

# INTRODUCTION

## 1. Role of infrastructure in socio-economic development

1.1 Infrastructure plays a catalytic role in the process of socio-economic development of a country. They facilitate the production of goods and services without themselves being part of the production process. The availability of quality infrastructure is, therefore, indispensable to sustainable socio-economic development of a country and improvement of human well being. This is true for any economic system, whether command/controlled economies or liberalized market driven economies, and particularly so for the fast developing mixed economy of India. Given the fact that the investment in infrastructure impacts positively on economic development, the supply of the infrastructure has to match with the demand for it so that no disequilibrium arises, which ultimately results in intraregional and inter-regional imbalances.

1.2 Improvement of infrastructure through stepped-up investment is crucial for the economy of India, which aims at sustaining the GDP growth rate of around 9% by the end of 10<sup>th</sup> Plan and achieving 10 % GDP growth rate by the end of 11<sup>th</sup> Five Year Plan. To achieve this Plan objective, the Government of India has set a target of Gross Capital Formation (GCF) in infrastructure sector of 8% of GDP by the end of the 11<sup>th</sup> Plan from the 10<sup>th</sup> Plan level of 5%. Further, in this era of globalization, infrastructure development must be guided by a global perspective. With a view to achieving these objectives, in August 2004, the Planning Commission, set up a Committee on Infrastructure (CoI) under the chairmanship of the Prime Minister with the following terms of reference,

- (i) for initiating policies that ensure time-bound creation of world class infrastructure delivering services matching international standards;
- (ii) for developing structures that maximize the role of public-private partnerships(PPP) in the field of infrastructure; and
- (iii) for monitoring progress of key infrastructure projects to ensure that established targets are realized.

1.3 Further, to facilitate the functioning of the Col, an Empowered Sub-Committee of the Col was constituted on 16th May 2005, headed by the Deputy Chairman of the Planning Commission. Col has been replaced by Cabinet Committee on Infrastructure(CCI) in July, 2009. A Special Purpose Vehicle (SPV) for providing Long Term Financial Assistance to Infrastructure Projects, namely India Infrastructure Finance Company Ltd. (IIFCL), has been created and incorporated on January 5, 2006, under the Companies Act 1956, as a wholly Government owned Company with an authorized capital of Rs. 1000 crore and paid-up capital of Rs. 300 crore. Besides, the resource-raising programme of the Company would have sovereign support, wherever required. IIFCL renders financial assistance to infrastructure projects including roads, railways, seaports, airports, inland waterways, power, urban infrastructure, gas pipelines, SEZs and Tourism.

1.4 The Central Government, Ministry of Finance, Department of Economic Affairs has notified a scheme for financial support to infrastructure projects that are to be undertaken through Public Private Partnership (PPP). Proposals made under this scheme shall be considered for providing Viability Gap Funding (VGF), one time or deferred, with the objective of making a PPP project commercially viable.

## **2. Uses and users of infrastructure statistics**

2.1 In view of the crucial role of infrastructure in promoting inclusive and sustainable socio-economic development, quality infrastructure statistics is very much essential for informed decision making in many spheres, the important ones being the following.

### **(i) Planning and policy making**

Quality statistics are essential for effective planning, monitoring and evaluation of infrastructure projects and for optimal allocation of scarce resources among the competing projects to achieve the desired plan objectives of inclusive and sustainable economic development.

### **(ii) Business promotion**

Decisions regarding industrial diversification to new areas and new markets and investment in infrastructure are to be based on up-to-date and reliable micro-level and macro-level data. Business houses can get these data either through the conduct of specialized surveys, which are very costly, or from the existing data sources of the Government, research institutions, business associations, etc. However, the data available from the National Statistics Offices are supposed to be of better quality than those available from other sources, because these are, in general, generated according to harmonized concepts and methods.

### **(iii) Research and development**

Research and development organizations dealing with and interested in infrastructure, require exhaustive data pertaining to all aspects of infrastructure. They need both micro-level and macro-level data on the structural and performance aspects of infrastructure for analyzing the problems and drawing meaningful conclusions.

