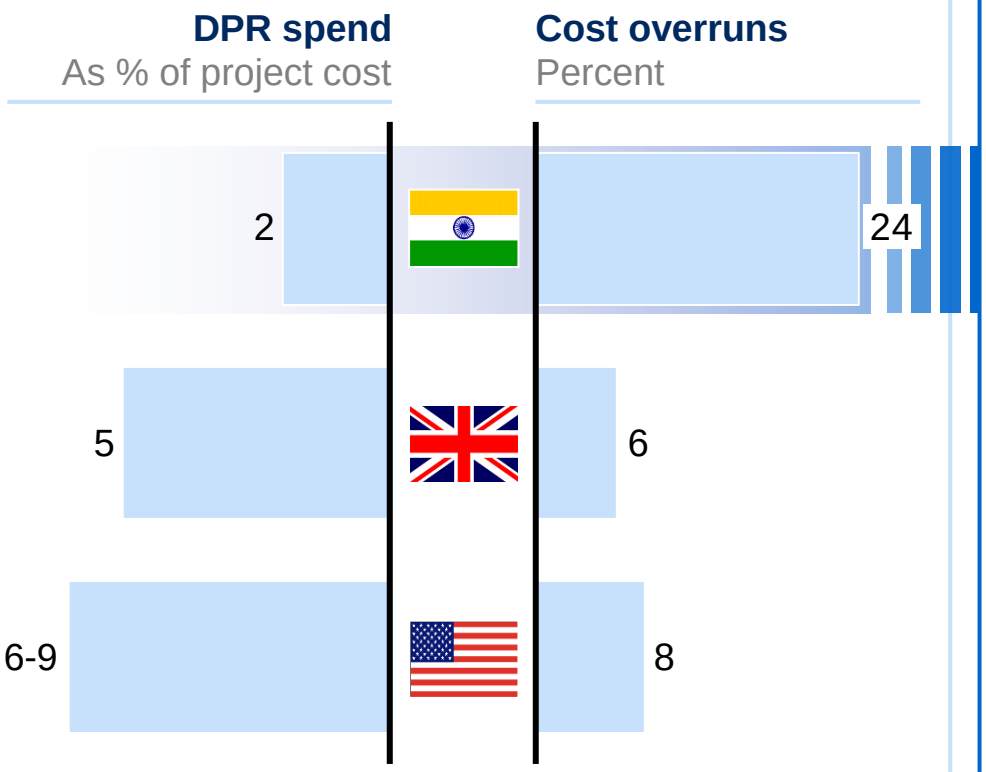
| | National vision & policies | Economic & land-use plans | Transportation strategic planning | Project scoping & identification | Feasibility analysis & Master planning |
|---|---|---|---|---|---|
| **Decision maker** | ▪ National cabinet | ▪ National cabinet<br>▪ Urban Re-development Authority (URA) | ▪ Ministry of Transport<br>▪ Land Transport Authority | ▪ Land Transport Authority<br>▪ Ministry of Transport | ▪ Development Planning Committee (DPC)<br>▪ Land Transport Authority |
| **Delineation of respon-sibilities** | ▪ Establishes **overall vision** for growth and national priorities | ▪ **Relevant minis-tries forecast labor** need over 50 years<br>▪ URA **translates into a spatial plan** (housing and employment) | ▪ **MoT** sets key transportation goals in consultation with **LTA** (the subsidiary working agency) | ▪ **LTA** identifies potential projects using mix of intuitive hypotheses and analyses (with MoT input) | ▪ **LTA** prepares paper for DPC<br>▪ **DPC** (composed of Ministers of Transport, Finance, and National Defense) approves all projects in master plan by consensus |
| **Analyses and evaluations** | ▪ **Emphasis on "Livability"** as defined by current urban planning academia, and preference for public transport | ▪ **Concept Plan** indicates zoning of every parcel of land & density<br>▪ **Master Plan** is "legally gazetted" doc 1 with design parameters and guidelines | ▪ **Targeted mode-share** of 70% public transport in morning peak time commute<br>▪ **Limited car ownership** increase to 1.0% by controlling allotment of certificates 2 | ▪ **Travel Demand Model (TDM)** takes URA's master plan and models future traffic demands against existing supply, highlighting expected bottle-necks | ▪ **DPC paper** includes strategic rationale, project schedules, and project BCR:<br>▪ **Benefit-Cost Ratio (BCR)** weighs costs against value of reduced commute time3, insurance cost avoided, other benefits |

1 Legally gazetted documents are published government documents and thus have legal standing
2 Fixed supply of certificates of entitlements required for car ownership
3 Value of time calculated from survey on willingness to pay

