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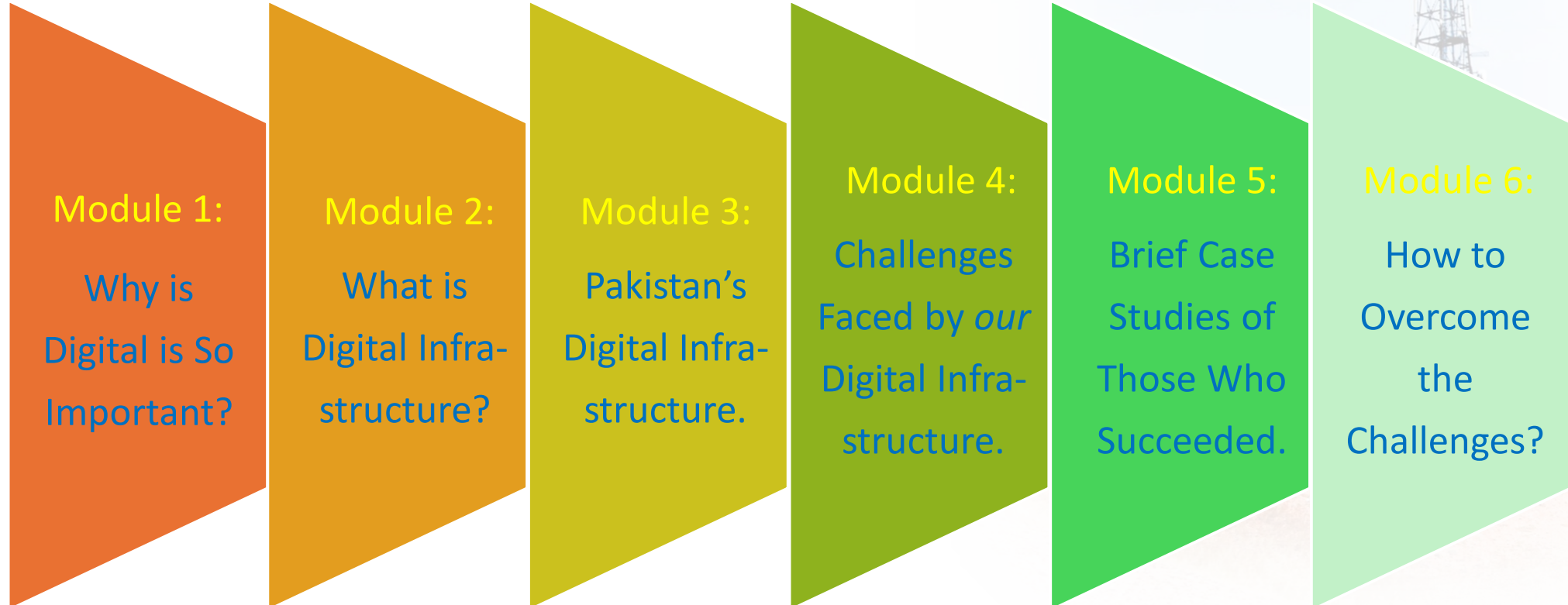
Digital Infrastructure

5G

Agenda – Why this conversation?

Digital Transformation is necessary to leapfrog to the next level of economic development.

But Digital Transformation is impossible without Digital Infrastructure. *Nothing* Digital runs without Digital Infrastructure. Against this backdrop, we will discuss the following:



A hand holding a smartphone is the central focus, set against a vibrant, futuristic digital background. The background is filled with various data visualization elements: bar charts, line graphs, and circular gauges. A prominent circular gauge in the bottom right corner is labeled 'CREDIT SCORE' and shows a green needle pointing towards 'GOOD'. Other elements include a world map with arrows, a DNA helix, and various data points and percentages like '241%'. The overall color palette is dominated by blues and oranges, creating a high-tech, data-driven atmosphere.

Why Digital is So Important?

How Digital helps in Economic Development - 1



Innovation

Platforms like Uber, Airbnb, & Fintech Cos. contribute Blns to global economy

Eg: Gig economy's contribution to U.S. GDP in 2020: around \$1.3 Trln

Competitiveness

80% of countries cite Digital Infrastructure as a key driver in a country's economic competitiveness - *World Economic Forum, 2019*

Digital Infrastructure can improve a country's economic competitiveness by up to 15% - *ITU, 2020*

Jobs

Digital Infrastructure can create up to 2.4 Million new jobs globally (*ITU, 2020*)

Digital Infrastructure can create up to 10% of new jobs in a country

- *Digital Infrastructure Association, 2020*

FDI

Digital facilitates international trade/commerce & enhances the overall business environment & ease of doing business.

70% of investors cite Digital as a key consideration - *fDi Intelligence (FT), 2020*

How Digital Helps in Economic Development - 2

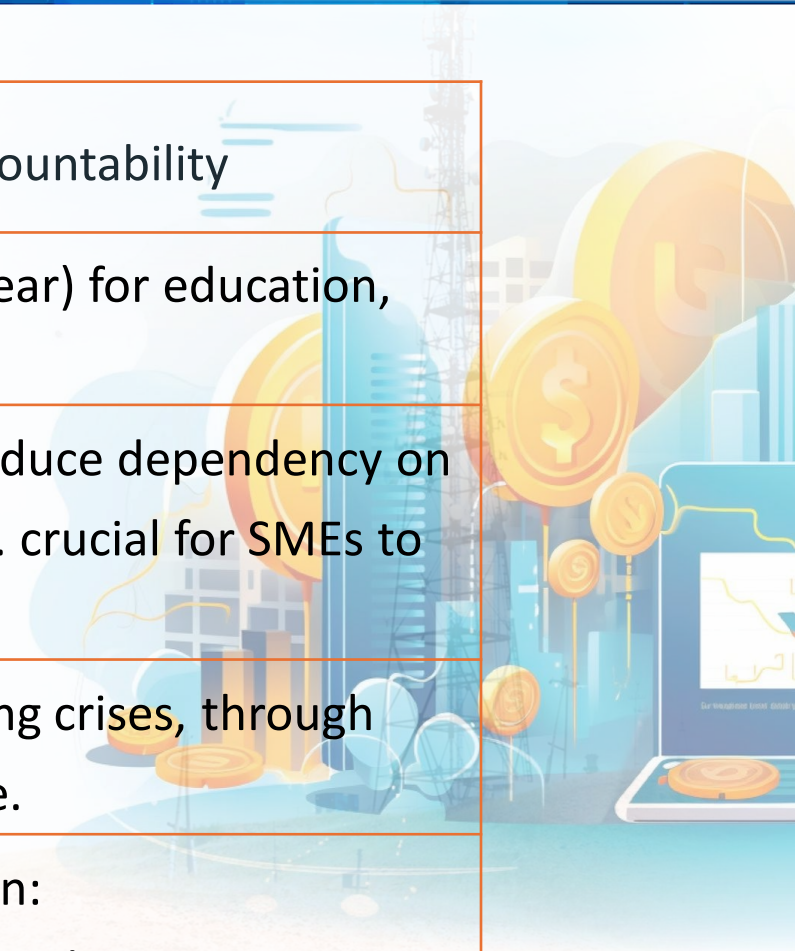
Facilitates Commerce	enabling businesses to reach global markets
Improves Efficiency	streamlining processes, reducing costs, & raising productivity
Drives Economic Growth	supporting startups, entrepreneurship, and innovation
Supports Remote Work	increasing flexibility & workforce participation
Enhances Human Capital	promoting digital literacy and digital skills development

In Pakistan itself:

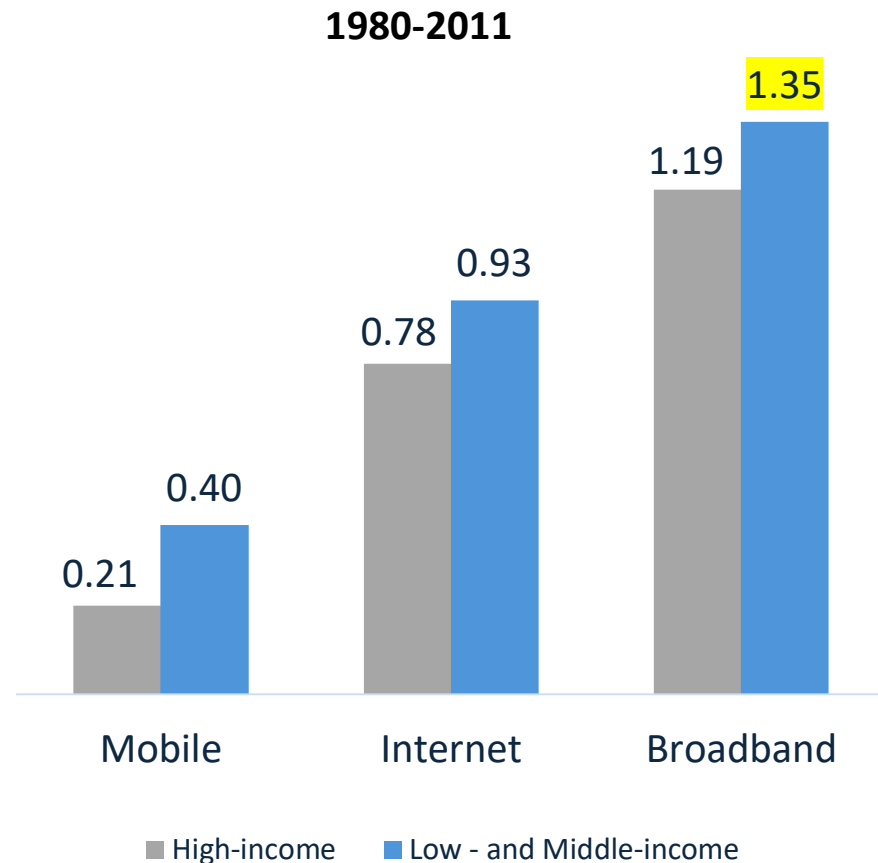
AlphaBeta (commissioned by Google) finds Digital can unlock PKR 9.7 Tr. (\$59.7 billion) worth of annual economic value by 2030.

How Digital Helps in Economic Development - 3

Enhances Govt. Services	improving service delivery, transparency, & accountability
Brings Inclusivity	expanding access to all (rich and poor, far or near) for education, healthcare, & finance
Access to Markets	allow businesses to reach a global audience, reduce dependency on local markets and increase opportunities – esp. crucial for SMEs to compete globally.
Resilience during Crisis	allows economies to continue functioning during crises, through remote work, online education, or e-commerce.
New jobs withing Digital	creates new job opportunities and businesses in: <ul style="list-style-type: none">- Own (Digital Infrastructure) construction & maintenance- in other sectors in delivering services



Digital Infrastructure facilitates Productivity



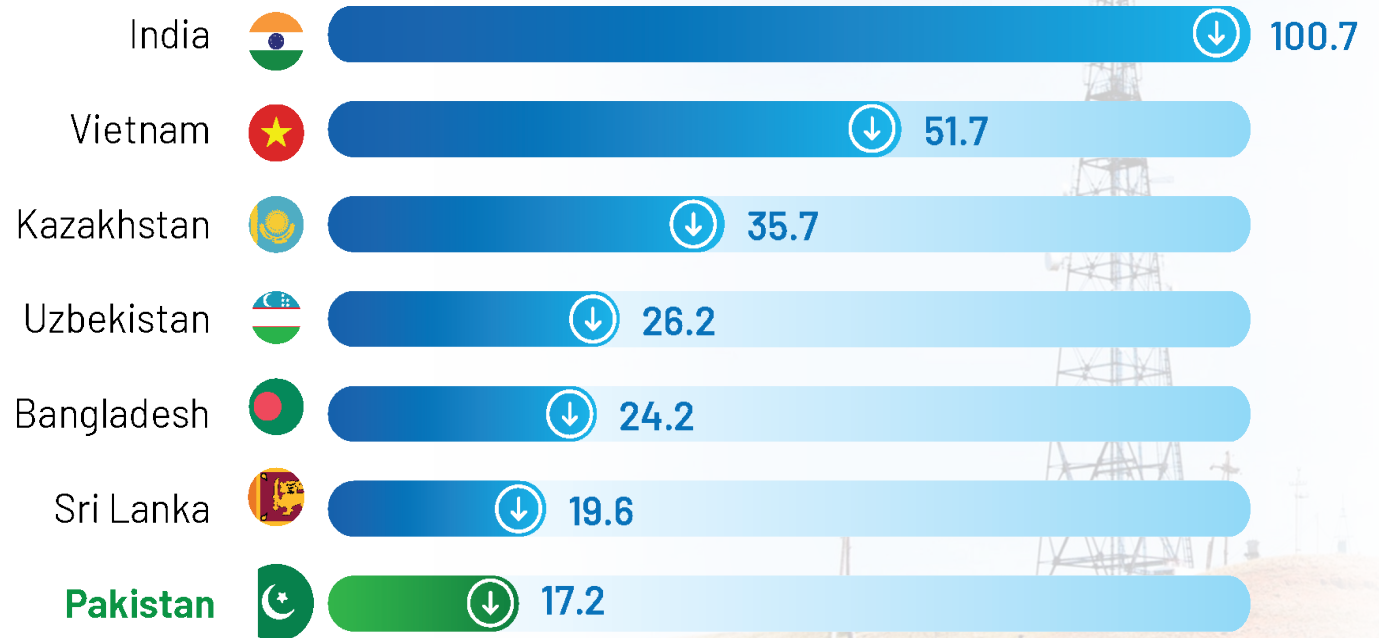
Source: Qiang et al. 2009 and Scott 2012

- 10% increase in Digital Infrastructure investment can lead up to 1.35% increase in **GDP growth** (*World Bank, 2019*)
- Digital Infrastructure can increase **Productivity** by up to 10% (*OECD, 2019*)
- Digital Infrastructure can increase **Productivity** by up to 20% (*McKinsey Global Institute, 2019*)
- Digital Infrastructure can contribute up to 25% of a country's **GDP growth** (*McKinsey, 2019*)

Good Digital Infrastr. Helps Economic Growth!

