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The Nature of Project Finance

Great projects fire the imagination. In conception and realisation, such ancient wonders as the Pyramids of Egypt, Aukor's temples, the stone city of Petra or Rome's revolutionary water courses have caused veneration and wonder in both the contemporary and modern viewer. They inspired emulation by successive kings and emperors, whether to honour a deity, subjugate a people or repel an invader, or to create a lasting economic infrastructure. More recent schemes such as the transoceanic Panama Canal or 19th and 20th century rail and water transport systems in Europe and North America have transformed the fortunes of national and global economies, and seemed to suggest unlimited scope for humans to transform the landscape they inhabit. Whether from commercial needs or the fiat decision of a ruler, it seems that great projects have been underway throughout recorded history, and a neglected curiosity that projects as diverse as the Stonehenge circle and the Inca road system were effectively subject to transaction costs and financing concerns.

What is most interesting is that the reasons for undertaking all such feats have changed little over the millennia. The typology of reasons that explain their construction remains relatively limited, although priorities have changed over time. Without putting too fine a point on it, these motives can be categorised as the demonstration of authority or reverence, the enhancement of security or the creation of new economic resources. They appear as devotional creations (temples, pyramids or cathedrals), schemes to manage the elements (great dams and irrigation schemes), economic structures (ports, transmission projects, canals, road or rail systems, mines, process engineering), and political (iconic public structures, developmental projects, the exploration of space, defence systems, and projects of prestige that demonstrate national power or emancipation). In an age of immense computational power the analysis of large-scale projects has become increasingly complex, and while our insight into the environmental, social and economic impact of all such schemes has developed immeasurably, it will remain inevitably incomplete. It is thus quite conceivable that future actions to address the negative impact induced by so many

major projects might yet depend on the instigation of still more, even on a more demanding scale.

This book aims to provide a framework to comprehend large projects in the modern world, concentrating on the financing of projects. In considering project finance, we draw on several other disciplines. Of necessity we make use of an economics vocabulary, but we approach it with a somewhat unconventional view. We take traditional demand, supply and economics of industrial organisation concepts based on market equilibrium analysis as handed down from neoclassical thinking, but our view is that to understand the world of project finance requires a further vocabulary of market imperfections. Hence the economics we use largely reflects the world of friction in economic exchange, contracts, transaction costs, agency conflicts and economic institutions. Possibly the most conventional part of our approach is to corporate capital budgeting decisions – in the end projects are expected to be feasible in aspects that are important to their promoters and hosts. To our knowledge there is not yet a widely accepted methodology to assess project feasibility in both the public and private sectors other than extended discounted cash flow methodology and its derivatives, although we do not pretend that observed market prices are necessarily information-efficient. We also do not confuse desirability with feasibility – this is a matter of political, ideological or philosophical choice. We concentrate largely on private-sector aspects of projects, but it will become clear that it matters little if the principal shareholders in project companies are public or private. Irrespective of political ideology we consider that societies everywhere continue to value the economic application of their resources, so we broadly assume this convention has merit.

This introductory chapter has five sections. First, we present a capsule history of a famous project of the recent past in order to provide indications of the approach we shall follow to large projects and their financing, and perhaps to introduce the richness of the world of large projects. Thereafter we describe generally the matrix of arrangements within which modern projects are typically executed, concentrating on concepts around corporations and their structures and how this framework functions to govern projects, and specialised project-related companies. A reader with knowledge gained from previous study of economics (especially institutional economics and transaction cost economics), finance (particularly banking and corporate finance), law (particularly commercial law), or business and accounting will recognise many of the concepts we describe throughout the book, but our objective is to explain concepts sufficient for students in a range of non-cognate disciplines to become fully comfortable with the subject matter. We thus outline the corporate context within which modern projects are conceived and executed. Third, we introduce the nature of project companies, their typical business model and financial structure, and the economic nature of modern project company facilities (such as bridges, tunnels, power plants, transmission pipelines, and refineries). Fourth, we believe it will be challenging to make sense of as disparate a field as project finance, because it draws on such a wide range of disciplines. Thus we fall back on an old ally to help make sense of complexity, and identify and outline a number of systems

theory concepts to guide our overall approach to complex matters as they arise in the rest of the book. Last, in Section 1.6 we present the plan for the rest of the book. In all, we wish to impart an approach to analysing the context of projects to identify where the likely economic, financial or political risks may be lurking, in order to consider how such risks are managed. No single concept here is radical but we prefer to think we are suggesting a novel way to approach the study of particular types of projects. In a practical sense, we consider this way of thinking to be appropriate for the analysis of any identifiable venture within a commercial context.

1.1 The world of projects today

Projects, projects everywhere. It would indeed be wonderful to write a book about the history, engineering, finance, and stories associated with mega-projects – each such story would be a gem: the Panama Canal, Suez Canal, Oresünd Link between Denmark and Sweden, the US interstate highway system, and many, many more. We simply do not have this luxury, so in order to spur early interest, we present a short narrative about an amazing project in terms of ambition, engineering ingenuity, and vision – the Channel Tunnel, developed in the 1980s and early 1990s linking France and the United Kingdom by a rail tunnel under the English Channel. It is ironic that this project has been hailed as a wonder of the modern world – and yet the finances of this magnificent project, in terms of the concepts covered in this book, remain an absolute mess, with several financial restructurings undertaken since it commenced operations in the early 1990s, with no real prospects of it being a successful infrastructure asset in economic terms for some time. An English Channel Tunnel has lain in the imagination of engineers from early Victorian times but in becoming a reality the project grew into a contractor's dream and an investor's nightmare. The project was conceived in the mid-1980s, in part as a high-profile cooperative venture between two long-standing national rivals, but has been viewed by successive British and French governments as a scheme that would not receive direct state capital investment or transactional support in either construction or operation. The selected design involved boring two rail tunnels and a third service tunnel between the south-east coast of England and a point in northern France, an undersea distance of around 34 km, and the creation of road and railway terminals and associated infrastructure (Figure 1.1). The plan was for the tunnel to be built, owned and used by commercial interests under a long-term franchise granted by the two governments.

Construction began in 1987 and the tunnel opened for commercial use in 1994. Work on development and construction was undertaken by TransManche Link, a company formed by a group of contractors and financing banks, and subsequently listed on the stock exchanges of London and Paris. TransManche Link's technical achievement is well-regarded, but its financial record was dire from the moment earth was first struck, and the company has been subject to repeated cash crises and financial restructurings. This can be ascribed to two main linked factors. First, the

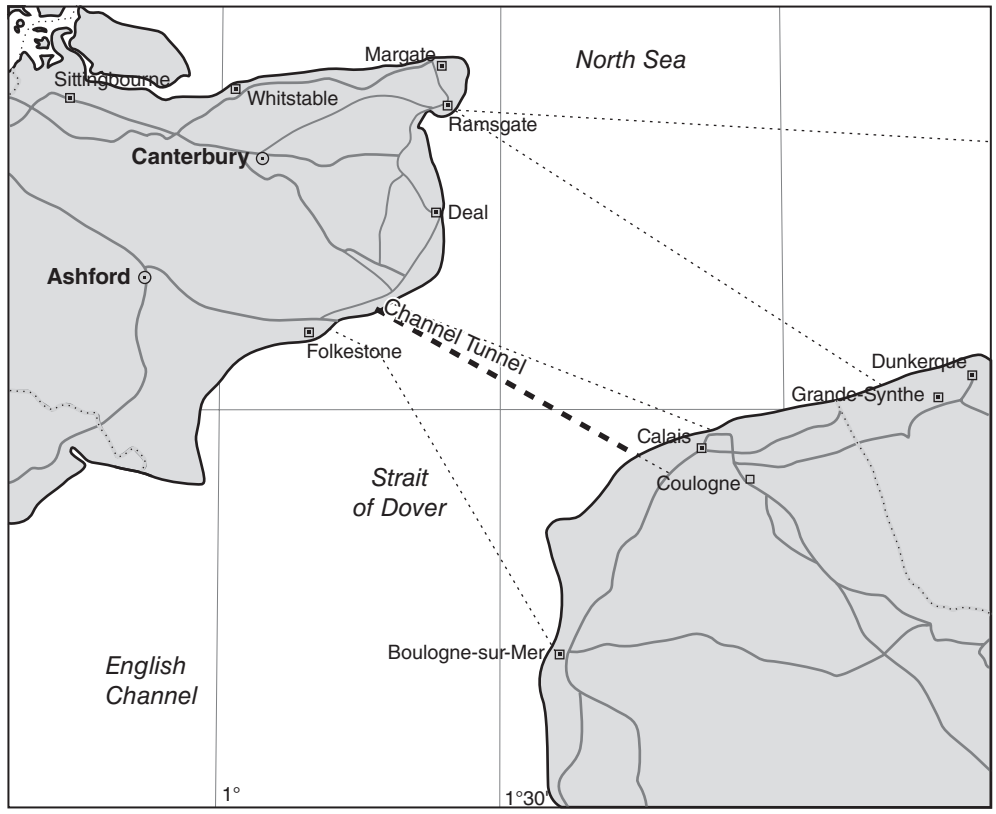

Figure 1.1 Geography of the Channel Tunnel.

attraction of being associated with a prestigious project blinded the sponsors and financiers to its true economics. TransManche Link was severely undercapitalised and poorly funded, and needed to be rescued by its creditors long before the tunnel opened to train traffic. Second, the sponsors were woefully optimistic in their revenue forecasting, and in particular neglected heightened competition from increasingly efficient ferry operators, which even today retain a significant portion of cross-channel traffic, and the more recent success of low-cost airlines.

In essence, the project's early financial modelling and strategy were wholly inadequate, and the scheme has never been financially stable. It should be noted that despite the financial ill-health of the tunnel builder/operator, both governments have expended resources in developing new infrastructure associated with the project, for example in city centre rail terminals, and together with its popularity among users this may ensure that the Eurotunnel project is 'too big to fail'. More technically, it may be significant that the project was developed prior to financial modelling becoming relatively sophisticated and integrated with the regulation of bank capital. One banker associated with the initial listing of shares has written about the casual

approach taken to forecasting which were it to take place today, might be the subject of litigation given that financial representation and disclosure is regulated more closely than in the 1980s (Freud, 2006). Furthermore, it is notable that among the large syndicate of banks that provided loan financing at the project's inception, very few were US-domiciled and only one US bank took a prominent part in the transaction. Major US lenders were then among the most well-resourced in credit risk and project analysis, and almost all were formidably sceptical as to the project's viability. By contrast, European banks faced unsubtle political pressure to join the transaction.[1]

1.2 Corporations, finance and projects: important concepts

To be true to the objective of simplicity, we consider it appropriate to open this book by outlining the circumstances that underpin the concept later defined as project finance. In order to avoid inevitable confusion if this book is to be read in parallel with other traditional texts on corporate or project finance, or the international financial system, it is preferable that we make no assumptions whatever about the existing language of finance, and thus commence by placing this book in its proper context. We therefore request the reader to be patient as we consider several concepts that we deem too important to take for granted.

In essence this book is about the economics, and in particular the financing, of certain classes of projects. While the development and financing of historic projects will remain great narratives in social custom, economics and politics, not to speak of the stories of powerful and single-minded patrons, the focus of this book is thoroughly modern. We are quite selective in our choice and use of economic concepts, what is meant by finance[2] and how it is set in context, in order to make sure that the analyses in this book can be applied as clearly as possible to representative and real-world problems. Further, we are also particular about the meaning and use of *project*, because, despite the ubiquity of the concept, some projects are more prone to failure than others, as the politics that surround some ventures will show (think of the Channel Tunnel as but one example). In short, some projects are more equal than others (apologies to George Orwell).

In such cases as Eurotunnel we see that the venture required an enabling organisation, a form of business entity, to execute development and then operate the project. This indicates our point of departure: projects do not simply happen; they require the formation of such enabling organisations, which in turn require enabling institutions for the project entity to fulfil its objectives. To make quick sense of this notion, we present a fast tour of the corporate world and where projects fit in. We concentrate

[1] Author's recollection from direct experience.
[2] It has been said that there is no economics, there is only finance . . .

on projects that can be categorised as having commercial objectives, but in later sections will also focus attention on the institutions and politics of projects driven by issues of public policy.

