1 Infrastructure – An Overview

Around the world, a not insignificant proportion of infrastructure assets is already in private hands. This is especially true of the telecommunications sector and, to a lesser extent, power generation and railways. It is expected that private money will continue to flow into these activities because publicly owned and operated infrastructures are becoming problematic due to pressure on budgets and tax-raising capacity.

Over the last three decades, the high start-up investment costs for infrastructure assets and the resulting negative impact on public budgets has triggered a steady reduction in the level of infrastructure investment in all Organisation for Economic Co-operation and Development (OECD) countries in both absolute and relative terms. In response to this situation, a number of governments have sought to identify new ways of providing adequate infrastructure facilities despite (or even because of) this dearth of state funding. In almost all of the countries concerned, the outcome has been cooperation with the private sector with a view to ensuring continued domestic economic productivity even in the face of growing populations and insufficient public budgets. Ultimately, the quality of a country's available infrastructure is a vital factor in its future economic growth.

To date, three countries in particular have accumulated a large degree of experience with privately financed infrastructure investments: the United Kingdom, Australia and Canada. In light of their largely positive experiences in terms of financing and realising all the scheduled projects, despite the urgent need for new and replacement investments in infrastructure and the limited funds available to the governments, a number of western countries as well as emerging economies in Asia, the Middle East and Eastern Europe have recently implemented extensive legislation opening up the possibility of infrastructure investments by the private sector. For its part, the private sector has recognised the financial benefits of funding, constructing and operating infrastructure assets, whether in the form of long-term concessions or permanent ownership.

On account of these benefits, the substantial decline in new Public Private Partnership/Private Finance Initiative (PPP/PFI) tenders resulting from the global financial market crisis of 2007/2008 is considered to be only temporary in nature and the number of tenders for such infrastructure projects is likely to return at least to pre-crisis levels once the current problems primarily caused by the financial crisis are overcome.

Before infrastructure is defined and its general characteristics addressed in some detail, the following section will provide a brief overview of the size of the infrastructure market and its investment requirements.

1.1 DEMAND FOR INFRASTRUCTURE

There is significant demand for investments in both economic and social infrastructure assets around the world. This is because public infrastructure in areas such as traffic, supply and disposal, health and social care, education, science and administration are some of the key location factors and growth drivers of any economy. Although this is common knowledge, the

combination of economic upturn, insufficient investment in these sectors and the inadequate maintenance of existing facilities over the past decades has led to a considerable imbalance between supply and demand when it comes to infrastructure assets. This has been exacerbated by population growth and the resulting increase in the cost of constructing, modernising or replacing existing assets. The World Bank estimates this excess demand at 1% of global Gross National Product (GNP). Meanwhile, the gap between the need for infrastructure investments and the ability of national budgets to meet this demand is continuing to widen throughout the world.

In less prosperous developing countries and emerging economies, demand for infrastructure investments continues to focus on primary care and supply facilities in particular. Funding for the development and operation of these projects, most of which are constructed on greenfield sites, has always been scarce. In the past, these requirements have largely been financed with the assistance of development subsidies and multilateral sponsor organisations, while the involvement of private investors used to be comparatively rare. However, this situation is changing dramatically for those emerging economies with dynamic economic growth. In countries such as China and India, PPP projects and private investment are becoming increasingly common as a means of meeting the vast capital requirements for the construction of the basic infrastructure. The same applies to the transitional economies of Eastern Europe, where the focus lies on the material privatisation of state-owned enterprises.

However, established industrialised nations are also facing growing financial challenges when it comes to providing efficient infrastructure facilities. Their existing infrastructure, which is generally well constructed, must be operated, serviced, maintained, modernised and adjusted to meet current requirements, which can entail new construction, renovation, expansion or conversion measures. Due to demographic change, this sometimes even requires the dismantling and fundamental redesign of the relevant assets. As mentioned previously, there is a significant investment bottleneck due to decades of neglect. As such, there is now an urgent need for the demolition of ageing physical structures that may appear functional but are in fact technically and economically outdated. In other words, infrastructure investments in many segments often involve brownfield projects. One particular challenge is financing the construction and operation of the cross-border infrastructure facilities that are extremely important for the integration of international economic communities, as is clearly shown by the example of the Trans-European Network (TEN).

As can be seen, all country types have a financing gap of some description that they need to close. However, there are considerable differences in terms of the political, legal and economic conditions and requirements for closing this gap with the aid of private capital. One particular consideration is the substantial variation in economic growth combined with the national debt and the existing tax and contribution ratios of the respective countries. For industrialised nations with low levels of growth and rapidly dwindling scope for financing infrastructure via new borrowing or further increasing the burden on taxpayers and users, it is particularly important to realise efficiency benefits through the expansion, maintenance and operation of the existing infrastructure. Therefore, these countries need to get hold of extra cash by making savings in their bureaucratic structures: in other words, they need to 'sweat out' these future expenses from the increasingly aching bones of their administrative machinery. Accordingly, value for money comparisons between conventional public-sector and private-sector infrastructure play a decisive role when selecting private investment solutions.

In contrast, the liquidity aspect is considerably more important in high-growth countries, because the required infrastructure needs to be available for use as quickly as possible –

whatever the cost. In a scenario reminiscent of the post-World War II economic boom in Germany, the aim here is to offset the resulting new debt with the growth generated wherever possible. In both cases, the acquisition of private capital is one of the primary objectives. In most industrialised nations, however, private investors are additionally subject to significantly higher expectations in terms of innovation and efficiency gains.

Building on this largely qualitative analysis of the demand structure, the following paragraphs aim to quantify these requirements to a greater extent.

Although governments are responsible for investments in new and existing infrastructure assets, and hence are in a position to influence positively the economic development of their country, events over recent years have highlighted the difficulty in achieving even the most basic maintenance of existing, ageing assets. According to estimates by the World Bank, global operating and maintenance costs for existing infrastructure assets alone amount to 1.2% of global GNP, that is, even higher than the excess demand for new investments of 1% that was mentioned earlier. These costs are due in part, although by no means exclusively, to overall rising raw material and energy costs (never mind the presumably only temporary prices decrease during the sub-prime crisis).

The growth in healthcare costs and pension obligations due to the ageing population structure accompanied by reduced tax receipts has led to a further deterioration in the financing options available to governments. In high-tax countries such as Germany in particular, tax increases are not a feasible option for funding infrastructure assets whereas the issue of fixed-income securities has a negative impact on the public purse and its financial rating and can be used to finance only an extremely limited number of projects. In short: the current public policy, regulatory and planning frameworks appear inadequately equipped to tackle the multi-faceted challenges facing infrastructure development over the next 25 years – this situation is likely to become even more critical following the onset of the crisis on the financial markets.

According to the comprehensive two-volume *Infrastructure 2030* OECD study published in 2006/2007, government spending on infrastructure in OECD countries amounted to 2.2% of GNP between 1997 and 2002, compared with 2.6% in 1991–1997 (OECD, 2006; OECD, 2007). A graphic illustrating this development, broken down by a selected number of OECD countries over a period of 30 years from 1970 until 2002, can be found in Figure 1.1. With the exception of the USA in 2002, the ratio of government infrastructure spending to total spending in the respective countries declined or stagnated over the same period.