- The impact of Digital Infrastructure's growth on a macro level is slow, but it is significant in the economy's growth — or inhibition.
- Nearby Examples:
 - Malaysia
 - India
 - Vietnam

Median Internet Download Speeds 2024
(Mbps)

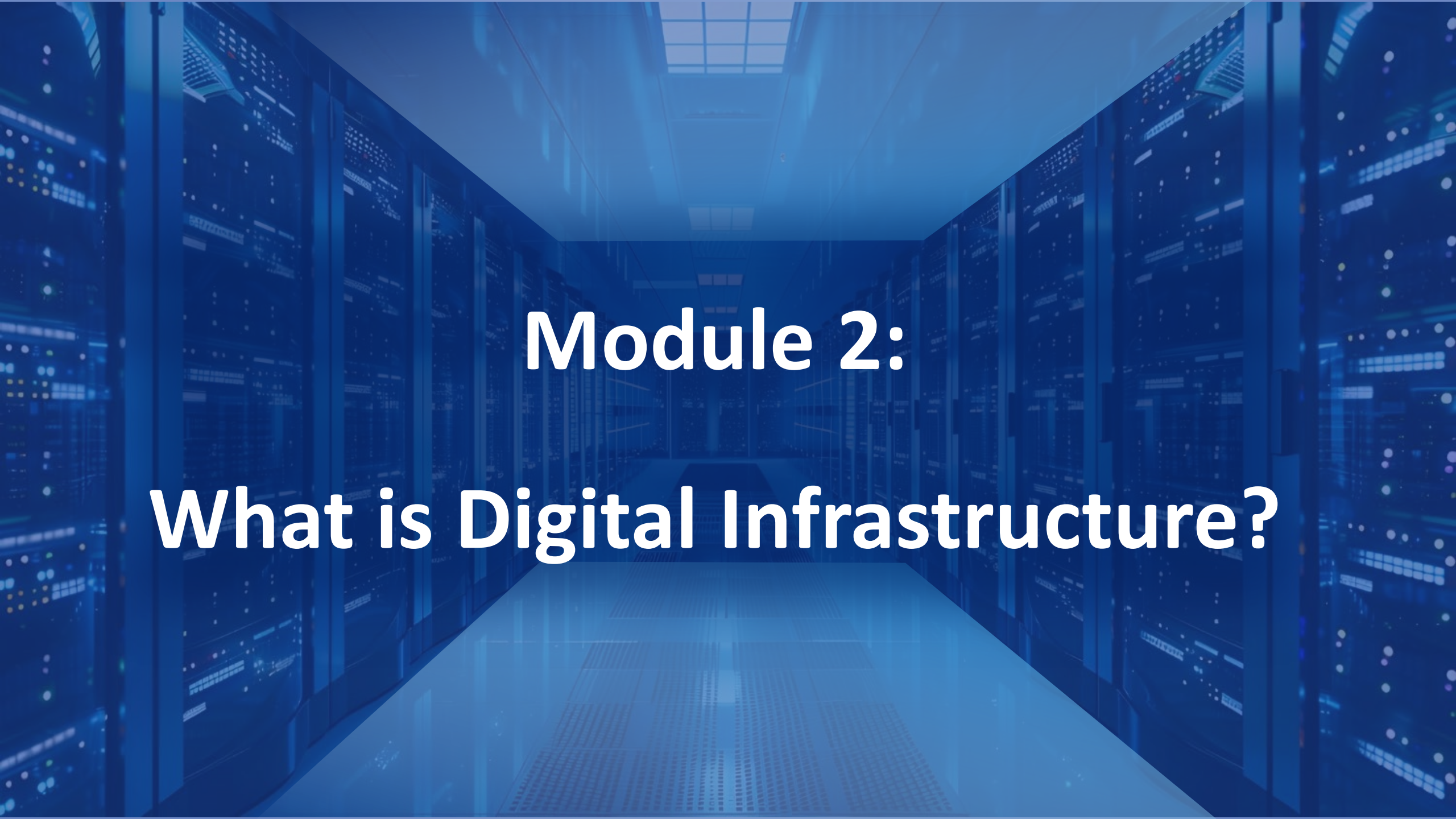


Source: <https://www.speedtest.net/global-index/pakistan#mobile>



Question 1:

What Examples can you think
of from your own daily life?
How is Digital Impacting your
lives?



Module 2:
What is Digital Infrastructure?

The 3 Miles of Digital Infrastructure – simplified

FIRST MILE

Foreign Data Centre
(where content is hosted)



Int'l
Undersea
Cables

Undersea
Cable
Landing
Station



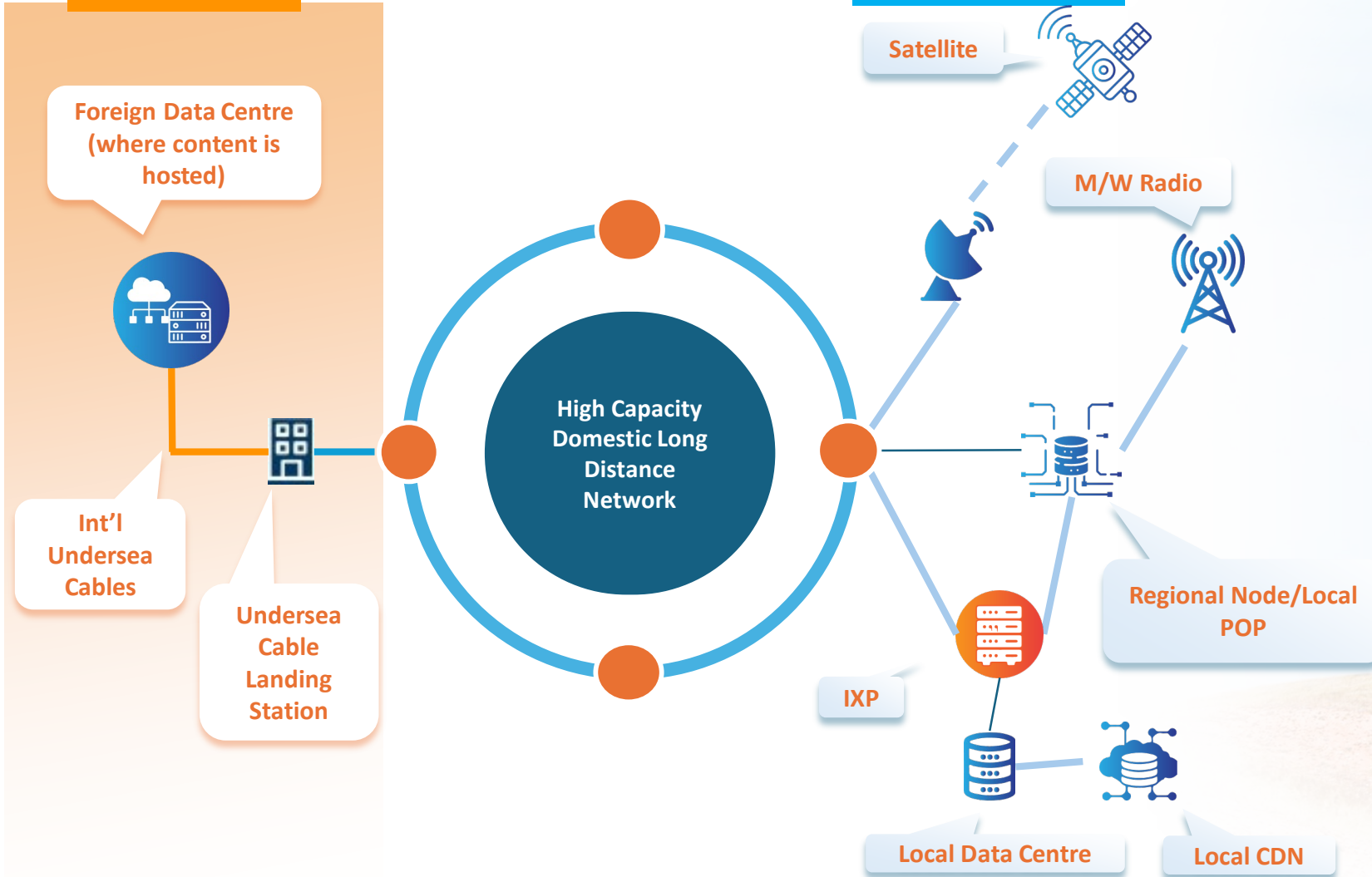
Long Distance International (LDI) Operator



The 3 Miles of Digital Infrastructure – simplified

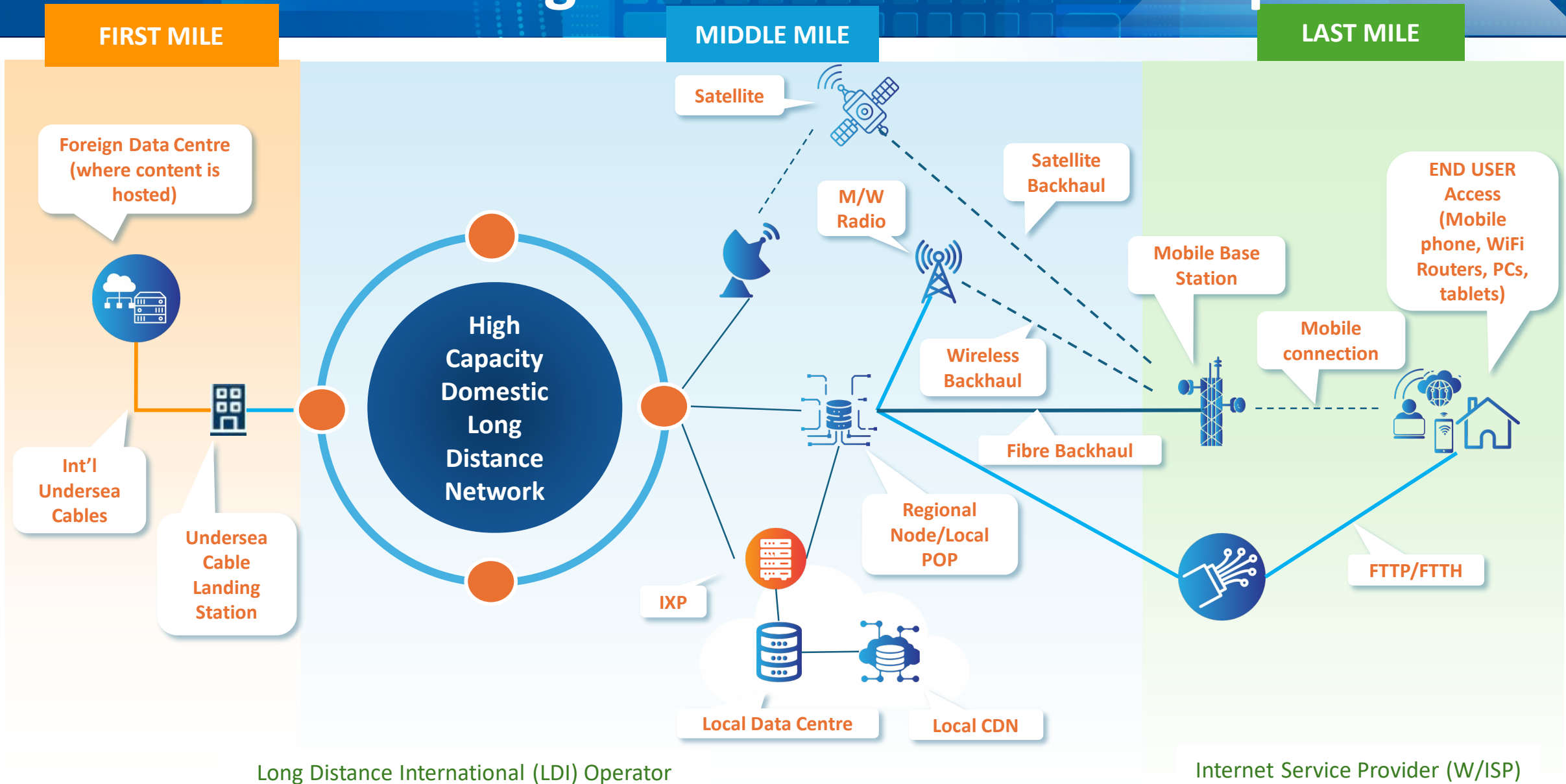
FIRST MILE

MIDDLE MILE



Long Distance International (LDI) Operator

The 3 Miles of Digital Infrastructure – simplified





Question 2:

Out of the 3 "Miles", which
"Mile" do you think needs
the most Attention?