1.2.1 Corporations, companies, and more: what is meant by project?

We commence with an attempt to circumscribe what is meant by project. It is correct to say that project finance refers to a particular family of financing mechanisms used to achieve objectives by very large, mostly multinational corporations, governments, banks, and developmental projects funded by regional multilateral organisations such as the World Bank or Asian Development Bank. This is not a mechanism that is in regular use by small and medium-sized enterprises, except in some cases in the specific industry sector of commercial property development. This fact requires that we approach project finance from the perspective of major, complex schemes and, to make the book useful, demands the introduction of many concepts and much vocabulary that is used commonly in such an environment.

In the first instance, our approach follows the meaning of project in business and corporate finance literature, where any and every decision to invest corporate funds in some business activity (i.e. the capital budgeting decisions of the company, or the corporation) may be viewed as a project, and is very often simply referred to as such. This view follows from well-established concepts in corporate planning, popularised by illustrious management personalities such as Chester Barnard, Peter Drucker, Russell Ackoff, Kenichi Ohmae, Michael Porter, Tom Peters, Peter Senge and other figures from the distant (and more recent) past. Any such narrative will tend to begin with *what* a company wishes to achieve, and *how* it may go about achieving it.

'What' is generally expressed as a corporate mission, a high-order, often abstract, statement of the purpose of the company. As many corporate annual reports will show, vision or mission statements are often artificial. Most true corporate purposes can be distilled to being the creation of wealth for shareholders, subject to the caveat that the means to do so is legal and considered morally acceptable. We understand stakeholder interests to be taken as part of legal and ethical considerations. Thus we see limits to being able to justify how any economy may function.

'How' the company sets about achieving its mission constitutes its strategy and, importantly, includes decisions about which products and services the company will create or procure, to whom it will market the products and at what price, all in line with the selected corporate strategy. Corporate, or business, strategy is a similar concept to business model, a term which we shall use in a somewhat revised context in following chapters.

More practically, however, how this mission further is seen to be achieved is through devising a corporate plan and setting and achieving of objectives, which are more usefully expressed in terms of the nature of business activities, or targets such as market share or product profitability. Once objectives and means (products, services) have been confirmed, a crucially important further variable in electing how to

achieve those objectives lies in decisions about organisational structure, from which comes the famous organisational design adage, '*structure follows strategy*'. This is then a short description of what is in general known as the systems approach to planning and, more pertinently for our purposes, to corporate planning. The essential features of this framework are shown in Figure 1.2, where the overall plan is developed from left to right. Internal consistency can be assessed by reversing the direction of the process as if from right to left, and considering whether each stage in the process necessarily leads to its successor.

In working towards describing the context of project finance, it is important to understand that the way the adjective-noun 'project finance' is used in this book is as the product of one organisational design strategy that responds to a particular set of financial circumstances (this will be explained in later sections and chapters). There will also be more about the systems approach; in fact it is fair to say that many of the structures presented in later chapters draw on this elegant old theory.

Let us elaborate in more practical terms on how we use the term 'project' within a corporate strategy framework. Consider a hypothetical large corporation which owns or controls a number of subsidiary companies, and which may be organised into a number of divisions for managerial purposes. At the highest level there is an overall corporate mission or vision guiding divisional objectives. Ideally, each subsidiary contributes in some way to a divisional objective, and so on, following the notion of nested objectives in corporate planning. The corporation's structure (corporate level, divisions and subsidiaries, functional management or matrix organisations, and so forth) is also organised to achieve objectives (structure follows strategy).[3]

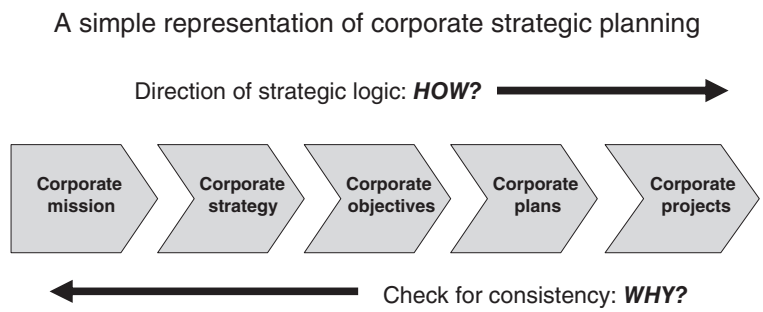

Figure 1.2 Structure follows strategy.

[3] Organisational theory students will be aware of what a bewildering array of organisational structures there are – from bureaucratic to organic, and so on (Handy, 1999). What is important is that these forms do not just happen; for our purposes they are a conscious response to an organisation's strategic objectives. Of course, organisation structures often lose their effectiveness, contribute to organisational decline, and form the subject of painful restructuring.

Within this hypothetical structure, each subsidiary may be viewed as a project defined by what product or service it deals in. For example, suppose Global Consilium Corporation (GC) is a large multinational mineral and energy resources company that explores for and extracts mineral deposits and energy resources (coal, oil and natural gas), and refines and sells a range of metals and energy resources in the organised international commodities markets.[4] Assume further that GC is considering acquiring a company that has production and resource capacity in a metal such as platinum which it considers to be of strategic importance: let us call it Kalgoorlie Platinum and locate it in Western Australia. It could analyse this opportunity as an investment project and make a decision based on its capital budgeting rules, typically applying extended discounted cash flow analysis using a target weighted average cost of capital (WACC) (Chapter 3), conduct due diligence, bid for and acquire the company. If the acquisition is not successfully concluded, GC may of course instead consider starting a new venture to produce the service or good itself, but in either case the task is taken to be a project.[5]

In strategic terms, GC might decide itself to develop, rather than buy a similar asset but it nevertheless remains a corporate project. In similar fashion, a decision to invest in research and development of a particular technology or product is considered a project, a new model car is a project, and by similar reasoning virtually every corporate investment (and divestment) in effect becomes a project. So there are corporate subsidiaries that may be projects, and the subsidiaries themselves may be portfolios of smaller projects. Where a project is defined within a corporate entity depends almost entirely on what is appropriate for corporate strategy and structure, and what seems efficient for management purposes. But importantly, it also matters for financial considerations, as we shall see in following sections.

As an illustration, we may consider any well-known large multinational company. The scope and complexity of such companies' project portfolio are typically large – think of engineering companies like Fluor or Bechtel, mining giants such as BHP Billiton of Australia, Anglo American Corporation of South Africa, or Rio Tinto of the United Kingdom, or think of the many projects of telecommunications and port infrastructure conglomerates like Hutchison Whampoa and Cheung Kong Infrastructure of Hong Kong. Each of these corporations functions across the globe and has wide-ranging, complex project portfolios which may be fully understood by only a small number of senior executives and decision-makers. In fact, a commonly used idiom in modern corporate planning is that corporate strategy can be viewed as a portfolio of present projects and options on future projects (Copeland and Antikarov, 2001).

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[4] The major soft commodity and metals markets are centred on Chicago or London, although oil and gas are traded substantially over-the-counter, or directly between buyers and sellers (Chapter 4).

[5] The symbiotic relationship between a powerful manufacturer and monopoly supplier and the strategic or contractual alternatives that then arise in production are typified by the 1930s case of General Motors Corporation and Fisher Body Inc. (Coase, 2000).

1.2.2 Finance and corporate finance

At this stage it seems appropriate to remind ourselves that this book is about finance. While we have been defining terms, we have also been purposely avoiding the term finance but can no longer do so.

In a narrow sense, this book represents a general introduction to one specialised aspect of corporate finance, known as project finance. This means corporate finance, as a concept that subsumes project finance, also has to be outlined briefly. Predictably, following Brealey *et al.* (2006), corporate finance concerns the financing of corporate activity. In the corporate strategy framework outlined above, this essentially means financing strategic investment decisions or if we revert to our project-centred framework, it may indicate the corporation's alternative choices in financing the acquisition or creation of a company/project it has identified as desirable. In general, it can be made this simple – given Global Consilium's decision to buy Kalgoorlie Platinum in Western Australia, *how does GC pay for it*?

At the most basic level it is this simple: GC pays with the proceeds of issuing equity or debt. Using a particle physics metaphor, there are only two fundamental sources of external finance from where all financial engineering originates, and these fundamental corporate finance instruments, or elemental financial claims, are *equity* and *debt*. Leases, in our view, are a specific form of debt where the transaction purports to achieve further objectives, which we will explain in Chapter 2. In essence all further transactional financial engineering derives from these fundamental contractual claims. Debt and equity are contributed to the company from external sources (they represent its liabilities), while internally generated funds (net retained cash flow over any accounting period) form a further source. Keep in mind that net internally generated funds technically belong to the company (and ultimately to its shareholders). However, this is not to say it is always easy to identify whether equity or debt is to be used, or was used in a particular application – a simple complication is illustrated by certain hybrid financial instruments such as convertible bonds, which may rank as equity or debt depending upon an external event, for example, the corporation's share price or lapse of time.

We do not intend to consider in this book more than the most fundamental corporate finance instruments, but it will become clear to students of financial engineering where this field of interest fits within corporate finance activity, and where further study of this interest will lead. A further observation about financial instruments: unlike investment finance textbooks, together with insurance, we consider a range of financial derivative instruments such as options, futures and forwards only in terms of their risk management uses. Although derivative instruments are extensively used in corporate finance and in project finance to hedge risks, we will suggest only their uses and not any technical features. Similarly, it will become clear to students who are interested in how corporate risks are hedged where this field of interest locates within corporate finance activities, and where to find inspiration for further study of this subject.

1.2.3 The project is a company

Given these points, we can turn to Figure 1.3, where we have illustrated Global Consilium's balance sheet as consisting of assets (all its subsidiary companies, or strategic projects, if you will), which are financed simply by corporate debt and equity – in aggregate the liabilities of the group. For the corporation we have arbitrarily chosen a capital structure of 69% debt and 31% equity (or a debt to equity ratio of 220%), which may be considered a fairly typical capital structure for a large diversified corporation, all things considered. Of course, recall that this is a consolidated balance sheet, so this final picture is the net accounting sum of each subsidiary company's assets and liabilities.[6]

The Global Consilium Corporation (founded 1929)

Consolidated Balance Sheet at June 30, 2007[a]
($ millions)

LIABILITIES		**$**	**%**	**ASSETS**		**$**	**%**
Equity				**Fixed assets**			
				Corporate head office			
Issued ordinary shares (breakdown)	11,000			building	1,000		
8% Cumulative preference shares							
(non-voting)	5,000			Fixtures and vehicles, etc.	50		
Retained earnings (accumulated past							
profit/losses)	20,000			**LESS:**			
Minority interests	3,500			Accumulated depreciation	-150		
Shareholders' funds, ("net worth")		**39,500**	**31**	**Net fixed assets**		**900**	**1**
Debt				**Associated companies[b]**			
Long-term debt				Consilium oil	30,000		
Secured bank debt, due 06/2010	31,500			Consilium mining	30,000		
Outstanding bonds, maturity at							
06/2015	48,000			Consilium jet engines	15,000		
				Consilium infrastructure and			
Long-term office lease	400			power	35,000		
Net long-term debt	**79,900**		**63**	Other consilium companies	11,000		
				Associated companies		**121,000**	**96**
Current liabilities							
Commercial paper: 3 months	5,000			**Current assets**			
Short-term bank loan: 1 month	2,000			Incidentals, inventory	1,400		
Current liabilities	**7,000**		**6**	Other current assets	2,000		
				Cash and marketable securities	1,100		
Total debt		**86,900**	**69**	**Current assets**		**4,500**	**4**
Total:		**$126,400**	**100**	**Total:**		**$126,400**	**100**

Notes

a Please understand that we make no effort at all to reflect Generally Accepted Accounting Principles as practiced in ANY jurisdiction in our analyses. The detail reflected here is not typical of many consolidated balance sheets.

b In many (most) jurisdictions, associated companies will NOT be named at all, there will simply be a one-line item reading 'Associated Companies', with a total against it. We itemise associates to illustrate the underlying structure of corporations that have project company subsidiaries.

Figure 1.3 The corporate balance sheet as a portfolio of projects.

[6] As stated before, we would prefer to err on the side of caution with vocabulary. So, if we assume no accounting knowledge, we have to say – assets must equal liabilities, and the balance sheet has to balance.