Figure 1.2 compares the key EU countries as well as the EU 15 countries as a whole over a timeframe of 30 years. It shows that there has been a substantial downward trend in public investment in the European Union (EU) since 1970, not only in relative but also in absolute terms.

According to the rough estimates contained in the *Infrastructure 2030* OECD study 2006/2007, the need for infrastructure investments – including additions, renewals and upgrades – has increased so significantly at a global level that investments totalling some US$ 60 trillion will be required between now and 2030 in order to improve the key infrastructure facilities around the world in line with requirements. At the time of the study, this corresponded to around 3.5% of global GNP annually. Since the onset of the financial crisis, this percentage is likely to have increased considerably.

Although this comprehensive study fails to provide details of the assumptions underlying these estimates and whether the investments constitute a ‘wish list’ of politicians or the essential requirements in the respective countries, there is no reason to doubt the prevailing trend. According to the study, the 30 OECD member states are expected to have to invest

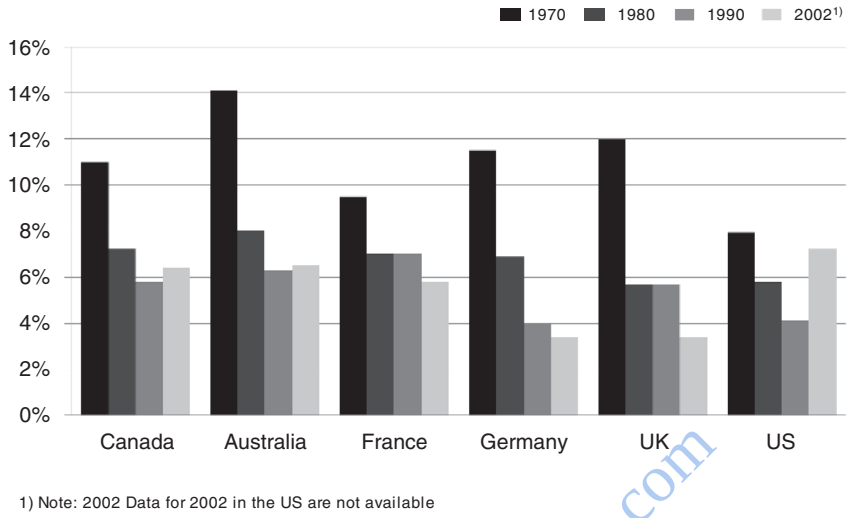

Figure 1.1 Government infrastructure investments as a percentage of total outlays in OECD countries
Source: OECD (2006)

more than US$ 500–600 billion a year in the electricity, road, rail and water infrastructure over the next 25 years. Infrastructural improvements in the energy sector alone are forecast to total around US$ 4 trillion over the next 30 years. The modernisation and expansion of water, electricity and transportation systems in the cities of Western Europe, the USA and Canada are expected to cost some US$ 16 trillion. In developed countries, there will also be a need to replace completely certain existing facilities and make additional new investments to account for rising demand.

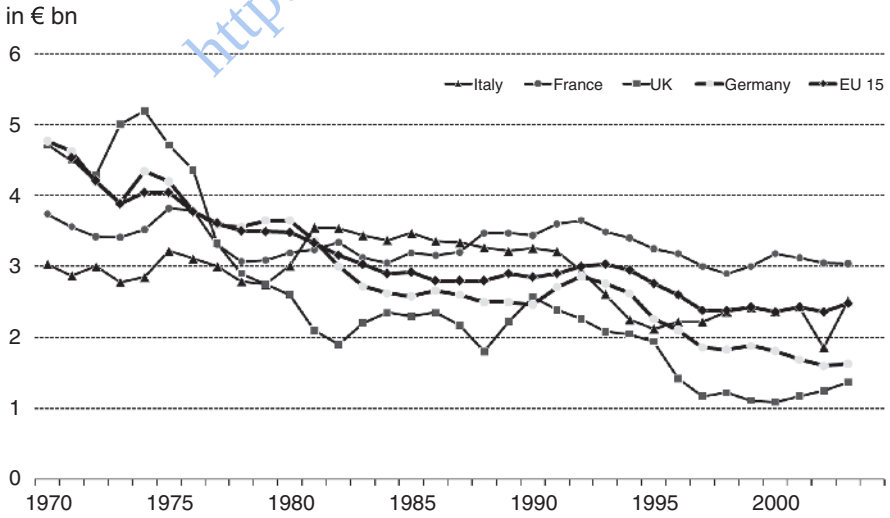

Figure 1.2 Infrastructure investments of EU governments
Source: OECD (2006)

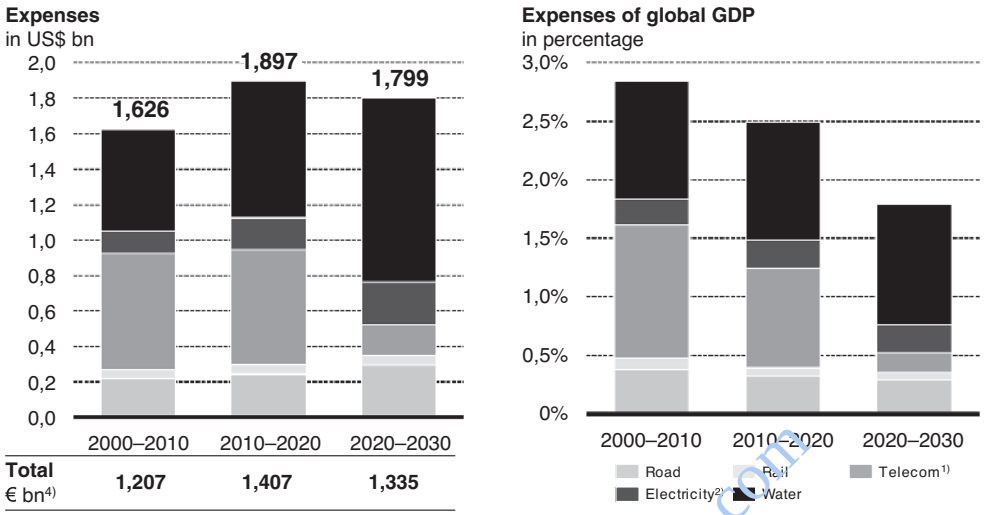

Figure 1.3 Estimated average annual infrastructure spending in OECD and BRIC countries (new and replacement investments) in selected sectors, 2000–2030, in US$ billion as a percentage of global GNP

Source: UBS (2006)

In high-growth countries, the imbalance between capital supply and demand is many times greater. Estimated annual investments of 5–9% of GDP would be necessary to maintain the projected growth in these countries and facilitate the estimated investments of US$ 460 billion over the coming years. In China alone, the infrastructure investments required to maintain the high level of economic growth are expected to total US$ 130 billion annually for the period from 2006 to 2010 (at the time of the OECD study, this represented around 6.9% of GNP). This would mean that China accounted for some 80% of all infrastructure spending in the East Asia region. According to the OECD, none of the countries concerned will be able to implement these measures without the support of the private sector.

Figure 1.3 presents the estimated spending on infrastructure over time in the OECD and BRIC countries broken down into selected sectors.