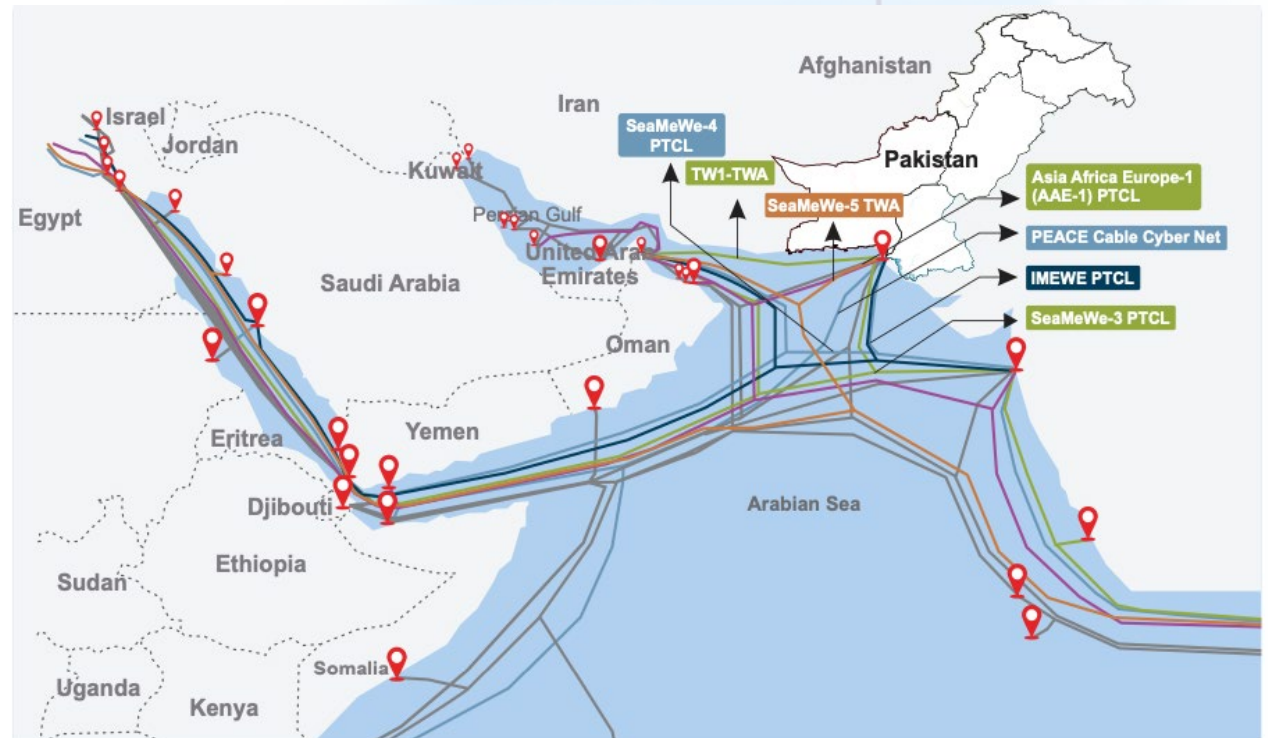
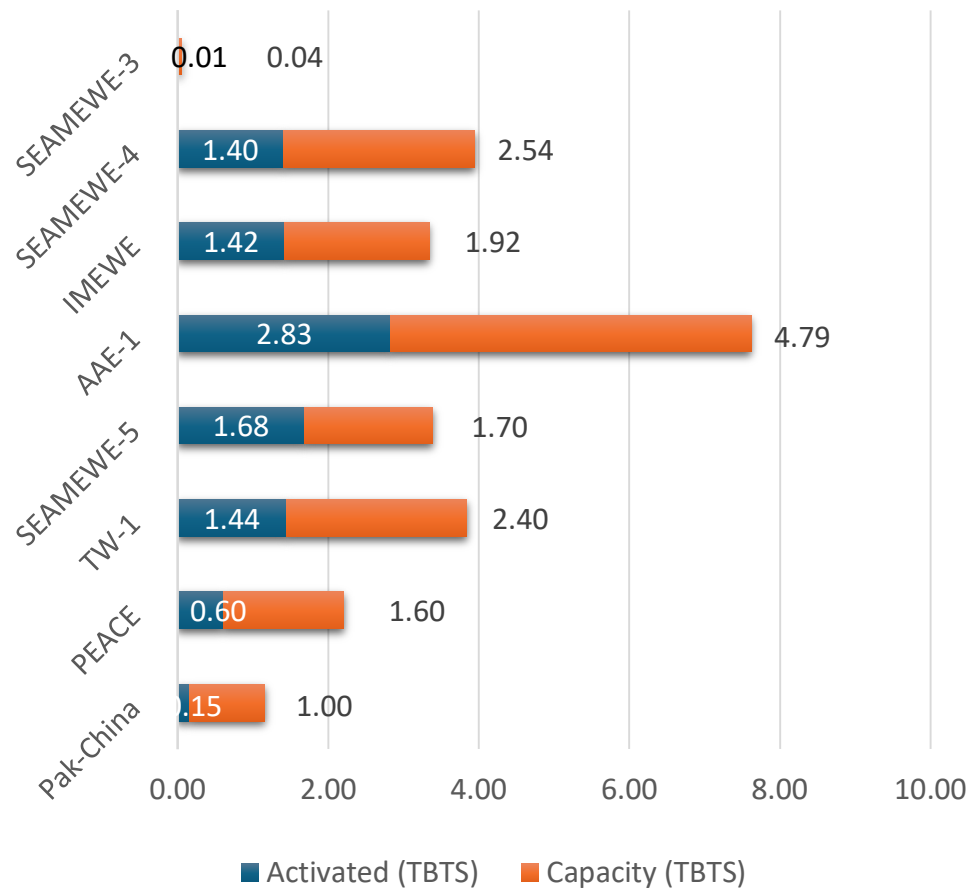
And Why?

The image shows an underwater scene with a large, circular metal structure, likely a cable landing station, in the center. Two thick, braided cables extend from the structure towards the left and right edges of the frame. The water is a deep blue-green color, and there are some white, foamy patches near the top of the structure. The text is overlaid in the center of the image.

Module 3:
Pakistan's Digital
Infrastructure

Pakistan – 1st Mile - International Connectivity

Capacities & Utilisation of International Cables



Source: PTA Annual Report 2022

Total Capacity: 16.0 TBTS
Total Utilised: 09.5 TBTS

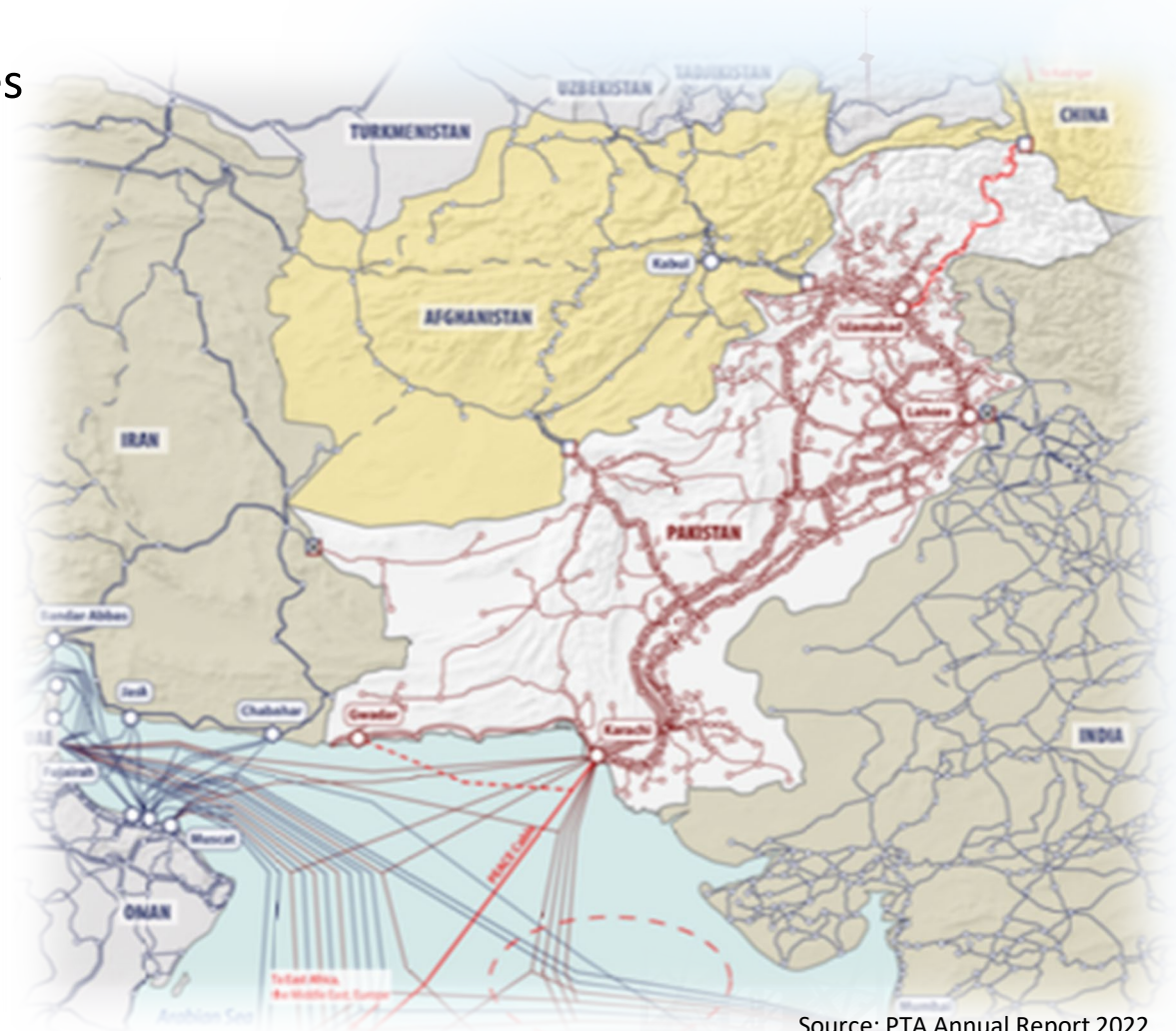
- Under construction:
1. Africa-1
 2. SMW-6
 3. 1Africa

Pakistan – Middle Mile - Domestic Connectivity

~ 125,000 kms long distance Optic Fibre Cables
+ ~ 90,000 kms metro Optic Fibre Cables
(incl: USF-subsidised 6,447 kms connecting 26
unserved THQs & 26 other small towns).

Major Fibre Operators:

1. PTCL (27%)
2. Wateen (25%)
3. CM Pak (14%)
4. LinkDotNet (Jazz) (11%)
5. Telenor (11%)
6. Mutinet (5%)
7. NTC (4%)
8. CyberNet



Source: PTA Annual Report 2022

Pakistan Internet Exchange Points & Data Centres

IXPs

Operators connected to IXPs in Pakistan

Islamabad 2017	Karachi 2019	Lahore 2023
Cybernet	Connect Comm.	Brain Net
Multinet	Cybernet	Connect Tel
Nayatel	GCS	Cybernet
PERN	Multinet	KK Networks
PTCL	PERN	Multinet
Telenor	Satcom	NexLinx
Virtuary	Telenor	PITB
Wateen	TWA	TWA
WiTribe	Wateen	Wateen
TWA		Telenor
Worldcall	-	-

Sub-optimal use of the 3 IXPs in Pakistan.