It follows then that we view corporate activities as projects contributing to an overall strategy. However, for legal and regulatory purposes, and often in accounting, projects are typically incorporated within separate companies, or even adopt an alternative form of business. Nevertheless, this is unusual, for close corporations, partnerships or sole traders hardly ever feature at the level and scale considered here, although some atypical private companies may do so (think of the Olympia & York group, which was for a long time a private venture, and its 1990s Canary Wharf development in London's Docklands). For simplicity, we assume that every project in Global Consilium's portfolio is incorporated as a wholly-owned subsidiary; or it could be itself a listed company, majority-owned or controlled by Global Consilium. In corporate matters every project's legal structure (a company or other business entity) matters greatly for legal and regulatory purposes. We shall also see in later chapters that the technical details of incorporation, shareholding and control all influence the reasons for adopting project finance as a strategic choice to finance a venture. A further dimension to consider here is that corporate law and business regulation differ between jurisdictions, so an additional layer of complexity is introduced when international projects and their incorporation are being considered. Following this, we wish to emphasise that the legal vehicle, or structure chosen to execute a project, plays a central role in the concepts presented in this book.

In the stylised corporate strategy framework presented above, a project company may be viewed as a company created or acquired to execute some strategic objective. Assume, for example, that GC has decided that platinum will be critical to the process of developing better catalytic converters so as to reduce pollution from fossil-based energy sources. Suppose, for illustration, that this objective is translated into the practical corporate objective '*to increase Global Consilium Corporation's share of world platinum sales to 30% by 2015*'. Assume further that Global Consilium Corporation creates Global Consilium Platinum Ltd (GCP), a wholly owned subsidiary, for the sole purpose of achieving this objective. Of course, there are many ways in which Global Consilium Platinum can go about achieving its objective. One way, for example, is to acquire controlling shareholdings in a sufficient number of existing platinum mining companies all over the world until it reaches the target market share. Another option may be to locate a large platinum deposit and develop its own platinum mine. Global Consilium Platinum then becomes a company with one asset only, a platinum mine, with one narrowly defined commercial activity, to operate the mine and extract and sell platinum. In the vocabulary of this book, Global Consilium Platinum is a company with a single asset, the mine, possibly with a sole shareholder in GC – this context explains the term project company as the term is used in the field of project finance. A critical further observation is necessary – Global Consilium Platinum may have been created as a company, but the mine still has to be developed, which carries much further significance, as we see in later chapters. This essentially means that GC, the single shareholder in Global Consilium Platinum Ltd, is also the mine's developer – in project finance terms also known as the sponsor or promoter.

The essence of what has broadly become known as project finance are the financial, regulatory and legal mechanisms that have developed around such single asset project companies and their financing. In practice, Global Consilium Platinum may have other shareholders (sponsors or promoters), and may even become a public company, but for present purposes it is a single asset project company with one shareholder-sponsor in the parent Global Consilium Corporation. Most project finance ventures since the early 1970s have been industrial or resource development projects such as oilfields, transmission pipelines, extractive mines, process engineering, hotel and resort development, but project finance has also been used extensively in infrastructural schemes, often in collaborative arrangements between governments and the private sector (public private partnerships (PPPs), private finance initiatives (PFIs), build-operate-transfer (BOT) schemes in sectors such as electricity generation, telecommunications, transportation infrastructure (roads, tunnels, bridges, railroads, water treatment facilities), hydroelectric projects, port facilities and container terminals, latterly also air-cargo terminals, and more. It has been applied widely in both developed and developing countries, including Asia Pacific, Africa, the Americas, and Europe – it is certainly a technique that is proven. But with this familiarity have also come problems, mostly from attempts to relax the fundamental project finance model in some applications such as PFI and PPP schemes – we will also draw attention to some such developments.

1.3 The project company business model

We have now introduced enough terms and presented sufficient context in order to move towards defining what is meant by a project company business model within the broader field of corporate finance. We described above what could be characterised as a typical project company; that is, a company that owns and operates a single economic asset such as a mine, toll road or oil refinery. In economics terminology these are described as highly specific assets, generally taken as capital assets that have only one economic function (or at most a small range of functions). For example, economically an oil pipeline can practically not be used for much besides a pipeline, unless significant additional investment is made in order to change its function. Typically mines, oil refineries, energy transmission pipelines, chemical process engineering plants, power plants, certain marine vessels (purpose-built liquefied gas carriers, for example), roads, bridges, tunnels, certain seaport and airport cargo handling facilities all exhibit high asset specificity – these assets certainly cannot easily be redeployed to some other function, or have the flexibility, say, of a personal computer in an office environment, or a delivery vehicle in an urban setting (more about asset specificity in Chapter 2).

Application of highly specific assets in a commercial setting raises further considerations about the risks surrounding their use. Not only are they typically capital and

scale-intensive, they also tend to utilise established and low-risk technologies within mature and well-understood industries, where risks are clear and well understood, and with well-delineated demand and supply chains. It may be argued that deploying assets such as these might not be risky, but that asset specificity itself is the risk and is at the heart of the problem of irreversibility (sunk capital) briefly considered in Chapter 3.

A useful further observation may be introduced to categorise typical project company assets, based on the way in which they generate earnings for their owners. We can think of two classes of assets, namely process-based assets and stock-flow assets. Process-based assets use raw material or basic inputs, which they convert through an industrial or chemical process, and sell the output – similar to the functioning of many industrial companies. In a project company context this may be illustrated by an oil refinery or electricity generating facility, where raw materials form a significant share of the facility's continuing cost function. Stock-flow assets are more complex. A pipeline scheme requires in its completed and operational state only limited further inputs (facility management, systems input) to generate revenue from the service it sells (product volume transmitted through the pipeline). Ongoing inputs are comparatively less important as an element of the system's cost function compared to most process-based facilities. The pipeline is said to represent a stock-flow asset: its value as a capital asset is represented by the total stock of services that can flow during its life or until it is unable to generate a service for which there exists demand (it may be economically depreciated, or there may simply be a substitute for the service it offers). Water treatment facilities, bridges, roads, tunnels, mines and oilfields may be conceived of similarly.

Project finance, therefore can be seen as a financing mechanism, developed around business ventures with assets that exhibit high-asset specific characteristics, often seen most clearly in relatively predictable revenue streams, within well-understood industries and often involving few technological uncertainties, as identified above. Project companies may often be financed by a parent group – there is no reason why not – in which case we may consider their financing to be simply consolidated into the corporate balance sheet under normal corporate finance conventions. But such project companies are often not financed with corporate finance, but instead are financed using what have become known as project finance principles. So what then constitutes project finance? Here, we take as a definition the narrow meaning accepted among all financiers, and which is constituent with the institutional approach that underlies this book.

Project finance thus represents a form of non-recourse external debt funding of an identified scheme, carrying defined claims to its revenues, assets or contractual rights (such as purchase contracts or third party insurance provided other than by the project sponsors), and without contractual rights or non-statutory claims in relation to the debt against the project sponsors or shareholders. The funding will almost always be provided to a company established solely for the purpose of owning the project, and

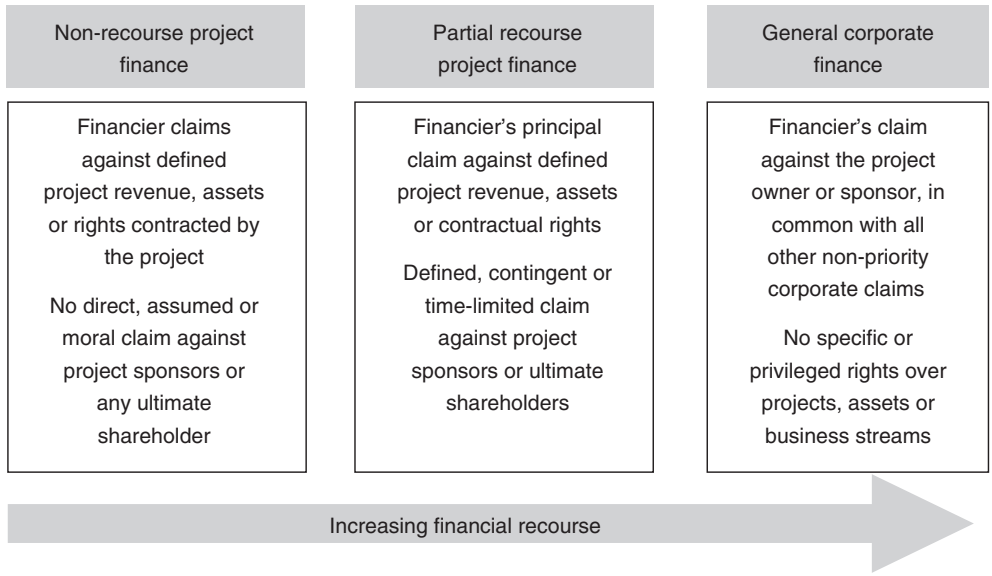

Figure 1.4 Degrees of financial recourse.

entering and servicing its funding liabilities. That this is distinct from other common forms of financing can be seen in Figure 1.4, which characterises the three elemental types of finance which interest us here.

Non-recourse financiers of projects, such as bank lenders or investors in project bonds, obtain claims only against the net assets of the project, usually including any rights that the project vehicle acquires from third parties. If the project falls into disuse or becomes a commercial failure and unable to service its debts, then the financier cannot look for recourse to the project's sponsors or shareholders, even if it is with them alone that negotiations then begin to find a solution to the project's problems. At the other extreme, general corporate finance will see funding being provided to a company or group – such as the sponsor of a project – without specific contractual rights over any specific part of its activities or assets. This is by far the most common form of external funding.

Between these extremes lies a form of project finance in which a degree of recourse is granted to the financier, perhaps for a limited period, or on certain quite specific terms, and is widely known as partial-recourse finance. Projects that take time to construct or mature may use each of these financing variants at different times, so that at inception when the project assets amount to no more than a pile of engineering blueprints, it may be cost-effective to induce lenders to provide short-term land or construction finance to the project sponsor. When the project is properly formed, it can be funded with partial-recourse finance, and when all is completed and revenue has begun to grow then non-recourse finance may be attractive to both lenders and

sponsors. We discuss in Chapter 2 the sequence of financing and phasing of transactions common to complex projects, but the basic elements are always simple, and intended to isolate and define the costs and risks of funding the project for its sponsors and financing investors.

Thus there are distinct features that make project companies somewhat different from a group that is corporate financed. These involve separate incorporation, capital structure, and management discretion over company assets (there is only one asset). Project companies are typically legally separate (standalone) capital-intensive single asset companies, often classed as a special purpose vehicle (SPV) or special purpose entity due to their lacking any activities not associated with the project. The project company or SPV is the entity through which are channelled all the project's contractual matters – typically also the SPV is the project company itself. They also have common capital structures, in particular concentrated equity ownership (no more than 5–10 sponsors usually own all the equity in a project), together with higher leverage in their capital structure than with frequently observed established companies.[7] This typical capital structure with relatively high levels of debt in relation to shareholders capital serves several purposes, each forming the subject of later sections in the book. (See Figure 1.5 for what a single asset project company balance sheet might look like.)

The Baguio Power Company (incorporated in the Republic of the Philppines 1999)

Balance Sheet at June 30, 2007

Liabilities			**($ thousands)**	**Assets**		**($ thousands)**
Equity				**Fixed assets**		
Issued ordinary shares:						
Global Consilium Corporation	175,000	35.0%		Power generating facility at Subic Bay (at cost) [1]	2,600,000	
Bagatelle Projects D&C Inc	175,000	35.0%		Furniture, fittings, equipment, vehicles, etc.	5,000	
Hydrex Turbines Inc	150,000	30.0%		**LESS:**		
Shareholders' equity			**500,000**	Accumulated depreciation	(1,000)	
				Fixed assets		**2,604,000**
Debt						
Long-term debt				**Current assets**		
Secured bank debt, due 06/2022	1,400,000			Incidentals, maintenance inventory	5,000	
Capital leases: generating equipment	600,000			Other current assets	310,000	
Long-term office lease	10,000			Cash and marketable securities	5,000	
Long-term debt		2,010,000		**Current assets**		**320,000**
Current liabilities						
Commercial paper: 3 months	114,000					
Short-term bank loan: 1 month	300,000					
Current liabilities		414,000				
Total debt			**2,424,000**			
Total			**2,924,000**	**Total**		**2,924,000**

1. The land at Subic Bay is leased from The Philippines Government at a neglible annual rent of US$1 per annum.

Figure 1.5 Typical project company balance sheet.

