The Global Market for Submarine Cables: Insights into Economic Development

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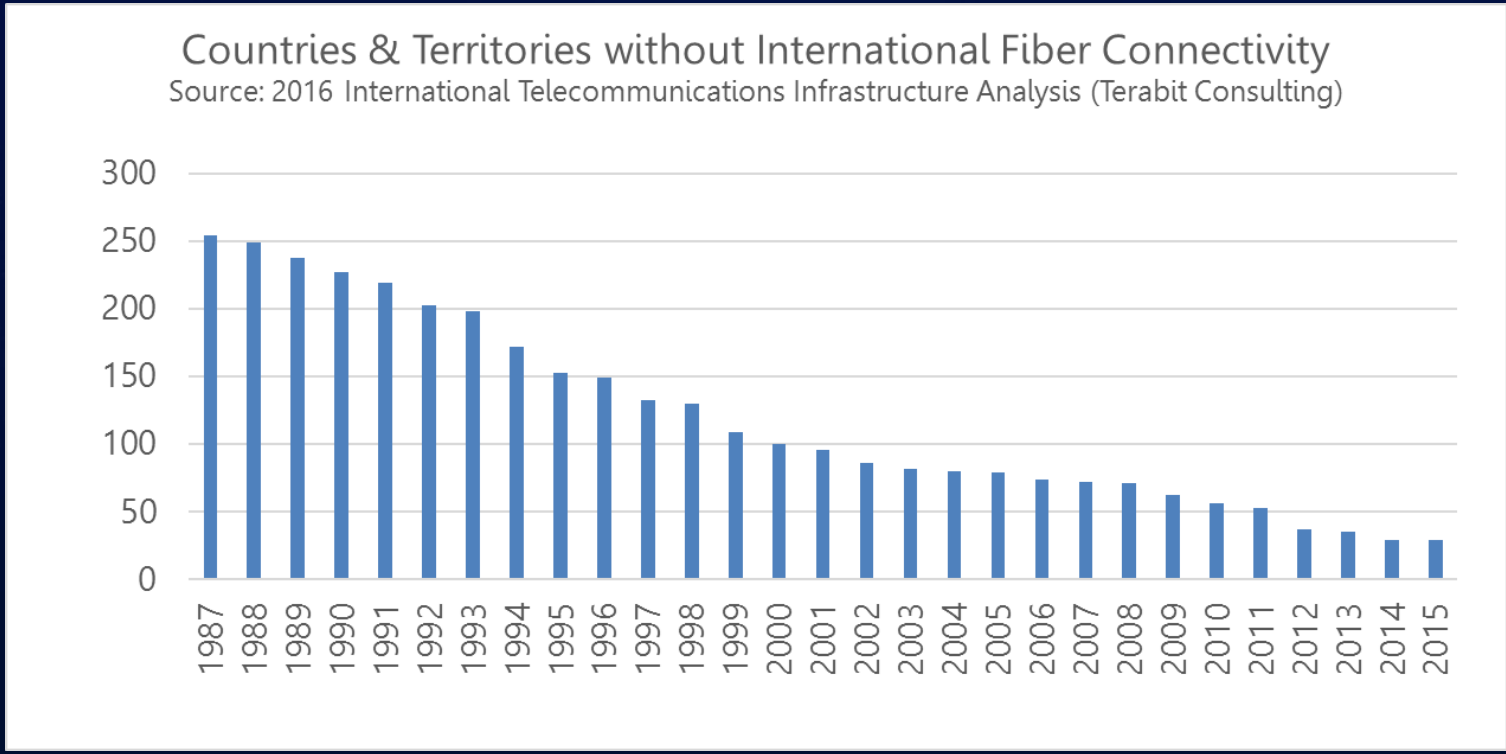
Submarine Cables: A Key Economic Facilitator

- Submarine cables are the world's primary path for international communications, international e-commerce, and international digitally-enabled services
  - Satellite handles less than 0.5% of international traffic
  - International terrestrial fiber optic networks, while a key complement to submarine connectivity, do not currently offer coherent, cost-effective international capacity

Submarine Cables Have Connected the World

- As of 2016, almost no mainland coastal country* or major island is without submarine fiber optic connectivity



- In nominal terms, the industry's efforts to connect the unconnected have been impressive.