Reasons:

- Operators' Mistrust
- IXPs late implementation
- Larger Operators avoid "giving advantage" to smaller ones

Data Centres

Approx. 22 Data Centres across Pakistan

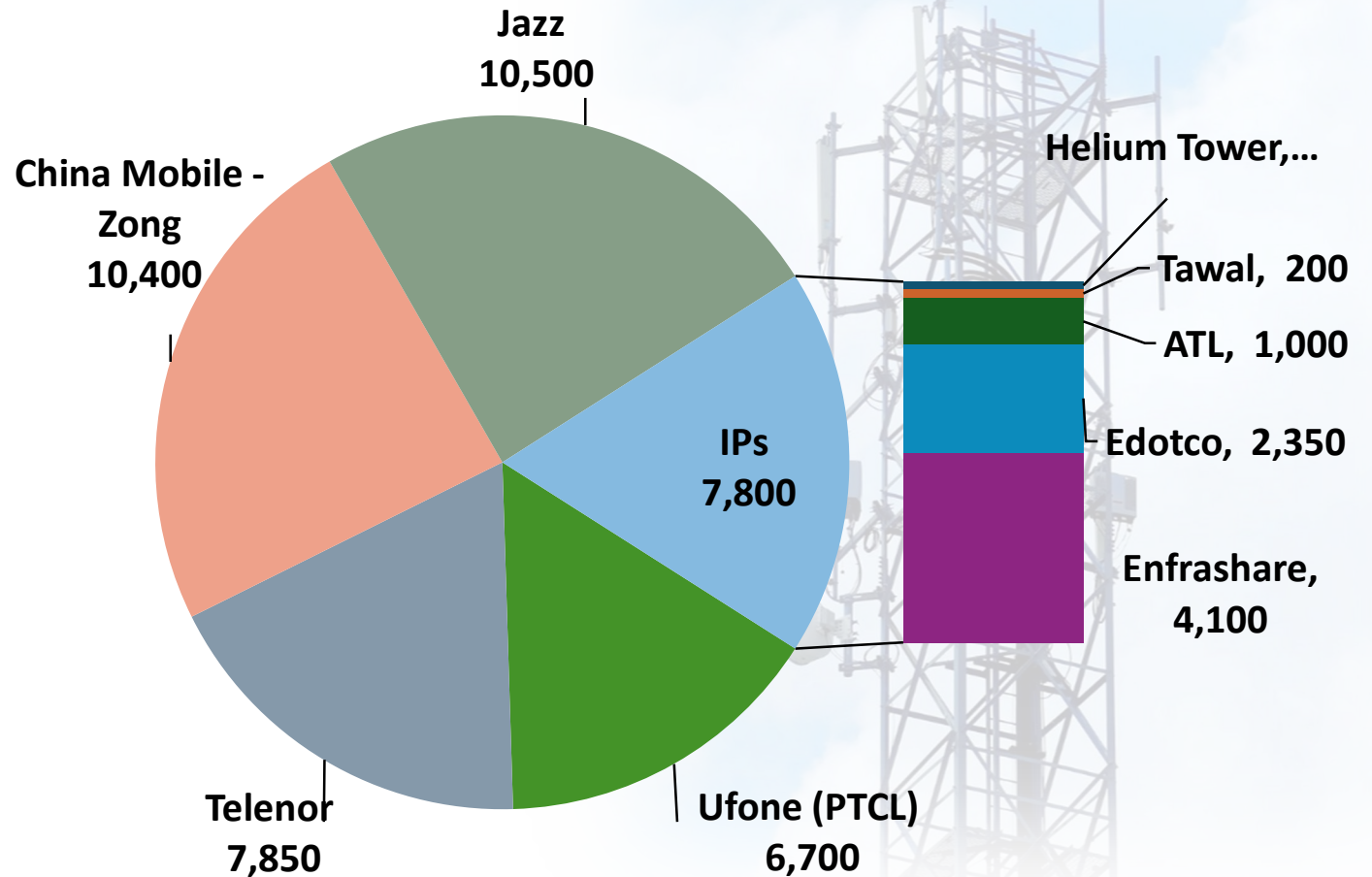
- 15 with International Certifications
- Owners: Telcos & other Large Orgs.

No global "Carrier-Neutral" Data Centre (like AWS, MS, etc.) because:

- General Uncertainty
- Unstable Power supply
- Security Issues
- Internet Shutdowns/Slowdowns
- Lack of Locally hosted Content (eg: PakWheels)
- Lack of Robust Digital Infrastructure (OFCs)

Pakistan – Last Mile - User Access

- Till recently, every Mobile Operator installed his own Towers – thus, multiple towers at every site
- Outsourcing to “Infrastructure Providers” started very recently

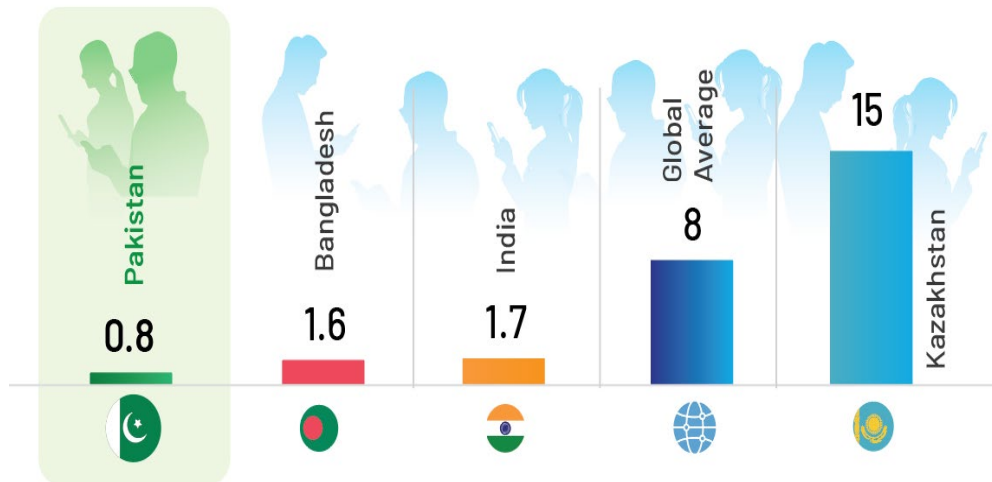


Only 18% Mobile Towers belong to “Infrastructure Providers” (IPs) in Pakistan

+ive: One of the Most Affordable Networks

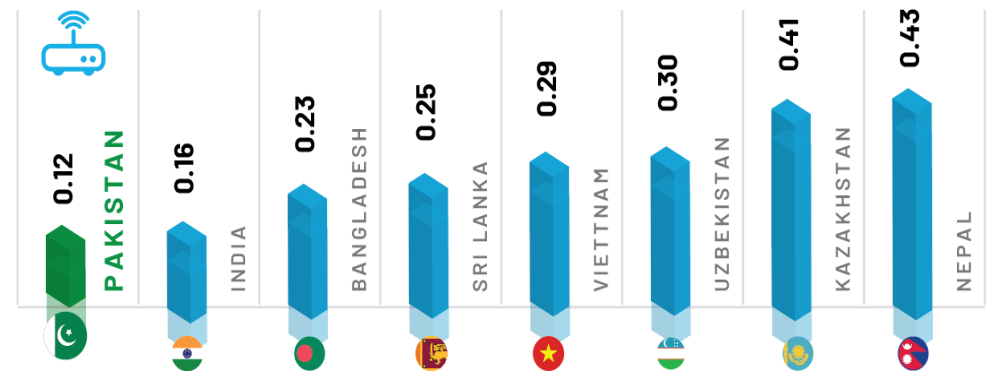
Voice

Average Revenue per User (ARPU US\$)



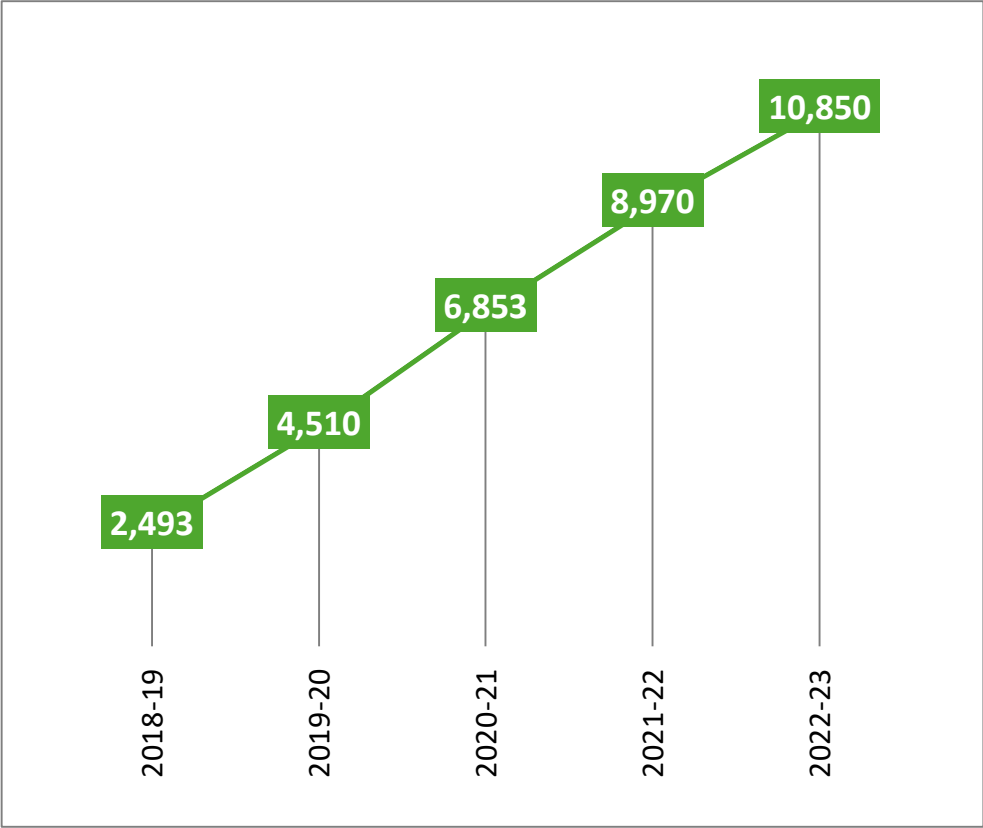
Data

Cost of 1 GB Data Mobile Broadband (US\$)

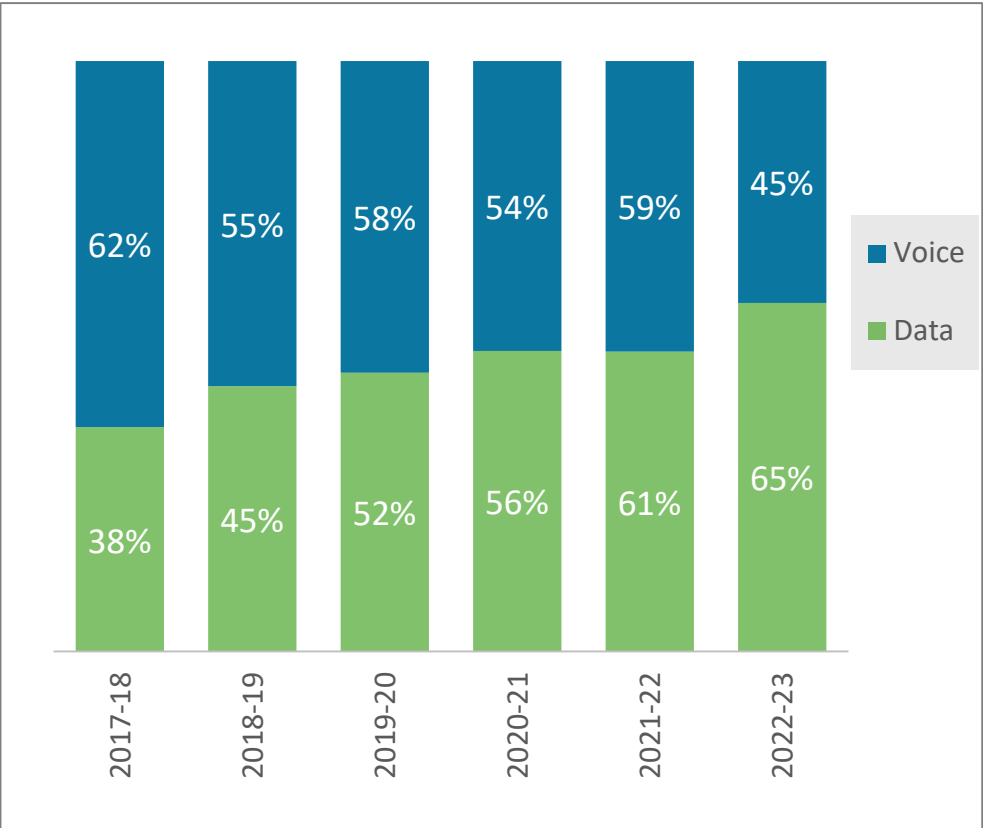


+ive: Appetite for Data Consumption

Growing Mobile Data Usage
(Petabytes)