[7] However, relatively high leverage can be common in particular industry sectors, for example, in trading-related businesses or utilities, and may change with long-term interest rate cycles.

We need to make further observations about project company capital structure, however. An ideal project finance arrangement would also aim to achieve a further characteristic with respect to its debt – it would aim to structure as non-recourse debt. This means that the providers of debt finance to the project company have no recourse to the project sponsor. In the event that the project company defaults on its debt the providers have recourse only to the project company and the project company's assets. Lenders have no recourse to shareholders or sponsors in the event that the project company defaults – hence non-recourse. This means that banks in practice are exposed to a different form of credit risk with project companies because the project company and its assets are alone devoted to the servicing and repayment of the debt. This is distinctly different from project companies financed with corporate finance, where banks may share recourse to all corporate assets, depending on the seniority of their loans. It would be incorrect to characterise the risks associated with lending to a project company as necessarily greater than that of a broader corporate claim, but they are distinct, and will tend to alter as the project matures. We refer to non-recourse debt as the ideal debt arrangement in project finance, in that project sponsors from the outset attempt to negotiate it as such. But non-recourse debt is seldom fully achieved in practice; it is most often limited recourse debt, which allows banks some recourse to sponsors or third party guarantors in the event of default or project failure, and which allows a degree of influence for the financiers in any subsequent negotiations, in effect as a control device to draw the sponsors to the negotiating table.

A further characteristic of typical project companies is the extent to which their activities are regulated by contracts entered into by the SPV. Much managerial discretion is curtailed through contracts – meaning that the company by contract is managed as a one-asset company only, with limited if any executive discretion over surplus revenue that may be generated during operation. Often this is brought about through stipulations in the debt contract, which may prescribe the way that the project company is to distribute its free cash flow (Chapter 3) – typically free cash flow is first applied to servicing and repayment of debt before any dividends may be declared. Another important reason for intensive contracting is to manage risks associated with the company's ability to service and repay its debt – recall that typically these companies are highly indebted. These contracts typically cover parties in the whole supply chain through to the purchasers of the project company's output – so we have long-term supply contracts covering raw materials and other inputs used in processing, such as energy, and also long-term contracts to purchase the output of the project – such as the platinum that will be produced by Global Consilium Platinum Ltd. The extensive use of supply and demand contracts functions to stabilise project company net earnings, or cash flow, in order to assess what its safe debt capacity is (safe debt capacity is a relative term, of course; financial risk can never be eliminated entirely). We consider below further how to conceive of project companies using systems concepts.

1.3.1 Why project finance?

There are matters to settle before we continue further. A fair question to ask is why use project finance as one special form of corporate finance rather than using corporate finance for all corporate projects? After all, companies may enter into what are often termed project funding loans, which tends to indicate the purpose for which a business or a group obtains a loan – in other words it is not a general business loan in which specific terms (loan covenants) restrict the use of proceeds. It may be obtained specifically for the purchase and development of real estate (as in a development and term loan), for the expansion of an industrial plant's capacity, or to finance a strategic acquisition. Such loans may also be large, and may also have to be provided by a syndicate or group of lenders acting in concert. The defining difference between these and project finance loans – regardless of their purpose – is the nature of the claim given to the lender – corporate term loans provide recourse to all group assets, and without specific recourse to particular project company assets as outlined above as we are describing business activities at the major corporate level, why should such enterprises consider a special kind of arrangement such as a project financed standalone project company? The multinational corporation (MNC) has the widest possible array of financing options available to finance any feasible chosen project, so what makes it consider using project finance? In principle we can isolate at least three reasons: two arise from financial imperatives, while the third relates to corporate governance. These are corporate consolidated balance sheet constraints, public sector financing constraints, and the contractual discipline and focus that project companies impose upon their managers as a result of funding with project company debt.

1.3.2 Balance sheet constraints

Balance sheet constraints are often cited as a primary reason for using project finance to finance the procurement of large capital assets, and while opinions differ, it mostly remains at least a valid consideration. First, remember that although there are important developments in financial accounting and international accounting rules that may be converging, there is still no single internationally accepted general accounting practice. The financing decision may be affected by accounting rules as formulated in certain jurisdictions, and the consequences of capital investment decisions for a commercial group's balance sheet. Mostly the argument centres around the costs and benefits of achieving off-balance sheet treatment for external financing – the ability to raise finance while not having to state fully such liabilities on the corporate balance sheet. It would then appear to readers of financial statements as if a corporation was less indebted than the true figure. To illustrate: suppose corporate accounting rules prescribe that if a corporation owns less than 40% (say, for example) of another company, and it is not contractually or formally liable for that company's liabilities (say, as a guarantor), then it may not be required to consolidate the associate's debt into its corporate balance sheet – the full amount of the associated company's debt

is thus 'off-balance sheet'. This example represents an economically justifiable reason for not consolidating the associated company's debt into the corporate balance sheet as, after all, it is not formally liable for any of the liabilities.[8]

Suppose further that GC is faced with many strategic investment projects, and that it simply cannot afford to allocate a large amount of capital to any one investment project. Recall the case of Global Consilium Platinum, and now remember that GC cannot finance this new development from group financial resources, because Global Consilium Platinum is only one of its many projects. However, by the treatment explained above, if it owns less than 40% of GCP equity, and it is not liable for any of GCP's liabilities, it need not consolidate GCP debt into the group balance sheet. This means if GC begins a joint venture with others to develop the mine, as long as it observes the shareholding and recourse rules, then a joint venture is feasible. Now assume two other companies are potential partners, Rambo Civil Engineering and WA Railways, which agree to construct civil and mechanical engineering works and a railway line to a nearby port. Each company is subject to identical accounting rules, and all face financial constraints as a consequence of limited corporate resources compared to plentiful investment opportunities. If these companies together form Global Consilium Platinum, each owning less than 40% of the shares, minimise the absolute amounts they invest (equity), and maximise GCP's debt, then they control GCP and none of them will need to report GCP's debt on their consolidated balance sheets – if the debt claim lacks recourse to any of them. The way to achieve this is through making the project company alone liable for its debt. This is the stylised private sector project finance company model, and readers will observe these characteristics in the hypothetical project company presented in Figure 1.5. Lenders agree to such arrangements under comprehensive conditions, including removing virtually all operating discretion from the project company, as explained in Chapter 4.

1.3.3 Public sector budget constraints

As companies in the private sector are balance sheet constrained, so the public sector is often also budget constrained. In a case analogous to the commercial example explained above, national, regional or local governments face many spending demands with limited resources, including the necessity to invest in costly infrastructure, whether roads, rail facilities or public buildings. Whatever our ideological views of its desirability, the world seems for the moment to favour a public finance model where the provision of public infrastructure is no longer solely a public sector financed activity; governments everywhere are adopting various forms of private sector participation in the provision of public infrastructure. Most examples of such cases (and

[8] This example describes the nature of one particular accounting rule. We generally caution readers against the quest for off-balance sheet finance as a good reason for financing decisions.

possibly the most desirable from many viewpoints) are modelled on the characteristics of typical project companies as described: concentrated equity investment, high non-recourse debt, and a large single-purpose asset. Any equity partners may be subject to a 40% equity accounting rule, but different rules may apply given public sector involvement while any project debt is non-recourse – so neither the public sector nor the private sector is liable. Important here is to recognise that while public and private sector accounting may differ in objectives and applications, the public sector may have just as great an interest as commercial entities in appearing to be underleveraged (implying a lower budget deficit) or efficient (signifying revenue maximisation).

The essential feature of public private sector ventures is that while capital investment in the asset is made solely by a private sector project company, the asset is ultimately intended for public use, so the project company will not own it forever. Depending on the stage of the project life cycle, private sector participation in financing public sector infrastructure assets is usually facilitated by transferring rights to a private sector project company to build the asset or operate the asset for an agreed term, and then return custody to the public sector. This is the well-known build-operate-transfer (BOT) model (and its numerous parallels), used widely in the development of roads, tunnels, power stations, rail projects, pipelines and other landmark projects all over the world. In the final analysis, the public sector obtains its infrastructure without drawing directly on limited public resources, and the private sector has temporary control for profit of a single-asset project company.

The central agreement between the private sector and the public sector that facilitates this form of collaboration is the contract which gives the private sector the right to build and/or operate the asset as a project company, including financing it. Such contracts are commonly referred to as concession agreements which set out details of the agreement between the parties, including the term of the agreement, regulations governing charges that the project company might levy on users, how changes in charges might be regulated, the government's undertakings with respect to restrictions on developing similar facilities, and the project company's responsibilities for managing the facility and handing it over in good condition. We give some insight into the nature of concession agreements in Box 1.1.

The potential to draw private sector finance into projects in emerging economies using the principles explained above has not gone unnoticed with developing states and multilateral organisations such as the World Bank, Asian Development Bank and Inter-American Development Bank. In the last two decades infrastructure projects of all kinds have been completed in Asia, Latin America and Africa with private sector participation in public infrastructural development. In many cases national or regional governments have participated as equity contributors together with international corporations such as Bechtel, Fluor and Enron (*that* Enron, yes), while debt has been provided by promoters, governments, development agencies, and very often by

Box 1.1 Concession agreements.

At the centre of all infrastructure projects with a government or government regulatory body as principal, there is typically a formal concession agreement. Normally, this is a right granted by a public authority to a particular person or corporation stipulating the rules under which they may be allowed to build and operate a public facility such as a power station, bridge or tunnel. In order to encourage private financing in building infrastructure and to minimise the public burden, a concession agreement may be granted to a private sector agent who then assumes the borrowing risk to provide the financial resources to develop a particular infrastructure facility. Concession agreements typically differ with different infrastructure assets, because the nature of risks will differ – for example, while a power purchasing agreement may be at the centre of the feasibility of developing a power plant in that it may stipulate volume and prices, it is unlikely that such a demand guarantee would be found in the agreements to develop a toll road. Concession agreements are an important mechanism to facilitate project finance, because they typically outline several regulatory and operating rules, often including prices for services generated by a facility, price adjustments over time, the term over which such rules are in operation, and possibly may further include taxation incentives as well as other privileges. A concession agreement normally stipulates where the private sector receives a concession from the state, for example a franchise to operate a tunnel for ten years, in return for its building and financing the particular facility. The acronym for this type of arrangement is BOT, which stands for build, operate, and transfer. The content of a BOT agreement may incorporate terms granting the promoter the privilege to design, finance, and construct the project, providing the promoter with ownership and operation rights over the infrastructure, specifying the party responsible for the operation of the infrastructure, and the ownership of the infrastructure reverting to the grantor after the expiry of the concession period.

international banks. In many cases the World Bank and other multilateral agencies have learnt in parallel through co-financing, similar to that of a part-guarantor of third party contractual performance, in order to encourage the participation of international lenders and other investors in developing country projects. It has been argued that often such projects test institutional development in host locations – we return to aspects of such arguments in Chapter 4.

1.3.4 Corporate governance

Corporate governance may be the least prominent of the three reasons that support the use of project finance principles to fund assets but has few opponents, particularly

amongst bankers and corporate investors. It has been recognised for some time that conflicts of interest arise between the claims of shareholders and professional managers of companies, more so with quoted companies with widely dispersed shareholders. A principal conflict arises over the use of free cash flow, considered to be the cash flow generated by the corporation in excess of that which it can profitably invest (in attractive projects). Under these circumstances, it has been shown that managers with no or little interest in the company may devote free cash flow to non-essential activities that tend to benefit themselves instead of the company – think of executive jets or luxury cars. One mechanism to prevent such behaviour is a corollary of external debt, which induces managers to focus on generating sufficient cash flow to service and repay debt, and allows little discretion over free cash flow. In many cases, higher leverage would also signify more complex contractual requirements in the terms of the debt, including restrictive covenants (Chapter 4) that provided a direct means to constrain managerial action. Moreover, the best candidates for high debt are companies that can be given a narrow business focus so as to not distract from company objectives, as with leveraged acquisitions of conglomerates in the 1980s, or today's infrastructural targets of private equity funds. The best candidates for high leverage are arguably single-asset companies – project companies – with specific resources in well-known industries, supporting reliable revenue generation and using proven technology. We return to these matters in Chapter 2.