- Civilian-inhabited countries and territories unserved by fiber:
  - 79 in 2005
  - 29 in 2015 (0.5% of population)

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**exception: DPR Korea*

The Economic and Developmental Impact of Submarine Cables

- Economic Growth: submarine cables stimulate the following:
  - Increased demand for output (demand multiplier), new opportunities for production (supply multiplier), new goods and services for consumers (final demand)
- Benefits to Consumers
  - Increased international bandwidth
  - Increased consumer affordability of broadband services
  - Increased reliability of international Internet and data services
- Increased Government Revenue
  - Growth in output as a result of increased ICT investment (tax revenue, employment)
- Regional Stability
  - Improved political, economic, and intercultural relations
  - Opportunities in educational, healthcare sectors

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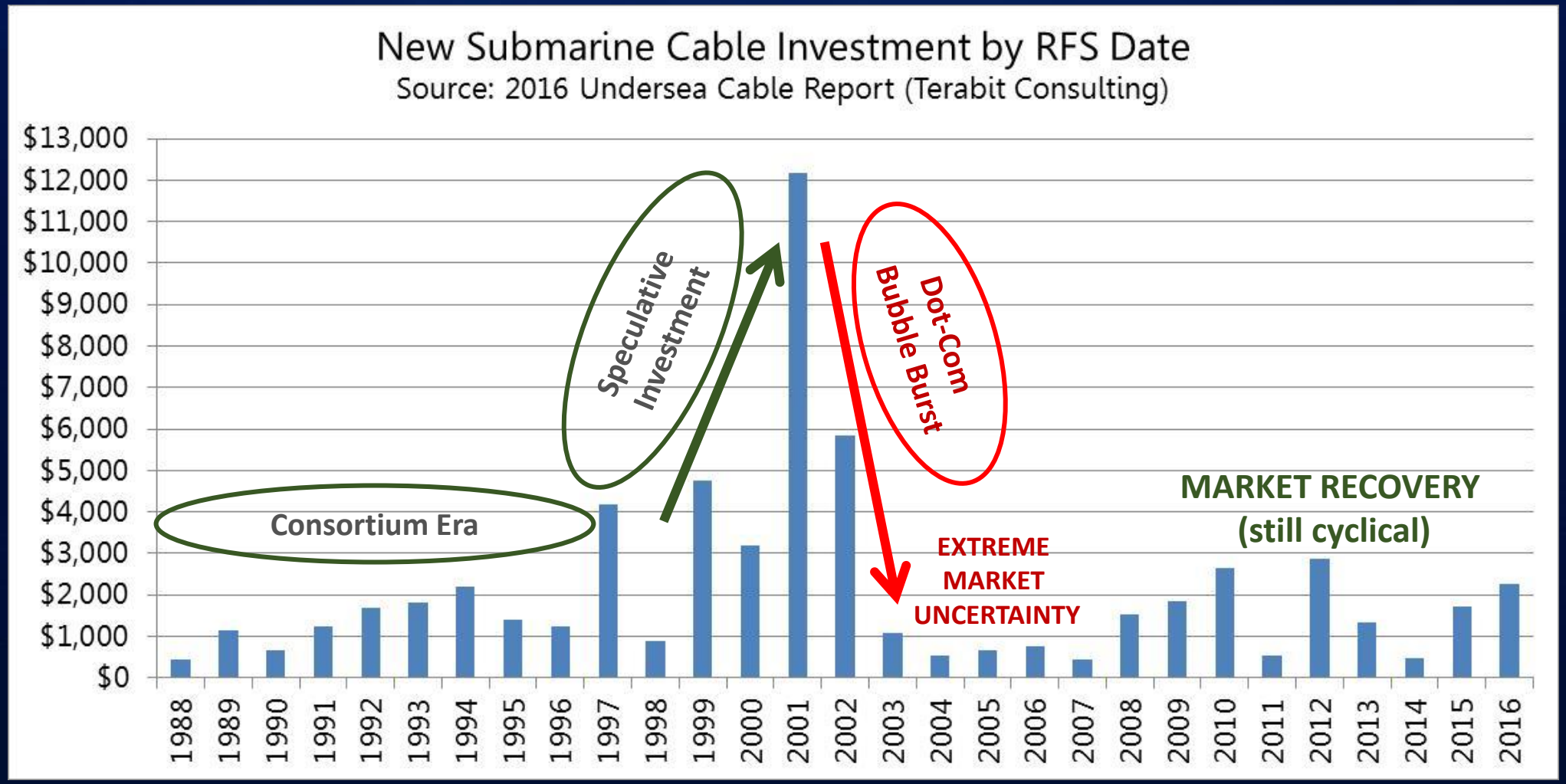
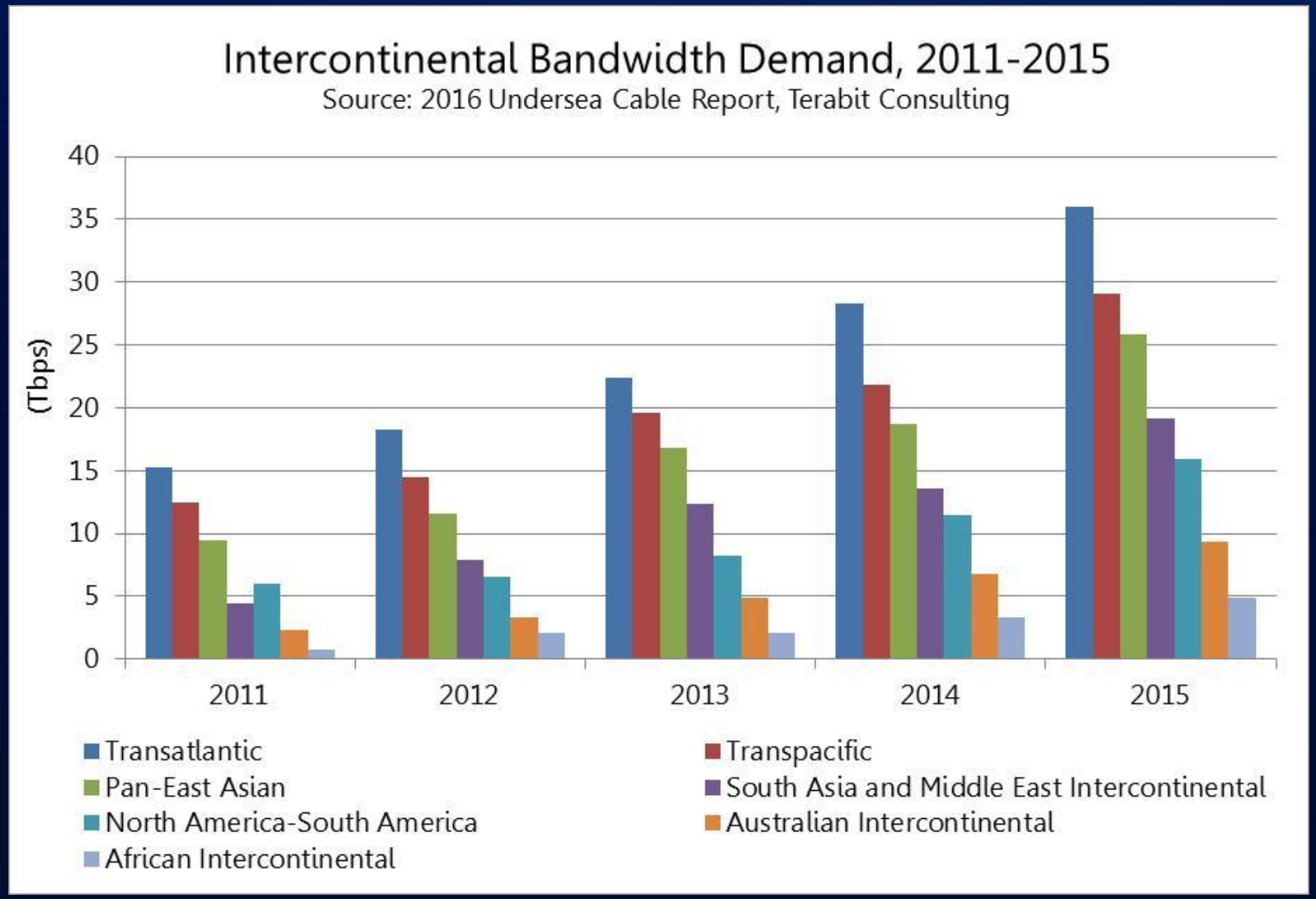
$70 Billion Worth of Investment To-Date