The only amount to increase steadily is the share of private infrastructure investments. Over recent years, the volume of private investments in infrastructure in general, and especially in variants of PPP models, has increased sharply across all regions (see Figure 1.4). This illustrates the investment commitment to infrastructure projects with private participation according to PPIAF (Public-Private Infrastructure Advisory Facility). Privatisation of state assets has been an important driver of this development. Since the 1980s, more than US$ 1 trillion of assets have been privatised in OECD countries and infrastructure has consistently taken centre stage. Aggregated figures for the period from 1990 to 2006 demonstrate that almost two-thirds of all privatisations in the OECD area related to utilities, transport, telecommunications or oil facilities. Over a similar period, some US$ 400 billion of state-owned assets were sold in non-OECD countries, approximately half of which were infrastructure-related (OECD, 2006; OECD, 2007).

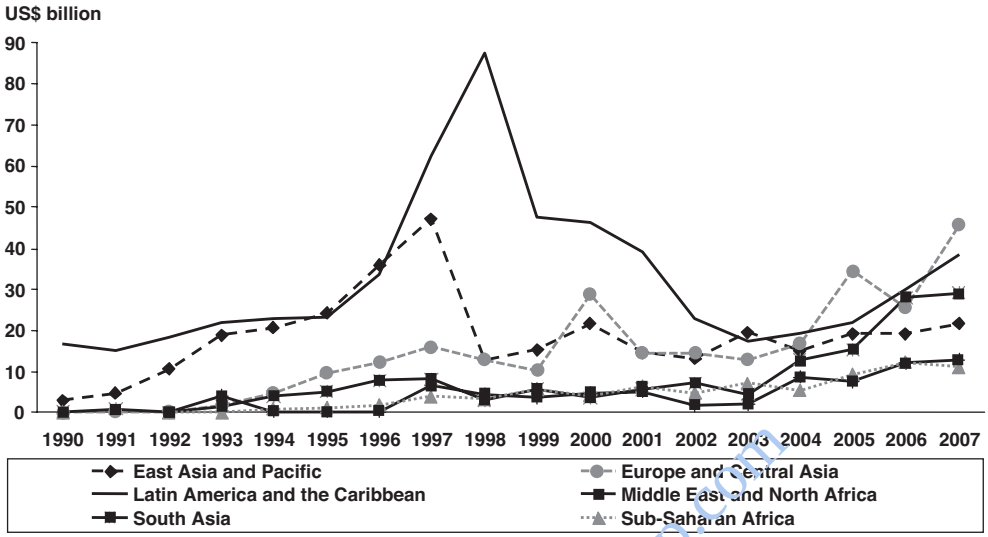

Figure 1.4 Investment commitment to infrastructure projects with private participation in developing countries by region, 1990–2007

Source: Private Participation in Infrastructure Project Database (2008).

Another indicator for the growing share of private infrastructure investments is the level of private investments in the form of listed infrastructure assets, the total stock of which tripled from US$ 465 billion in 2000 to US$ 1.7 trillion in 2008 (Elliott, 2009 – see Section 2.2.1 'Listed infrastructure investments' for further information).

Commitments to unlisted funds are a further indicator. According to an infrastructure report by Probitas Partners (2009), globally, over 80 unlisted closed-end infrastructure-focused funds were raised from 2004 to 2008 with an estimated value of US$ 80 billion. More precisely, a total of US$ 2.4 billion was raised in 2004. This figure increased to US$ 5.2 billion in 2005, US$ 17.9 billion in 2006 and US$ 34.3 billion in 2007, followed by US$ 24.7 billion in 2008 and a mere US$ 1.3 billion in the first quarter of 2009. Preqin (2009), another provider of infrastructure market data, reported an estimated value of over US$ 100 billion capital raised for unlisted infrastructure-focused funds during the same time period. According to Preqin, at the end of the second quarter of 2009, there were 94 funds actively seeking US$ 97 billion of capital.

Although there may be some debate as to the precise investment volumes, the high level of global demand for infrastructure investments and the inability of governments to cope with the level of capital and expertise required is undeniable. Funding investments of this magnitude via tax increases would be neither feasible nor sensible. By cooperating with the private sector, however, the necessary repairs, modernisation work, operating, maintenance and new construction of infrastructure assets can be largely achieved in the medium to long term without significant tax hikes or additional borrowing. Needless to say, this is not possible without a long-term shift in the spending priorities of the government, increased user finance and more efficient infrastructure management; after all, there is no such thing as a free lunch. Here, too, greater cooperation between the public sector and private investors could make an important contribution.

1.2 DEFINITION AND CHARACTERISTICS OF INFRASTRUCTURE

The term 'infrastructure' was originally used in the military context referring to military assets such as caserns and airfields. Relatively recently, infrastructure has come to mean the necessary organisational backbone of an economy. However, a huge variety of definitions has been suggested by national agencies, national and regional governments, academia, dictionaries and of course the financial community, encompassing all things to all people. This approach is hardly a useful way to define infrastructure, but instead clouds the ability of investors, governments and their citizens to understand, advocate and direct capital toward these assets. Therefore, this book seeks first to provide a brief overview of the width of definitions in order then to present the definition used throughout this book.

One of the broadest definitions of 'infrastructure' goes back to Jochimesen (1966), who focused on infrastructure's role in the development of a market economy. To this end, he considered not only economic and technological elements, but also social and cultural aspects in the equation. Accordingly, he describes *infrastructure* as follows:

> *the sum of all material, institutional and personal assets, facilities and conditions available to an economy based on the division of labour and its individual economic units that contribute to realising the assimilation of factor remunerations given an expedient allocation of resources. The term material infrastructure stands for the sum of all physical assets, equipment and facilities and the term institutional infrastructure points to the norms and rules, which develop and are set in a society over time; in addition, the term personal infrastructure is used to encompass the number and qualities of people in a market economy. (Jochimesen, 1966)*

With this definition, Jochimesen refers back to the works of List (1841) and Malinowski (1944/2006). Jochimesen focused on these issues because a central question in economic policy is to determine the conditions necessary for the development and growth of a market economy as well as the related constellation of the various required types of infrastructure.

In turn, the narrowest 'definition' (or 'understanding') of infrastructure is found within the financial industry. Given the focus of this book, this definition is of particular interest and therefore shall be addressed in more detail.

In response to the fact that the key factor for the individual investor is ultimately not the specific infrastructure sector or supply characteristics of the physical infrastructure assets, but rather their specific risk-return profiles that largely depend on the various characteristics of the respective investment opportunities, the financial industry took it upon itself to define infrastructure on the basis of certain economic and financial characteristics (see Section 2.1). However, the characteristics they introduce and on which their understanding is based, effectively only apply to *a small subset* of the universe of real infrastructure assets in existence, namely, the conservatively structured ones. These characteristics are as follows:

- *Key public service.* Infrastructure assets meet key public requirements in everyday life, such as the provision of water, energy, mobility, communications, education, security, culture or healthcare, making them a basic prerequisite for economic growth, prosperity and quality of life.
- *Low elasticity of demand.* Due to their fundamental functions, demand for such infrastructure services is relatively independent of industry cycles and economic performance even when prices increase (e.g., due to inflation adjustment regulations), stable (i.e., subject to low

volatility) and predictable (e.g. due to long-term contracts), and it generally rises in line with GDP growth.