1.4 The project cycle

We explained that project finance is characterised by the generally specific nature of project assets. We also explained that corporations may choose to purchase an existing project company, or to employ a new project company to develop a project asset, all dependent on the economics of the choice and strategic objectives. A familiar concept in project finance literature is the project cycle, a mechanism that we use extensively in Chapter 4 to identify risks that may arise in the project finance model that might require risk management action. We introduce the project cycle concept here to illustrate the fundamental differences in risks associated with different times in the project's life and to hint at how such risks may be managed.

For now, let us return to Global Consilium Corporation and its subsidiary, Global Consilium Platinum. Suppose GCP is considering the development of a new platinum mine, following a breakdown in negotiations to purchase an existing operational mine. Under these circumstances GCP has to go through a typical five-phase life-cycle of a project facility before generating revenue from the sale of platinum. Of course, it is also possible for Global Consilium Platinum to negotiate entry at a different phase in the life of a project under separate development by other sponsors. In any event, the five-stage life-cycle model of project companies is presented in Figure 1.6.

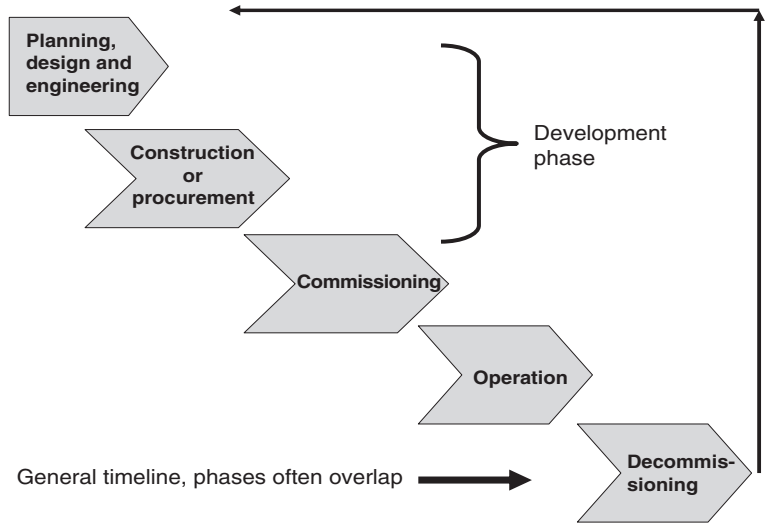

Figure 1.6 The project cycle.

The stages in the project cycle are summarised as follows:

1. Planning, design and engineering
2. Construction (or procurement)
3. Commissioning
4. Operation
5. Decommissioning

} Development phase

The first three can be grouped loosely as the development phase, which for present purposes we may treat as one phase. Each phase carries particular risks, which may or may not be quantifiable, and which all have implications for the project finance model. A critically important fact is that no operating project company exists before the development phase is successfully complete. This means that if development is unsuccessful, no revenue generation is possible, which is hardly attractive. It requires no leap of imagination to realise that even if conceived properly, the risks to the success of a project company are substantial in the development phase (even if manageable), because it is here where the project company either procures a working asset or not. We mentioned that the project finance model evolved around single-purpose assets, with well-developed technologies and in well-understood industry sectors. Transactional familiarity and standardisation in revenue generation also facilitated the development of risk management in the context of many typical projects, which include varying risks associated with the project's maturity. In the rest of this section we outline the context within which the project company functions in each phase of its life so as to appreciate how risks may vary between different phases. As in later

sections and chapters, we change the sequence of phases in order to emphasise the importance of the development phase. We therefore discuss the nature of the operational phase first, followed by the development phase, and then make some concluding comments about decommissioning.

1.4.1 Operational phase

Concern with the operational phase in a project life cycle allows us first to conceptualise the project vehicle as a going concern, to use an old accounting term. Recall from the last section that the operational project company will typically have a high leverage ratio, as illustrated by the fictional Baguio Power Company's (BPC) balance sheet in Figure 1.5. BPC is of course another Global Consilium brainchild, and for explanatory purposes, let us suppose that BPC owns a US$2.5 billion, 2000 MW coal-fired electricity generating plant built on a 50 Ha site next to a deep sea port near Manila, the capital of the Philippines. A dedicated coal terminal was developed as part of the power plant's supply chain arrangements, complete with stockpiling, coal handling and road infrastructure to service the plant and link it to Metropolitan Manila's road network.

BPC is a continuous process system, turning coal into electricity on a large scale and at low unit cost for sale to a diversified regional customer base. For practical purposes BPC's electricity generating process may be viewed as fully automated, consisting of four large combined cycle turbine-generators with all necessary technical control equipment, driven by steam produced by a continuous coal combustion process. At BPC's transmission exchange facility, its electricity output is metered formally and fed into the receiving distribution grid. To manage, operate and maintain this process facility BPC has in place a proven team of operations managers and highly competent technical and maintenance professionals from an international pool of project operating teams. BPC's operation can be presented as centred around a continuous electricity generating process (Figure 1.7).

Baguio Power's operations illustrate what we categorise as a process-based single-asset project company. Suppose also that BPC has a power purchasing agreement (PPA) with the Manila Electricity Distribution Board, owned by the Metropolitan Manila authorities, which buys some 80% of its outputs for distribution to its customers. BPC has high leverage and we assume that a major proportion of its cash flow is committed to debt service and repayment. Generally, operational risk is more broadly defined as any and all risks that may cause the project company financial distress during operation. A high proportion of debt in the project company's capital structure requires some observation about financial instruments, and the terms of debt contracts in particular. While long-term supply and purchasing agreements may seek to address certain market risks, many debt contracts will introduce additional operational risks in the form of interest rate volatility, and international debt and input supply and off-take contracts may involve exchange rate risks. We return to these in Chapter 4, but for now suffice it to say that the critical operational objective

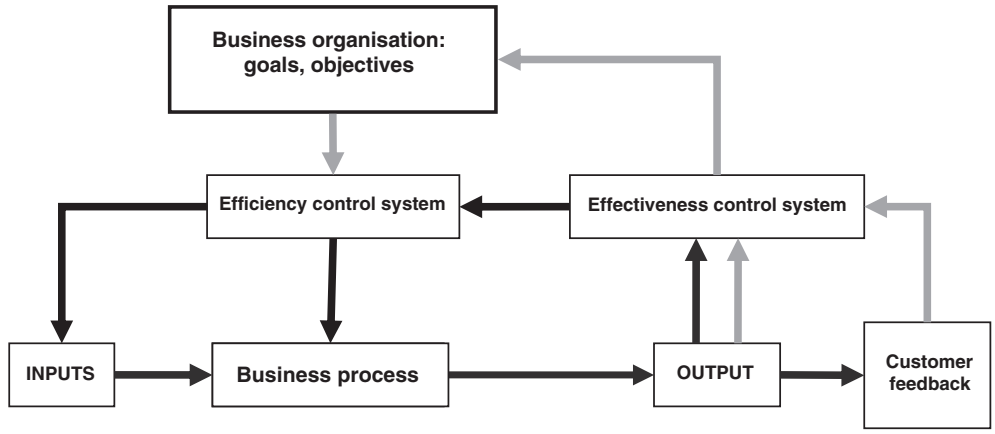

Figure 1.7 The Baguio Power Company – a process-based project asset.

of, and risk to, the project company is inadequate or unstable cash flow and consequent financial risks.

We wish further to highlight three categories of risks that emerge from considering BPC in the operational phase, namely input risks, process risks and demand and distribution (customer) risks. However, we remain mindful of the project's lenders' position first, and so emphasise those risks which threaten the project company's ability to generate sufficient cash flow to service and repay debt. If a large proportion of cash flow is committed to debt service and repayment, the project company would prefer cash flow to be stabilised as far as is possible in order to manage this commitment. We may disregard for now process risks as BPC deploys proven technology; thus its operational risks are concentrated in input supply and supply chain risks (coal), and demand for and distribution of electricity it produces. Both demand and supply are subject to market risks – taken to be volume availability and price volatility.

The essence of BPC's operational risk management is aimed at stabilising supply, demand and price risks by entering into long-term input supply contracts, matched on the demand side by long-term off-take agreements, with both agreements allowing for volume and price adjustments. Prospective financiers may often require matched agreements to be agreed in principle and in place before contemplating lending to a project company, and established formally prior to disbursing funds. With stock-flow type project companies, on the other hand, it may be argued that most risks are concentrated in demand for the service generated by the project asset, say a toll tunnel, but off-take agreements may be unfeasible with such projects but project financers nevertheless commit to lend, usually based upon certainty of traffic forecasts. Two such cases are dealt with in Chapters 6 and 7.

Generally, the project company attempts to minimise its net exposure to operational risks by shifting them to suppliers and customers, and so make cash flow predictable throughout operations, regardless of the behaviour of these market-determined

cost and output variables. This allows revenue to be dedicated first to debt service and repayment, and thus gross cash flow becomes the principal determinant of the project company's debt capacity. Think of it as follows: if there were no debt, much of this risk would disappear at a stroke – high debt imposes a range of disciplines on managing the project company in its operational phase. And also, in the world of finance every contract has a probability of not being honoured, including long-term supply and off-take agreements made with reputable suppliers and governments. Not all risks can be managed in a world where humans are fallible or cannot devise perfect contracts, and where the unpredictable often happens. Thus we also see that the world of project companies is further characterised by a spectrum of third party guarantees to compensate for the cost of contractual failure – these are frequently required as preconditions to lending to the project company.

1.4.2 Development phase

While the basic project finance model and the operational phase in a project company's life cycle may be read together as characteristic of typical project companies as going concerns, the project development phase undoubtedly presents the single biggest obstacle to the creation of a successful project, if only for its complexity. Furthermore, it invariably takes a long time to conclude; for example, it may take 3–5 years to develop an electricity generating facility using fossil fuel, and developing a large-scale deep-shaft mine can easily take ten years. If we consider the scope for costly mistakes and unplanned events during project planning, design, engineering and construction, it is to the credit of those responsible that many more financially disastrous projects are not recorded. The complexity of these transactions is legendary, not least because of the scale and capital needs of many projects (think of the complexity of building the Panama Canal). Economically, there is no viable project until the asset produces according to plan in terms of capacity, volume and quality. Before it produces according to plan, there is no cash flow to service debt, or pay dividends to shareholders – there is nothing. This is a project promoter and banker's nightmare, and this stark fact has thus also brought about a fundamental strategic response by project company lenders. We draw your attention to this strategy shortly, but first we embellish the circumstances that surround the development phase.

Of course, before considering the development phase and its pitfalls, one has to assume that the fundamental economics of the project are sound – there is a demand for the service or output generated by the project asset, and it can be satisfied profitably given the associated supply chain and off-take risks. In all, this remains a corporate capital budgeting decision, and whether it represents a strategic investment decision (such as a growth option in real options terminology), or an investment opportunity that satisfies all current corporate investment criteria is not considered here; we assume that the corporate decision to develop the project is justified economically and financially (we present insight into these decisions in Chapter 3). Thus development risks surround decisions about planning, design, and engineering the

project, and the directly associated risk that the asset will cost more than it is worth. This explains amply the critical importance of controlling development and construction costs throughout the development phase – particularly if kept in mind the multi-billion dollar scale of the investments. With these assumptions, we briefly consider risks in planning, design and engineering project facilities, thereafter we briefly consider construction risks, and then briefly present accepted mechanisms to manage both these risks.

The fundamental approach to risk in the project development phase is avoidance, whenever possible. Because most of the technologies employed in projects such as electricity generating, chemical process engineering, road and rail development, or tunnelling are well understood, designing or choosing appropriate technologies and engineering solutions for facilities to perform to target outputs and desired quality is commonplace among experienced professionals. There are, however, always informational problems surrounding broad planning of the project facility itself that could lead to serious errors in assumptions about geography, geology, infrastructure, supply chains, distribution chains and many further physical project facility requirements. Dedicated roads, railways and other physical infrastructure may be essential for project success, just as dedicated rail and port development may be required for Global Consilium Platinum or port facilities for Baguio Power. Despite involving experienced professionals and adopting best practices, careful planning and attention to detail, each project is unique, has a different location with its own geographical and institutional circumstances – and thus carries non-replicable risks. It is a challenge to plan new projects without making errors, simply because of the scope and complexity and far-reaching impact that any scheme will have on its physical and economic environment. Possibly somewhat more serious, there may be assumptions about institutional arrangements that are simply mistaken, often in elementary factors such as operating licences and regulatory arrangements.