SOURCE: Interview with former Singapore MoT employee

# Sufficient investment in up-front planning and engineering is key to controlling construction cost and schedule

## Relationship between spend incurred on Detailed Project Report (DPR) & cost overruns – roads sector




**Low DPR spend in India is driven by a pure L-1[1] based bid process, as opposed to QCBA[2] process**

## Illustrations of impact of bad DPRs in India

**Scope changes**

"In a roads project, a temple was adjacent to the site of a proposed flyover. This aspect was overlooked in the DPR phase. The flyover got built, and subsequently erased due to local pressure, wasting INR 21 crores in the process"

**High project costs**

"In a thermal power project, the L-1 consultant quoted an abnormally low price, then did not deploy enough resources to prepare the DPR. The resulting design & cost estimate was heavily bloated, and the nodal agency saved 10-20% on it by doing the DPR again"

1 Purely cost-based bidder evaluation
2 Quality-cum-cost based approval: bidder evaluation based on cost committed by and technical qualification of the bidder

SOURCE: Build India report, based on interviews and McKinsey analysis

# Value engineering yields significant savings – example road surface

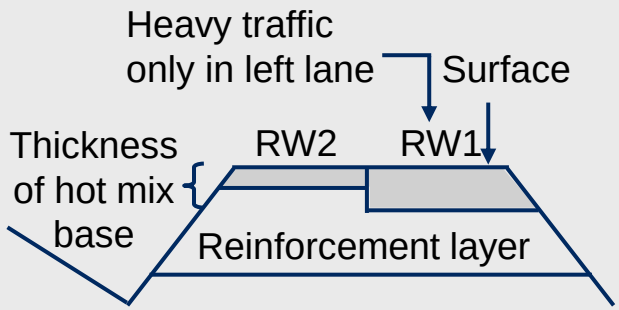
**Source of waste**

Same thickness of hot mix base in all lanes independently from traffic expected per lane

Impact – reduced amount of hot mix base by differentiating between light and heavy traffic lanes

**Heavy traffic lane**

**Light traffic lane**




**Incentives introduced to apply active design (profit sharing)**

SOURCE: McKinsey

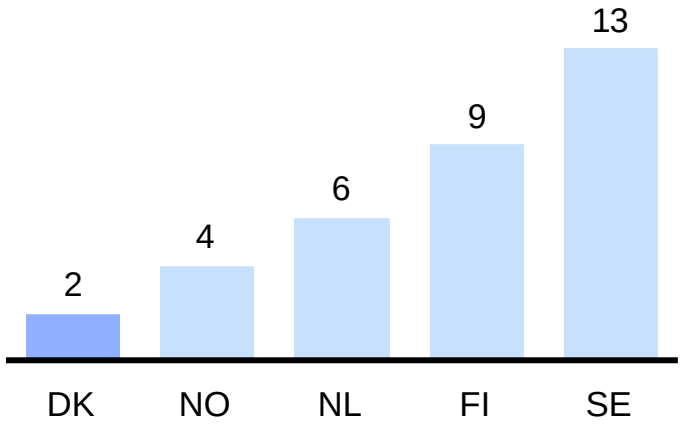
# Countries can foster greater competition in order increase construction sector productivity

## Danish construction sector showing significant productivity and cost improvement potential …

- Construction costs in Denmark ~20% higher than the average of its Western European peers
- International companies more productive than domestic ones, with average cost difference of more than 20%, but underrepresented