The Primary Driver of New System Demand: International Bandwidth



Intercontinental submarine cable bandwidth has increased from ~50 Tbps in 2011 to ~ 140 Tbps in 2015

Growth is highest in:
- Southeast Asia
- South Asia & ME
- Australia
- Latin America
- Africa

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An Optimal Time for New Investment in Submarine Cables

- Healthy competition in supply market
- Lower overall system costs
- Tremendous efficiencies offered by mature 100G technology
- Sophisticated financing options
  - More experienced private lenders, multilateral development banks, and supply community
  - Strong understanding of the path toward project success

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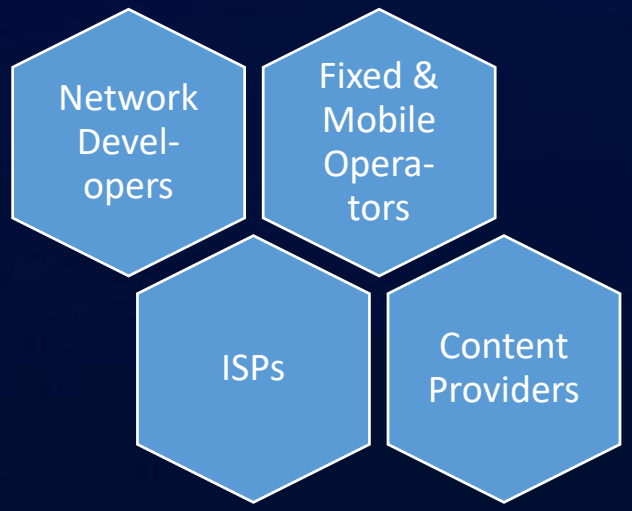
A New Development-Oriented Model of International Fiber Investment

Private Investors → Governments → Multilateral Development Banks and Other IFIs → System and Equipment Suppliers



PPP Structures

- SPV w/ Gov't. Sharehold
- SPV w/ Gov't Contribution
- BOT Concessions
- Project Mgmt. Contracts

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Appropriate Cost-Sensitive Solutions

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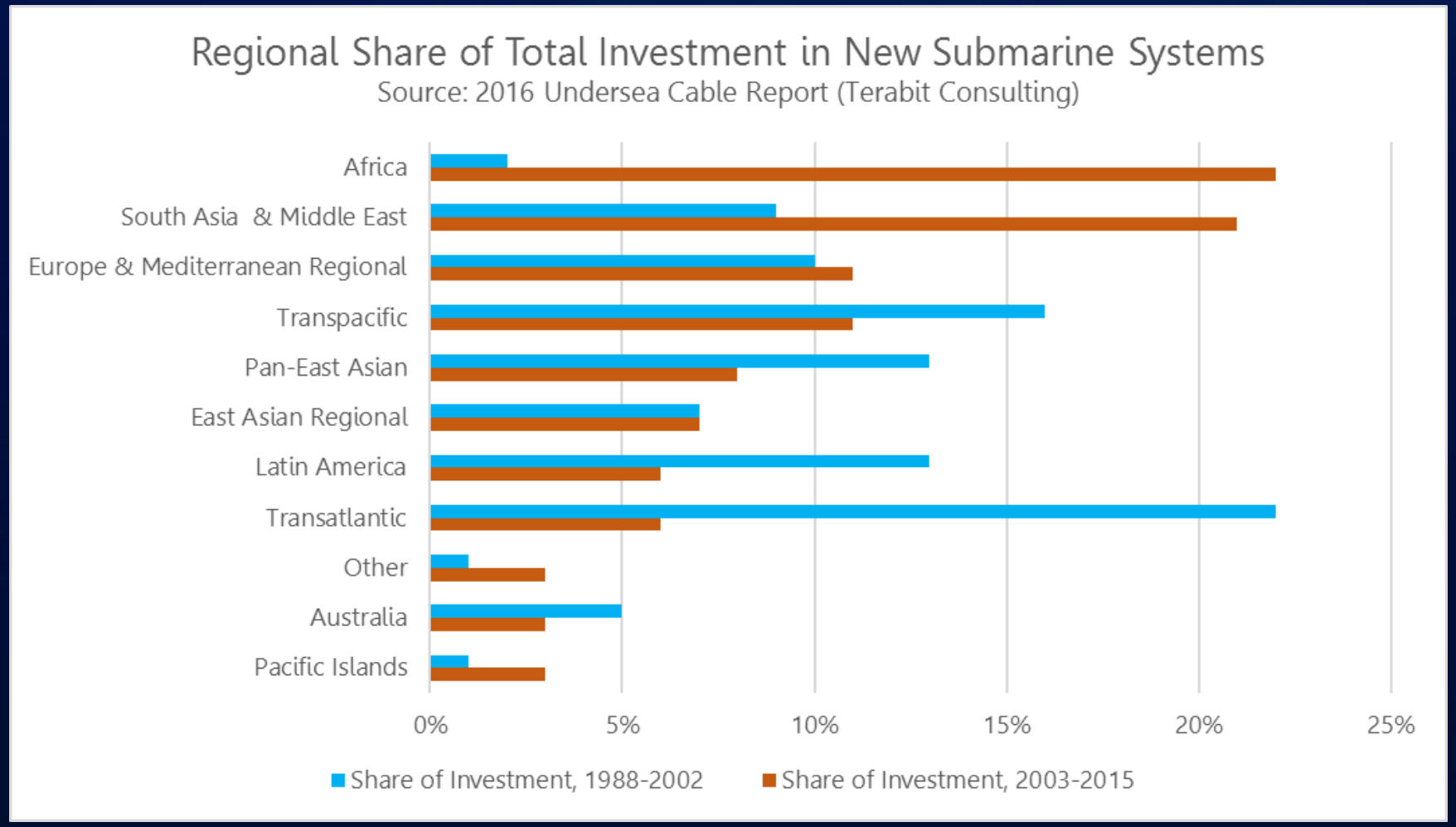
Submarine Investment Has Shifted toward Emerging and Less-Developed Markets