- *(Quasi-)monopoly situation with high barriers to market entry.* Infrastructure assets are hard to duplicate on account of the high start-up investment costs for the construction of a water, electricity or telephone network, for example. After commissioning, the cost of providing each additional service/product unit, for example, a new connection to the water supply or an extra unit of electricity supply, is comparatively low. This combination of circumstances means that the barriers to market entry are high. Accordingly, these kinds of infrastructure assets have little or no competition.
- *Regulation.* In situations with little or no competition, regulatory authorities perform a corrective function on the market, for example, by fixing prices or providing minimum payments guarantees. However, a regulated market per se does not necessary eliminate the market risk for the provider. The best example of this is the telecommunications market.
- *Long service life.* Infrastructure assets have service lives of as much as 100 years or more. There are many historical examples with significantly longer lives, such as Roman aqueducts. In addition to the physical and technical life of an asset, however, a key factor is economic life, which may even be less than five years in the case of laboratory or medical facilities. For investors, the amortisation of their investments over the economic life of the asset is important.
- *Inflation protection.* Infrastructure assets may provide a natural hedge against inflation, because revenue from infrastructure investments is often combined with inflation adjustment mechanisms, whether through regulated income clauses, guaranteed yields or any other form of contractual guarantees. Project income generated via user charges (e.g., toll roads, public utility plants) rather than availability payments is usually tied to GDP or the consumer price index (CPI).
- *Regular, stable cash flows.* Infrastructure assets that possess the characteristics listed above generally have stable, predictable and in most cases inflation-adjusted long-term revenues that can weather a storm and economic cycles and support a significant credit burden.

Although these generalised characteristics serve as an indicator of the potential attractiveness of infrastructure investments as a whole, only *some* assets of the available universe meet the requirements for classification as infrastructure in accordance with these characteristics, and there are just as many 'real' infrastructure assets that meet them only in part. In other words, infrastructure assets *may* have the comparatively low-risk, in some cases bond-like characteristics highlighted by the financial industry. Not every real infrastructure asset, however – whether greenfield or brownfield – has these characteristics, and in particular the associated risk/return profile.

This inconsistency – not to say misrepresentation – has led to considerable confusion among investors who – in real life – are effectively confronted with all kinds of infrastructure assets, the characteristics of which go clearly beyond this 'definition'. In the opinion of the authors, this 'definition' is not only short-sighted, but could actually risk misleading investors who are less familiar with infrastructure as an asset class.

Hence, what the financial community needs is a realistic, practical, and pragmatic definition of infrastructure, which takes all the aspects mentioned above into consideration rather than somewhat denying their existence.

To this end, it serves to recognise that the modern general linguistic usage identifies the term infrastructure with material infrastructure, which consists of physical assets such as roads, ports, utilities and the like (Frey, 1978). Although Buhr (2007) generally agrees with the

practical focus on material infrastructure, he classifies it by initially concentrating on the physical and social needs of human living, in order then to deduce the required infrastructure output (e.g., water, energy, heat, light) and the associated physical assets (material infrastructure).

Following a similar line of thought, Fulmer (2009) finds that 'inconsistencies and sector-specific biases abound, [. . .] common threads run through the myriads of definitions. Nearly all mention or imply the following characteristics: interrelated systems, physical components and societal needs'. A sample definition is as follows:

> *The infrastructure supporting human activities includes complex and interrelated physical, social, economic, and technological systems such as transportation and energy production and distribution; water resources management; waste management; facilities supporting urban and rural communities; communications; sustainable resources development; and environmental protection (American Society of Civil Engineers, 2009).*

Aiming to come up with a practical definition that integrates the common themes of systems, physical assets and societal needs, Fulmer (2009) concisely suggests 'the physical components of interrelated systems providing commodities and services essential to enable, sustain, or enhance societal living conditions'.

Following this brief overview of the variety of definitions and understandings of infrastructure prevalent in the market, this book now also suggests to address 'only' material infrastructure and its underlying structures, organisations, business models and rules and regulations. This includes all physical assets, equipment and facilities of interrelated systems and the necessary service providers that offer all the commodities and services relating to the sectors and sub-sectors presented in Figure 1.5 to the individual economic units or the wider public in order to enable, sustain or enhance societal living conditions. The figures headed

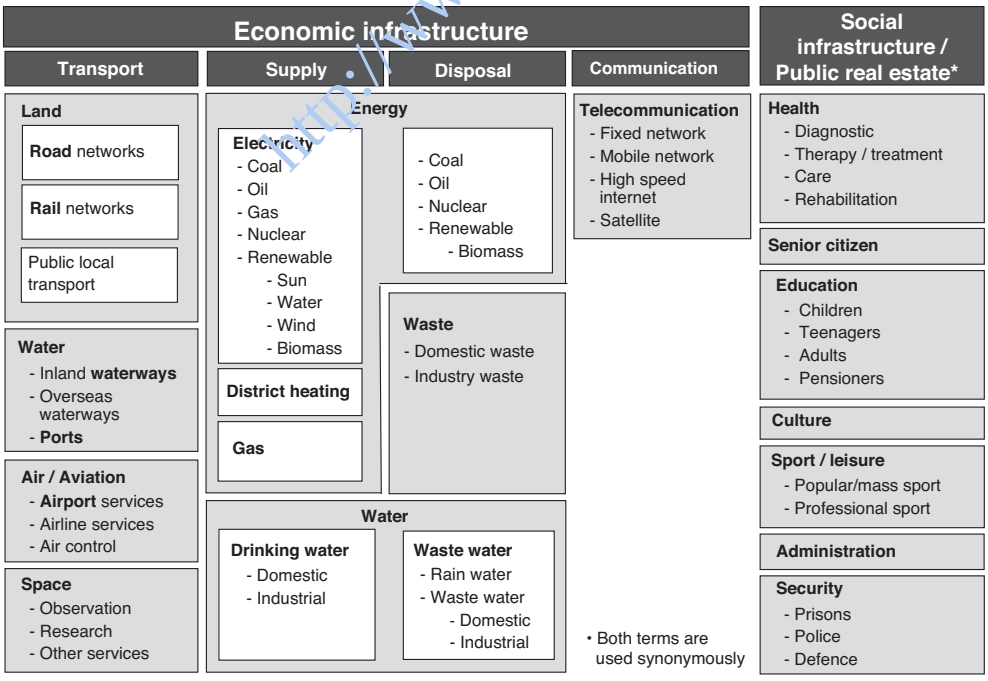

Figure 1.5 Infrastructure – sectors and sub-sectors (authors' own source)