Project companies have at their disposal a range of options to address planning, design and engineering risks. It is important to understand that such companies as Royal Dutch Shell and British Petroleum have resources commensurate to plan most facilities that they may consider developing. So they conduct much of their planning, if not all, in-house. Other project companies may require planning to be outsourced to a separate professional firm, as their project-based activities may be insufficient to justify economical employment of project planning teams. There may also be the case where the corporation and its project company may be faced with a project that they simply have no previous experience with – it will be an extremely irresponsible project company that does not acquire all possible planning resources. Thus in the world of corporations and project companies there is a range of planning activities that may be outsourced based on the companies involved, their projects, previous experience and budgets.

While there are relatively fewer risks in facility design and engineering than in overall project planning, the construction phase of any project generates further complexities and problems that no planning can fully anticipate given bounded rationality

– the inability to foresee perfectly and plan for any and all future circumstances and contingencies that may arise during the execution of large, complex, capital intensive construction projects, possibly in remote locations with poor infrastructure and problematic logistical facilities (as may be the case with Global Consilium Platinum in remote Western Australia, more than a thousand kilometres from the closest port and with little usable transport infrastructure). Imagine supervising the construction and assembly of scores of thousands of components, and the logistical challenges associated with such endeavours under extreme geographical circumstances. And from a project customer's view, there loom the customary construction industry project risks of cost overruns, missed delivery dates and quality risks, all with potentially serious effects on project feasibility. Despite the fact that cost overruns, missed delivery dates and quality risks are well understood professionally and intellectually, they are viewed in the construction industry with a combination of depressed inevitability and hope that the current project will be an elusive exception. Economically, the worst case for the project company is to have sunk budgeted funds into a fixed and irreversible capital investment, but find the project is incomplete and has output quality problems, for once construction has commenced, under most circumstances withdrawal from the project is rarely a feasible option. It is thus unsurprising that project companies take cost, delivery and quality targets seriously, if not by their own imperative then as a consequence of external professional advice, and frequently also by industry analysts and providers of construction finance.

Fortunately project companies are not passive recipients of construction industry characteristics. They act strategically to manage construction risks, mostly through procurement systems (or contract strategies, as these are also referred to) and financial instruments such as performance guarantees. Risks of cost overruns can be managed through contractual means such as guarantees of maximum costs, or incentives to save costs are achievable with target cost contracts with sharing of savings and overruns, depending on where responsibility is located. Further, in all construction projects there are disputes about delays, quality and costs, so that construction contract dispute resolution is now highly sophisticated. In the world of large projects, however, design and construct contracts are commonly encountered as a mechanism to conclude transactions for large project facilities. Under such arrangements project companies typically invite bids from pre-qualified reputable and experienced design and construct companies, and then engage the successful firm to plan, design and engineer the project facility, in addition to managing its construction. The intention is simply that the design contractor hands over a completed facility with all ancillary works on a particular date, and to an agreed budget at a required level of quality. Such arrangements may include target costs, guaranteed maximum costs or gain-pain sharing agreements, but in essence the principle is simple: the project company employs a design and construct company to deliver a completed and fully commissioned project facility, and only this party is responsible for those actions under the core contract. If this sounds too good to be true, it often is, but it does allow clearly the identification of the contractual performance requirements of all parties, and in

certain industries (energy, chemical process engineering) such design and construct companies have grown into giant and respected corporations, and include companies like Bechtel, Fluor and ABB Asea Brown Boveri. Plus, such arrangements typically include third party performance guarantees, and post-contract maintenance arrangements to manage quality. Construction contracting is notoriously complex, but is populated by astute advisors acting for both counterparties.

A last and important point has to be made about the different project phases and differences in risks in the various phases. Recall that the operational project company is often highly leveraged, but also note that the project lenders technically invest long term in the project company once it is commissioned and operational – that is, once the development phase, including commissioning, has been concluded successfully. This is somewhat of a half-truth, though, because it is normal for lenders to provide commitments that they will fund the operating project company on the condition that asset is successfully constructed and commissioned. In this way lenders manage development phase risks by technically not being exposed to these risks at all.[9] But this is further accompanied by appreciating that there is also a profitable lending opportunity in providing finance to the project company to develop the facility. Lenders do take both opportunities by legally separating the two phases, and providing two sequential loans. First, a short-term construction loan is agreed between the lender and the project company (sometimes the design and construct company), to be repaid by the expected completion and commissioning of the project facility. Further, the project company's parent will often guarantee repayment of the loan (or the design and construct company if it is the recipient of a construction loan). The successor loan, providing long-term project company debt, is conditional upon successful construction and commissioning. In this manner, if all goes well, a lender manages to book two large loan transactions in sequence, often with the same counterparties, both with attractive transaction fees earned from arranging the facilities. Further, as construction loans are inherently more risky than loans to a revenue-generating project company, interest margins earned on construction loans will also be higher, relative to the duration of the two transactions. There is more to this, however, and we return to it in Chapter 4.

1.4.3 Decommissioning

Over the last two decades decommissioning of facilities has become a matter of substantial concern, even more so as the reality of the planet's environmental state has moved from society's fringes to mainstream social, political and economic agendas throughout the world. Societies are now entering a new era where accountability for pollution and contamination is demanded and will become increasingly difficult to escape. For example, in some important test cases banks have been held jointly liable

[9] Be sure that there are also many cases where banks are less risk averse than this statement implies. Also, banks also lend for project formation without firm take-out commitment.

with corporate borrowers in damages for land contamination. We argue that decommissioning risks are most productively considered in planning and design, by choosing technologies and processes that prevent physical contamination and pollution that will be costly to remedy (given imperfect information about environmental impact now or in the future). For example, while it may have been the best environmental option for Shell to dispose of its disused Brent Spar production platform in 1998 by sinking it in the North Sea, public outrage at that option indicates what may become customary with all environmentally sensitive corporate decisions. We cannot imagine the circumstances that will surround the decommissioning of industrial facilities even one decade from writing. As information becomes more generally available, our understanding of the effects of pollution and contamination grows as never before, and problems identified that were once never considered, as with the use of asbestos insulation until the latter part of the last century. In all, our point of departure is that decommissioning critically represents a matter of corporate values, which relates to the attitude with which decisions are made in the present. As the saying goes, '*. . . as the circle of knowledge expands, its border with ignorance increases . . .*'. Because these are complex issues, we view pollution and decommissioning more philosophically as part of our discussion of institutions in Chapter 4. It should be noted that increasing attention to ethical investment in developed markets may induce more responsible corporate behaviour in these respects for reasons that are entirely driven by share price concerns.

1.5 Systems concepts and the project company

We alluded above to the fact that we will borrow selected systems theory concepts to form a framework to consider risk and project companies, and we now turn in this direction. As with other theoretical concepts in this book, we will concentrate on those systems ideas that are immediately useful, and will thus sacrifice many of the intellectually appealing aspects of systems theory. However, be sure that there is nothing as practical as a good theory, and so it is with systems.[10] For our purposes, think of systems theory merely as an analytical tool – a way of ordering complex environments for further inquiry, be it our ecological, socio-economic, technological, commercial, political, institutional or social environment. One of the great applications of systems thinking is its ability to facilitate comprehension of complexity in our environment. Since the late 1980s there has been something of a renaissance in enquiry into complex systems; think of research at the Santa Fe Institute in New Mexico into the new science of complex systems, much of it inspired by concerns for

[10] Systems theory is likely to enthuse some readers who venture to read more about it – there is an exciting journey ahead for those who do read more (Senge, 1990; Checkland, 1999; Blockley and Godfrey, 2000).

the environment, climate change and complex social systems.[11] For our purposes, however, the system we will be dissecting is the project company as a business venture, also because many of the risks it faces are determined by the company in its technological, geographical, socio-economic and institutional environments.

An early note about complexity will be useful. What do we mean by complexity? There is no single definition or description that does justice to the width and depth of this concept. We may have technologically complex machines, built by industrial processes that display relatively little organisational complexity (for example, a car assembly plant). The companies that build the vehicles, however, may exhibit higher complexity, but of a different kind – social and organisational complexity. Alternatively we may have a technologically relatively low complexity project, say a toll road, needing to pass scrutiny by a range of stakeholders in a politically and socially complex process. Immediately we see here more than one side of complexity: technological complexity, situational complexity, process complexity, or institutional complexity. In Chapter 2 we return to transactional complexity as one particular concern with this term.

First, however, we need to introduce selected systems theory concepts as useful vocabulary to make sense of organisations, products, processes, and more. We introduce three concepts which we consider important to facilitate initial comprehension of complex business and project arrangements. We introduce the fundamental notion of emergent properties and systems functions/objectives, and then discuss the important concept of systems boundaries – critical to understanding risks in project company environments.

1.5.1 The first principle of systems: emergence

We have to start with a somewhat technical definition of a system. For our purposes a system is seen to have at least three properties.[12] The first is that all systems have an emergent property. Kramer and DeSmit (1977) define a system as:

> *'. . . a set of interrelated entities (parts), of which no subset is not related to any other subset. This means that a system as a whole displays properties which none of its parts or subsystems has.'*

As an example, a bicycle is a set of parts but when assembled, a transportation system emerges as the assembly's higher order function. Analysing each individual

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[11] We highly recommend the Santa Fe Institute's work as an important entry point to understand the problems of complexity as it most certainly applies to social, ecological and open systems generally. A very accessible entry is found in Waldorp (1992). This is a wonderful counterpoint to the frustrations that many experience with the logic of the scientific method when complexity is evident.

[12] Many systems theorists expand the set of essential requirements of a system. We are not going to bore the reader with the many differing views; we believe that we need only convey the essential principles to use systems concepts fruitfully for present purposes.

part (entity) of the bicycle in isolation cannot explain the emergent property of the whole – it is necessary also to consider interrelationships between parts. It follows that parts of the system may also be systems; this is the origin of the term subsystem. So an entity, or a part, can be a subsystem. The bicycle's pedals, cogs, gears and chain collectively form the locomotion subsystem (requiring human pedal power, though); the brakes form a subsystem, and in this case it may also be viewed as a feedback and control system, which allows an operator to adjust the system's behaviour according to what may be desirable, or required by an external prescribed norm.[13] It may not be socially acceptable or legal to travel at 160 km/h in a city on a bicycle.

A durable idea that has entered and left fashion with social scientists a number of times is that all forms of human organisations can be viewed as systems, including business organisations (of which project companies are a subset). We represent a typical organisation as a system in Figure 1.8. This could be any human organisation, such as a school, a statutory body such as a city's road traffic authority, an industrial company, a state or provincial government, a regulatory institution such as a central bank, or a stall operator in a street market anywhere in the world.

This representation views a business organisation as a system which transforms inputs (raw materials, energy, labour) through some business process (possibly utilising capital equipment), and produces an output – in the case of a commercial enterprise this will be a product or service to be sold to customers, such as electricity from the hypothetical Baguio Power Company, or road access from a toll tunnel. However, the business organisation cannot simply produce products or services in some abstract way: it is part of the economy of some society, and will be influenced by how it fits into a wider economic system. In essence, any single business output is itself part of

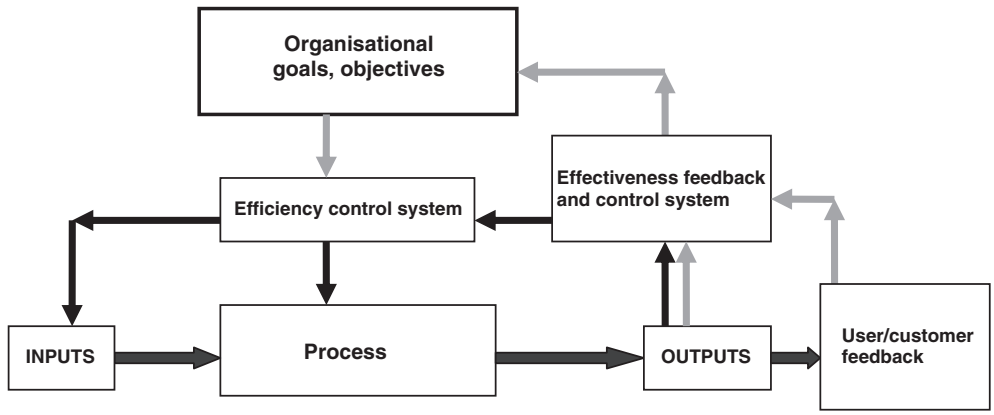

Figure 1.8 A simple business system.