### **(iv) Public awareness**

Public Infrastructure is generally created, maintained and provided by the government, central, state or local bodies, although in recent years Public Private Partnerships (PPP) of different types are coming up in these areas. Infrastructure items are public goods and every citizen should have access to these without any discrimination on any ground. Further, these are required to be of admissible quality and need to be provided at costs affordable by the consumers, particularly the poor and vulnerable sections of the society. A well maintained, disseminated and easily accessible infrastructure database enables the general public to secure the desired information for claiming their rights, for protesting about the mismanagement, corruption, nepotism in the provision of infrastructure services. It also helps the general public in framing up their infrastructure service requirements.

## **3. Present status of infrastructure statistics in India**

3.1 In spite of the pivotal role of infrastructure statistics mentioned in the previous section, generation of 'quality' infrastructure statistics has not been possible till date throughout the world, mostly because of (i) the lack of an

unambiguous and precise definition (discussed in Section 4) and (ii) the public goods nature (discussed in Section 5) of infrastructure, which gives rise to identification, demarcation and measurement problems. Because of this, statistics on infrastructure, whether on structural or performance parameters, are often limited and inadequate. In the study of the National Statistical System, the Rangarajan Commission(2001), (henceforth the Commission), have dealt with this problem, identified the existing data gaps in the statistics available and suggested for improvement of infrastructure statistics. According to the Commission, “The list of infrastructure activities should be finalized by the Ministry of Statistics and Programme Implementation (MoS&PI) on the basis of the characteristics recommended for identification of infrastructure and a mechanism to collect reliable data on the infrastructure activities should be evolved immediately by the respective authorities in consultation with the MoS&PI.” The Commission further recommended that Infrastructure Statistics generated in different sub-sectors, may be published in one document by the MoS&PI, so as to improve the accessibility of data to policy makers and other data users.

#### **4. The notion of infrastructure**

4.1 There is no unanimity among the economists and the development scientists about what constitutes infrastructure. Infrastructure has meant different things to different people at one time and space and it has also meant different things at different points of time and place to the same people, depending on the changes in the technology, lifestyles of the people and the socio-economic and political environment under consideration. For example: IT & Civil Aviation would not be viewed as infrastructure sectors

some 30 years back. But today, the use of e-commerce, e-governance, e-mail and air travel has increased to such extent that these qualify for critical infrastructure items.

4.2 Within India, different organizations have identified their own list of infrastructure for their functional requirements (Table-I). All these functions have been succinctly divided into two groups: Support Function and Surveillance Function. The items suggested by the NSC and the Planning Commission belong to the latter category, and all these items have been included in the compilation.

## **5. Attributes of infrastructure**

5.1 Knowledge of the special characteristics or attributes of infrastructure facilitates their proper identification, classification and measurement. Some of the important characteristics are delineated under the following sub-headings:

### **(i) Infrastructure are Legacy Assets**

Infrastructure like roads, railways, telecommunication networks, etc. comprise a stock of legacy assets, which are the products of past decisions commensurate with a country's geography, demographics and patterns of development over the last decades or centuries and, which may or may not be relevant to the present day or the future.