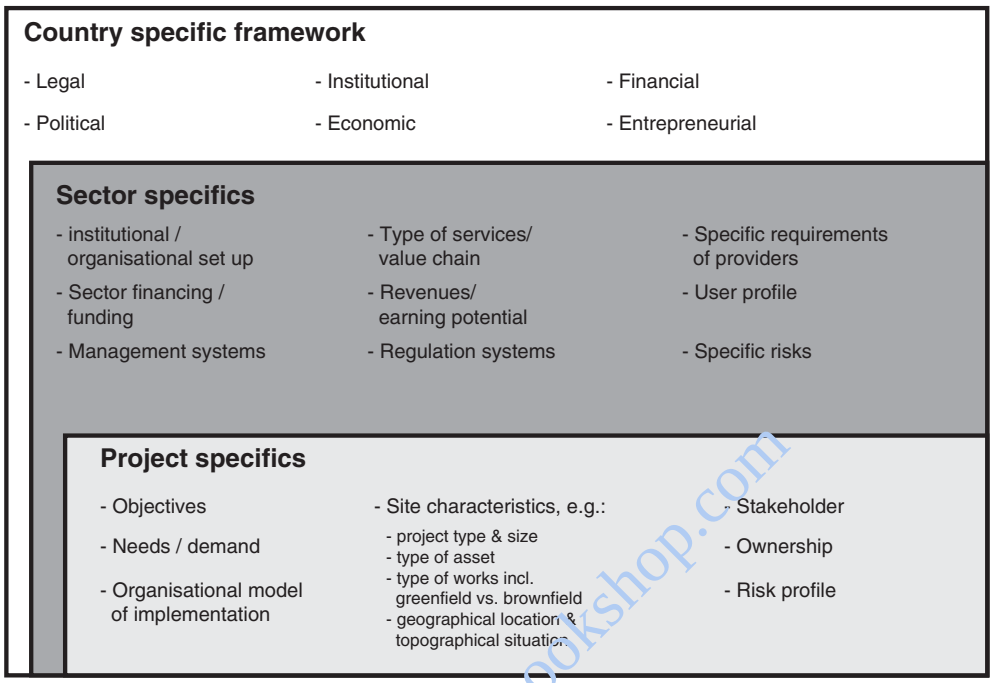

Figure 1.6 Country-, sector- and project-specific characteristics (authors' own source)

'Value added and investment' and 'Sources of revenue and value added', which appear in each of the sub-sections of Chapter 4 which covers the different sub-sections, show the typical movable and immovable real assets in the individual sub-sectors, further defining the spectrum of the respective physical infrastructure assets with a view to presenting the actual investments and investment opportunities in this area.

On the basis of this wider, more commonly applied definition of infrastructure, Figure 1.6 shows that infrastructure assets in that sense can be further broken down on the basis of their country-specific, sector- and sub-sector-specific and project-specific characteristics.

Country-specific characteristics generally describe the legal, political, institutional, economic, financial and entrepreneurial framework and the conditions of competition with a tangible influence on all assets, and hence any investments in such assets. These may vary significantly from country to country and therefore cannot be discussed in detail in this book. However, the various international examples incorporated into the text throughout the book are intended to provide at least an insight into them. In addition, the structural, regulatory and contractual characteristics that may be specific to the relevant sector or sub-sector and, in particular, the project- and transaction-specific characteristics are extremely important.

The sector- and sub-sector-specific characteristics, which will be discussed in detail in Chapter 4, include in particular:

- institutional and organisational structure of the sector or sub-sector and the distribution of responsibilities and administrative functions;
- nature and extent of existing public financing/funding within the sector;
- situations of competition and existing regulation and management systems;

- value chain and its individual elements/type of services, the nature and extent of their integration and the related revenue or earnings potential;
- regulation system;
- specific requirements of providers of the corresponding infrastructure services;
- special user profiles;
- specific risks.

These characteristics may also vary considerably from country to country. Certain aspects, however, apply to all sectors alike and hence can be addressed on a cross-sector basis, as can be seen from Sections 1.2.2 onwards. In Chapter 4, these and other characteristics will be presented and discussed in detail using the example of selected sectors and sub-sectors.

In addition to the country- and sector-specific characteristics, notable project- and transaction-specific characteristics include:

- objectives and the demand situation;
- site characteristics, for example
  - size and the geographical location of the project;
  - type of asset, that is, single asset, network or bundle of assets, etc.;
  - type of works, that is, new construction, widening/extension, rehabilitation/modernisation, maintenance and operation, etc. (including the aspect of greenfield versus brownfield) along with their individual specifications;
- composition of the stakeholders and their specific expectations;
- ownership interests in the project;
- overall risk profile;
- overall organisational model applied to the implementation of the infrastructure project determined by the privatisation, partnership, business, contractual and financing models (see Chapter 3 for a systematic analysis of the overall organisational model).

All these aspects that may influence the performance of an individual infrastructure project in a particular sector and country are largely addressed in detail in Chapter 5, in conjunction with the project finance structures that are most commonly used or required for direct investments.

The following section discusses the most important cross-sector characteristics of infrastructure assets with a view to providing an initial insight into the key determining factors behind investments in infrastructure.

1.2.1 Infrastructure sectors

In the previous section, Figure 1.5 provides an overview of the most important infrastructure sectors and their sub-sectors. Each of these infrastructure sectors – and often also their sub-sectors – are subject to individual institutional and organisational conditions with which investors should intensively familiarise themselves in advance (see also Figure 1.6 on page 10). A knowledge of the responsibilities and the distribution of functions within the public administration, the existing financing structures and sources of revenue, the existing privatisation models and their structures and procedures, the specific legislative framework, norms, standards and other rules and regulations, which may vary significantly between the individual sectors and sub-sectors and from country to country, is essential for a successful investment. In addition, investors must examine the infrastructure elements or value components to be privatised in terms of their consistency with the investors' overriding investment strategies,

the corresponding revenue and earnings potential and the compatibility of the interfaces with other, potentially non-privatised components within the integrated value chain. Examples include the network, passenger and goods transportation services and stations owned by railway companies. The transportation services are often privatised, whereas the network and the stations remain in the hands and under the control of the government. This requires a precise definition of the allocation of functions and responsibilities, and risks, mutual requirements and interfaces. Potential investors should also be aware of the specific competitive structures in the respective sector, including any regulatory systems that may be in place. Chapter 4 provides a comprehensive description of all these topics using selected sectors as examples.

1.2.2 Types of infrastructure companies

Private investors generally invest in infrastructure via companies offering infrastructure related products and services, which operate as self-contained entities. As such, they are primarily interested in the profits generated by such companies and the risks to which they are exposed. In addition to the return on capital employed, strategic investors examine also the profits from additional value added to their own core operations.

Infrastructure companies can be broken down into three types: (i) project companies; (ii) operating companies; and (iii) service companies, depending on their typical business purpose.

Infrastructure project companies have a business purpose that is closely linked to a specific project in terms of location, timing and functions. A typical example would be a PPP project under which the construction, financing/investment and operation of a road project between points A and B is transferred to a company that is specially formed for this purpose for a period of, for example, 30 years under the terms of an agreement with the characteristics of a contract for work and services, with ownership returning to the public-sector principal at the end of the contractual term.

This company may have an exclusively private-sector shareholder structure or may have both public- and private-sector shareholders. Typical (first-time) investors include strategic investors such as construction groups or infrastructure operating companies (discussed below), which expect to generate a profit from their core operations in addition to the pure return on their capital. Financial investors often – though not always – invest after the ramp-up phase, replacing the strategic investors in part or in full. Ownership of the infrastructure assets commonly remains with the public-sector principal or is transferred to the company only for the term of the contract. The remuneration structure, that is, the future sources of revenue from the company (for the investors), may include one of the following:

- Fixed availability fees to be paid by the principal (i.e., depending on the performance of the contractual services), under which the investors are exposed solely to performance risk.
- User fees, for example, where the project company obtains a concession granting it the right to levy fees in order to finance the contractual services – including the investments – via the users of the project; in this case, investors are exposed to demand risk as well as performance risk, although this may be cushioned to a greater or lesser extent by government guarantees depending on the respective circumstances.