[13] The study of control/feedback systems is termed cybernetics – The 'Terminator' is a cyborg, short for cybernetic organism.

another organisation's inputs; similarly the business may use another organisation's outputs. In this way a national and the international economic system are integrated in a complex matrix of input-output relationships: natural gas is piped to a power plant, used to produce electricity, used in manufacturing of vehicles in Germany, which requires transportation infrastructure, to transport food to markets, and to transport maintenance personnel and equipment to manage the power plant and pipeline, and so on. In ecological systems we have the most amazing and complex nested input-output phenomena – think of the richness of life along a river system as an example. Often the word holon is also used in this context, broadly indicating connectivity of parts within subsystems within systems, from which some property emerges.

In the wider economic system, any business organisation in a well-functioning market economy will be subject to forces and constraints which will affect its functioning. From an economic perspective there will exist economising constraints that may result from various sources: costs of inputs, price and volume of outputs, process costs, or users' satisfaction with the service. In typical business systems there are two feedback and control mechanisms, simply termed efficiency and effectiveness control systems. In Figure 1.9 we present these as separated subsystems, since not all their feedback signals are necessarily common. We may simplify the efficiency control system by presenting it as primarily being concerned with economising – appropriate use of resources, waste elimination, and so on. The effectiveness control system is concerned with the business entity in an organic and dynamic economic environment, where business organisations respond to their environments in order not to be rendered superfluous. In order to do so, the business system requires further basic

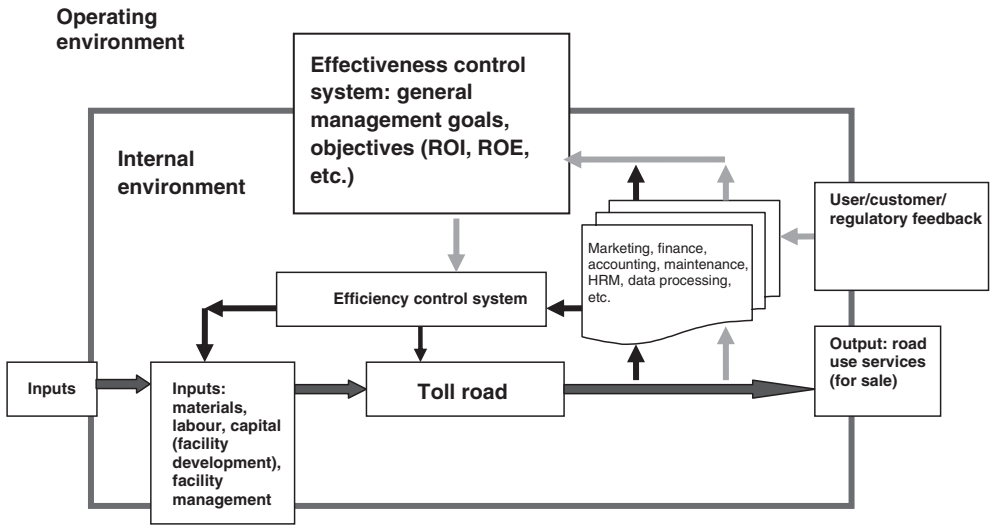

Figure 1.9 A slightly modified business system.

inputs – goals and objectives, and feedback mechanisms to control the system according to the goals and objectives. This is the effectiveness control mechanism, but we show that an important input into the effectiveness control mechanism is efficiency – in most circumstances efficient use of resources remains a critical concern.

1.5.2 The second principle of systems: function, purpose or goal

Before considering systems objectives or functions critically, we need to take a step back to consider emergence again. In nature, we may say we see that a system's function emerges – it has come about. One emergent result of forested hills is soil preservation and ultimately flood control, but humankind may have come to realise a little late just how important this function is in the complex input-output system of a river basin. There is a difference between emergent functions in a natural system and conscious human decisions to design and engineer systems to have some function we desire – in systems design terminology, the objective of the system being developed (more correctly the intended objective) is the emergent property we desire. Thus, the second fundamental principle follows from the above definition, and that is that a system (and therefore a subsystem) has a function, or purpose or goal. In natural systems it is from the interaction between parts and subsystems that the function of the system (the whole) emerges; for example, an ecological system sustains life, amongst other things. With design of human organisations and physical machine systems such as a bicycle, the process is mostly reversed in that the emergent property is defined first (what is the purpose of this organisation?) and then it is designed, developed or engineered to achieve this function or objective.[14] Subsystem interactions and the system's emergent property are often not directly observable, for example in human organisations or biochemistry, but particularly in physical systems such as machines they are typically clearly observable, as with our bicycle above. We may term a bicycle a hard system, because its function is clear, the interaction between parts and subsystems is clear and predictable and can be carefully engineered for efficiency; its behaviour will likely be as intended, and so on. We may also say this is a purposeful system. Some hard systems can be engineered to an exquisite degree, as the manufacturers of the world have shown with cars, consumer electronics, computer hardware, and so on, but it seems that we have only started learning with more complex hard systems (like applications software).

For analytical purposes, most business literature considers systems theory to be an appropriate model to analyse businesses as human organisations, and we therefore also consider it appropriate to apply it to project companies. When viewed as a system, a business enterprise would have some intended function or purpose reflecting the intention of its creators (as difficult as this may sometimes be to imagine). Recall our

[14] We must also immediately say that many human/social organisations evolved historically into their current forms and were not consciously designed (some political systems, for example).

rendition of Global Consilium Corporation's corporate strategy/planning machinations in Section 1.2, and that this process relied explicitly on a statement of corporate objectives – for our purposes, these become the system's objectives. Cynics might say that any business has only one objective, and that is to make money, but this loses sight of the fact that all business organisations ultimately have some function in highly complex societies (remember, by definition a society's culture includes its economy). Until a better metric of effectiveness is devised, money unfortunately continues to be the principal measure of a business' success in fulfilling its objectives.[15] Businesses are social systems created by humans to pursue some objective in the economy, but because humans are purposive and human motives and incentives often cannot be directly observed, it means interactions between a business's functional parts and subsystems (marketing, finance, accounting and administration, human resources, production, general management) are not always predictable, and to a significant extent how the system itself ultimately may behave is not predictable. Human systems are often also described as soft systems, which cannot be finely engineered to achieve well-defined purposes with the expectation of much success.

The concepts of a system's function or purpose, and that of control systems are closely related. Because unpredictable disturbances may enter a system which may cause its actual performance to deviate from its intended performance, feedback about system performance and adjustment mechanisms are necessary. Feedback/control systems must generate signals to allow the system to adjust or compensate for disturbances, and it therefore follows that subsystems, depending on their complexity, may in turn have further control systems. In systems development, the integration of subsystems may in fact be a matter of integrating a number of nested control systems, as may be the case with a chemical process engineering plant. Figure 1.9 may well represent for our purposes a toll road leading from one city to another, built and operated by a private project company under a BOT arrangement with an appropriate transport authority, with the expressed hard objective of providing users of road transportation vehicles access to high quality, safe and convenient road transportation at an affordable cost. For the project company, one control metric may require that this be provided in a profitable manner to shareholders, while another control metric may be to beat low accident targets to comply with its operating concession. The system (the toll road) is designed, engineered and built to achieve the planned objectives, or functions.

1.5.3 The third principle of systems: systems boundaries and systems thinking

An important principle surrounding systems planning, design, engineering and operation of a business system such as a project company concerns subsystem interaction

[15] Perhaps accounting systems may still develop to broaden this metric, but we are still grappling for proper multi-purpose metrics that can reflect accurately sustainability.

and systemic behaviour. It is generally accepted that when designing (or developing) a system to achieve a particular function or purpose, and each subsystem is designed to be as efficient as it can be or each part of the system is optimised, it is likely that the system itself will under-perform – it may not be as effective as it could be. The very best braking system for a bicycle may make it too heavy; the very best mechanical systems in a building may undermine feasibility; the very best technology in a manufacturing facility may add no value to customers while undermining unit cost competitiveness; and the very best individual players may not combine into the best football team. This is the difference between efficiency and effectiveness in systems thinking: efficient parts may not integrate into an effective whole.

In system design and development optimising individual parts is known as reductionism. This follows from the first principle, the fact that in systems the sum of the functioning parts is less than the functioning of the whole – often also described as synergy. For example, note in Figure 1.9 that we identify two control systems: an efficiency feedback, and an effectiveness feedback system. For our purposes, we note that a business system consists of hard and soft subsystems. Efficiency could be viewed as being concerned with how well the system is performing its hard functions – how energy efficient is it, how low are unit costs, is the quality as planned? Effectiveness may be viewed as incorporating its soft, human systems and the interface with the hard systems – how effective is the project overall in achieving the project company's objectives? It may be efficient in achieving its output, cost and quality targets, in a hard sense; but overall it may not as profitable as had been planned for. Thus it may be viewed as not as effective in achieving its goals as hoped for. Thus some adjustment may be required – change in inputs, throughput, quality, pricing, marketing. In all, we may consider that effectiveness is concerned with overall performance, and efficiency with the specific performance of subsystems. Of course, we have to alert readers again to the fact that there are no rules about when efficiency and when effectiveness becomes the measure – it will depend on a system in its environment where such boundaries are defined. We start dealing with these concepts in the following subsection.

Reductionism in systems design and development can undermine a system's intended function, and systems thinking is fundamentally non-reductionist. Systems thinking fundamentally requires that we firstly regard reality in terms of the effectiveness of the whole and not optimality or efficiency of subsystems or parts. From these first principles almost all of systems theory is developed, and for our purposes we will isolate a further important concept that is relevant for analysing risks and the project finance company. We need to introduce the third systems concept, namely the system's boundary, which is intended to define where the system under analysis ends and where the system's environment begins. While our last thoughts on reductionism urged us not to be reductionist, view the world systemically and avoid optimising subsystems performance, we also know that in practice, to use Checkland's words (1999:60):

> *'. . . Cursory inspection of the world suggests it is a giant complex with dense connections between its parts. We cannot cope with it in that form and are forced to reduce it to some separate areas which we can examine separately'.*

Unfortunately we have to be reductionist on occasion to achieve practical outcomes, but this is forgivable only if we think systemically first. This is the context within which we attempt to understand and use the concept of a system's environment and its boundary when analysing risks in project companies as systems.

1.5.4 System boundaries and the system's environment, open and closed systems

In general, a systemic view considers the economy, ecology, and human institutions as a set of interlinked systems with increasing complexity. In order to make sense of a system's behaviour and how feedback mechanisms may have developed (as in ecological and biological systems), or which feedback mechanisms may be appropriate when developing business systems or other human organisations, it is necessary to define as clearly as is possible the system's boundary, which effectively separates the system from its environment. As we extend our view outwards from a given system we consider those things that influence the behaviour of the system, termed the system's environment.[16] A rich systems perspective will include more of these concerns in an analysis of any system within its wider systems environment and at various levels of aggregation while a narrow(er) systems perspective attempts to isolate systems from the richer systems environment possibly for closer analysis, problem identification and possibly intervention (as may be the case with project companies or other business organisations). In essence we wish to concentrate more on the logic of a business system's boundary and environment here, because insights into what can be achieved with risk management depend in great measure on identification of the boundary of the venture under analysis. This is a most critical concept in understanding the limits to what risk management and risk mitigation can practically be expected to achieve.

In essence, a system's boundary often depends on what the particular purpose of a system's analysis may be. Of course, if a system has a boundary, it implies the boundary is between it and its environment. First then, we narrowly envisage the system boundary as between the system and its environment. A *closed system* is a system which does not interact with its environment – one could say the environment does not exist in the case of a closed system. One could envisage a solid-state electronic component such as a semi-conductor as a closed subsystem – its output signal depends

[16] Paradoxically the levels of complexity may also increase as the level of aggregation decreases, as we may observe with particle physics and quantum theory, and complex biochemical processes such as the functioning of the human brain.

entirely and directly on one input signal only, and its control mechanism (if any) is independent of the environment. In contrast, we speak of an *open system* when a system does interact with its environment. Defining an open system's boundary can often be a confounding problem, and what's more, it happens that boundaries may be defined differently for different purposes or, more frustrating, boundaries may not be stable. We may explain an open system as one where there is a set of entities outside the system, which does not belong to the system, but could influence the system or could be influenced by the system. With human organisations it is to be expected that system and subsystem boundaries may not be stable, that entities outside the system/subsystem may influence its behaviour, and this is in fact one of the risks to manage or mitigate in project finance arrangements, particularly with international ventures. We also have to deal with the concept of open and closed systems when a system's boundary is under consideration.