- Since 2003, the share of submarine investment serving less-developed and emerging markets has increased from 33% to more than 60%.

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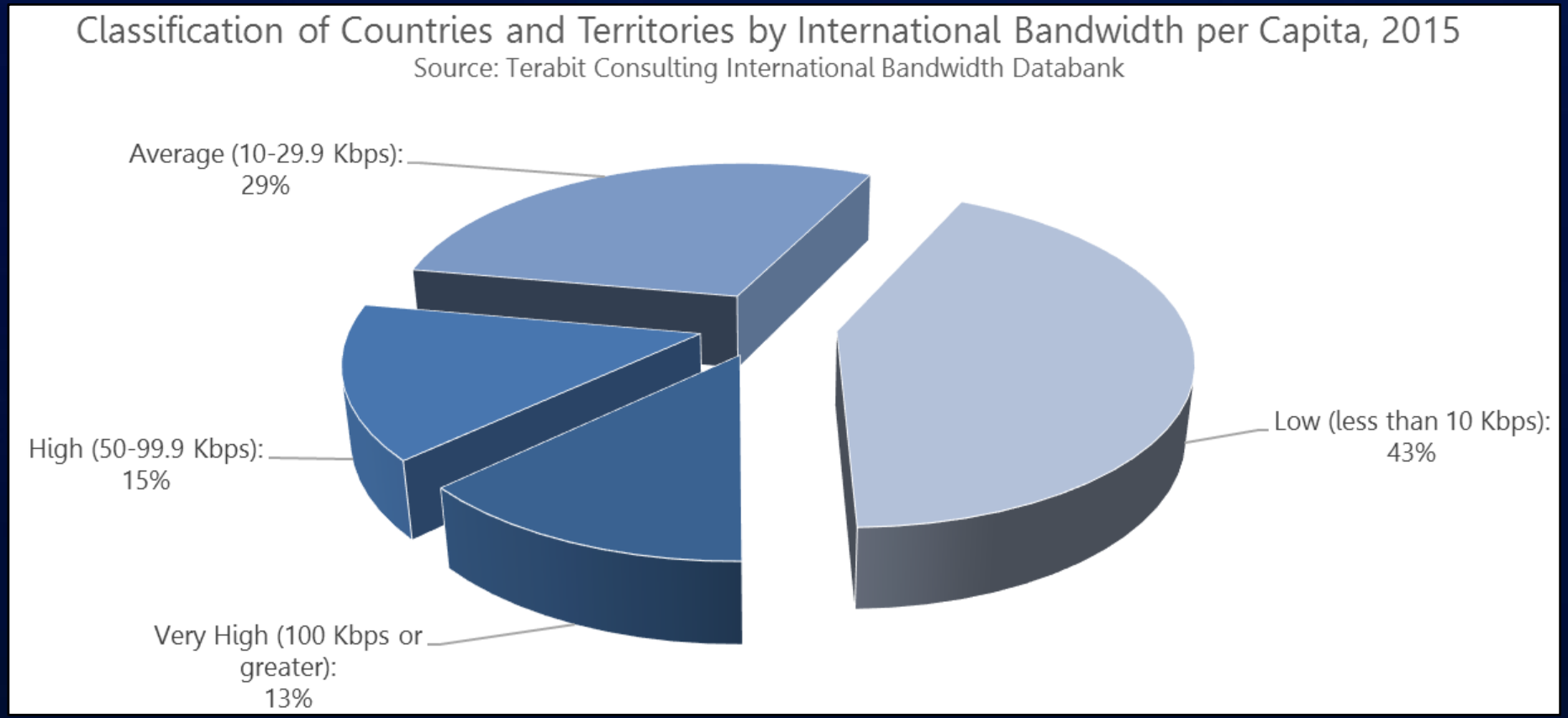
The Bandwidth Divide Remains: 43% of Countries Have Insufficient Bandwidth