Projects that are still partially or wholly owned by the public sector are generally marketed via public tender processes. At this point, investors are in competition 'for the market' with other investors and investor groups. During the subsequent project term, however, the project company itself is in many instances no longer in competition on the open market. Accordingly, projects are usually subject to (fee) regulation if they are user-financed. Infrastructure project

companies are becoming increasingly common around the world, with examples found in practically all infrastructure sectors.

In contrast to pure project companies, *infrastructure operating companies* have an essentially unlimited scope in terms of timing and location. Rather than concentrating on a specific project, they generally focus on one (e.g., utilities) or several (e.g., multi-utility companies) infrastructure sectors. These purely private or mixed-ownership companies invest in infrastructure assets and perform comprehensive infrastructure services on their own account and their own responsibility with a direct (contractual) relationship with the users, who ensure that the project is financed via user charges. They also invest in infrastructure project companies. In contrast to project companies, operating companies are established as permanent entities and generally also own at least those infrastructure assets that they are permanently responsible for operating; as such, they are exposed to both performance and demand risk. Private infrastructure operating companies often arise from enterprises that were originally in the public sector, whether as the result of an initial public offering (IPO) or the auction of some (partial privatisation) or all (full privatisation) of the shares in the existing enterprises by way of a public tender. Privatisation is often driven by the need for additional capital to renovate or expand the company's existing infrastructure assets. The involvement of private investors also seeks to achieve more efficient structures and improved performance on the part of the company. These companies are in direct competition with other similar companies on the market. Where monopoly situations exist, they are subject to regulation with regard to their pricing policy in the respective markets at the very least. Notable examples include power suppliers such as E.ON and EDF, water suppliers such as Veolia and Suez, waste disposal companies such as Sita (Suez) and Remondis, and telecommunications companies such as Vodafone and Telefonica, as well as global providers of transport infrastructure, for example, toll roads, airports or port terminals.

Infrastructure service companies focus on one or more service categories in one or more infrastructure sectors and perform these services in exchange for contractually agreed fees. Examples include consulting, construction and facility management companies and other companies or service providers, for example, Techem, which specialises in recording data on energy and water consumption. Generally speaking, this type of company does not invest in infrastructure in its own right, does not perform any cross-lifecycle infrastructure services and hence is not exposed to any of the corresponding performance or demand risks. However, their service range is always subject to a relatively large degree of pressure from competing companies.

As can be seen above, any investment decision must take into account the specific infrastructure involvement of the type of company in question. It is also important to examine the infrastructure sector in which the company is primarily active. To this end, it is essential to become familiar with the characteristics of the individual infrastructure sectors and subsectors, their specific technical, economic, institutional, organisational, regulatory, legal and political conditions and the resulting requirements in order to be able to estimate in particular the specific risks arising as a result. This is especially important for infrastructure project and infrastructure operating companies due to the significantly longer term of their involvement and the fact that this is usually backed by a substantial amount of initial equity, whereas it is somewhat less crucial for infrastructure service companies, which can be replaced or move in and out of a project more easily.

1.2.3 Role of the private sector and PPPs

A growing number of infrastructure assets are being operated by or in cooperation with private investors and operators, for example, under long-term concession agreements or other PPP

models. However, the nature and extent of the private sector's involvement and the individual business models can vary significantly between the different infrastructure sectors and subsectors. Private sector participation in 'public functions' involving private investment may range from PPP models based on long-term contractual arrangements through to full material privatisation, under which private providers operate on a permanent and independent basis in competition with other private-sector or, in some cases, public-sector providers.

Certain sectors are naturally unsuited to the full range of privatisation models (for a detailed description and discussion of the different privatisation models – formal, functional and material privatisation – see Section 3.1). In the road sector or certain fields of social infrastructure, for example, there are practically no examples of full privatisation anywhere in the world; instead, a highly diversified range of PPP models exists. This is because publicly dedicated roads, defence and police facilities, prisons and educational establishments are usually owned by the public sector and required to remain as such by law. The opposite is true in the energy and telecommunications sectors, both of which have been fully privatised in a number of countries, and the large number of airports privatised over the past 15 to 20 years use both PPP models and full or partial material privatisation models. In some sectors, private and public structures exist alongside each other at every stage of the value chain, for example, where individual private operators use the public rail network in exchange for track charges, individual private port terminals are granted concessions by the public-sector operators of the main port facilities, or waste water is transported via the public sewer system to a private sewerage treatment plant. In the waste sector, however, these priorities are harder to distinguish. For example, although the private sector's involvement in Spain and Germany focuses on waste disposal, particularly in the form of incineration plants, waste collection in Sweden is largely performed by private companies and disposal is primarily organised by the public administration (PSIRU, 2006).

As well as the boundaries and opportunities inherent to the system, aspects such as tradition, public-sector mentality and existing structures that are often difficult to change may serve to promote or restrict the use of the full range of existing organisational models, or even prevent the possibility of private investment in public infrastructure as a whole.

As this discussion makes apparent, there are significant sector- and country-specific variations in the models used for private-sector investment. There is very little transparency with regard to the chosen business model approach or even the underlying contractual models. On the contrary, some of the individual models and structures that have evolved have their own terminology and are essentially impossible to compare. An internationally understood and accepted, cross-sector standardisation would be highly desirable, not to mention extremely useful to investors. Chapter 3 of this book in particular seeks to make a substantial contribution to this development by systematically recording, defining and classifying the known privatisation, partnership, business, contractual and financial models (on the basis of extensive international experience), which finally can (or indeed should) be combined and structured to an overall organisational model for every individual project.

1.2.4 Value added and value chains

The value added arising from infrastructure services can be broken down into two types: (i) value added resulting from the (movable and immovable) assets belonging to the respective service range; and (ii) value added resulting from the service range itself.

Movable assets, such as locomotives and carriages in the rail sector or ships in the water transport sector, and immovable assets, that is, fixed buildings and physical structures, represent the actual investments to be undertaken as independent value added elements. These are combined with additional value added elements such as planning, construction (erection and provision of equipment), financing, and constructive and operational maintenance (comprehensive overhaul measures and ongoing maintenance respectively). Constructive and operational maintenance are often aggregated as the operation of infrastructure assets.

The value added elements associated with the realisation and operation of the movable and immovable assets exist to a greater or lesser extent for every type of infrastructure service and differ only in terms of the type of asset involved. The providers of such services include engineering offices, construction firms and facility managers for the performance of technical functions, and financiers, that is, investors and banks, for investment and financing. These parties frequently offer cross-sector services rather than specialising in a specific type of infrastructure. For example, larger engineering offices and construction firms may perform planning and construction services for roads, airports and railways as well as hydro power plants, water mains and sewage treatment plants.

Investors can be broken down into pure financial investors, who are primarily interested in the return on the equity they invest in the infrastructure (so-called institutional investors), and strategic investors, who expect various additional forms of value added from the aforementioned services. Accordingly, financial investors largely invest across various sectors, primarily driven by risk and return opportunities, whereas strategic investors tend to limit themselves to those sectors that are strategically relevant to them. As such, the latter group is required to perform a mixed calculation in order to determine its total return expectations and results.