Growing Share of Data Revenue in
Total Cellular Mobile Revenue

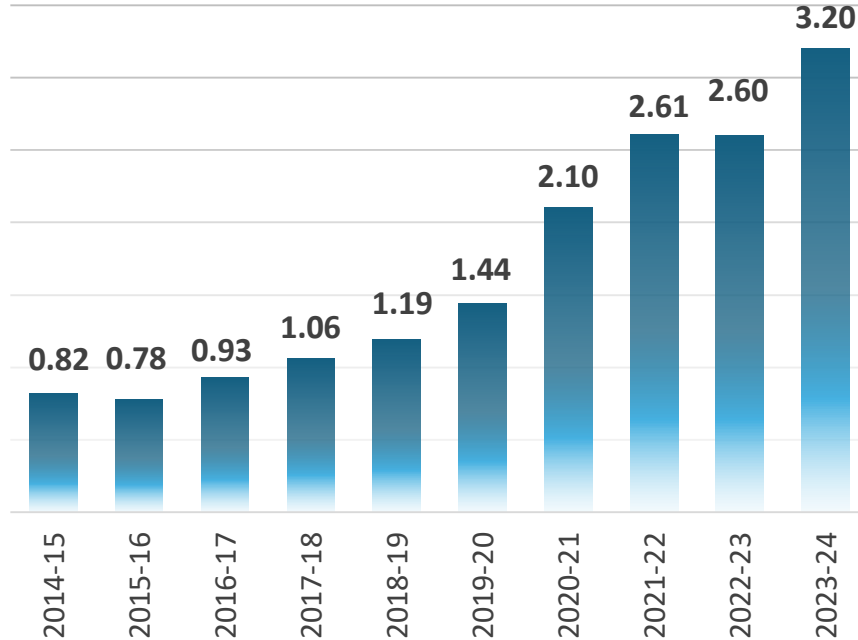


Source: PTA Website, 10-Oct. 2024

+ive: Digital Exports Growing

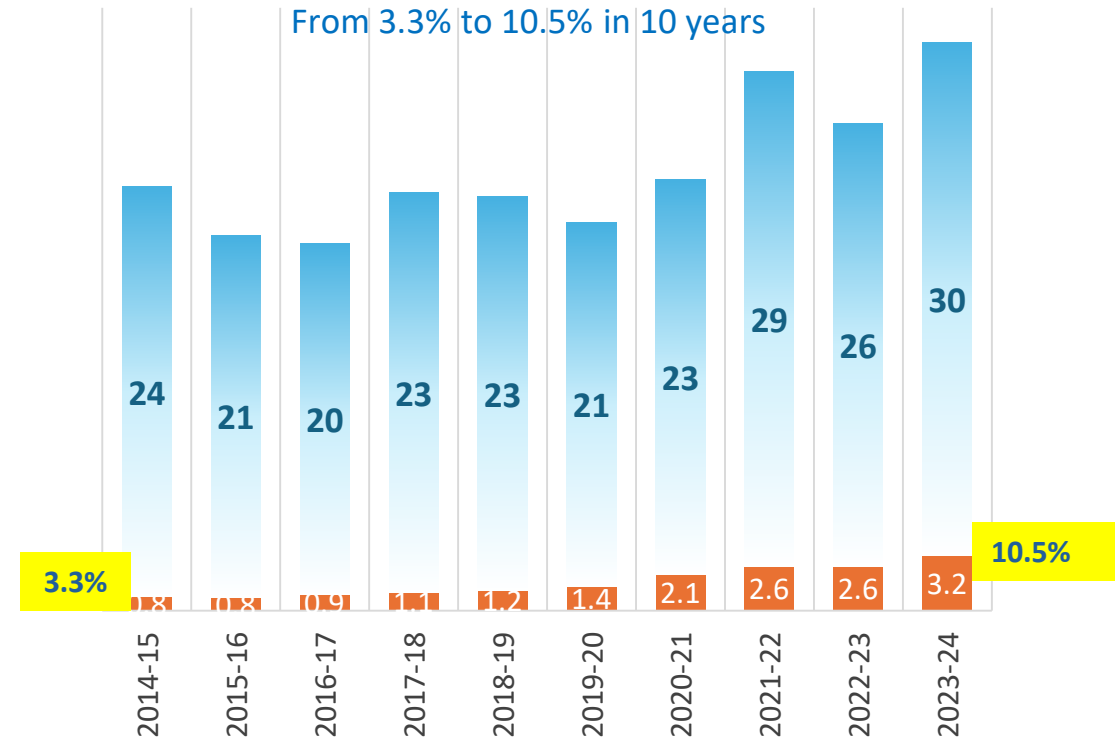
Digital Export Earnings (USD\$ Billions)

400% growth in 10 years



Growing part of IT Exports in Total Exports (US\$ Billions)

From 3.3% to 10.5% in 10 years




Source: SBP

https://www.sbp.org.pk/departments/stats/Annual_Export_Receipt/FY23/1.1.pdf



Question 3:

Are you satisfied with
the quality of service of
your Internet?



Module 4

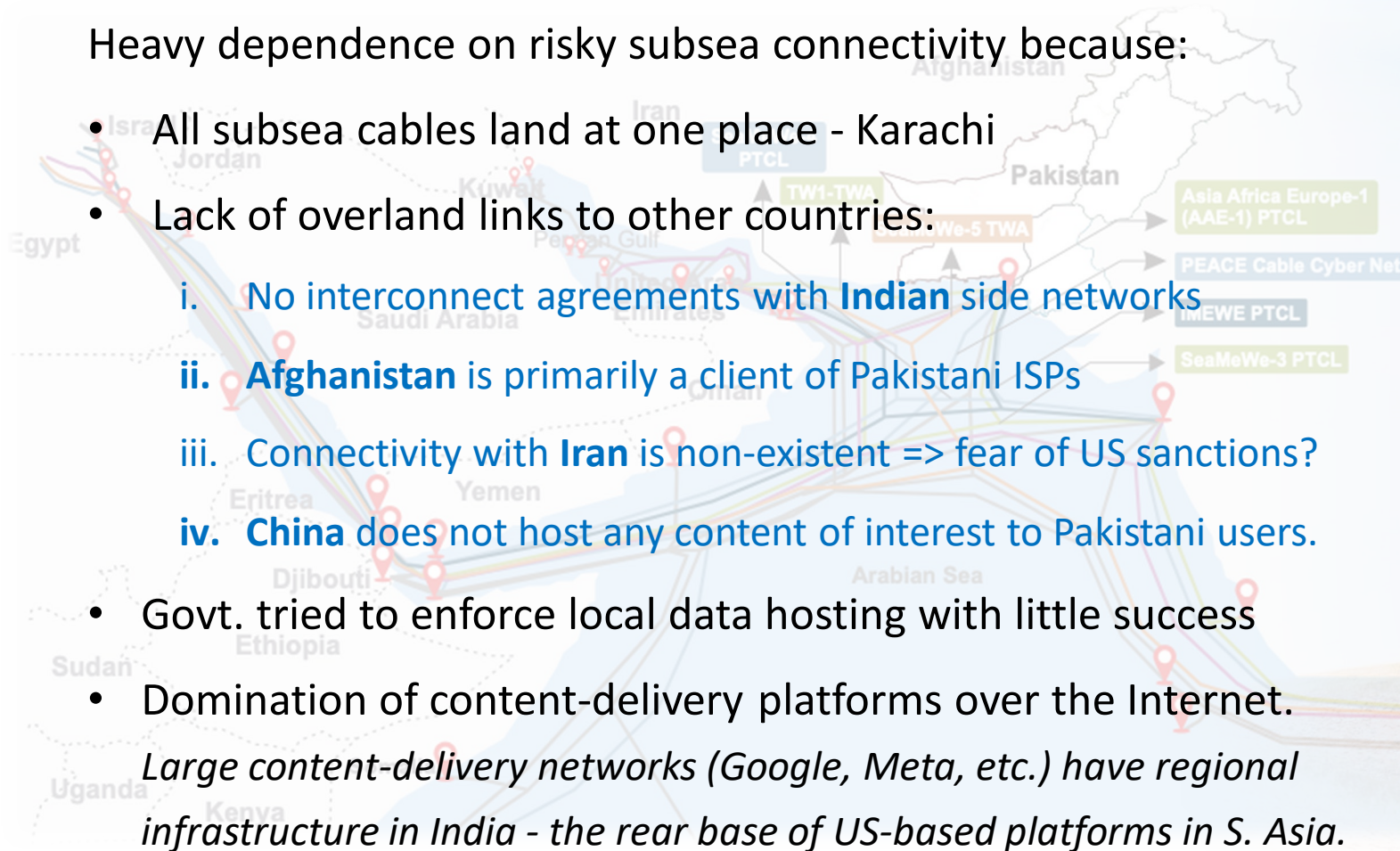
Challenges faced by our Digital Infrastructure

Pakistan 1st Mile Challenges

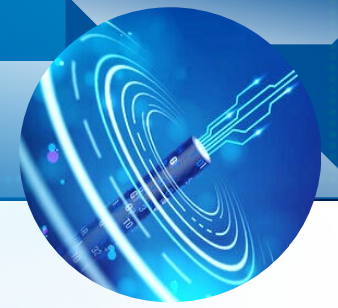
Heavy dependence on risky subsea connectivity because:

- All subsea cables land at one place - Karachi
- Lack of overland links to other countries:
 - i. No interconnect agreements with **Indian** side networks
 - ii. **Afghanistan** is primarily a client of Pakistani ISPs
 - iii. Connectivity with **Iran** is non-existent => fear of US sanctions?
 - iv. **China** does not host any content of interest to Pakistani users.
- Govt. tried to enforce local data hosting with little success
- Domination of content-delivery platforms over the Internet.

Large content-delivery networks (Google, Meta, etc.) have regional infrastructure in India - the rear base of US-based platforms in S. Asia.



Pakistan Middle Mile Challenges



Domestic connectivity is concentrated north-south corridor along the Indus.