**Table-I: Sectors/ Sub- Sectors of Infrastructure in India identified by different Organizations/Agencies**

Sector	NSC	CSO (SCINS)	RBI	Income Tax	IRDA	Economic Survey	World Bank	Planning Commission (CCoI)
Irrigation	Yes	yes	yes	yes	yes			Yes
Storage		yes	yes	yes				Yes
Housing					Yes		Yes	
Urban services(Street lighting, solid waste management)	Yes	Yes	Yes	Yes	Yes(SWM)	Yes	Yes	Yes
Oil production	Yes	Yes	Yes	Yes				
Oil pipe lines	Yes	Yes	Yes	Yes			Yes	Yes
Mining		Yes	Yes				Yes	
Gas Pipelines	Yes	Yes	Yes	Yes			Yes	Yes
Aircrafts	yes	yes						
Vehicles, trucks, buses, etc( Road transport)	Yes	Yes	Yes	Yes	Yes			
Industrial park/SEZ			Yes	Yes	Yes			
Educational institutions			Yes		Yes			
Hospitals			Yes	Yes	Yes			
Posts		Yes				Yes		
Electricity	yes	yes	yes	yes	yes	yes	yes	yes
Water supply	yes	yes	yes	yes	yes	yes	yes	yes
Sewerage	yes	Yes	yes	yes	yes	yes	yes	yes
Telecommunication	yes	yes	yes	yes	yes	yes	yes	yes
Roads & bridges	yes	yes	yes	yes	yes	yes	yes	yes
Sea Ports	yes	yes	yes	yes	yes	yes	yes	yes
Airports	yes	yes	yes	yes	yes	yes	yes	yes
Railways	yes	yes	yes	yes	yes	yes	yes	yes
Inland Water ways	Yes	Yes	Yes	Yes	Yes			Yes
Rail(Rolling Stock)	yes	yes				yes	yes	yes
Renewable Energy		Yes						Yes

*Source: Notes on definition of Infrastructure by Planning Commission(CoI), M/o Finance, Minutes of the second meeting of SCINS*

From a policy perspective, the legacy nature of infrastructure has several implications. Valuation of these assets is difficult. First, valuing the legacy assets, which have useful economic life, at their acquisition cost need not be a good measure of underlying value of assets. Second, depreciated replacement cost may not be a good measure of the value if, in re-designing the system, the asset type and their configuration would be much different to those in place today.

The appropriate basis for valuing long-life assets that are typical of infrastructure has given rise to complex issues in their regulation, for instance, of the airports and electricity sectors. Issues surrounding value are most acute in the context of economic regulation and the determination of prices that have to be paid for use of the infrastructure assets.

## **(ii) Natural Monopolies**

Infrastructure assets usually involve large and lumpy investments that, once made, tend to have relatively low alternative use values, i.e. **High Sunk Costs**. For example, the cost of investing in a road is generally sunk. Once made, the value of the road, apart from the land it sits upon, generally has low, or no, opportunity value.

Large, lumpy and sunk cost investments are generally characteristics of **Natural Monopolies**. As the term implies, a natural monopoly asset is one where the barriers to entry are high; often so high that it is not efficient to have competing service providers. In general, road and rail networks and gas and electricity



reticulation systems, are examples of sectors with strong natural monopoly characteristics.

Where natural monopolies exist, there can be incentives for service providers to price above, and restrict the quality and quantity of supply of services below, that which would be obtained in a competitive market. In this situation, there can be grounds for considering some form of economic regulation to promote efficient outcomes.

### **(ii) Public goods nature of Infrastructure**

The theory of infrastructure derives mainly from the public goods theory. Two major characteristics of public goods are (a) **non-excludability** and (b) **non-rival consumption**. Non-excludability implies that nobody in the user group can be excluded from consuming the benefits from the infrastructural facilities unless or until a strict enforcement is enacted to exclude certain individuals. Even if somebody can be excluded through enforcement from utilizing the benefits, the transaction cost of doing so would be a costly option and, therefore, the decision would be economically nonviable. **Non-rival consumption** of the benefits means that the consumption of the benefits by one individual does not result in affecting the consumption of same benefits by another individual unless or until a negative externality problem such as water pollution arises. Infrastructure is a social capital that positively affects larger society, in the absence of externality.

### **(iii) Non-tradability of output**

The outputs of infrastructure are the services derived from their use. Services are intangible and non-tradable i.e. they cannot be transported. In most cases they have to be consumed at the same place they are produced, although exceptions are there (for example, packaged software). This characteristic has significant

policy implications as far as location of the infrastructure is concerned. Infrastructure have to be created at consumption points, irrespective of their economical viability or otherwise.