In order to illustrate the nature of open and (somewhat) closed systems and their boundaries in project companies, consider again the Baguio Power Company. The Baguio Power Project is a 2000 MW coal-fired electricity generating plant located next to a deep sea port close to the city of Manila in the Philippines. BPC is a continuous processing system and produces electricity at large scale and low unit cost. As part of this massively capital intensive facility we have numerous process control systems that control the rate of burning, steam distribution, emissions, and so on (the hard systems), including control mechanisms that manage technical goals for the project (overall efficiency of factor inputs). Together these describe the business system's internal environment. In a narrow sense we can represent the internal environment and its boundary as illustrated in Figure 1.10, itself an expanded version of Figure 1.9.

For practical purposes BPC's electricity generating process may be viewed as fully automated. At BPC's transmission exchange facility, the electricity it produces is metered formally and fed into the receiving electricity distribution grid. In Figure 1.10 we see that the plant operations management team is supported by the normal business functions that provide efficiency and effectiveness information for control purposes, such as accounting and administration, facility management, data processing, and so on. This information function effectively informs both the effectiveness and the process control systems. Together with the electricity generating system itself, this is presented as the system's internal environment.[17] The effectiveness control system is part of BPC's internal and operating environments, and it reacts to BPC's relations with GC's corporate objectives for BPC, such as return on invested capital (RIC), return on equity invested (ROE), and other corporate objectives. From here it controls the internal environment through the process control system. This is to illustrate that BPC's management obtains signals from the operating environment

[17] For the sake of economy, this curtailed description neglects altogether the detail of electricity generating plants' operations.

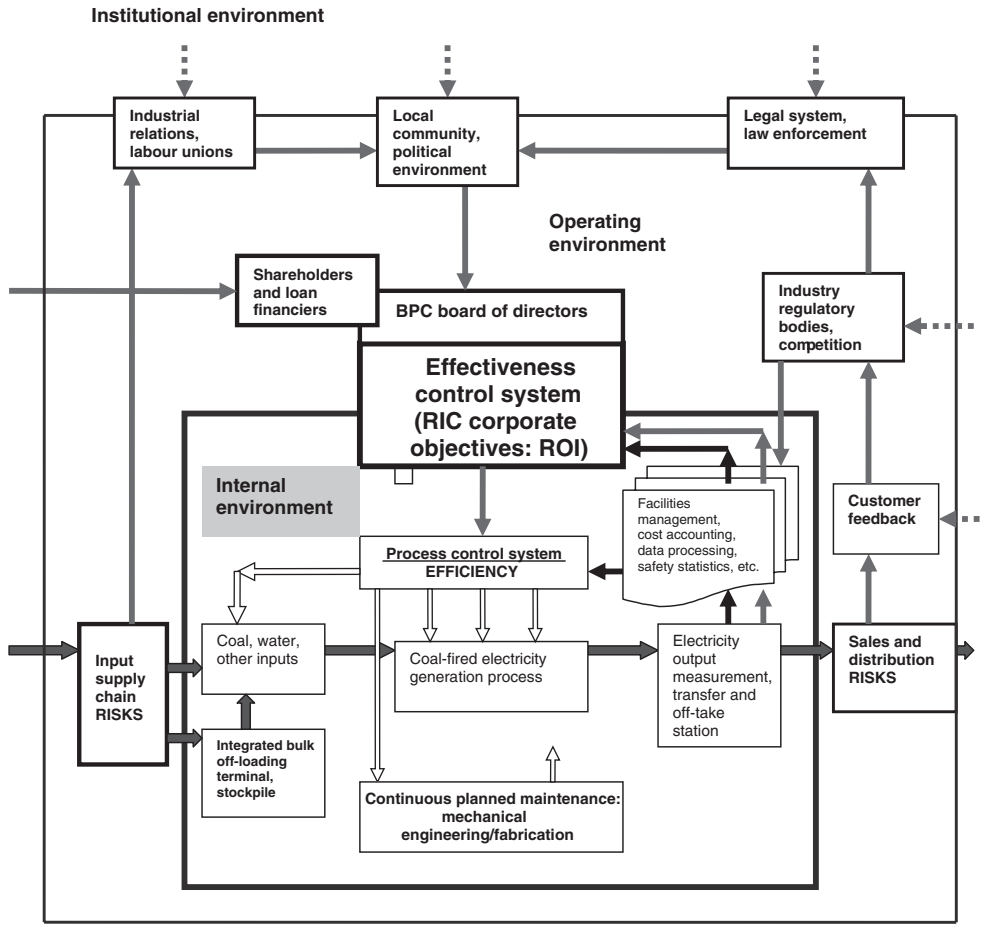

Figure 1.10 BPC coal-fired power project: internal and operating environment.

and adjusts objectives if required, which would likely require effectiveness and efficiency objectives to be altered accordingly. In business systems, we thus differentiate the system's relevant environment into what we described as the internal environment, possibly containing the production process itself and the normal harder functions such as accounting and administration; the operating environment, concerned with the business in its competitive environment; and the institutional environment, the regulatory bodies, laws, norms, customs, etc. in the society in which the business is located.

This characterisation of a business's environment into internal, operating and institutional environments is useful because each of these indicates an increase in the level of complexity in the environment, as well as a decreasing ability to exert influence over the environment. Each level is also associated with a higher noise to signal

ratio – less certainty about information. For example, typically a well-managed business would have good information about its internal environment, and possibly less specific information about competitors and other factors in the operating environment. The institutional environment requires special attention, because there can be excellent information with well-developed institutions, or very poor information with weak institutional environments. Of necessity there are some overlaps in this categorisation, but the framework explains how one could conceive of a project's environment and where the boundaries between the different levels of environment may be. At some stage in analysing a system, it becomes clear which factors may affect the project's operating environment and lead to financial risks, and it also could become clear which risks can be managed or mitigated and which cannot. It is clear that finding the boundary(ies) between the project company and its various categories of environment is important to understanding where risks originate and how they may be approached from a managerial perspective. In Chapter 4 we return to the project company's environment as an analytical mechanism to help identify risks in the project company's various levels of environment, in order to conceptualise risk management activities. We also devote part of Chapter 4 to the institutional environment, where the project company is least able to influence its environment, and may be most vulnerable to being influenced.

1.6 Plan of the book

Recall that the definition of project finance introduced in Section 1.3 implies that at least three interdependent elements should be included in the analysis of project financed ventures. These are:

- the economic/business unit under study (the project company including its business model and environment, earnings/cash flow, and risks)
- the nature of the assets deployed by the business unit (highly specific assets)
- the business unit's financial structure (with particular attention to the business unit's debt, and its servicing and repayment), including agency conflicts in finance and management of the project.

In order to consider the context within which any project company is created and operates, an unstated fourth element also matters. In our view a useful analytical framework should facilitate an integrated analysis of any project finance venture, and facilitate identification and explanation of decisions surrounding the first three elements when consideration is given to the institutional environment of any project finance transaction. Integrated analysis is also intended to facilitate forming of ideas about planning, design, engineering, construction and financing project financed ventures. All this implies that a particular viewpoint for such a framework is required,

and we apply systems theory and institutional economics concepts as general paradigms to consider the economic and financial nature and structure of project companies, and systems theory concepts in general to maintain functional logic for the presentation where required. All of what follows in this book is either an elaboration of or application of concepts introduced in Sections 1.2 to 1.5. The overall aim of our book is thus to produce a text that details an analytical framework drawing on applied institutional economics, which facilitates analysis of the logic which underpins the structure of generic project financed arrangements. Our approach is based on an analysis of the institutions that govern project financed transactions, the economics and agency risks of costly contracts (transactions), and risk management concerns derived from these analyses.

The framework outlined above provides the logic for the book's structure. Chapter 2 introduces the world of complex transactions. We use basic institutional economics concepts to build an image of complexity in single, large, unusual economic transactions, as is the case with large single-asset project companies. In the process we introduce the fields of transaction costs, contracts and concepts of agency theory and incentive alignment as part of the costs of transacting. We point out where the project finance model with high asset specificity and typically high indebtedness locates within the corporate finance environment. Many concepts identified in Chapter 2 require a further institutional economics context, which is made more explicit in Chapter 4 where we consider the importance of institutions in concluding complex transactions successfully.

Chapter 3 represents an entirely conventional approach to the three most important financial decisions in typical project financed companies. We firstly consider the fundamental capital budgeting decision faced by any corporation that is considering investing in a facility such as a road tunnel or other typical project. Thereafter we consider the financing decision associated with such a decision, and we also consider the financial circumstances that surround the construction phase of such a venture.

Chapter 4 considers broadly how financial risks originate from the project finance business model. We outline generally approaches to risk management, and present introductory explanations to a range of risk management mechanisms including a number of important financial instruments such as options, futures and swaps. The emphasis of this chapter is, however, on explaining an approach to risk identification based on systems concepts, and we do not attempt to provide the detailed machinations of any particular risk management approaches. In Chapter 4 we also present a compact introduction to the institutional context within which project companies function, and indeed within which all commercial activity is conducted. We identify important institutions in (normally) well-functioning economies, and point out their relevance to identification of risks that face project companies, as well as their relevance to the success of project ventures, particularly in an international context. We note the importance of government, legal, corporate, political and regulatory institu-

tions that influence project ventures, and also consider the risks generated by unstable or poorly developed institutions.

Chapter 5 considers a further category of complex transaction, namely PFIs and PPPs, and a range of transactions with catchy acronyms. We present these as well-intentioned variants on the idealised project finance arrangement motivated by public sector budgetary constraints, but with important differences. While the typical project finance transaction is based on a narrowly defined business objective, a single highly specific capital asset and relatively clear risks, the PFI and PPP structures seem to test increasingly the logic of the project finance business model by structuring transactions around less well-defined assets with more complex income generating characteristics than typical project ventures (schools, hospitals).

Chapters 6 to 9 present case studies, with both general and specific purposes. Application of the frameworks introduced in Chapters 1 to 5 in the text will be illustrated through a number of project cases from a number of world regions at different stages of political, legal, regulatory and financial sector development. The intention is that while each project case will have a general integrative theme, it will also be used to illustrate one or more specific project finance principles highlighted in the text.

Chapter 6 outlines the circumstance surrounding the recent development of the Sydney CrossCity Tunnel, a toll-road tunnel that provides an alternative route to surface road users in the busy and traffic congested Sydney central business district. This case introduces decisions concerning project special purpose vehicle structuring considered in Chapter 3, and risk identification concepts in Chapter 4. It further hints at concerns with PFI and PPP concepts.

Chapter 7 also considers a toll-road tunnel, this time under Hong Kong Harbour. We present the Western Harbour Crossing, a project that forms part of the infrastructure created around Hong Kong's international airport. This case is concerned with two particular financial decisions raised in Chapter 3, namely the capital budgeting decision and the financing decision. In particular, it is concerned with the estimation of the scale of a loan decision pending a hypothetical decision to purchase the West Harbour Crossing SPV by investors.

Chapter 8 explains the institutional problems and conflicts surrounding the infamous Dabhol Power Plant close to Mumbai in India. Focusing on concepts outlined in Chapters 2 and 4, this case relates a range of problems from project company risks associated with political opportunism to issues with enforceability of third-party guarantees in power purchase agreements, to problems that may be described as a lack of credible corporate commitment by project promoters.

Chapter 9 returns to PFI and PPP arrangements outlined in Chapter 5. We present the problematical attempts to raise capital to modernise the London Underground system through private sector participation. The case explains problems associated with the nature and state of the system's assets, which draws on asset-specificity concepts introduced in Chapter 2.

Key concepts

The following concepts are considered sufficiently important to memorise as key vocabulary for use in subsequent chapters.

Corporate finance
Emergent properties
Financial structure
Internal environment, operating environment, institutional environment
Non-recourse, limited recourse finance
Project companies
Project finance
Systems model, closed system, open system