Average Per-Capita GDP of Countries and Territories in Each International Bandwidth Classification, 2015

Terabit Consulting International Bandwidth Classification, 2015	Average GDP per Capita, 2015 (PPP terms)
Very High (100+ Kbps)	$45,776
High (50-99.9 Kbps)	$38,582
Average (10-29.9 Kbps)	$22,126
Low (<10 Kbps)	$6,839

Source: Terabit Consulting International Bandwidth Databank

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The Bandwidth *Haves* and the Bandwidth *Have-Nots*

- Terabit Consulting analysis very clearly reveals a *bandwidth divide* that prevents 43 percent of countries and territories from basic levels of affordable, reliable, quality access
  - Weak international bandwidth is accompanied by high prices and low competition
- Even in countries with higher international bandwidth levels, there can be uneven distribution
  - Broadband is often concentrated in urban, coastal, affluent communities

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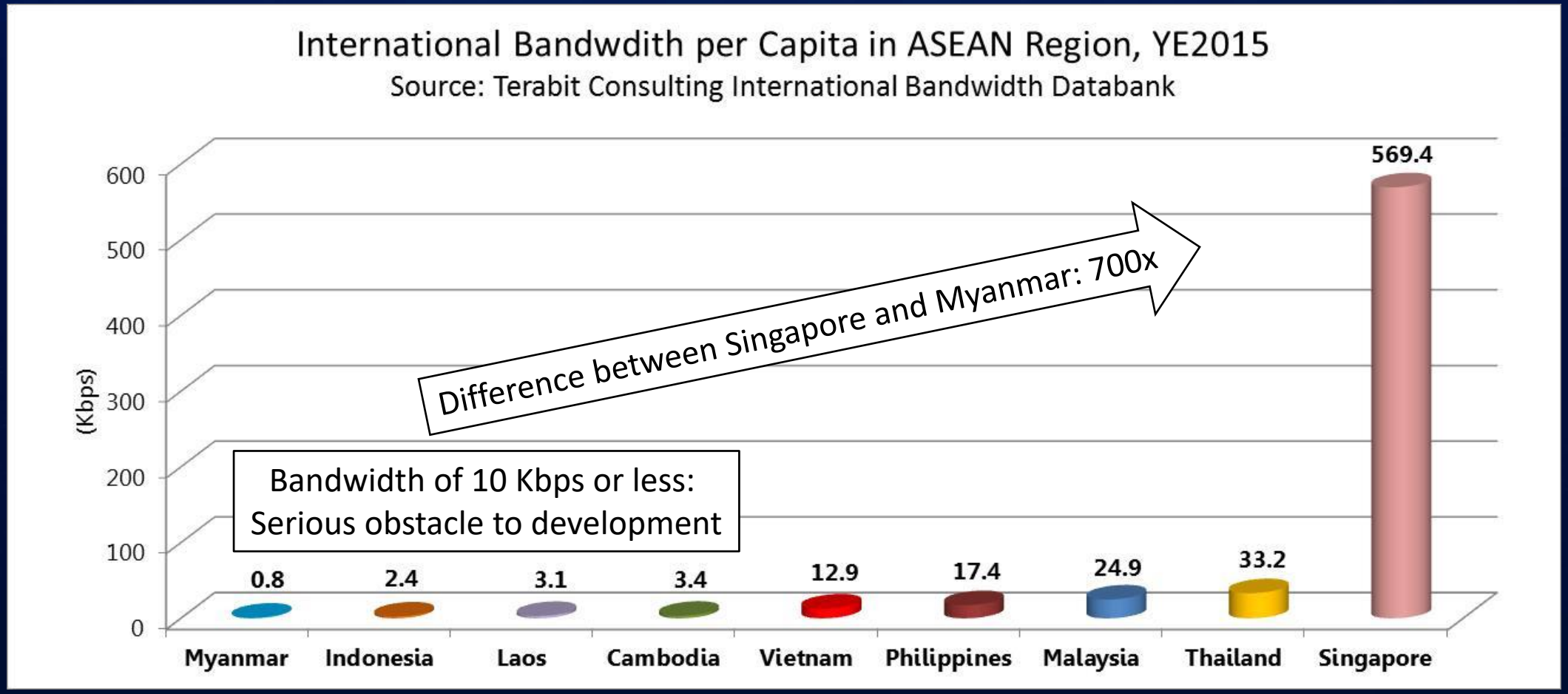
Where the Bandwidth Divide is Most Pronounced: ASEAN Region