#### **(v) Risk-prone nature of Infrastructure**

Although all assets are risk-prone, the degree of risk-proneness to catastrophic failure of infrastructure, is very high because of their integrated and networked characteristics, which require significantly high costs for replacement. Further, catastrophic failure of any critical infrastructure could have far reaching economic and social implications. It is because of this risk-prone nature, coupled with high sunk costs and public-goods nature, infrastructure have been created, maintained and provided under monopolistic conditions, mostly by the state.

### **6. Identification of infrastructure applying their characteristics**

6.1 The Commission have identified in their Report the following six distinguishing characteristics of infrastructure.

- (i) Natural monopoly,
- (ii) High-sunk costs or asset specificity,
- (iii) Non-tradability of output,
- (iv) Non-rivalness (up to congestion limits) in consumption,
- (v) Possibility of price exclusion, and
- (vi) Bestowing externalities on society.

Applying all these characteristics simultaneously, the Commission have identified the following items, which constitute infrastructure.

- Railway tracks, signaling system, stations
- Roads, bridges
- Runways and other airport facilities
- Transmission and distribution of electricity
- Telephone lines, telecommunications network
- Pipelines for water, crude oil, slurry, etc.
- Waterways, port facilities
- Canal networks for irrigation
- Sanitation or sewerage.

6.2 The Commission has recommended for compiling data for the above items and subsequently extend the list of infrastructure by including the items that qualify as infrastructure on the basis of the consideration of characteristics (ii), (iv) and (v).The additional items include the following;

- Rolling stock on railways
- Vehicles
- Aircrafts
- Power generating plants
- Crude oil refinery plants, plants for purification of water
- Ships and other vessels.

## 7. Infrastructural Indicators

7.1 Various infrastructural indicators can be grouped under following two broad categories:

- (i) Outcome or Performance Indicators and
- (ii) Institutional Reform Indicators

### (i) Performance Indicators

Sector performance is widely considered to be the main concern for policy makers, which can be assessed through **outcome measures or outcome indicators**. In this context, a particular sector is considered to improve its economic performance if access to the service increases among the population, if the service becomes more affordable, if the quality of the service improves and if the provision of the service is cost-effective. Accordingly, the performance indicators are further divided as Access, Affordability, Quality and Costs & Revenue indicators. Brief descriptions of these indicators are given in the following paragraphs.

**Accessibility** of infrastructure can be considered as availability of infrastructure backed by its acceptability to and affordability by the consumers and the right to use - not necessarily actual use- the service. The accessibility of infrastructure can be assessed through multiple dimensions. Geographically, it captures the spread of the service over the area. Time-wise, it measures how frequently the service is provided or how long does it take to be connected. Socially, it measures if all citizens have access to services, or what portion of citizens have access to the service, or if services are limited to specific groups (e.g. special groups, families, elderly, etc.). For example, in case of road transport infrastructure, the

access indicators include: total road length, road length per thousand Sq. km. of geographical area; road length per thousand population, total number of vehicles, No. of vehicles per thousand population, average distance to nearest bus stop or railway station, etc.

**Affordability indicators** give a sense of the extent to which infrastructure services are provided at a reasonable price. Ideally, measures of this outcome indicator should tell us the extent to which the price of a standard consumption bundle is consistent with the ability to pay of the users. Ideally also, these measures should be gathered from household surveys—e.g. surveys specifying the percentage of the household income or household expenditure allocated to a specific service for different income classes. In practice, the indicators used are: the average price , sometimes the nominal price and, occasionally, the tariff structure.

**Quality indicators** should encompass both qualitative and quantitative measures. The former may be **perceived quality indicators** or **technical quality indicators**. Perceived quality indicators are computed from the subjective information collected by asking qualitative questions (like rank from 1 to 5 the quality of the service). An example from road infrastructure includes: Reasons behind number of accidents per thousand of registered vehicles. The **technical quality indicators** are usually reported by the utilities or providers. Examples are: electric outages or reported phone faults. Quality indicators, which are expressed in quantitative terms include: share of surfaced or paved roads in the total and No. of road accidents per 1000 registered vehicles.

**Fiscal and revenue indicators** tell about the economic and financial viability of the performance of a particular sector in order to support analytical research. Examples are: Budget outlays, investments, Expenditure, Revenue generated etc.

