

INTRODUCTION TO INFRASTRUCTURE

K. M. Mohiuddin Ekram
Lecturer,
Department of Urban and Regional Planning
Khulna University of Engineering and Technology

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1. WHAT IS INFRASTRUCTURE?

- There is no single definition for the term “Infrastructure”. It is a term used in variety of disciplines.
- The “Merriam Webster” dictionary defines infrastructure as “The underlying foundation or basic framework (as of a system or organization)”
- Infrastructure is a category of investment that is generally, but not always, a **public good**. In general, investments in infrastructure either produce services directly for household **consumption** (water, sanitation, social services, telecommunications, electricity) or provide the critical inputs used by enterprises in the **production process** (transport, port facilities, electricity, and information and communications technology [ICT]).

1.1 CLASSIFICATION OF GOODS

There are 4 types of Goods in Economics based on “Excludability” and “Rivalry”:

1. Public Goods
2. Private Goods
3. Club Goods
4. Common Goods

Types of Good (with e.g.)	Excludable	Non-excludable	Rival	Non-Rival
Public Goods (e.g. Fresh Air)		✓		✓
Private Goods (e.g. Food, Cloth)	✓		✓	
Club Goods (e.g. Cable TV)	✓			✓
Common Goods (e.g. River Fish)		✓	✓	

2. ATTRIBUTES OR CHARACTERISTICS

- Infrastructures play role in **Production and consumption**.
- Infrastructure can be evaluated or defined in two dimensions:
Services from physical facilities and **Physical Facility** itself.
- Infrastructure facilities are generally available to **large groups of people**.
- Infrastructure helps deliver **essential services** for the functioning of an organization or society.
- Infrastructure helps achieve **economic and social objectives**.
- Infrastructure is **the base** upon which society and its activities rest.

2. ATTRIBUTES OR CHARACTERISTICS

- As a public good, infrastructure is characterized for the most part by two features: it is mostly **non-rivalrous** (that is, if I use it, I do not limit your capacity to use it), and **non-excludable** (I cannot stop you from using it). Think paved roads or public parks.
- And the production function of infrastructure is often characterized by **economies of scale or increasing returns**, meaning that the more that the good is produced or supplied, the cheaper the marginal cost of producing or supplying it.

3. TYPES OF INFRASTRUCTURE

The World Bank's *World Development Report 2009* defines infrastructure according to three categories:

- **Spatially universal infrastructure**, which includes things that are necessary anywhere people live, such as housing, water, sanitation, and basic social services (e.g., education and health).
- **Economically productive infrastructure**, such as energy, ICT, irrigation, ports, and transport (roads and railways), which can help to facilitate economic growth and employment.
- **Spatially connective infrastructure**, which can include transport modes that connect regions within a country or that facilitate international trade (either cross-border within a region or with global markets)

3. TYPES OF INFRASTRUCTURE

From a broad perspective Infrastructure can be divided in following two groups:

- **Hard Infrastructure:** Refers to the large physical networks necessary for the functioning of a modern industrial nation
- **Soft Infrastructure:** Refers to all the institutions which are required to maintain the economic health, cultural and social standards of a country such as the financial system, the education system, the health care system, the system of government and law enforcement, as well as emergency services.