Only 6 countrywide Long-Distance Fibre networks because:

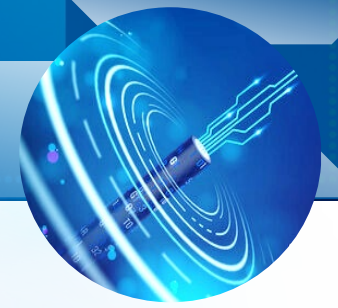
- high investment with slow rate of return
- high taxes/duties on fibre cables & associated eqpt.
- instability – esp. in western provinces.
- difficulties of getting right-of-way (RoW) from rent-seeking RoW owners

A Comparison of RoW Charges

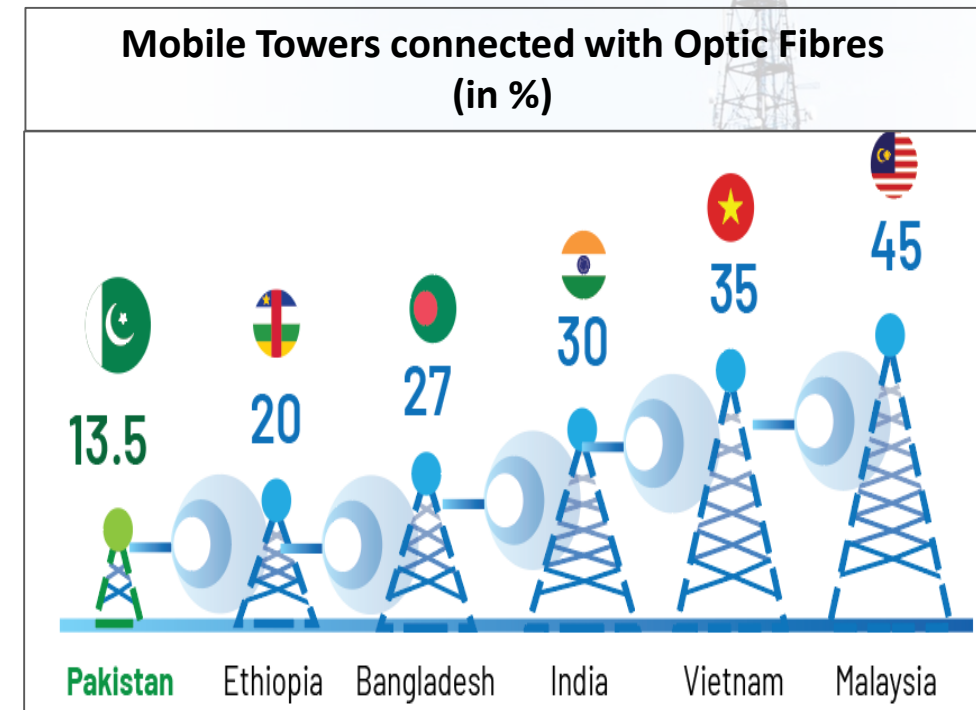
Item	India	Pakistan
For buried cables	INR 1 per meter, only ONCE	PkR 35 – 60 per meter, EVERY YEAR
For Mobile Towers	INR 10,000, only ONCE	PkR 240,000 EVERY YEAR
Below the surface boring	ZERO	PkR 300 – 500 per meter
For use of street poles	INR 150 (rural) 300 (urban) per yr	PkR 240,000 per year
Single Window	Yes	No

INR 1 = PKR 3.30

Pakistan Last Mile Challenges



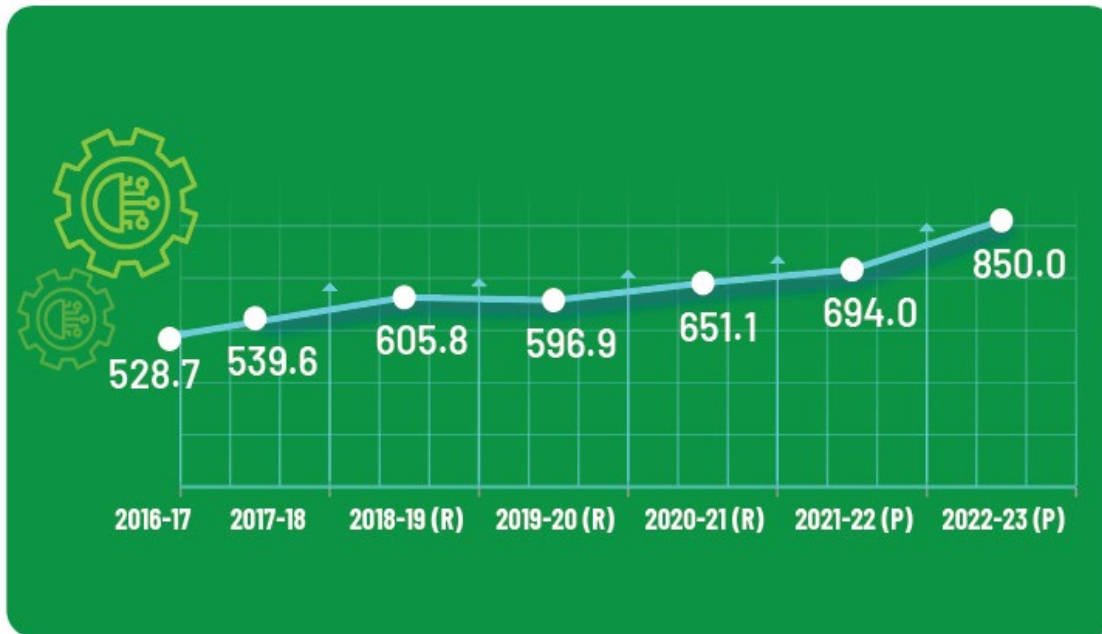
- 97% of Internet subscriptions are Mobile
- Good quality Mobile Internet needs fibre backhaul, but only 13.5% Towers connected with fibres.
- Only 1% end-users connected with Fibre-to-the-Home (FTTH) - roughly 1/3rd of the Asia-Pacific average
- All FTTH only in affluent localities of big cities
- In 2nd/3rd tier cities, fibres only in main Commercial areas
- Reasons are the same as in 2nd Mile



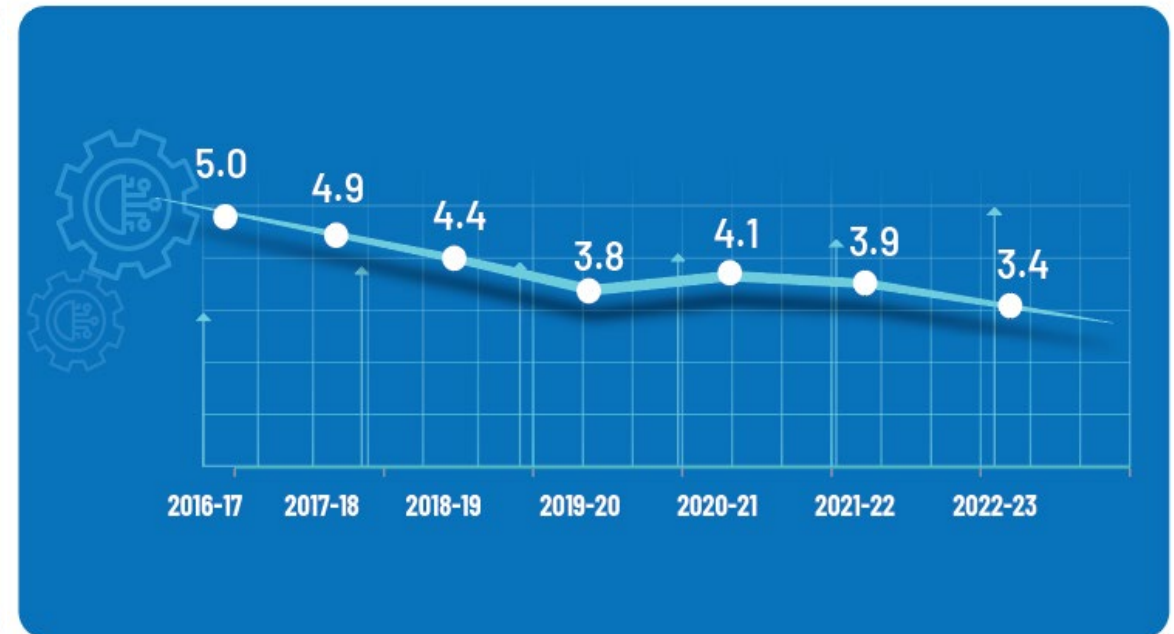
Declining Revenues Challenge

In Real Terms, Telco Revenues are declining

Annual Revenues in Million PkRs



Annual Revenues Converted in Billion US\$



Source: PTA, <https://www.exchangerates.org.uk/USD-PKR-exchange-rate-history.html>

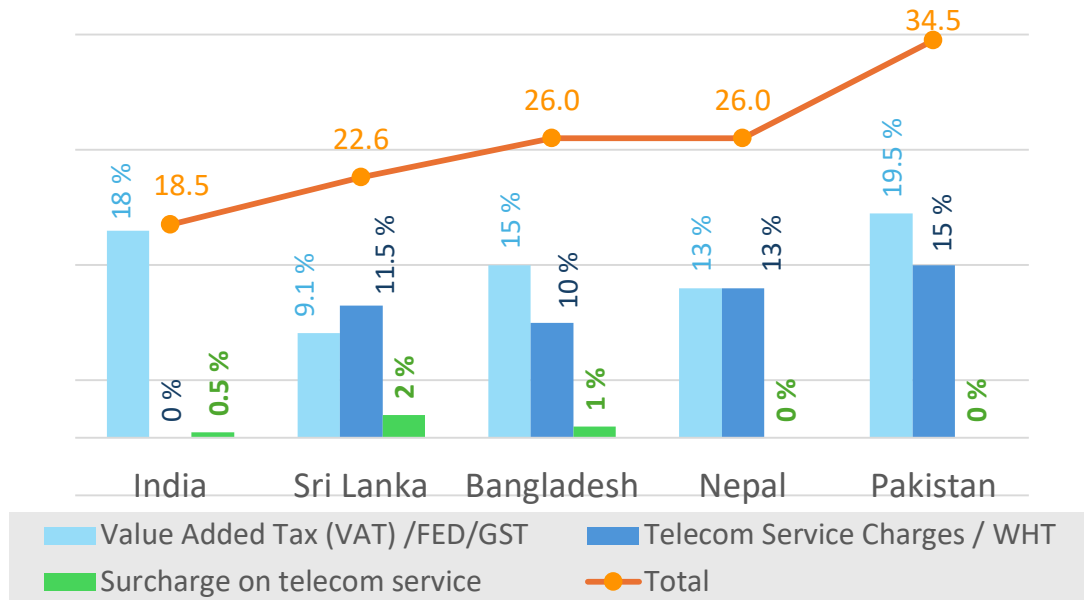
Note: PTA PkR figures converted in USDs using average USD rates of respective years:

2016-17: **104.73**, 2017-18: **109.90**, 2018-19: **136.14**, 2019-20: **158.34**, 2020-21: **159.94**, 2021-22: **177.67**, 2022-23: **247.72**

High Taxes / Costs Challenge

- Dig Infra/service providers are heavily taxed

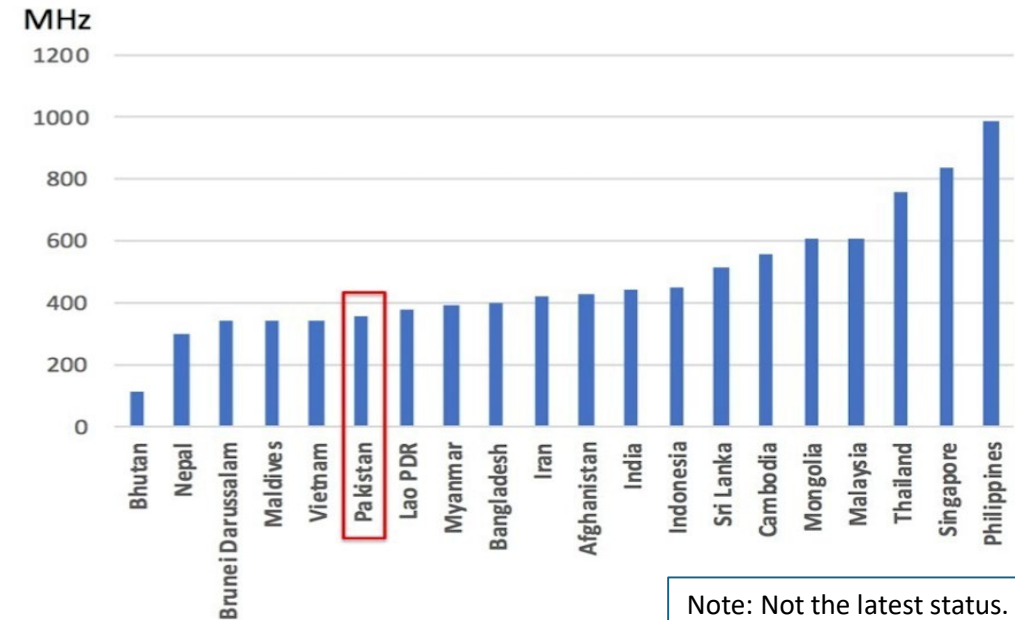
Comparison of Digital Usage Taxes



- Despite over 2 decades old decision Telcos still pay Commercial Tariffs for Electricity - not Industrial.

- Spectrum is offered at a cost that wireless Telcos cannot afford, making Pakistan one of the most spectrum-starved countries.

Comparison of Allocated Spectrum



Note: Not the latest status.

Internet Shutdowns and Slowdowns Challenge

The Economic Cost of Internet Closures is **PKR 1.3 Billion per day.**

- *Pakistan Institute of Development Economics*

PIDE THE ECONOMIC COST OF INTERNET CLOSURE
Pakistan Institute of Development Economics

Dr. Nadeem Ul Haque, VC Pakistan Institute of Development Economics (PIDE), Islamabad
 Mohammad Shaaf Najib, Research Fellow, (PIDE)
 Mohsin Ali, Graphic Designer, (PIDE)

Due to closure of 3G/4G services in the country, businesses face a direct loss of

PKR 1.3 billion OR **0.57%** of daily GDP **Per day**

while the indirect loss faced by businesses and economic agents due to the loss of these activities is beyond this and unaccounted for. Details of these are shared ahead.