## **(ii) Institutional Reform Indicators**

The main purpose of the institutional reform indicators is to better document governance and institutional developments related to infrastructure at the sector level. Ideally, the compiled indicators should enable the policy makers to identify every step of reforms and their intensity. Three important indicators of this type include **economic liberalization indicators**, **economic regulation indicators** and **environmental regulation indicators**.

**Economic liberalization indicators** of a particular infrastructure sector/sub-sector measure the degree of involvement of the state in the activities of that sector/sub-sector or the degree of competition prevailing therein. Percentage share of ownership of enterprises (public/ private/ mixed) along with share of invested capital in the sector tell about the economic liberalization efforts of the state i.e. the willingness of the government to open a sector to private operators.

**Economic regulation indicators** tell about the existence or otherwise of an independent regulator in a sector, which reflects the extent to which a country is willing to separate the regulatory function from other sector policies to avoid conflicts of interests. These indicators are attributes, expressed by 'presence' or 'absence'.

**Environmental regulation indicators** tell about the existence or otherwise of environmental regulation, which throw light on the willingness or otherwise of

the state for controlling and maintaining the environmental quality for achieving sustainable economic development. They can also tell about the extent of state efforts in preserving the environment. The number of infrastructure projects sanctioned environmental clearance by the state pollution control boards is one such indicator.

These three categories correspond to the main areas of institutional reforms that have been considered or have taken place during the 1990s. Considered jointly, the three groups of indicators provide a useful snapshot of the level and type of institutional reforms in any given country. However, due to poor data availability, these types of indicators have not been compiled for this publication, except for some figures on private investment in some sectors.

## **8. Central Statistical Office(CSO) Publication on Infrastructure Statistics**

In view of the differing notions of infrastructure and to implement the recommendations of the Commission on infrastructure statistics, the permanent National Statistical Commission (NSC), have initiated action through the CSO for compilation of the “Annual Infrastructure Statistics Publication”. CSO has constituted a Standing Committee on Infrastructure Statistics (SCINS), under the chairmanship of DG,CSO and with representatives from the Secretariat of the Cabinet Committee on Infrastructure of the Planning Commission (CCoI), M/o Finance, Reserve Bank of India (RBI), Department of Industrial Promotion and Policy (DIPP) and other subject matter ministries; to provide continuous guidance for bringing out the publication in most useful manner. The coverage of sectors and sub sectors under infrastructure finalized by SCINS is as given below:

**Table II: Coverage of Sectors/ Subsectors in Annual Infrastructure Statistics**

Infrastructure Sector	Sub-sector	Coverage of AIS as proposed by SCINS	
		Infrastructure Items included in CCol List	Other Items
Transport	Road transport	Roads and bridges,	Tunnels, Motor vehicles
	Rail transport	Railways, Signaling, & communications systems, Rail yards, Stations.	Rolling stock
	Inland water transport	Inland waterways	Inland water vessels.
	Sea and coastal transport	Seaports	Ships and other vessels
	Air transport	Airports	Air crafts
Energy/power	Electricity(Thermal, Hydro, Nuclear)	Generation plants, wind mills, transmission and distribution lines, electric substations	Coal Reserves, Coal fields/mines, Coal washeries
	Petroleum and Natural gas	Oil and gas pipeline networks	Distribution terminals, Gas fields/wells, refineries
Drinking water supply, sanitation and Street lighting	Drinking water supply	Water supply pipelines, filtration and treatment plants	
	Sanitation	Sewage treatment plants, Drainage pipelines, On site sanitation facilities, Land fills, Incinerators	
Irrigation	Irrigation	Major and minor irrigation structures, Command area, Irrigation canals, Reservoirs, Water shed development	
Communication	Telecommunication	Telephone network ( landlines, mobile), Internet servers, Communication satellites, Cable television network	Postal communication Postal network, Courier mail service
Storage	Storage	Food grain Storages, Cold Storages, Warehouses	

*CCol- Cabinet Committee on Infrastructure, Planning Commission*



## **8.1 Objective of the publication**

The main objectives behind the compilation of this publication are:

- (i) To bridge the existing data gaps on infrastructure statistics,
- (ii) To generate infrastructure statistics following harmonized and universally comparable concepts, definitions, standards and classifications, and
- (iii) To put in one place statistics pertaining to the sectors and sub-sectors of infrastructure as finalized by the Standing Committee on Infrastructure Statistics, which will be a handy reference guide for planners, policy makers, researchers, business houses and the general public.