3. TYPES OF INFRASTRUCTURE

3.1 Hard Infrastructure

1. Transport Infrastructure

1.1 Road and Highway networks

1.2 Mass transit system

1.3 Railway

1.4 Canals

1.5 Sea ports and lighthouse

1.6 Airports including air navigational system

1.7 Bicycle paths and pedestrian walkways

1.8 Ferries

2. Energy Infrastructure

3. Water management infrastructure

4. Communication Infrastructure

5. Solid waste management

6. Earth monitoring and measurement networks

3.2 Soft Infrastructure

1. Governance

Infrastructure

2. Economic Infrastructure

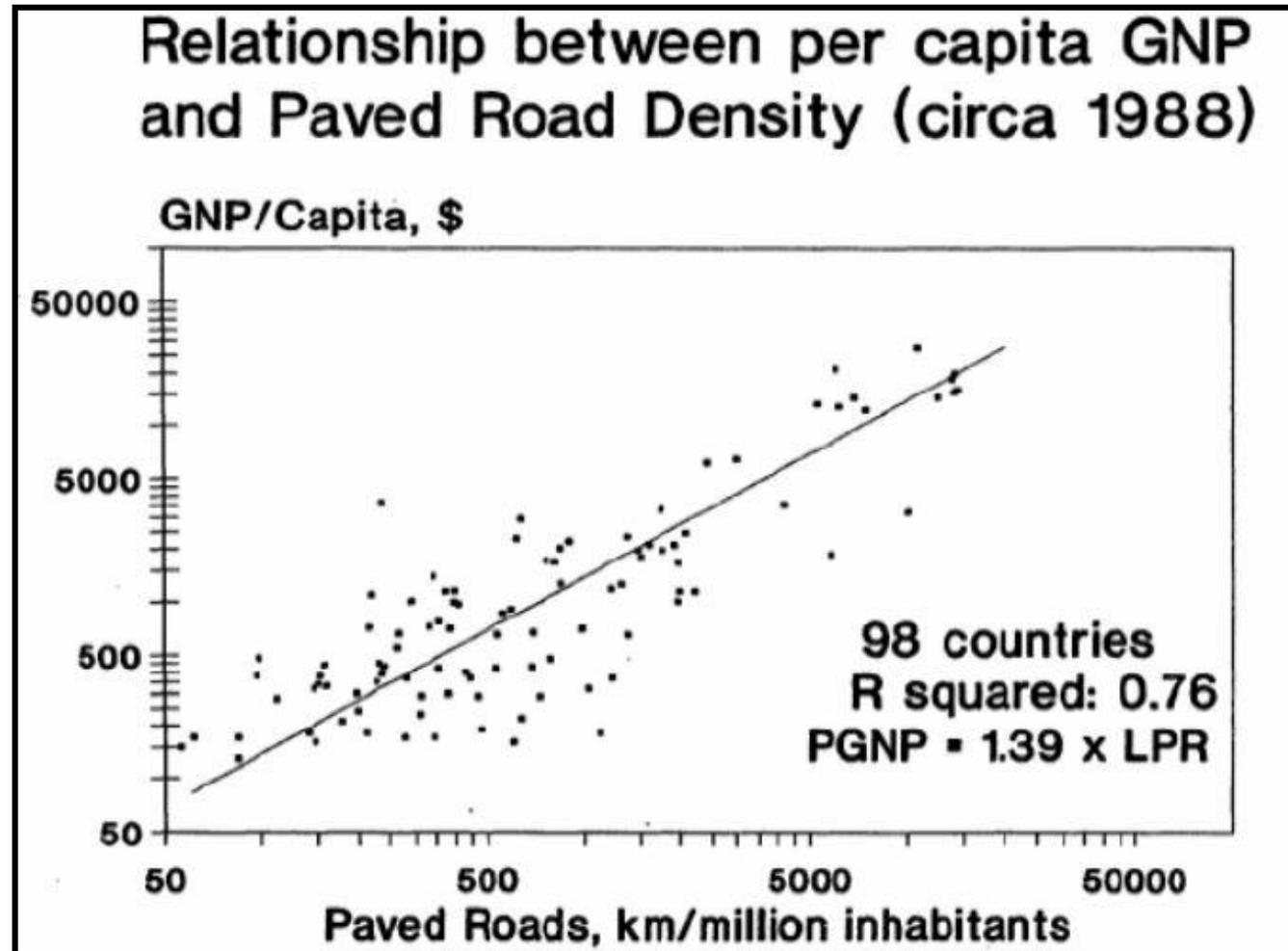
3. Social Infrastructure

4. Cultural, Sports and recreational infrastructure

4. INFRASTRUCTURE & ECONOMIC GROWTH

Infrastructure is the key to:

- Economic Growth
- Production of goods & services
- Trade & investment
- Regional integration



4. INFRASTRUCTURE, ECONOMIC GROWTH & POVERTY REDUCTION

	<u>ECONOMIC GROWTH</u>	<u>POVERTY REDUCTION</u>
Transportation	Faster access to destination, increase in productivity.	More reliable access to markets so that fresher goods can be sold at lower wastage levels.
Water & Sanitation	Incentives for construction of facilities, infrastructure and residential infrastructure, which in turn promote economic growth.	Improved health, reduction in health related spending, potential increase in income savings.
Telecommunication	Improved access and transfer of data, leading to reduced travel time and increase in productivity.	Increased access to information leading to improved ability to make decisions like selling price of products.
Energy	Reliable and abundant power enables setting up of industries and residences that create jobs, manufacture products and promote economic growth.	24 hour electricity increase the duration of the productive working day, thereby, augmenting income, increasing agricultural yields etc.