Value added and the associated services resulting from the infrastructure service range itself can vary significantly from sector to sector and require wide-ranging knowledge and expertise. Accordingly, providers generally specialise in certain sectors, such as transportation, water, waste or energy, or even specific sub-sectors. One exception is multi-utility companies, which seek to exploit synergies in their customer base by offering cross-sector services.

Depending on the perspective adopted, total sector- and sub-sector-specific value added can generally be broken down into individual value added elements or combined to form a value chain in a more or less aggregated or differentiated form. For example, the water sector consists of water supply, waste water disposal and – due to its environmental relevance – watercourse maintenance and expansion. In turn, the supply of (drinking) water is composed of the elements of catchment, collection/storage, preparation, distribution (to the domestic or industrial supply point) and billing. Each of these individual elements can also be broken down further. As such, the differences between the service ranges offered by each infrastructure company are just as pronounced.

For investors, this knowledge and the resulting opportunities for structuring their investments are important, because different individual or combined service ranges can allow them to leverage different value added potential, and hence different return or yield potential.

The same applies to the general corporate objectives pursued when making a given investment. Investments are principally conducted in order to do one of the following on the basis of an order or due to strategic internal capacity considerations:

- meet additional (internal or external) demand/requirements (new and/or expansion investments);

- compensate for technical and/or economic obsolescence (overhaul/replacement investments);
- leverage additional efficiency potential within a value added element (streamlining investments).

Investments may also seek (i) to leverage additional upside potential by expanding or, in some cases, (ii) concentrating the activities of the company itself. Expansion or concentration processes may relate to a specific region or customer base or to the value chain as a whole.

In the first case, known as *horizontal diversification or integration*, companies offering the same or similar value added are combined with a view to expanding market share, that is, realising economies of scale and increasing market power. Returning to the example of the water sector, horizontal integration is particularly relevant due to the existence of natural monopolies. With almost no exceptions, business combinations are implemented with the aim of expanding regional service areas.

In the second case, known as *vertical diversification or integration*, a company expands its activities to incorporate other value added elements. This may affect the depth (e.g., expansion of capacities for the realisation of components/services within a production or service process that were previously procured externally) or breadth (e.g., expansion of product or service range) of the value chain or the number of steps in the value chain (e.g., the upstream or downstream integration of individual consecutive elements in the chain).

A further option in the infrastructure sector is *lateral diversification*, in which companies connect elements of entirely unrelated value chains. Common examples include multi-utility companies in the private sector and public or semi-public utilities, which may offer a wide range of supply, disposal and transport services or bundle all three service areas. In particular, the network infrastructures for water, electricity, gas, transport, telecommunications, etc., and the potentially largely identical customer bases of these otherwise extremely different sectors, may offer significant synergy potential and hence provide a strong incentive to bundle services in this way.

1.2.5 Greenfield versus brownfield investments

In the case of infrastructure projects, a distinction is usually made between greenfield and brownfield projects, otherwise known as development and operational projects or primary and secondary projects respectively. This classification reflects the specific (project) risks associated with the different development stages of an investment project. Investors tend to assume that the risk of a greenfield investment is always higher than that of a brownfield investment. As we will see, this is probably a safe assumption to make. In specific cases, however, it may be surprising to learn that selected greenfield investments can have a level of risk similar to that of brownfield investments (see also Weber, 2009).

This book defines greenfield projects as assets that are generally constructed for the first time at a specific site. They may be in the planning, development, financing or construction stage. In contrast, brownfield or secondary projects are already operational and/or have a predecessor of some description at the same location. These projects may involve the reconstruction, renovation or expansion of existing assets. In other words, the key differences lie in the maturity of the project and the available project-specific experience, which is significantly less in the case of greenfield projects. This may lead to a considerably higher degree of uncertainty and risk on the cost and revenue side.

The cost-side risks of greenfield projects primarily relate to planning, development, the receipt of approvals and environmental permits, public acceptance and construction and operation, particularly where new and unproven technologies are used; compare the construction of a new hydropower plant with the expansion of an existing plant to install additional turbines, for instance. On the revenue-side, demand and price uncertainty constitute the primary risk. This applies in particular to user-financed projects (see Section 1.2.6 'Sources of revenue and financing'). These factors can only be fully identified once the facility has been taken into operation. For example, toll roads in comparatively undeveloped areas are considered to be significantly more risky than comparable projects to replace existing road connections with proven high volumes of traffic. Even in the latter case, however, the acceptance/usage and price risk remains if the previous road was toll-free and there is a corresponding lack of historical data with regard to price sensitivity. In the case of greenfield projects where revenues are covered partially or entirely by public funds and/or guarantees from trustworthy institutions in one form or another, the revenue risk should ideally also be eliminated by way of the project (contractual) structure (again, see also Section 1.2.6).

By contrast, brownfield projects relate to existing, operational assets that have already gone through the greenfield/development phase. This means that all the risks arising from the development, approval process, commissioning, technology and initial demand are generally outdated. The main residual risk types are operational risk, regulatory risk and market risk, neglecting geographical, political and legal risk, etc. for the time being. However, some of the typical greenfield risks may return if extensive replacement or expansion measures become necessary, such as the demolition and reconstruction of an existing facility.

As a matter of principle, existing assets are comparatively easy to evaluate (e.g., in terms of demand, operation and maintenance) on the basis of historical data and past experience. However, other risks must be taken into account: contamination or hidden defects may be highly relevant for this type of project, for example.

A further important difference between greenfield and brownfield projects is that investors in greenfield projects do not generally turn a profit on their investments in the first years of the development and construction phase, but instead are merely required to make payments. Initial capital is only returned when the respective facility is operative (making for a 'J curve', which is typical of cash flows from private equity investments). Investors accept this J curve and the higher risk associated with greenfield compared to brownfield investments because the growth potential of an asset is at its highest in the start-up phase, meaning that they can participate in the value growth of projects in this phase and possibly generate higher returns as a result.

By contrast, conservative brownfield projects in a good condition will ideally offer stable, predictable current cash flows from the very start in the form of dividends or interest payments in a similar way to real estate or fixed-income products. In other words, such conservatively structured brownfield projects tend to be particularly suitable for risk-averse yield-driven investors, whereas greenfield projects are more appropriate for capital gain- or growth-style investors who are prepared to take additional risk (see also Chapter 2).

However, it would be a mistake to conclude that necessarily every brownfield investment has low risk and bond-like returns. The risk profile of brownfield assets that are in a poor condition, for example, due to their age, inadequate maintenance, weak management, heavy usage and/or financial distress due to, for example, high leverage or no long-term contracts, may be quite high and the return/cash flow profile very unpredictable and unstable. In this case, the aim is to generate value added through operational improvements, repairs and capacity expansions, new forms of use, or financial and/or contractual renegotiations and restructuring, for example.