**Market share of foreign companies among top 10 firms**

Percent, 2009




## … suggesting several levers for increasing productivity through competition

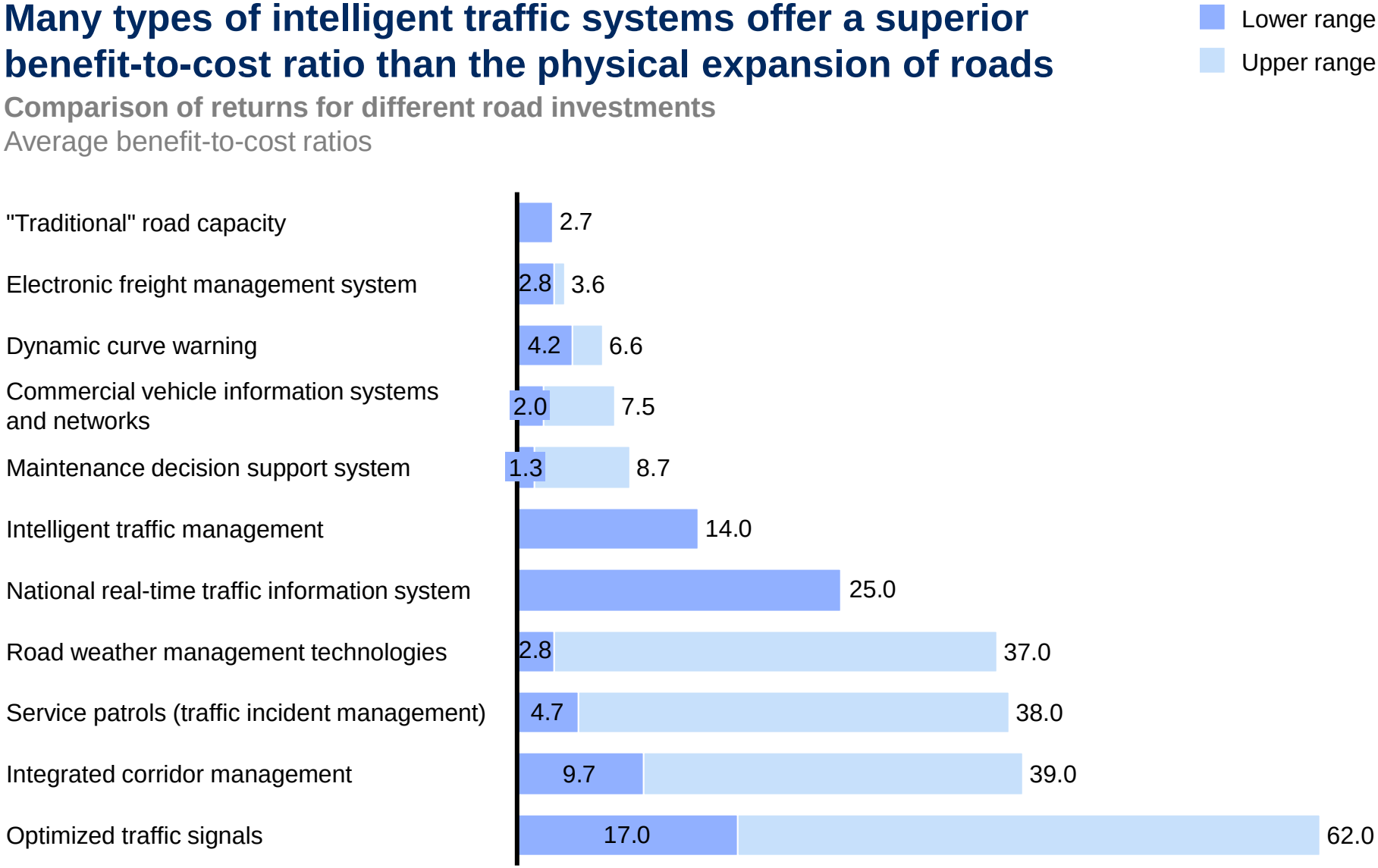
- **Removing technical barriers to competition**, incl. zoning regulations, which prevent construction companies from achieving economies of scale from large building programs, as well as the lack of harmonization of standards with other markets (e.g., in building materials)
- **Attracting best-practice foreign companies**, e.g., through
  - Intensified marketing to international business by ensuring awareness of tenders abroad / publicizing in languages other than Danish
  - Expanding the scope of “Invest in Denmark”, which is part of the Ministry of Foreign Affairs, to service sectors
- **Building critical “enablers”,** e.g.,
  - Training programs that provide a broader scope of training and education to facilitate coordination across trades
  - Changes to the institutional powers of the Danish Competition and Consumer Authority, including providing the authority with direct powers to prosecute cases

SOURCE: McKinsey Global Institute

# Many types of intelligent traffic systems offer a superior benefit-to-cost ratio than the physical expansion of roads

## Comparison of returns for different road investments

Average benefit-to-cost ratios




SOURCE: *Intelligent transportation systems*, Capitol Research, Council of State Governments, April 2010; Transport for London, 2007; *Intelligent transportation systems benefits, costs, deployment, and lessons learned desk reference: 2011 update*, US Department of Transportation, September 2011; *Urban mobility plan*, Seattle Department of Transportation, January 2008; McKinsey Global Institute analysis

# Congestion pricing in cities has proved both its effectiveness as a demand management measure, as well as its financial viability

| | Impact | Financial success |
|---|---|---|
|  | ▪ London's congestion has decreased by ~ 30%<br>▪ Revenue fund improved public transport; bus reliability has increased by over 25%; peak time bus speeds up 20% | ▪ NPV positive in year 2<br>▪ 18%p.a. revenue growth over 7 years |
|  | ▪ Stockholm's traffic passing in and out of the cordon reduced by between 20 and 25% during the period of the trial<br>▪ Air quality improved<br>▪ 96% complied with paying the tax on time, which raised 399 m SEK during the period | ▪ NPV positive in first 3 years |
|  | ▪ Oslo's 3-5% reduction in traffic created new space for efficient public transport, walking, cycling<br>▪ 6-9% growth in public transport | ▪ NPV positive in first 2 years |
|  | ▪ Singapore's Congestion Zone has seen a 13% reduction of traffic during charging period; 22% rise of traffic speeds<br>▪ Achieving free-flow road speed targets of 45-65 kph on expressways, and 20-30 kph on arterials | ▪ NPV positive in first 3 years<br>▪ 56% increase in revenues from 2006 to 2008 |
|  | ▪ Seoul's bus ridership went up 5%<br>▪ 25% decline in bus accidents<br>▪ Passenger satisfaction went up 30%<br>▪ Ticket prices went down 5%<br>▪ Average bus speed went up by 100% | ▪ Increase in revenues allowed for more affordable pricing of public transportation |