5. FACTORS OF INFRASTRUCTURE INVESTMENT DECISIONS

There are at least **SIX** broad factors that influence decisions about infrastructure Investment:

1. Economic Growth
2. Technology
3. Sustainable Development Goals (SDG); UN Millennium Development Goal (MDG) etc.
4. Social Considerations
5. Fiscal Constraints
6. Climate Change

5.1 Economic Growth

- Infrastructure can help to spur economic growth
- Growth and rising per capita income bring increased demand for more and better quality infrastructure
- In short, income levels influence the demand for infrastructure.
- But when there is **significant poverty**, low-income groups may be **unable to afford** even the minimal payments required to cover the **marginal cost of supply**.
- Such demand-side constraints may make it difficult to recover costs for new infrastructural investments in low-income countries in the absence of significant subsidies.
- Hence, in low- and middle-income countries, **quality differentials** exist in infrastructure—whether water and sanitation, health, education, and transport— **between urban and rural areas** while such differentials typically do not exist in high-income countries

5.2 Technology

- Demand for ICT technologies drives investment in infrastructure.
- Technology innovations will also create pressure for new investment that can **replace outmoded technologies**.
- Demand for infrastructure may be shaped by **innovative approaches** to the delivery of infrastructural services. (E.g. Metro Rail Project)

5.3 SDGs/MDGs



5.3 SDGs/MDGs

TABLE 1: PERCENTAGE OF POPULATION COVERAGE AND MILLIONS OF PEOPLE TO SERVE TO ACHIEVE UNIVERSAL ACCESS TO WATER, SANITATION, AND HYGIENE BY 2030, 140 COUNTRIES

	Water				Sanitation					Hygiene	
	Basic water		Safely managed water		Any ^a	Basic sanitation		Safely managed sanitation		Hand washing	
	Urban	Rural	Urban	Rural		Rural	Urban	Rural	Urban	Rural	Urban
Current coverage (percent, 2015)	87	76	68	20	72	76	46	26	34	82	50
Population to serve by 2030 (millions)	1,396	892	1,977	2,554	1,121	1,721	1,727	3,214	2,095	1,674	3,154
	2,278		4,531		1,121	3,448		5,309		4,828	

Source: *Joint Monitoring Programme, literature sources and author extrapolations for current coverage, UN Statistics Division for population growth until 2030 (medium variant)*

a. Simple or traditional pit latrines to end open defecation. See Annex A for definitions of 'basic' and 'safely managed'.

Finding 1. Current levels of financing can cover the capital costs of achieving universal basic service for drinking water, sanitation, and hygiene by 2030, provided resources are targeted to the needs.

Extending basic WASH services to the unserved will cost **\$28.4 billion** per year from 2015 to 2030, or **0.10 percent** of the **global product (GP)** of the 140 countries included.

(Global product is the global equivalent of the gross domestic product (GDP) at the country level.)