Telecommunication Sector Closure of 3G/4G Internet Services **Total Loss PKR 450 million**

Source: As per information provided by the industry

Financial Sector Unable to process POS Transactions through debit/credit card **Total Loss in transaction value PKR 325 million**

Source: <https://www.dawn.com/news/1702314>

Method	Volume Change	Value Change
Via 1Link	45% ↓ From 127,000 (daily average) to 68,000	46% ↓ from PKR 606 million to PKR 330 million
Via PayPak	52% ↓ from over 34,000 to 18,000	56% ↓ from almost PKR 111 million to PKR 62 million

Online Cab Services Unable to book rides **97% ↓** Reduction in number of rides **Loss of Business PKR 29.1 to 32.7 million**

Source: Author calculations based on information provided by the industry

Average daily rides: **40,000 to 45,000**
 Average daily rides on days with 3G/4G closure: **1,200 to 1,350**
 Assuming average ride cost of **PKR 750**

Online Food Delivery Services **75% ↓** Reduction in number of orders **Loss of Business PKR 135 million**

Source: Author calculations based on information provided by the industry

Unable to place orders to restaurants through online food delivery apps
 Average daily orders: **200,000**
 Average daily orders on days with 3G/4G closure: **50,000**
 Average order value: **PKR 900**

Freelancing Services **\$0.5 billion** Annual Revenue earned from Freelancing Services **\$1.37 million** Daily Average of Revenue Earned **Loss of Earning PKR 390 million**

Denial of orders to Pakistan based freelance workers due to internet disruptions **Using \$1= PKR 285**

In addition to the aforementioned economic costs, the following additional loss was also faced by the economy on a daily basis due to road closures as a result of protests; on the days 3G/4G internet services were also shut down:

Commercial Inter-City Public Transport Services **Loss of Revenue PKR 400 to 500 million**

Source: Author calculations based on information provided by the industry

Transport unable to serve on routes (pre-dominantly in and through Punjab and KPK areas)

Postal Services & Couriers **2-4 Days** Delivery Delay per consignment

Unable to delivered booked consignments on time

To read more about the Economic Costs of Political Conflicts, visit: <https://pide.org.pk/research/economic-cost-of-political-conflict-2/>

Impact of Internet Slowdowns and Shutdowns



- **GSMA:** Revenue losses of Digital platforms* in Pakistan, up to 25%
- **Freelancing:** 3 Million Freelancers contributing US\$ 500 Mil/Annum. Platforms like Fiverr & Upwork rank Pakistan lower due to unreliable internet, discouraging international clients from working with Pakistanis.



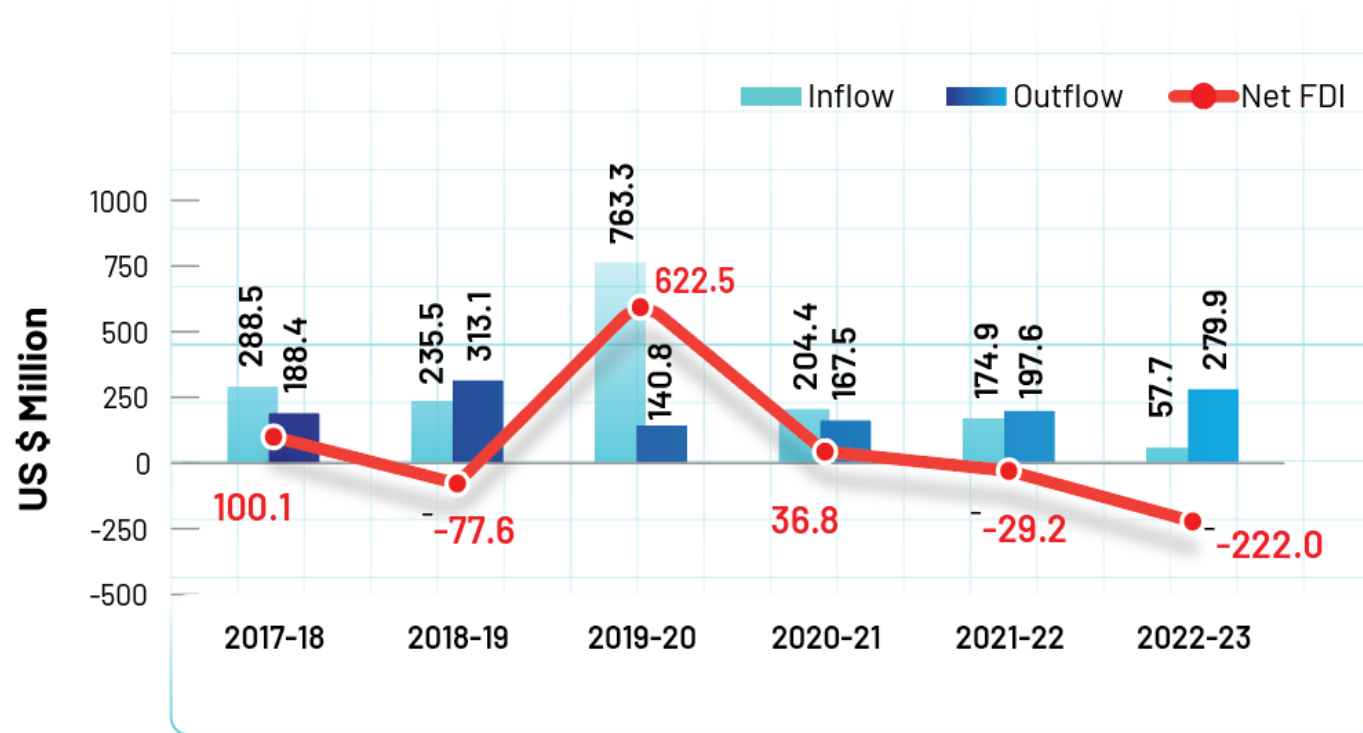
- **Statista:** In 2023 Pakistan ranked 7th globally in economic losses from internet shutdowns costing Pakistan over \$ 237.6 M, affecting 83 M people.
- **SMEs:** Many SMEs in the tech sector have been forced to scale back operations.



- **P@SHA:** e-businesses have experienced revenue losses of \$ 300 M
- Effects extend beyond tech. industry, disrupting daily life and undermining confidence in Pakistan's economic stability, deterring local and foreign investors.

Declining Investments Challenge

FDI in Telecom (US\$ Million)



- Exits by investors, eg:

- Oman Tel (WorldCall)
- Qtel (Burraq/WiTribe)
- Dhabi Group (Warid)
- Telenor

- A slightly more conducive environment can quickly mobilise sizeable private sector capital while also boosting FDI (has happened in the past!)

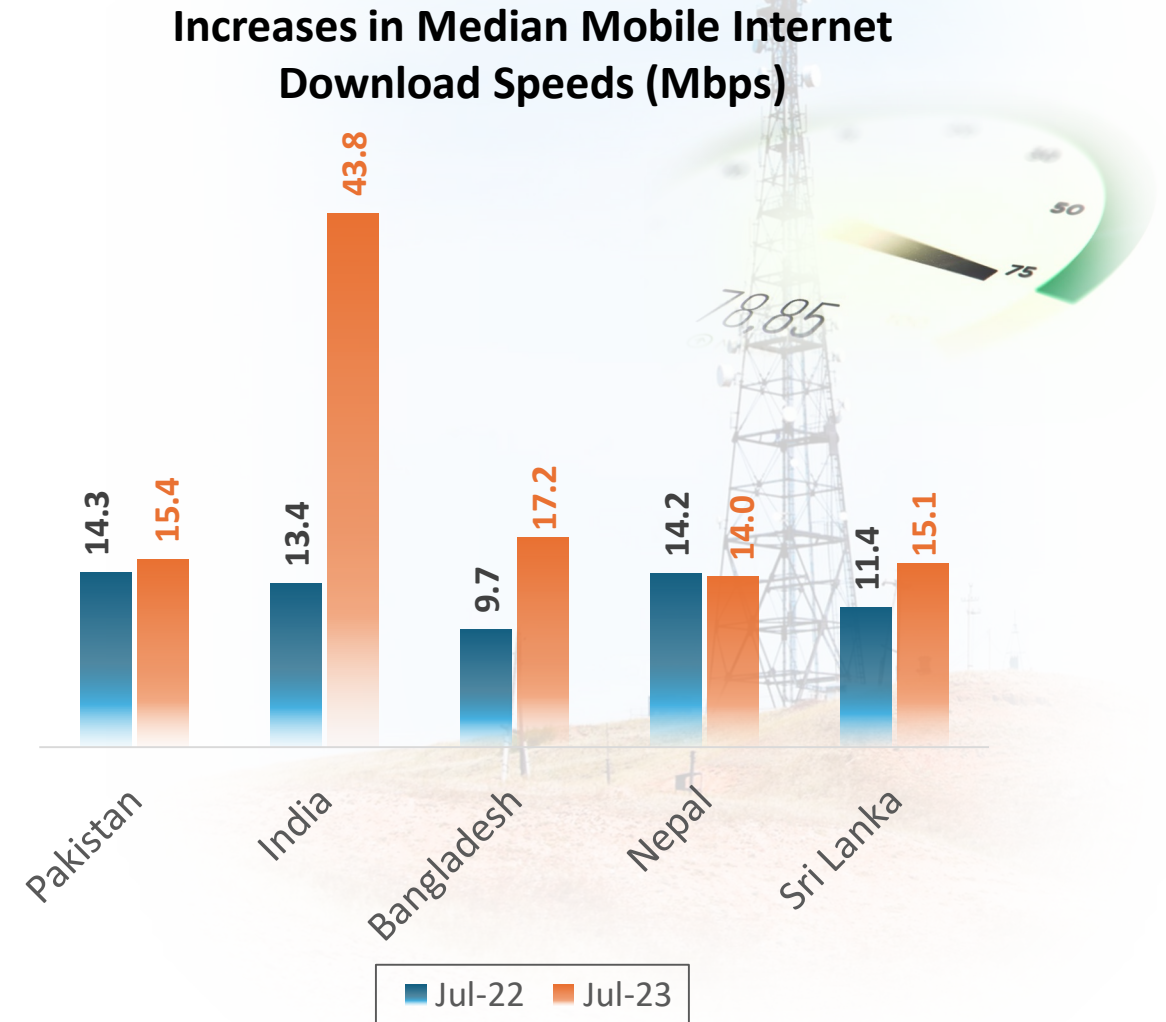
Source: PTA Annual Report 2023, Pg 115.

https://www.pta.gov.pk/assets/media/pta_annual_report_12022024.pdf

Result: Declining Service Quality

Key Findings of a Recent PTA Survey on voice services, webpage loading, and latency.

- No operator met all the required KPIs.
- Most Mobile Operators met Voice KPIs but only partially (call drops and poor call quality persisted)
- Network latency and slow webpage loading times were common in Data services.