SOURCE: Land Transport Authority of Singapore; Institute for Transportation & Development Policy; Gorpe (2000, 2001); May (1992); www.lta.gov.sg; IDTP; Norwegian Public Roads Administration; www.visitoslo.com; http://www.fjellinjen.no/en; University of Minnesota; Press; Transport for London; Victoria Transport Policy Institute; "Intelligent transportation systems", Stephen Ezell, January 2010, The Information Technology and Innovation Foundation (ITIF)

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# Good chance of following infrastructure best practices only if the right system, governance, and enablers are in place

## Data and accounting

- Infrastructure balance sheets to overcome issues of scattered, incomplete, and inconsistent data

## Technocrats vs. politicians

- While politicians need to set the objectives, technocrats need a level of independence for planning and evaluation

## Capacity and capability

- Leadership and vision at the top and a sufficient number of high-quality project managers and planners below

## Private sector orchestration

- Opportunities to create more competitive markets
- Private sector can help originate and improve planning proposals

## Stakeholder engagement

- Establish transparency and trust early on to avoid bad decisions and delays

## Coordination between institutions

- Orchestration of decision makers across regions and types of infrastructure

SOURCE: McKinsey Global Institute

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# There are ample opportunities for the private sector

**Drive productivity within company operations**

- Tendering & procurement
- Value engineering, design innovation, modularization
- Lean construction
- Operational improvements

**Engage in a productive dialogue at industry level with public sector stakeholders**

- Highlighting international best practice
- Co-investing in education, R&D, demonstration projects
- Highlighting barriers to construction sector development

**Develop new business and contracting models**

- Proposing new investments
- Offer capabilities that fill gaps in capabilities among owners (e.g., engineering, contract & project management, etc.)
- Developing infrastructure balance sheets
- Contract structures that allow operators to benefit from demand management

SOURCE: McKinsey Global Institute

# Our scorecard allows a convenient overview of current performance in the public sector

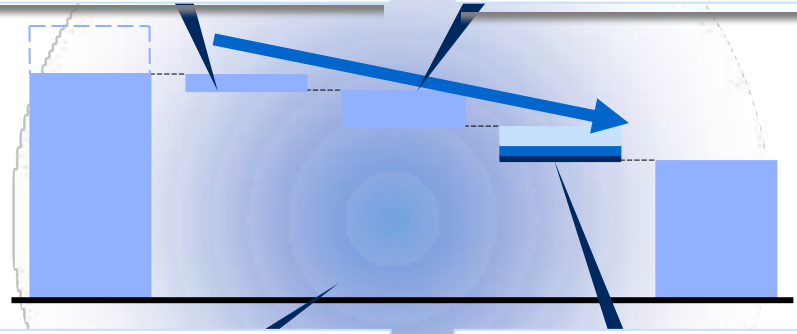
ILLUSTRATIVE

## Making better decisions about project selection

| Lever | Assessment |
|---|---|
| Identifying projects with a clear purpose, based on socioeconomic priorities | |
| Evaluating projects using improved cost-benefit analyses and reference-class forecasting | |
| Prioritize projects at the portfolio level using fact-based, transparent decision making | |

## Streamlining delivery

| Lever | Assessment |
|---|---|
| Streamlining permit approvals and land acquisition | |
| Sophisticated procurement, contracting, and tendering methods | |
| Best-practice project planning, design-to-cost, and lean construction methods | |
| Strpng cooperation with contractors | |
| Construction sector capabilities and productivity | |



## Enablers

| Lever | Assessment |
|---|---|
| Data and accounting | |
| Delineation technocrats vs. politicians | |
| Private sector orchestration | |
| Capacity and capability | |
| Coordination between institutions | |
| Stakeholder engagement | |

## Make the most out of existing infrastructure

| Lever | Assessment |
|---|---|
| Operations | |
| Maintenance<br>▪ Strategy<br>▪ Quality reviews<br>▪ Sustainability | |
| Demand management<br>▪ Strategy<br>▪ Operator incentives<br>▪ Education and communication<br>▪ Enforcement<br>▪ Access and equity | |

SOURCE: McKinsey Global Institute