The Economic Impacts of Weak Submarine Connectivity & Weak International Bandwidth

- There is a strong correlation between international bandwidth and per-capita GDP
  - Bandwidth inequality serves to perpetuate economic inequality
  - Digital communications have been identified as an essential economic flow (with transport, trade, and finance)
- At the macroeconomic level: obstacles to economic and human development
  - Detachment from the digital economy
  - Continued economic inefficiencies and restrained growth
  - Impediment to regional integration
    - (submarine connectivity is essential for ASEAN common market)
  - Lack of access to critical social development tools
    - (telemedicine, distance learning, scientific/research networks
- Weak international bandwidth constrains the telecom environment
  - High wholesale and consumer prices
  - Lower broadband penetration rates
  - Compromised services and applications (lower reliability and utility)

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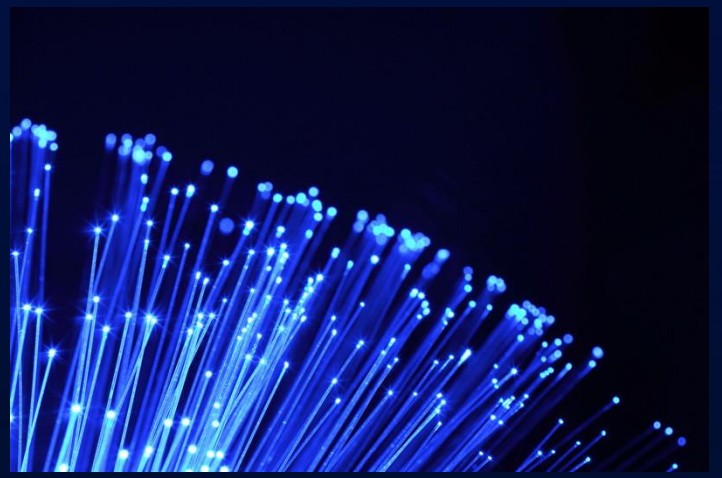
Solutions for Improving Asian Regional Connectivity

1. Multilateral participation in project development
2. Pan-regional cooperation, coordination, and harmonization
3. In cases of market failure: promotion of open access and non-discrimination
4. Elimination of downstream obstacles that prevent bandwidth utilization
   - Greater competition in backhaul, int'l. gateway
   - Development of intercity and metro fiber networks
   - Promotion of advanced broadband services
   - Programs to encourage ICT adoption
   - Investment in supporting rural infrastructure (e.g. electricity)



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THANK YOU

Intelligence, Analysis, and Forecasting for the International Telecommunications Infrastructure Community

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