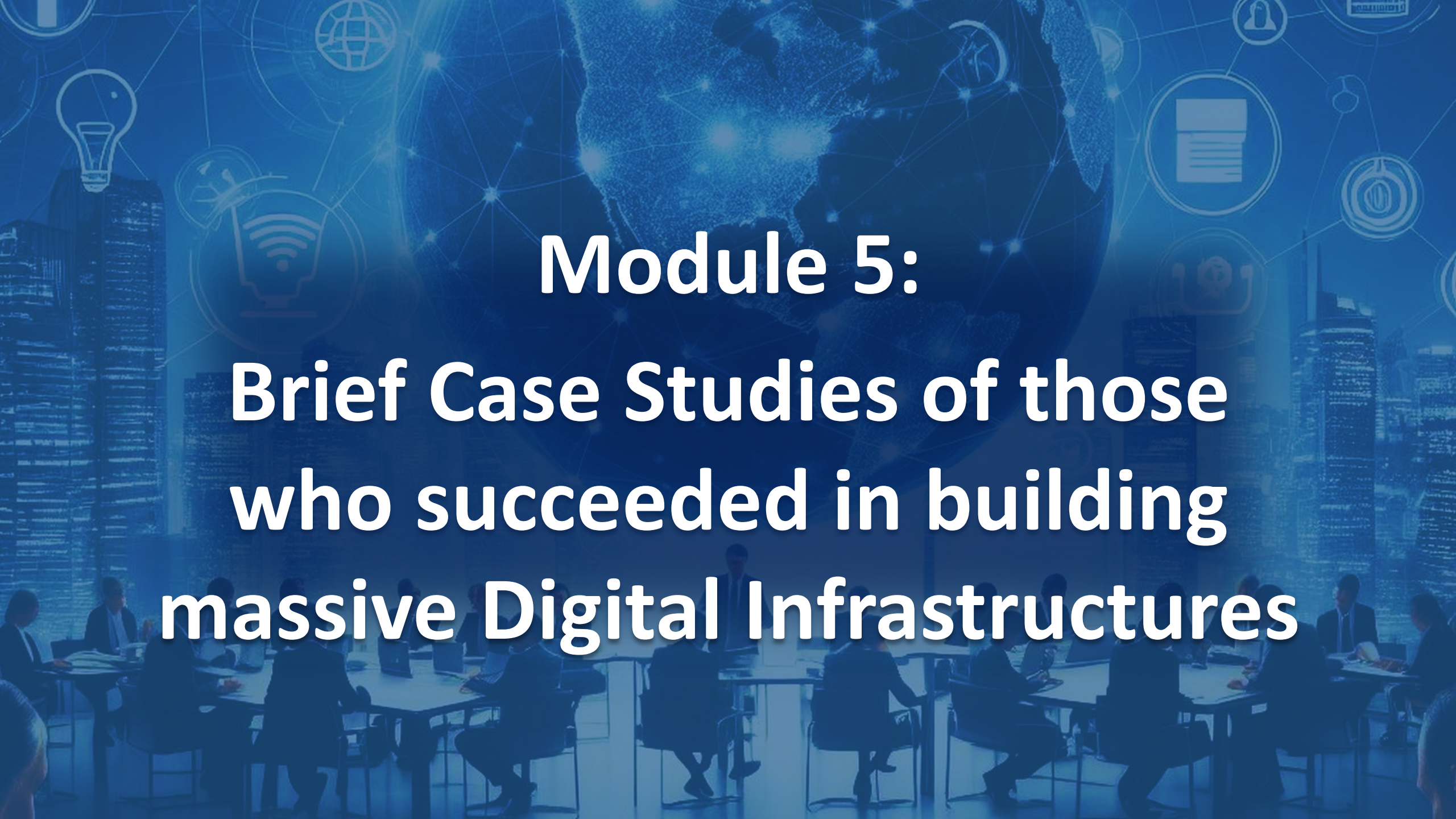
Question 4:

There can be 2 ways to overcome lack of Investment:



- a) State intervenes & Invests on Supply Side in Digital Infrastructure (via Public Sector)
- b) State intervenes to enhance Demand, prompting Investments (via Private Sector)

Which way to go? And Why?



Module 5:
Brief Case Studies of those
who succeeded in building
massive Digital Infrastructures

Brief Case Studies

Long-termism, ie Clear Long-term Policies implemented over periods longer than a Government's tenure



Estonia's digital transformation

Widespread cross-party support for Govt's long-term planning of e-Estonia (launched 2002) is a fundamental constant to make it the most successful digital transformation globally.



IT@School program, Kerala, India

Initiated in 2001 – Successful because of its long-term strategy, which successive Govt's from different political parties continued to support.

Long-term National Plans

- Singapore

- A long-term National Broadband Plan aims affordable 1 GBPS broadband by 2025 for 90% population.
- Some telcos were not getting easy access to underground fibre infrastructure that belonged to incumbent SingTel. A neutral passive infrastructure provider was created. Singapore has now full-fibre coverage.



- China

- From 2016 to 2018, MI IT and NDRC jointly implemented a 3-year action plan to construct Digital Infrastructure, which cost US\$ 170.41 B.
- In 2017, Digital Silk Road (DSR) was launched as part of 'Belt and Road Initiative' to promote digital connectivity among various countries.
- In 2019, China Mobile announced to build 300 "Gigabit Cities," with fixed broadband access.



Ambitious Targets, Public Funding...

- **South Korea**

- 2012 Giga Korea project targets speeds of 1Gbps fixed-line & 100 Mbps wireless connections
- Investments are shared 75% by the govt. and 25% by private sector.
- South Korea's FTTH reach is the highest in the world, at 83%



- **India**

- National Digital Communications Policy 2018 laid long-term Objectives:
 - Universal Broadband at 50Mbps for everyone;
 - USOF funded:
 - 1Gbps to all Gram Panchayats
 - 100Mbps for key development institutions,



Setting Vision and following it up

- Saudi Arabia

- Saudi Arabia's Long-term Vision 2030: National Transformation Programme, National Agenda for Data & AI, & Saudi Data & AI Authority (SDAIA) established.
- King Abdul Aziz City for Science and Technology (KACST) established a Data Analytics and AI Center to provide research environment while the curricula contain programs on machine learning, AI and technology skills.

- UAE

- Among the fastest in 5G index - median speed 421.26 Mbps
- Regional leader in attracting data centre investments - Microsoft, IBM, AWS, have already established Data Centres there.



Pakistan's own experience of Long Termism

- Telecom Deregulation Started in 1990 by “**Pakistan Telecommunication Corporation Ordinance 1990**”
- Followed by “**Pakistan Telecommunications (Re-organisation) Act, 1996**”
- About SIX (6) Governments changed between 1990 and 2008
- However, the same Telecom Policies were followed - and updated - with the basics remaining the same.

Results (2008)








Financial

2008 Total FDI : US\$ 5.4 Billion
Telecom FDI : US\$ 3.4 Billion

Technical

	Country	Teledensity
1	Pakistan	57%
2	Sri Lanka	51%
3	India	24%
4	Bangladesh	19%
5	Nepal	10%

Today Pakistan Lags behind in Global ICT Rankings

Index	Rankings							Pakistan	Total Countries
	 Thailand	 Sri Lanka	 Iran	 India	 Bangladesh	 Nepal	 Myanmar		
Network Readiness Index 2023	42	80	87	60	91	114	-	90	134
ICT Development Index 2023	39	112	75	-	130	-	123	142	169
GSMA Mobile Connectivity 2023	53	113	88	84	122	119	129	137	173
UNDESA E-Govt Development Index 2024	52	98	101	97	100	119	138	136	193
Economist Inclusive Internet Index 2022	40	59	45	50	64	-	69	79	100
UNDESA Telecom Infrastructure Index 2024	38	95	56	135	123	101	122	149	193



Question 5:

Other than “long-termism”,
what other Success Factors
could you recommend?



Module 6:

What needs to be done?

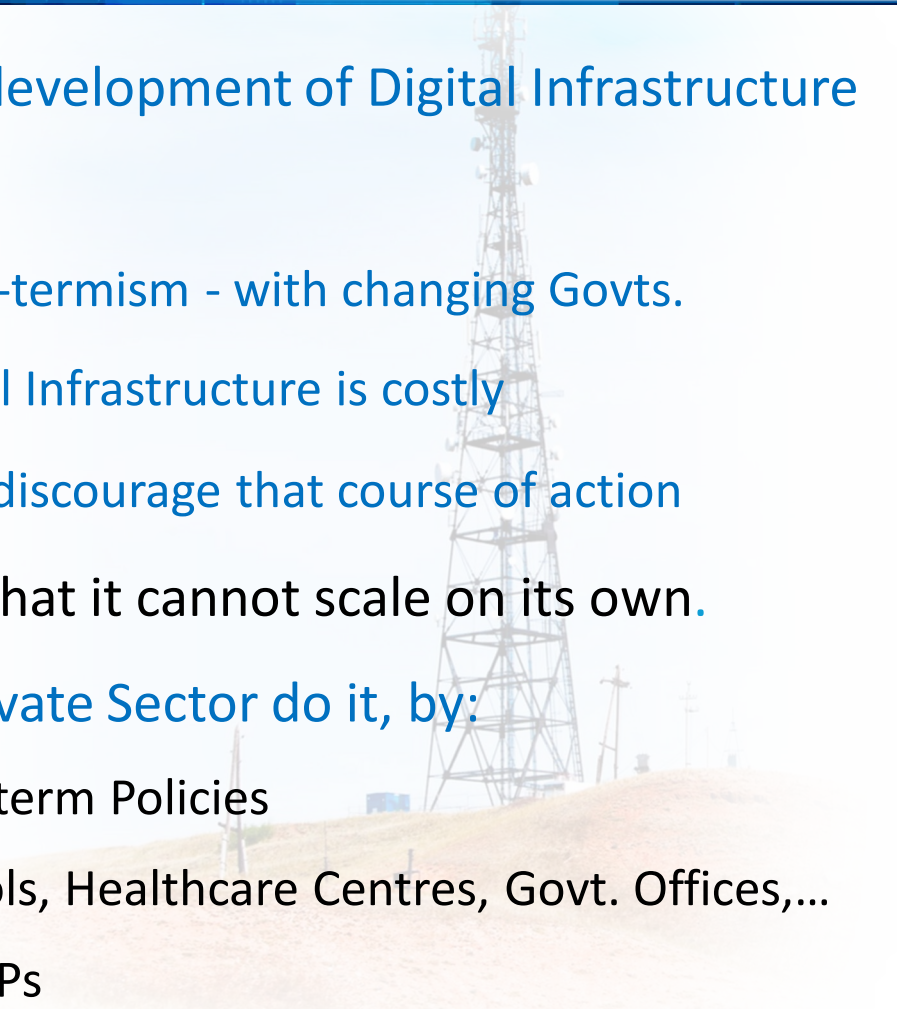
What is it that YOU can do?

We must Leapfrog – But How?

Taking stock of technologies that have been tried and refined elsewhere and implementing the most up-to-date version, skipping over successive technology generations.

Ideally, the State should take over the development of Digital Infrastructure

- However,
 - a) The Public Sector cannot sustain long-termism - with changing Govts.
 - b) The State is cash-strapped, and Digital Infrastructure is costly
 - c) Examples like the Steel Mills and PIA discourage that course of action
- But the Private Sector's weakness is that it cannot scale on its own.
- The only Option left is to **help** the Private Sector do it, by:
 - a) Formulating and Implementing Long-term Policies
 - b) Creating Demand – eg: Fibre to Schools, Healthcare Centres, Govt. Offices,...
 - c) Arranging Catalytic Investments in PPPs



Private Sector “makes too much money”?

- ✓ Firstly, Wealth Creation should not be taken as a negative
- ✓ Investors (esp. Foreign) invest big and put in huge efforts - to earn profits, not for any “social good”!
- ✓ They provide us with vital (digital) services, fiercely competing with each other, under a strong Regulator, offering lowest tariffs in the world. If they still manage to earn, well...
- ✓ If the Investors were making unreasonable Profits, many more investors would flock to Pakistan, and none would exit.
- ✓ Remember, other countries welcome them - even lure them.

Therefore, a Change of Mindset is also needed!



Some basic Policy-level Actions

Reverse Engineer

Any announcement of any high-level Vision (e.g. Tax-to-GDP ratio will be “X”, or IT exports will be “Y”) should lead to reverse engineering in the Business and Policy sectors.
Ask: What do we need to do to get there?

Encourage

Policies should encourage and reward those investing their money and efforts in developing the Digital Infrastructure.

Action Plan

Policies must have Action Plans (unlike Telkom Policy 2015)

Create Space

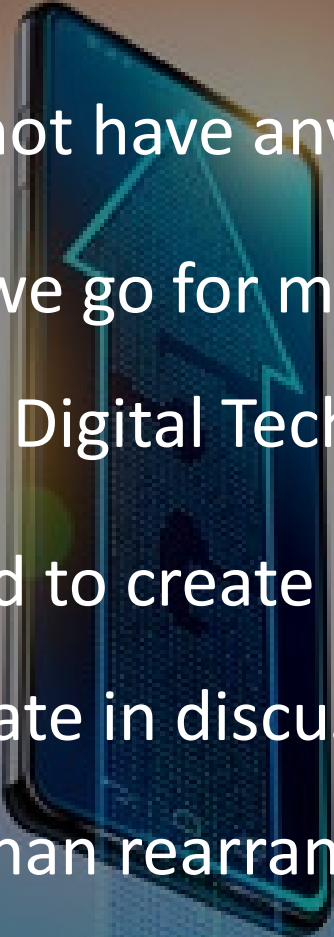
Enable more lending to those who need it and reduce the cost of doing business

Reduce the stranglehold of Rules/Regulations

To unleash creative and innovative energies, introduce some “enlightened” (or “lite-touch”) Regulations



Digital Technology is our/your future

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- We do not have anything else to leapfrog
 - Even if we go for manufacturing, can it be done without Digital Technology?
 - We need to create champions who understand and participate in discussions to grow this country rather than rearranging things on a sliding deck.
 - Your role as Policymakers and Implementors is Key!



Question:

Think!

What can YOU do to help the
growth of
Digital Infrastructure?

Thanks