5.3 SDGs/MDGs

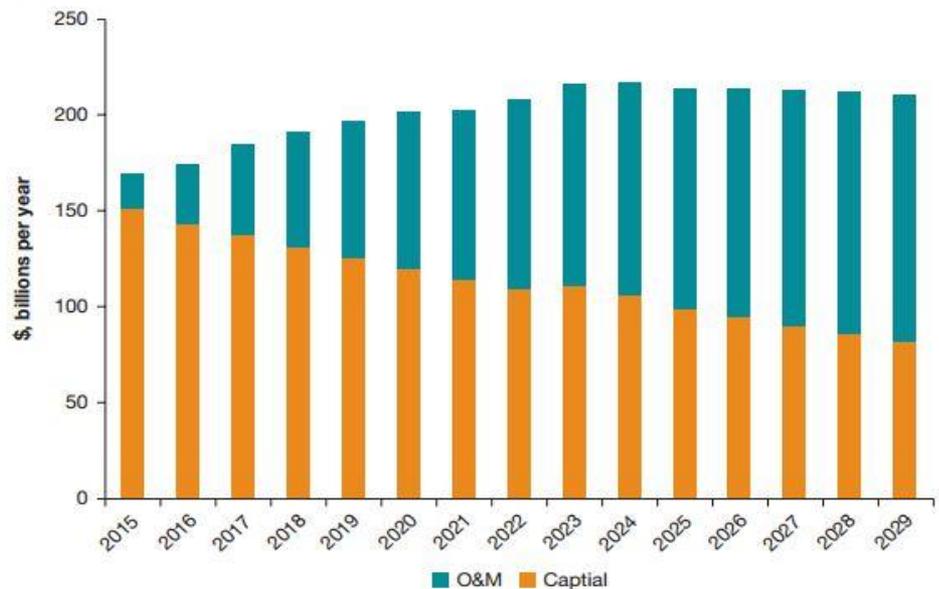
Finding 2. *The capital investments required to achieve the water supply, sanitation, and hygiene SDGs (targets 6.1 and 6.2) amount to about three times the current investment levels.*

The total capital cost of meeting targets 6.1 and 6.2 is **\$114 billion** per year. This total comprises the annual costs of safe water (\$37.6 billion), basic sanitation (\$19.5 billion), and safe fecal waste management (\$49 billion), plus hygiene (\$2 billion)

Finding 3. *Sustained universal coverage requires more than capital inflows: financial and institutional strengthening will be needed to ensure that capital investments translate into effective service delivery.*

FIGURE 3: CONSTANT FINANCING NEEDS: AS INVESTMENT NEEDS DECLINE TO SERVE THE UNSERVED, O&M GOES UP

Time Series of Total Annual Costs to Achieve SDG Targets 6.1 and 6.2, Comparing Capital and O&M Costs: 2015–29



Note: O&M = operations and maintenance.

5.4 Societal Considerations

- Alternatively related to Poverty reduction and economic growth.
- In the absence of physical infrastructure, households are forced to adapt in significant ways.
- For example, without piped water or a village well, women and children may spend hours each day hauling water. Their energy (and associated nutritional requirements) essentially makes up for the absence of electricity, but the value of their services is rarely reflected in GDP estimates and is often ignored in considering the costs and benefits of infrastructure provision. The payoff to the provision of infrastructure may thus be understated.

5.5 Fiscal Constraints

- Have significant impact on infrastructure investment.
- Private provision of infrastructure has been relatively limited.
- Public sector's ability to access financial resources often determine the level of overall investment.
- Inclination to global capital market or Public-private partnership (PPP).

5.5 Climate Change

- Over the next several decades, climate change will result in both rising sea levels and more frequent and intense storms, with an associated higher level of storm surge.
- Climate change may thus **undercut the viability** of some areas for settlement in the absence of **coastal protection infrastructure**.
- In some cities, it may affect the viability of existing housing infrastructure and settlements and lead to **migration or resettlement**, creating new demands for infrastructure.
- It may also lead to an increased risk of periodic flooding, requiring both **emergency welfare outlays** and **infrastructural rehabilitation outlays**

6. INFRASTRUCTURE CRISIS

- Despite the importance of infrastructure for economic and social well being we are faced with several problems.
- Infrastructure in developed countries is old, unreliable, inefficient and in need of replacement.
- The **developing countries**, infrastructure is often not available.
 - Large portions of urban and rural populations in developing countries have **inadequate access to water and sanitation**.
 - **Power supply** is non-existent or unreliable and people are faced with frequent power-cuts.
 - Quality of **road infrastructure** is often bad, leading to long travel times, traffic jams and increased vehicle maintenance costs.
- Several of these problems currently hold true for many areas in Bangladesh as well. This is therefore a golden opportunity for planners with technical as well as managerial and policy level knowledge of these issues, since there is a huge demand for such people to enter the workforce and solve the worlds infrastructure inadequacies.