However objective of the present publication is to make a beginning in the direction of the ultimate objective; based on compilation of information readily available with the source agencies. In future specific data collection for this purpose may have to be initiated.

## **8.2 Scope and Coverage of the Publication**

Ideally for data compilation we should follow the objective approach or we can say inclusive approach so that data is available on a superset basis to serve the purpose of all users. All the items which are considered as infrastructure by any section of society or economy, may appear there.

However to begin with, and to limit the work horizon, only economic infrastructure as approved by the SCINS(Table II) is covered in this publication. All the infrastructure items have been arranged in six broad sectors viz. Transport, Energy, Drinking Water Supply and Sanitation, Irrigation, Communication and Storage. Under each category statistics have been compiled on infrastructure items and other related items which are important for giving a

clear idea about the status and major constraints of the sector. For e.g. the capacity for power generation does not only depend on number of power plants, but also on capacity of coal, petroleum and natural gas production. Since thermal power has 79% share in the power production, separate chapters have been kept on mining and quarrying, and petroleum and natural gas extraction sectors.

The available data on new and renewable energy systems, is covered in the chapter on electricity. Because unlike mining and quarrying and petroleum and natural gas sectors, output of new and renewable energy systems is directly in the form of heat or electricity. And grid connected electricity from NER sources shares the network of electricity obtained from other sources. Further data on number of grid connected NER systems is not available with the M/o New and Renewable Energy.

### **8.3 Indicators Compiled**

It may be pointed out that data included in this publication have been compiled from the secondary data generated as official by-products and available in a dispersed fashion in the functional ministries/departments. The list of the basic statistics and derived indicators compiled for each sub-sector of infrastructure and incorporated in the publication are grouped under the following heads.

- A. Access indicators
- B. Quality indicators
- C. Fiscal costs & revenue indicators
- D. Utilization indicators.
- E. Affordability indicators.

#### **8.4 Level of data disaggregation**

The macro level infrastructure indicators proposed to be compiled and published in the Annual Infrastructure Statistics will be used for planning and policy formulations at the national level. To keep the size of this publication handy, it includes disaggregated data up to the state-level/zonal-level, not below that. Since development of some of the items of infrastructure are the sole responsibility of States/UTs and some are concurrent responsibilities, it is desirable that States/UTs try to compile such infrastructure statistics at their levels including disaggregated data for districts and other lower levels for their own uses. Such compilations will improve the consistency of data, plan and policy coordination between the centre and the States/UTs.

#### **8.5 Organization of the publication**

The publication has six parts corresponding to six broad infrastructure sectors. Each part contains at the outset coverage and data gaps, for that sector. Further each part is subdivided into chapters. For the purpose of statistics compilation, chapterisation has been made as per the source ministries.

Each chapter contains concepts and definitions used, description of data sources, analytical highlights for that class according to access, quality, fiscal cost, utilization and affordability indicators; followed by data tables. Detailed data tables for each class are preceded by a summary table giving time trends for important indicators based on availability of data, to give at a glance idea of the sector. It is specially useful for users who are interested in only all India picture or have less time.

Abbreviations used in the text and tables, table on inflation rate, State-wise population, Geographical area and other reference tables/ material which may be helpful in better understanding the contents of the publication are given in annexure at the end of the publication.

### **8.6 Reference period of data**

Unless otherwise stated reference date for stock variables is 31<sup>st</sup> March and reference period for flow variables is financial year ending 31<sup>st</sup> March, corresponding to the year mentioned against the data.