1.2.6 Sources of revenue and financing

Financing in the individual sectors in terms of the responsibility of the relevant public bodies was briefly touched upon in Section 1.2.1. It was mentioned that their financing and operational functions are housed with different public-sector offices. The potential risks arising from this situation for private investors were also mentioned in this context. This section intends to address the origin and usage of funds in general, that is, the sources of revenue and how these are ultimately used for the public or private financing of infrastructure (investment costs, current expenses, interest on capital, repayment of debt and equity). Figure 4.1 in Section 4.1.1.5 (on page 85) illustrates exemplarily potential sources of revenue in the transport sector.

Revenue of some sort is required in order to finance infrastructure investments and the subsequent operation of the respective assets, whether publicly or privately. In a purely state-based system, this revenue is generated from taxes and duties that may be sector-specific (e.g., motor vehicle tax in the road transport sector) or general (e.g., income tax) as well as user charges, which are naturally sector-specific in their nature (e.g., tolls, water charges, waste collection charges, etc.). As a matter of principle, government revenue/expenditure systems are based on the principle of general budget appropriation, meaning that all sources of revenue are initially aggregated – in the form of the public budget – before being allocated to the individual area-specific budgets on the basis of corresponding negotiations. This applies equally to general and sector-specific taxes and duties and user charges. Irrespective of the principle of general budget appropriation, some countries earmark certain proceeds for a specific purpose, for example, revenue that can be directly allocated to a specific sector – whether in the form of taxes, duties or user charges – is also dispensed in the same sector, that is, on a sector-specific basis. Such revenue does not reach the general public budget, but instead remains in the budget of the respective sector. One typical example is road funds, which are generated from fuel duty, motor vehicle tax and, where applicable, toll revenue, that is, without being fed into the wider public budget at any point.

The clearest case of earmarking is when a government grants a private infrastructure investment operator the long-term right to apply the user charges from a project directly to cover any project costs (investment costs, current expenses, interest on capital, repayment of debt and equity), including to generate a profit. In this case, it could be said that the earmarking is not only sector-specific, but also project-specific. This sums up the government's perspective.

For private infrastructure investors, there are two basic sources of revenue: user charges or, where these do not exist on a project-specific basis or are unavailable to the investor, budget funds paid by a public-sector principal as a regular fee. Internationally, a number of sub-sectors are largely user-financed, particularly water and power supply, but also public transportation by rail, sea or air. The disposal sector is less clear-cut, because some countries still do not charge for waste or waste water disposal.

Opinions also differ when it comes to the road transport infrastructure. User charges are traditionally levied in a number of countries, at least for high-priority roads. A distinction is made between mileage-based tolls and time-dependent charges in the form of vignettes (toll stickers). User financing for social infrastructure facilities is a further sticking point. Although users in some countries pay charges to a greater or lesser extent, such as school and university tuition fees in the education sector or direct fees charged by doctors, hospitals or other institutions in the healthcare sector, such facilities are mostly financed only by cost allocation systems (in German: Umlagensysteme) that frequently pose problems in terms of collection when it comes to the private (re-)financing of individual facilities. Even in the case of (mass) sport and cultural institutions, the revenue generated is almost always insufficient

to cover the costs incurred. In certain sectors, such as the administrative, security/defence and penal systems, such kinds of revenue streams are unthinkable in the first place.

There is no need to rule out the possibility of private investment just because a user-financed approach is impossible or inadequate. However, such assets must ultimately be financed by the public purse, for example, in the form of PPP measures. These regular, service- and/or performance-based payments by the public-sector project executing agency/principal to the private operating investor under PPP projects are also referred to as availability payments (see Section 3.4).

User finance naturally entails the greatest risk for private investors, particularly if the revenue risk is passed on to the investor in full. These risks result from the uncertainty that is inherent to the long-term revenue forecasts. As such, it is important to make an accurate estimate of future volumes and demand (e.g., traffic or refuse volumes, power or water demand, etc.) as well as future prices and charges. In infrastructure markets, the long-term development of both of these parameters is influenced by a number of factors over which private infrastructure investors naturally have little or no control. For example, volume development is generally determined by macroeconomic and economic policy factors or changes in legislation rather than by user behaviour falling within the investor's sphere of influence, and prices are often driven by the applicable regulations and not by the operator's pricing strategy.

These revenue risks do not apply if the operating investor is remunerated in the form of regular payments from the public budget. In this case, the relevant factors are the operator's performance with respect to the contractually agreed standards and, in particular, the creditworthiness of the public-sector principal in terms of its ability and willingness to meet its payment obligations. Payments by the public-sector principal are generally governed by a complicated set of funding instruments that varies significantly from country to country. However, it is sometimes difficult or impossible to reconcile the specific subsidy conditions associated with the respective 'pots' with private investment. This naturally also entails risks for the operating investor that must be identified and actively managed to the greatest possible extent. In some cases, it may even be necessary to amend legislation or administrative regulations in order to enable the required compatibility.

1.2.7 Competition and regulation

Whenever there is a fear of market distortion or even market failure in an economic sense, for example, natural monopolies or other forms of restriction on competition in the case of common assets, the government can and must intervene in the form of regulation. Market regulation therefore describes the body of all rules and regulations used by the government to this end. This is achieved through the issue of statutory provisions and ordinances that serve to limit the effect of market forces while ensuring legal security and reducing information and transaction costs. In other words, it is important to achieve a suitable degree of regulation and employ the right systems and methods. These responsibilities are generally assigned to regulatory authorities.

A regulatory authority is a government body involved in determining competition policy in a similar way to an anti-trust authority, but with more extensive duties. Anti-trust authorities are usually responsible for the ex post control of markets, whereas regulatory authorities are primarily created for economic sectors in which this is insufficient to maintain the required degree of competition. They are characterised by far-reaching instruments of ex ante control, such as price and product approval, operate on an industry-specific basis and are generally

found in markets with a tendency for monopoly situations, such as line- or network-based sectors in which the creation of parallel networks is either undesirable or economically unfeasible. This typically includes the telecommunications, post, rail, broadcasting, gas and power markets. Regulation is also essentially indispensable in the water and aviation markets and the toll road sector.

Within the European Community, the national regulatory authorities are obliged to implement the relevant EU directives.

At a global level, a distinction is made between various regulation systems based on their impact:

- *Volume regulation*, where the number of competitors in the market or the production volume is affected in the form of the licences and concessions that are required for market entry, for example. Service obligations and prohibitions on activity are also used in order to increase the attractiveness of a market by determining its scope.
- *Price regulation,* which seeks to achieve a specific price level. Fixed prices and price floors and caps are used to set absolute limits. Potential measures also include cost tariffs that specify the relevant price calculation procedures and the imposition of individual prices that cannot be changed without the approval of the responsible regulatory authority.
- *Rate of return regulation,* which sets a limit on the return on capital employed.

Additional regulatory procedures, some of which are sector-specific in nature, are described in detail in the following chapters.

This first chapter clearly has shown the high level of demand for infrastructure investments and illustrates the most important general, non-sector-specific characteristics of infrastructure assets, including some of the financing issues that are relevant for investors. As such, it forms the basis for the information on investment considerations among institutional investors, and in particular financial investors (in contrast to strategic investors), contained in the following chapters.

In the following chapter, the first objective is to explain and position infrastructure as an asset class. To this end, a number of research reports are analysed and discussed, focusing on risk and return as well as portfolio diversification issues. Then, a wide range of different investment opportunities – particularly in unlisted infrastructure funds – and concrete tools for their evaluation will be discussed.